DOE/RL 88-33

Hanford Site Waste Management Plan

United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

Available from
U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

NTIS Price Codes:
Microfiche Copy: A01
Printed Copy:

Pages	Price Codes	Pages	Price Codes
001-025	A02	301-325	A14
026-050	A03	326-350	A15
051-075	A04	351-375	A16
076-100	A05	376-400	A17
101-125	A06	401-425	A18
126-150	A07	426-450	A19
151-175	A08	451-475	A20
176-200	A09	476-500	A21
201-225	A10	501-525	A22
226-250	A11	526-550	A23
251-275	A12	551-575	A24
276-300	A13	576-600	A25

Printed in the United States of America

DOE/RL--88-33

DE89 011034

Hanford Site Waste Management Plan

Defense Waste Management
Westinghouse Hanford Company

Date Published
December 1988

United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

This page intentionally left blank.

HANFORD SITE WASTE MANAGEMENT PLAN

ABSTRACT

The Hanford Site Waste Management Plan (HWMP) was prepared in accordance with the outline and format described in the U.S. Department of Energy Order 5820.2A. The HWMP presents the actions, schedules, and projected costs associated with the management and disposal of Hanford defense wastes, both radioactive and hazardous. The HWMP addresses the Waste Management Program. It does not include the Environmental Restoration Program, itself divided into the Environmental Restoration Remedial Action Program and the Decontamination and Decommissioning Program.

The executive summary provides the basis for the plans, schedules, and costs within the scope of the Waste Management Program at Hanford. It summarizes fiscal year (FY) 1988 including the principal issues and the degree to which planned activities were accomplished. It further provides a forecast of FY 1989 including significant milestones.

Section 1 provides general information for the Hanford Site including the organization and administration associated with the Waste Management Program and a description of the Site focusing on waste management operations.

Section 2 and Section 3 describe radioactive and mixed waste management operations and hazardous waste management, respectively. Each section includes descriptions of the waste management systems and facilities, the characteristics of the wastes managed, and a discussion of the future direction of operations.

Section 4 presents a schedule and cost summary for FY 1989 and for the period from FY 1990 through FY 1994. Section 5 describes the status of environmental monitoring that supports waste management operations.

Section 6 discusses related subjects including quality assurance, training, documentation associated with the National Environmental Policy Act, environmental compliance projects, and technology issues.

Appendix A provides a brief description of significant documentation associated with the Waste Management Program. Appendix B describes the separate Hanford Environmental Restoration Remedial Action Program and its relationship to the Waste Management Program.

This page intentionally left blank.

EXECUTIVE SUMMARY

This Hanford Site Waste Management Plan (HWMP) presents the actions, schedules, and projected costs associated with the management and permanent disposal of Hanford Site defense wastes, including the waste being generated through fiscal year (FY) 2015. Both radioactive and hazardous waste, separate or mixed, are addressed in this plan. The HWMP addresses the Waste Management Program at Hanford. It does not include the Environmental Restoration (ER) Program, itself divided into the ER Remedial Action Program and the Decontamination and Decommissioning (D&D) Program.

The key waste management objective addressed by this document is the disposal of all existing and future Hanford Site defense wastes. In accomplishing this objective, radioactive and mixed wastes (MW) are to be managed in a manner that ensures protection of the health and safety of the public, DOE, and contractor employees, and the environment. The generation, treatment, storage, transportation, and disposal of radioactive wastes, and the other pollutants or hazardous substances they contain, are to be accomplished in a manner that minimizes the generation of such wastes and complies with all applicable Federal, State, and local environmental, safety, and health laws and regulations and DOE requirements.

The schedules and costs cover a 28-yr range from FY 1988 through FY 2015. These schedules and costs are derived from two sources: (1) the FY 1990 Budget Submittal from the Manager, Richland Operations Office (Hanford Site) of the U.S. Department of Energy (DOE) to the DOE Headquarters Office of Defense Waste and Transportation Management, Office of Defense Programs (DP) from FY 1988 through FY 1994, and (2) engineering estimates from FY 1995 through FY 2015. All cost projections beyond FY 1990 are represented in FY 1990 dollars. It is projected that disposal activities under the Waste Management Program could be completed by FY 2015, based on the cost projections presented in this document, whereas the ER Program, which is not within the scope of the HWMP, will continue beyond FY 2015.

The FY 1990 Budget Submittal, prepared and submitted by the Richland Operations Office in April 1988, provides input to the overall DOE budget submittal and the continuing federal budget cycle. The April 1988 submittal contains "guidance" versus "required" levels for FY 1989 and "target" versus "required" levels from FY 1990 through FY 1994. In this plan the "guidance" level is used for FY 1989 and the "target" level is used from FY 1990 through FY 1994, thereby representing a more conservative funding pattern. The FY 1989 guidance presented in the FY 1990 Budget Submittal, and represented in this issuance of the HWMP without modification, has not undergone significant changes at the Hanford Site as a result of the recent Congressional appropriations of the FY 1989 funds.

The projected costs in this document are identified in three major categories: (1) storage and surveillance which includes environmental monitoring and control, interim operations, and laboratory services, (2) technology and disposal operations, and (3) Capital Equipment Not Related

To Construction (CENRTC) and Construction which includes capital work orders, general plant projects, and capital line items.

FISCAL YEAR 1988

During FY 1988, four significant programmatic decisions stand out as influencing the course of the Waste Management Program at the Hanford Site in future years:

- The DOE decision in January 1988 to place the N Reactor on a standby status
- The issuance of the Record of Decision (ROD) resulting from the Environmental Impact Statement on the Disposal of Hanford Defense High-Level, Transuranic, and Tank Wastes (HDW-EIS)
- The breakout of the ER Remedial Action Program from the Waste Management Program. The ER Remedial Action Program places emphasis on remedial actions to waste sites under Comprehensive Environmental Response, Compensation, and Liability Act/Superfund Amendments and Reauthorization Act (CERCLA/SARA) and Resource Conservation and Recovery Act (RCRA) 3004(u)
- The initiation of negotiations on a Tri-Party Agreement between the U.S. Environmental Protection Agency (EPA), the Washington State Department of Ecology (WDOE), and DOE-RL with the purpose of achieving compliance with certain environmental regulations on a schedule to which all three parties agree.

As a result of the N Reactor production cutback, and the corresponding decrease in the Plutonium-Uranium Extraction (PUREX) Plant production and waste generation, the near-term impact to the Waste Management Program involved either the cancellation or rescoping of several Capital Line Items for an approximate $60 million cost reduction. The long-term impact affects the projected duration of operations at B Plant, the Grout Treatment Facility (GTF) and the Hanford Waste Vitrification Plant (HWVP), all three utilized for treating and disposing of the tank wastes.

As stated in the ROD, published in April 1988, DOE will implement the preferred alternative, which was presented in the Final HDW-EIS. The preferred alternative recommends disposal of double-shell tank waste, retrievably stored and newly generated transuranic waste, and encapsulated cesium and strontium waste. Also to be disposed of is the only solid waste site from before 1970 suspected of being contaminated with transuranic elements and not on Hanford's central plateau.

The preferred alternative also recommends additional technology be developed and evaluations done before a final disposal decision is made on the other defense wastes addressed in the HDW-EIS. These include: single-shell tank waste, transuranic-contaminated soil sites, and pre-1970 buried suspect transuranic-contaminated solid waste sites. These activities are included in the ER Remedial Action Program.

The ER Remedial Action Program performs environmental work involving inactive sites identification, investigation, technology development and demonstration, and remedial activities including cleanup of past contamination by designated hazardous substances. The primary objective of the DOE ER Remedial Action Program is to bring all known inactive hazardous waste sites (those that ceased operation before March 1, 1987) at DP Installations into compliance with applicable Federal, State, and local environmental laws and regulations.

Significant progress has been made on the development of the Tri-Party Agreement between the EPA, the WDOE, and the DOE-RL with the purpose of achieving compliance with certain environmental regulations. The Agreement is expected to include a comprehensive plan for Hanford Site remedial actions. Efforts remaining include finalizing major milestones and development of the supporting work schedule. The Tri-Party Agreement is expected to result in acceleration of work covered by this issuance of the HWMP.

Additional key accomplishments for FY 1988 include the following.

- The Final Environmental Impact Statement on the Disposal of Hanford Defense High-Level, Transuranic, and Tank Wastes (HDW-EIS) was issued in December 1987. This was the culmination of 5 yr of intensive preparation, including Federal, State, and public interaction.

- Three single-shell tanks were interim stabilized, exceeding the milestone by one and bringing the total number of interim stabilized to ninety-eight. Fifty-one remain to be interim stabilized. Four single-shell tanks were isolated, bringing the total number isolated to eight-nine. Sixty remain to be isolated.

- The milestone for completion of 19.3 ML (5.1 Mgal) of double-shell tank space recovered by evaporation was achieved ahead of schedule. The total recovery was 21.8 ML (5.7 Mgal) with an evaporator throughput of 50.3 ML (13.3 Mgal).

- The Hanford Environmental Compliance Project was validated to $87.5 million. The total estimate for the Project is $180 million. It will support eliminating radioactive liquid waste discharges to the soil column and upgrading existing facilities to comply with RCRA.

- The issuance of the Best Available Technology Guidance Document was a key element in the plan to eliminate contaminated liquid discharges to the soil column. It is the first of its kind in the DOE Complex, and is expected to serve as a model for other DOE Sites.

- The startup of the Grout Treatment Facility (GTF) on August 30, 1988, marked the first permanent disposal of low-level double-shell tank waste at Hanford. Approximately 428,000 L (113,000 gal) of waste was processed by the end of FY 1988. It is anticipated that this will lead to a permitted treatment and disposal facility for low-level, double-shell tank mixed waste by FY 1991.
- Submittal of 16 RCRA Part A applications to WDOE allows continuation of operations for these facilities under an interim status.

During the course of FY 1988, two DOE Headquarters controlled and monitored baseline milestones associated with the Waste Management Program at Hanford were deleted by agreement: an FY 1990 milestone on demonstration technology for double-shell tank waste characterization was withdrawn pending improved definition and a FY 1993 milestone for completion of the 241-AQ Tank Farm was eliminated as a result of the cutback in N Reactor production. The milestone to initiate shipments of certified transuranic waste to the Waste Isolation Pilot Plant (WIPP) was deferred to a date currently unspecified. Milestones due for completion in FY 1988 were all completed on or near the scheduled date. The startup of the GTF to initiate processing of a low-level, nonhazardous waste was rescheduled from mid-June until August 30, 1988.

Three major problems occurred in FY 1988 that are considered notable:

On June 6, 1988, Radiation Sterilizers, Inc., in Decatur, Georgia, detected increased levels of radiation above the irradiator pool that stores leased cesium capsules from the Hanford Site. Capsules have been leased to Radiation Sterilizers, Inc. for commercial applications. A special team of technical personnel, including safety and quality assurance representatives, was assembled to provide support to a capsule recovery effort. A plan was developed and inspection of the capsules and pools at the two Radiation Sterilizers, Inc. irradiator facilities at Decatur and Westerville, Ohio, was completed. In addition, three suspect capsules were shipped from the Decatur facility to the Oak Ridge National Laboratory for evaluation and testing. A work plan has been developed, and all Radiation Sterilizers, Inc.-leased capsules will be returned to Hanford in FY 1989.

It was determined that ammonia levels in the ammonia scrubber waste being discharged from the PUREX Plant to the soil were above acceptable limits. An order was issued by WDOE to cease the discharge. In compliance with the order, the ammonia scrubber waste was diverted to the double-shell tank system. Subsequent evaporation in the 242-A Evaporator resulted in unacceptable releases of ammonia and ^{106}Ru. By implementing more exact monitoring for these releases and controlling feedstock blends to the evaporator, process condensate discharges below acceptable limits were achieved.

The WDOE and EPA were advised that the levels in six SSTs had changed. One of these tanks, designated 241-SX-104, has shown a decline of about 18,900 L (5,000 gal). The remaining tanks have shown considerably less level changes. Except for 241-SX-104, pumpable liquid was transferred to new double-shell tanks. Tank 241-SX-104 will continue to be pumped through FY 1989.

The appropriations compared with the actual expenditures in FY 1988 for the Waste Management Program follow:

Millions of dollars	Appropriations	Actuals
Operating and Expense Budget	113.9	113.2
Capital Equipment and Construction	26.3	29.8*
Total	140.2	143.0

Numerous small differences contribute to the overall difference.

The operating and expense costs for solid waste storage and disposal, hazardous waste operations, and the Hanford environmental management program are liquidated to the generators and are not included in the above costs except where the generators are funded by the Waste Management Program. The liquidated costs for FY 1988 were $26.8 million.

The costs shown in Sections 2.0, 3.0, and 4.0 for FY 1988 are appropriations.

THE CURRENT FISCAL YEAR (1989)

The Waste Management Activities at Hanford for FY 1989 are guided by the following major assumptions:

- The Waste Management Program will provide facilities for the receipt and disposal of liquid and solid radioactive, mixed, and hazardous waste.
- N Reactor will be placed on a standby status.
- PUREX Plant processing will be completed in FY 1993 and terminal clean out of the PUREX Plant will be completed by FY 1996.
- The Plutonium Finishing Plant (PFP) will continue operations through FY 1993 followed by terminal clean out beyond FY 2000.
- B Plant will be used for the pretreatment of designated double-shell tank waste for the HWVP and the GTF.

---

*Increase includes current year expenditures against previous appropriations.

- The Neutralized Current Acid Waste (NCAW) demonstration run at B Plant will be started in October 1993 which supports the initiation of operations of HWVP in FY 1999.
- The GTF will complete the processing of 13 campaigns through September 1993. Current funding at the target level will only support completion of 10 campaigns.
- All 149 single-shell tanks will be interim stabilized and isolated by the end of FY 1996. Interim stabilization may be accelerated with increased funding and double-shell tank space availability.
- Certified transuranic waste will be shipped to the Waste Isolation Pilot Plant for disposal but a date to initiate shipping is not currently identified.
- The WRAP will initiate operations in FY 1996. This goal could be accelerated with increased funding.
- The treated effluent disposal facility will initiate operations by FY 1995 using Best Available Technology (BAT) to dispose of Phase I end-of-pipe treated effluents and Phase II discharges.

Five project startups are planned for FY 1989: W-017H, Ground Water Monitoring Wells; W-007H, BCP Treatment Facility; W-020H, Cathodic Protection; V-791H, 300/400 Area Waste Water Facilities; and W-016H, Radioactive Mixed Waste Storage Facilities. Each of these five projects is associated with the portion of the HEC project which has been validated. Facility upgrades will continue on the double-shell tank farm system, which includes the 242-A evaporator-crystallizer, and the B Plant complex, which includes the Waste Encapsulation Storage Facility (WESF). Two capital line items will be completed, project B-455 on the WESF K-3 filter system and project B-463 on the B Plant F Filter.

The significant milestones for FY 1989 associated with the Waste Management Program include the following:

Milestone	Completion
Submit Part B Permit Application for Grout Treatment Facility to WDOE	11/88
Submit FY 1989 Site Waste Management Plan to Headquarters per DOE Order 5820.2A	12/88
HWVP Project Plan approved by DOE-HQ	1Q/FY 89
Complete characterization of first Neutralized Current Acid Waste (NCAW) sample from Tank 241-AZ-101	08/89
Submit DOE Order 5820.2A Implementation Plan	04/89

Complete the Return of Commercially Leased Cesium Capsules to Waste Encapsulation and Storage Facility from RSI Facilities	08/89
HWVP Project Management Plan Approved by DOE-RL	2Q/FY 89
Complete first Grout Campaign (1 Mgal Phosphate/ Sulfate Waste)	07/89
Submit Part B Permit Application for HWVP to WDOE	07/89
Stabilize 2 single-shell tanks for a total of 100 out of 149; isolate 2 single-shell tanks for a total of 91 out of 149	09/89
Achieve 5.1 Mgal of double-shell tank waste reduction through evaporation	09/89
Submit Annual Status Report on Implementation of Plan and Schedule to Discontinue Disposal of Contaminated Liquid to the Soil Column	09/89
Complete installation of 7 Resource Conservation and Recovery Act Ground Water Monitoring Wells for a total of 42	09/89
Complete Conceptual Design for NCAW Retrieval System Demonstration	09/89
Complete FY 1989 Annual Waste Volume Projections Document	09/89
Finalize HWVP NCAW Feed Specifications	4Q/FY 89

The guidance level in the FY 1990 Budget submittal is compared with the current guidance for FY 1989 as follows:

Millions of dollars	Budget Submittal Guidance Level	Current Guidance
Operating and Expense Budget	133.5	134.1
Capital Equipment and Construction	47.6	47.8
Total	181.1	181.9

The operating and expense costs for solid waste storage and disposal, hazardous waste operations, and the Hanford Environmental Management Program are liquidated to the generators and are not included in the above costs except where the generators are funded by the Waste Management Program. The liquidated costs for FY 1989 are estimated at $27.1 million. The costs shown in Sections 2.0, 3.0, and 4.0 are from the budget submittal.

This page intentionally left blank.

LIST OF TERMS

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
BAT	Best Available Technology
BCP	B Plant Process Condensate
CC	complexant concentrate
CDR	conceptual design report
CENRTC	Capital Equipment Not Related to Construction
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CH	contact-handled
CY	calendar year
D&D	decontamination and decommissioning
DMF	Dry-Materials Facility
DOE-EH	U.S. Department of Energy, Office of Environment, Safety, and Health
DOE-DP	U.S. Department of Energy, Office of Defense Programs
DOE-HQ	U.S. Department of Energy, Headquarters
DOE-RL	U.S. Department of Energy, Richland Operations Office
DOT	Department of Transportation
DSS	double-shell slurry
DSSF	double-shell slurry feed
DST	double-shell tank
DW	dangerous waste
EHW	extremely hazardous waste
EMP	Environmental Monitoring Plan
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
FDC	functional design criteria
FEMP	Facility-specific Effluent Monitoring Plan
FFTF	Fast Flux Test Facility
FOLRP	Field Office Long-Range Plan
FOMP	Field Office Management Plan
FOWP	Field Office Work Plan
FR	Federal Register
FRP	fiberglass-reinforced polyester
FY	fiscal year
GTF	Grout Treatment Facility
HAZWMP	Hazardous Waste Management Plan
HAZWRAP	Hazardous Waste Remedial Action Program
HDW-EIS	Hanford Defense Waste-Environmental Impact Statement
HEC	Hanford Environmental Compliance Project
HEMPP	Hanford Environmental Management Program Plan
HEPA	high-efficiency particulate air
HIP	HEMP Implementation Plan
HLW	high-level waste
HRS	Hazard Ranking System
HSWA	Hazardous Solid Waste Amendment
HWMP	Hanford Waste Management Plan
HWMTP	Hanford Waste Management Technology Plan

HWVP	Hanford Waste Vitrification Plant
LLMW	low-level mixed waste
LLW	low-level waste
MW	mixed waste
NAS	National Academy of Sciences
NHWRDDC	Northwest Hazardous Waste Research, Development, and Demonstration Center
NCAW	neutralized current acid waste
NCRW	neutralized cladding removal waste
NEPA	National Environmental Policy Act
NPL	National Priority List
NRC	U.S. Nuclear Regulatory Commission
NRDWL	nonradioactive dangerous waste landfill
NRDWSF	nonradioactive dangerous waste storage facility
OEC	Operating and Engineering Contractor
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Act
OU	operational units
PCB	polychlorinated biphenyls
PFP	Plutonium Finishing Plant
PL	public law
PNL	Pacific Northwest Laboratory
PSW	phosphate-sulfate waste
QA	quality assurance
PUREX	Plutonium-Uranium Extraction
R&D	research and development
RCRA	Resource Conservation and Recovery Act
RH	remote-handled
RI/FS	Remedial Investigation/Feasibility Study
RMW	radioactive mixed waste
ROD	Record of Decision
RSI	Radiation Sterilizers, Inc.
RTR	real-time radiography
SARA	Superfund Amendments and Reauthorization Act
SRE	sodium reactor experiment
SST	single-shell tank
Supply System	Washington Public Power Supply System
TEC	total estimated cost
TGE	transportable grout equipment
TRU	transuranic
TRUEX	transuranic extraction
TRUPACT	Transuranium Package Transporter
TRUSAF	Transuranic Storage and Assay Facility
USGS	U.S. Geological Survey
WAC	Washington Administrative Codes
WAG	waste area group
WDOE	Washington State Department of Ecology
WESF	Waste Encapsulation and Solidification Facility
Westinghouse Hanford	Westinghouse Hanford Company
WIPP	Waste Isolation Pilot Plant
WRAP	Waste Receiving and Processing
WMD	Waste Management Division

CONTENTS

1.0 General Site Information 1-1
  1.1 Organization and Administration 1-1
  1.2 Guiding and Supporting Documentation 1-6
  1.3 Site Description 1-9

2.0 Radioactive and Mixed Waste 2-1
  2.1 High-Level Waste and Other Waste Managed as High-Level Waste 2-1
  2.2 Transuranic Waste 2-32
  2.3 Low-level Waste 2-45

3.0 Hazardous Waste Management 3-1
  3.1 Hazardous Waste 3-1
  3.2 System and Facility Descriptions 3-1
  3.3 Current and Future Plans 3-4

4.0 Cost and Schedule Summary 4-1
  4.1 Fiscal Year 1989 Costs and Operational Schedules 4-1
  4.2 Cost and Schedule Projections for Fiscal Years 1990 Through 1994 4-1

5.0 Environmental Monitoring Programs 5-1
  5.1 Overview 5-1
  5.2 Environmental Monitoring and Reporting 5-2
  5.3 Compliance Status 5-3

6.0 Related Subjects 6-1
  6.1 Quality Assurance in the Waste Management Program 6-1
  6.2 Training in the Waste Management Program 6-2
  6.3 Documentation Responsive to the National Environmental Policy Act 6-3
  6.4 Hanford Environmental Compliance Project 6-4
  6.5 Hanford Waste Management Technology Plan 6-10

7.0 References 7-1

This page intentionally left blank.

LIST OF FIGURES

1-1 U.S. Department of Energy, Richland Operations Office Organizational Structure 1-2
1-2 Westinghouse Hanford Company Organizational Structure 1-4
1-3 Pacific Northwest Laboratory Organizational Structure 1-5
1-4 Waste Management Planning and Compliance Documentation 1-7
1-5 Location of the Hanford Site 1-10
1-6 The 200 West Area at the Hanford Site 1-12
1-7 The 200 East Area at the Hanford Site 1-13
2-1 Overview of Treatment, Storage, and Disposal of Hanford Site Waste 2-3
2-2 Capsule Design Information for Encapsulated Waste 2-5
2-3 Location of Waste Encapsulation and Solidification Facility 2-6
2-4 Waste Encapsulation and Solidification Facility Layout 2-7
2-5 Plan for Disposal of Encapsulated Wastes 2-9
2-6 Schedule for Encapsulated Cesium and Strontium Management and Disposal 2-11
2-7 Double-Shell Tank Waste Treatment, Storage, and Disposal Flowchart 2-12
2-8 Cutaway View of a Double-Shell Tank 2-15
2-9 Schematic of Hanford Tank Farm Facilities 2-16
2-10 Typical Cross-Section of Buildings 221-B and 271-B 2-17
2-11 Hanford Waste Vitrification Plant 2-19
2-12 Hanford Waste Vitrification Plant Process Flowsheet 2-20
2-13 Neutralized Current Acid Waste Pretreatment Process Flowsheet 2-21
2-14 Neutralized Cladding Removal Waste Pretreatment Process Flowsheet 2-22
2-15 Complexant Concentrate Waste Pretreatment Process Flowsheet 2-23
2-16 Plutonium Finishing Plant Waste Pretreatment Process Flowsheet 2-24
2-17 Future Plans for Processing Double-Shell Tank Wastes for Final Disposal 2-25
2-18 Schedule for Double-Shell Tank Waste Management and Disposal 2-28
2-19 Cross-Sectional Views of Hanford Single-Shell Tanks 2-30
2-20 Pumping of Solutions from Single-Shell Tanks 2-31
2-21 Treatment, Storage, and Disposal Overview for Solid Transuranic Waste 2-34
2-22 Contact-Handled Transuranic Waste Storage Module 2-36
2-23 Caisson for Remote-Handled Transuranic Waste Storage 2-37
2-24 Artist's Conception of Proposed Hanford Central Waste Complex 2-40
2-25 Schedule for Stored and Newly Generated Transuranic Solid Waste Management and Disposal 2-41
2-26 Transuranic Storage and Assay Facility Location at Building 224-T 2-43
2-27 Transuranic Storage and Assay Facility Process Flow 2-44
2-28 Schematic of the Grout Treatment Process 2-47
2-29 The 204-AR Unloading Facility 2-49
2-30 The 242-A Evaporator/Crystallizer Simplified Schematic 2-50

LIST OF FIGURES (continued)

2-31 Grout Treatment Facility 2-51
2-32 Grouted Waste Disposal Vaults 2-53
2-33 Alternative Treatment and Disposal for Soil Column Discharges 2-56
2-34 Example of Crib Construction 2-58
2-35 Schedule for Liquid Low-Level Waste Management and Disposal ... 2-60
2-36 Schematic of Solid Low-Level Waste Treatment, Storage, and Disposal 2-62
2-37 Schedule for Solid Low-Level Waste Management and Disposal 2-65
3-1 Uniform Hazardous Waste Manifest 3-3
3-2 Nonradioactive Dangerous Waste Storage Facility Floor Plan 3-5
4-1 Waste Management Program Operating Schedule for FY 1989 4-2
4-2 Schedule for Waste Management Program 4-3

LIST OF TABLES

2-1 Encapsulated Cesium and Strontium Inventory Data 2-8
2-2 Projected Costs for Encapsulated Cesium and Strontium Management and Disposal 2-11
2-3 Projected Costs for Double-Shell Tank Waste Management and Disposal, High-Level Waste Fraction 2-28
2-4 Projected Costs for Single-Shell Tank Waste Interim Operations 2-32
2-5 Projected Costs for Solid Transuranic Waste Management and Disposal 2-41
2-6 Projected Costs for Double-Shell Tank Waste Management and Disposal, Low-Level Fraction 2-54
2-7 Projected Costs for Liquid Low-Level Waste Management and Disposal 2-60
2-8 Projected Costs for Solid Low-Level Waste Management and Disposal 2-65
3-1 Projected Costs for Hazardous Waste Disposal 3-6
4-1 Projected Costs for the Hanford Waste Management Program (FY 1990 Through FY 1994) 4-1
5-1 Monitoring of Effluent Streams on the Hanford Site 5-2
6-1 Hanford Environmental Compliance Subprojects 6-5
6-2 Additional Candidate Subprojects 6-9

This page intentionally left blank.

HANFORD SITE WASTE MANAGEMENT PLAN

1.0 GENERAL SITE INFORMATION

1.1 ORGANIZATION AND ADMINISTRATION

The U.S. Department of Energy (DOE) Assistant Secretary of Defense Programs (DP) is responsible for managing waste that is either generated by DP or is accepted by DP through negotiations with other government entities. The Assistant Secretary, DOE-DP, has the authority for establishing policy for the management of DOE waste and ensuring that DOE waste within the purview of DP is managed according to the requirements of DOE Order 5820.2A.

The Hanford Site in Washington State is administered by the DOE through the Richland Operations Office (DOE-RL) located in Richland, Washington. The Manager of the Richland Operations Office, M. J. Lawrence, is responsible for all activities that affect the treatment, storage, or disposal of waste at the Hanford Site. In reference to the organizational chart in Figure 1-1, this responsibility is delegated to the Assistant Manager for Operation, A. J. Rizzo, and further to the Director of the Waste Management Division (WMD), R. E. Gerton. Construction projects are managed by the Assistant Manager for Research and Projects, J. H. Antonnen, and further to the Director of the Project Management Division, L. C. Williams, and the Director of the Hanford Waste Vitrification Plant (HWVP) Division, R. W. Brown. The WMD is responsible for preparation of this plan. The Environmental Restoration (ER) Division is responsible for ensuring compliance with environmental statutes and regulations through the Policy and Permits Branch. The Office of Safety, Environment, and Security is responsible for oversight in all activities.

Four contractors operate the Hanford Site: Hanford Environmental Health Foundation, Kaiser Engineers Hanford, Pacific Northwest Laboratory (PNL), operated by Battelle Memorial Institute, and Westinghouse Hanford Company (Westinghouse Hanford). The Boeing Computer Services Richland, Inc., is subcontracted to Westinghouse Hanford. All of these contractors generate regulated waste, that is, waste that is either radioactive, and subject to the requirements pursuant to the Atomic Energy Act of 1954 as amended (public law 83-703), or hazardous, and subject to the regulations pursuant to the Resource Conservation and Recovery Act of 1976 (RCRA) as amended (public law (PL) 94-580). Only PNL and Westinghouse Hanford are responsible for managing the treatment, storage, or disposal of regulated waste.

Westinghouse Hanford, as the Operating and Engineering Contractor (OEC) for the Site, is directly responsible for the management of regulated waste. The PNL is responsible for portions of the research and development (R&D) associated with the management of regulated waste and has the lead responsibility for away-from-facility environmental monitoring.

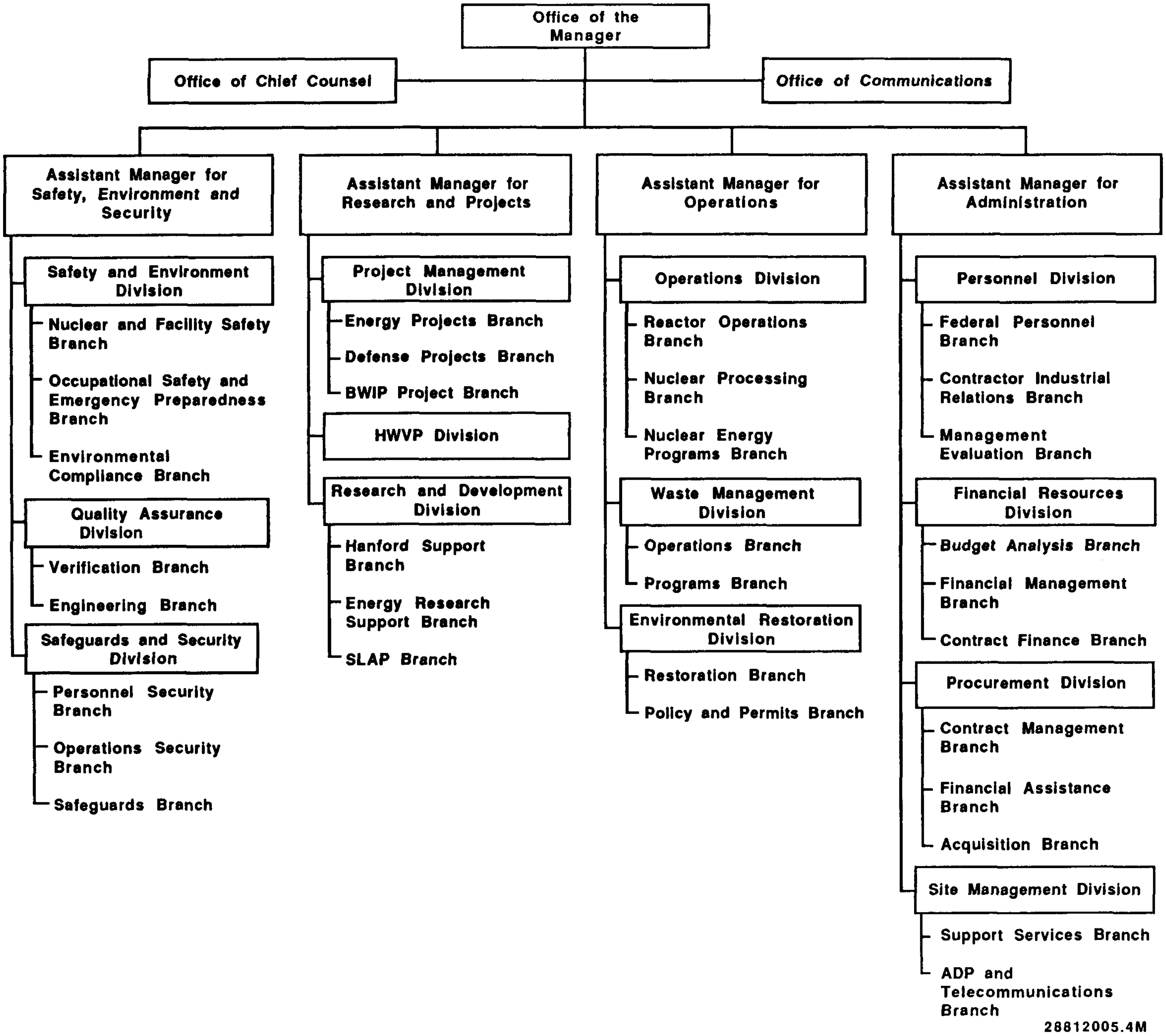


Figure 1-1. U.S. Department of Energy, Richland Operations Office Organizational Structure.

The Westinghouse Hanford organizational structure is shown in Figure 1-2. The Defense Waste Management Division is the principal organization with responsibility and authority for the operation of facilities for regulated waste. The Projects Department is responsible for the construction of the HWVP and other major projects associated with the management of regulated waste. The Environmental Division is responsible for the strategy and negotiations associated with obtaining regulatory permits for certain facilities, for coordination of permit application preparation, and for regulatory compliance activities. The Safety, Quality Assurance, and Security Department is responsible for oversight in all activities.

The PNL organizational structure is shown in Figure 1-3. The Waste Technology Center is the principal organization associated with the R&D for managing regulated waste. Much of the R&D for the HWVP and the Grout Treatment Facility (GTF), two major treatment facilities at the Hanford Site, is accomplished in this part of PNL. To a lesser extent, four other departments contribute to some technical aspects for regulated waste: Earth and Environmental Sciences Center, Material and Chemical Sciences Center, Office of Hanford Environment, and Office of Technology Planning and Analysis. The PNL also has specific responsibilities for environmental surveillance and monitoring as described in Section 5.0 of this plan. Facilities and Operations has responsibility for storage of mixed waste (MW) or hazardous waste generated by PNL.

The DOE-RL, in association with the Hanford Site contractors, has interfaces with several governmental agencies both at the Federal and State level. These agencies include the U.S. Environmental Protection Agency (EPA), and the EPA regional office in Seattle, Washington, the Washington Department of Ecology (WDOE), and the U.S. Nuclear Regulatory Commission (NRC).

The EPA has authorized the WDOE to regulate the treatment, storage, and disposal of hazardous waste and the hazardous constituents of MW and remedial actions at inactive sites and facilities at Hanford. The DOE-RL is pursuing development of a Tri-Party Agreement with the EPA and the WDOE to cover RCRA regulatory actions and Comprehensive Environmental Response, Compensation, and Liability Act/Superfund Amendments and Reauthorization Act (CERCLA/SARA) remedial actions. This agreement will establish the basis for a long-term regulatory compliance strategy.

The NRC has licensing jurisdiction for facilities expressly authorized for disposal of high-level waste (HLW). Coordination is maintained with NRC as appropriate to ensure compliance with applicable regulations.

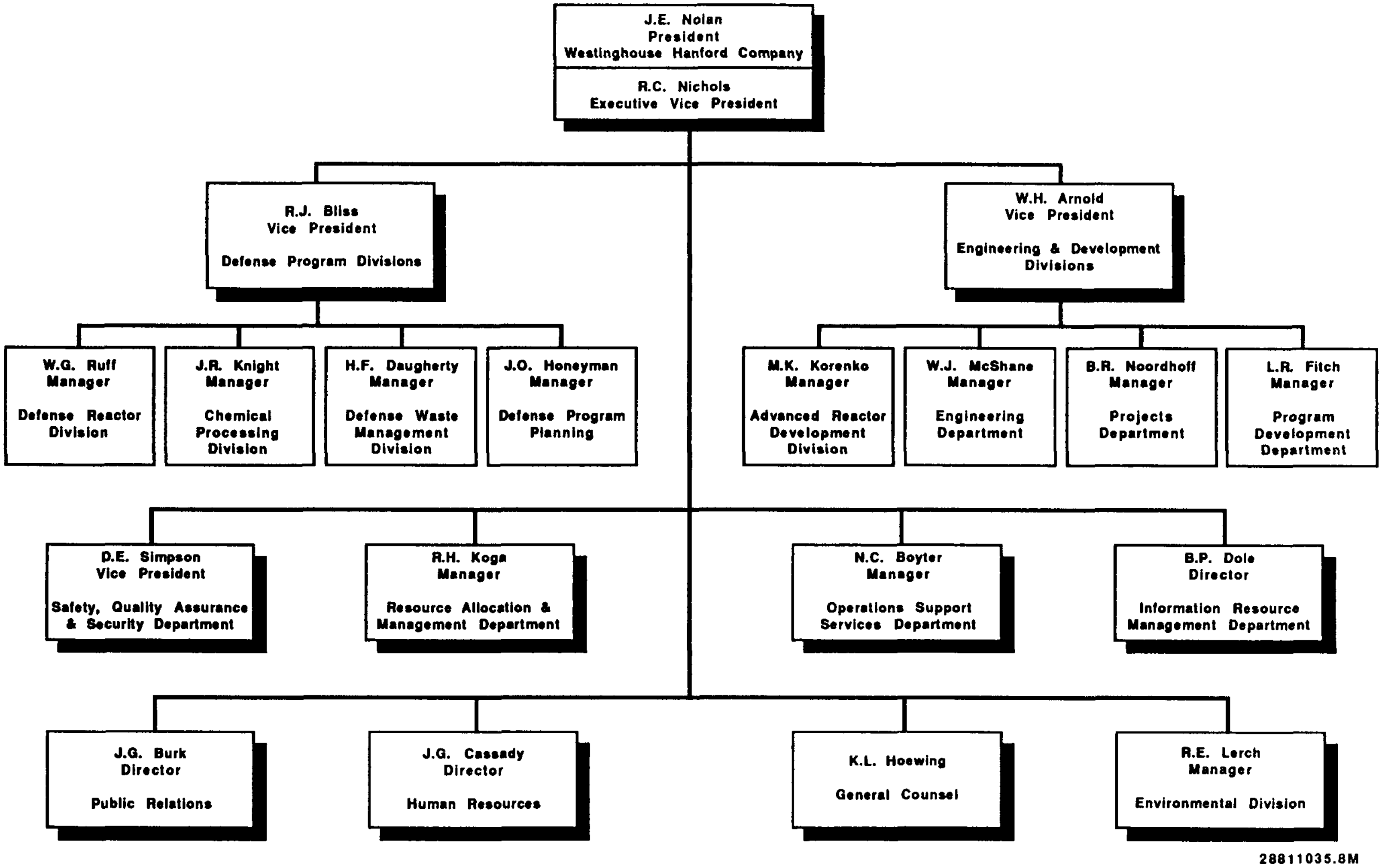


Figure 1-2. Westinghouse Hanford Company Organizational Structure.

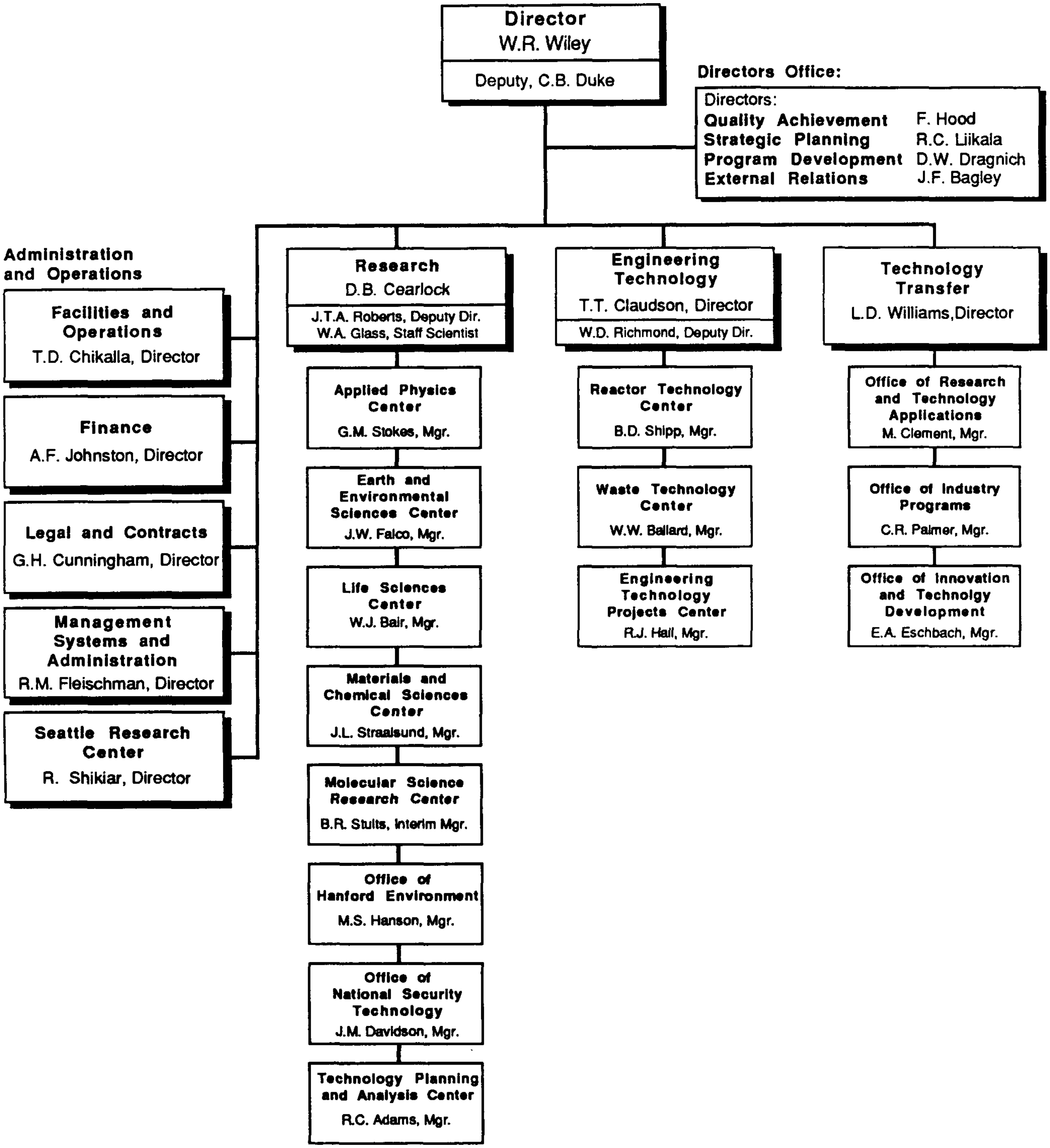


Figure 1-3. Pacific Northwest Laboratory Organizational Structure.

1.2 GUIDING AND SUPPORTING DOCUMENTATION

The Waste Management Document Tree in Figure 1-4 illustrates the major documentation that guides and supports the waste management program at the Hanford Site. The elements in the document hierarchy and their relationships are described in the following paragraphs. The first two sections (1.2.1, Statutes, and 1.2.2, Regulations and DOE Orders) discuss the requirements for the planning and program documents described in the subsequent sections.

1.2.1 Statutes

The Atomic Energy Act of 1954 (PL 83-703) as amended by the Energy Reorganization Act of 1974 authorizes the DOE to conduct nuclear materials production, R&D, and associated activities. The Atomic Energy Act authorizes the agency to regulate its R&D and production activities and to adopt such orders and standards as it may deem necessary to protect health and safety.

The principal environmental statutes with requirements applicable to ongoing operations at the Hanford Site include the Federal Clean Air Act (PL 91-604), the Federal Clean Water Act (PL 92-500), RCRA (PL 94-580) and 1984 amendments, the CERCLA (PL 96-510), the SARA which is a 1986 amendment to CERCLA, the Safe Drinking Water Act (PL 93-523) and State of Washington environmental statutes implementing the Federal statutes.

1.2.2 Regulations and U.S. Department of Energy Orders

The DOE Order 5820.2A establishes policies and guidelines by which DOE manages its radioactive waste, waste byproducts, and radioactively contaminated surplus facilities. The provisions of DOE Order 5820.2A apply to all DOE elements and, as required by law or contract, all DOE contractors and subcontractors performing work that involves management of radioactive waste or radioactively contaminated facilities for DOE under the Atomic Energy Act of 1954 as amended.

The EPA is authorized to promulgate environmental regulations through Chapter 40 of the Code of Federal Regulations (CFR) in compliance with environmental statutes including those cited above. The State of Washington also sets forth standards under the Washington Administrative Codes (WAC) which are at least as stringent as the EPA regulations. Regarding air quality, a third jurisdiction, the Benton-Franklin-Walla Walla Counties Air Pollution Control Authority, sets forth its requirements. Limits set forth by State and local governments are approved or authorized by the EPA. Both DOE Headquarters (DOE-HQ) and Field Offices prepare Orders for internal and contractor compliance including Orders that further interpret and clarify environmental regulations and standards.

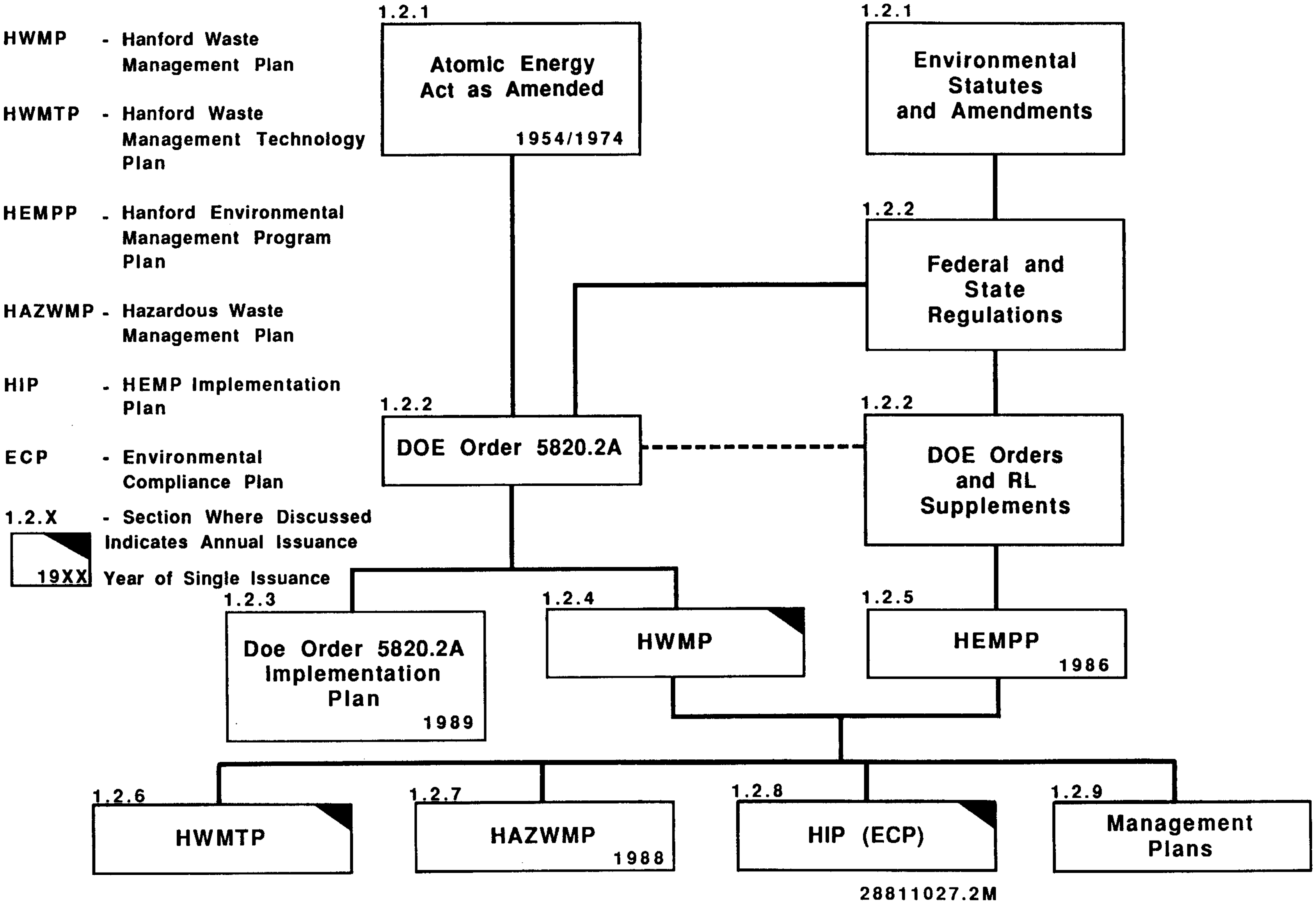


Figure 1-4. Waste Management Planning and Compliance Documentation.

1.2.3 U.S. Department of Energy Order 5820.2A Implementation Plan

The DOE Order 5820.2A Implementation Plan, planned for issuance in April 1989, will provide an assessment of the current status of compliance with the Order. The DOE Order 5820.2A requires that it be issued as a separate document in FY 1989 and that the implementation status be updated in the annual issuance of the Hanford Site Waste Management Plan (HWMP) in future years. The WMD at DOE-RL is responsible for the issuance.

1.2.4 Hanford Waste Management Plan

The DOE Order 5820.2A requires each field organization to prepare an annual update of a waste management plan for all operations under their cognizance according to a prescribed format in Chapter VI of the Order. These plans are to be submitted to the DOE-HQ in December of each year. The WMD DOE-RL is responsible for the preparation and issuance.

1.2.5 Hanford Environmental Management Program Plan

The Hanford Environmental Management Program Plan (HEMPP) (DOE-RL 1986) states the policies, objectives, scope, and processes involved in implementing the environmental management program at the Hanford Site. The DOE-RL ER Division was responsible for preparation and issuance of the HEMPP. As a followup to the HEMPP, the Hanford Environmental Management Program Implementation Plan was prepared and issued (see Section 1.2.8).

1.2.6 Hanford Waste Management Technology Plan

The Hanford Waste Management Technology Plan (HWMTP) (WHC 1988e) describes the technology needed to support the programs described in the HWMP. Technology issues are broken down into tasks for which resources, costs, and scheduling requirements are identified to support logical and orderly technology development. These requirements are summarized in individual sections of the HWMP. The Westinghouse Hanford Defense Waste Management Division is responsible for issuance of the HWMTP. More details regarding this plan are presented in Section 6.0.

1.2.7 Hazardous Waste Management Plan

The Hazardous Waste Management Plan (HAZWMP) (DOE-RL 1988a) provides an integrated plan for the safe transport, treatment, storage, and disposal of current and future hazardous waste generated on, or received by, the Hanford Site. The plan includes nonradioactive hazardous waste and mixed low-level waste (LLW). Future updates of the information in the HAZWMP will be incorporated in other related documents, such as the Environmental Compliance Plan and the RCRA Permitting Plan.

1.2.8 Hanford Environmental Management Program Implementation Plan

The HEMP Implementation Plan (HIP) (WHC 1988d) describes the costs, schedules, and actions needed to implement the policy as outlined in the HEMPP. The HIP has been divided into eight activities:

1. Integrated Environmental Management
2. Gaseous Effluent Management
3. Liquid Effluent Management
4. Solid Waste Management
5. Toxic and Hazardous Material Utilization
6. Inactive Site Management
7. Environmental Monitoring and Reporting
8. Environmental Data Resources.

Future issuances of the HIP will be referred to as the Environmental Compliance Plan. Activity 6, Inactive Site Management, will not be included but it will be reported under the ER Remedial Action Program. The ER Division at DOE-RL is responsible for the issuance of the HIP and forthcoming Environmental Compliance Plan.

1.2.9 Management Plans

Management Plans set forth the plans, organizations, and control systems for management of a defined portion of the overall Waste Management Program. Management Plans are internal documents defining the interfaces between DOE-RL and Westinghouse Hanford and the manner in which business is conducted. Management Plans are being prepared for DST Waste Management (as described in Sections 2.1.2 and 2.3.1) and Solid Waste Management (as described in Sections 2.2.1, 2.2.2, and 2.3.3).

1.3 SITE DESCRIPTION

The approximately 1,500 km^2 (560-mi^2) Hanford Site is a DOE installation occupying a semi-arid region near the Columbia River in south-central Washington State as illustrated in Figure 1-5. In 1943, the U.S. Army Corps of Engineers selected the area to build the Nation's first plutonium production reactors and processing facilities. The Hanford Site has since been dedicated to the production of nuclear materials, waste management, R&D, and related activities.

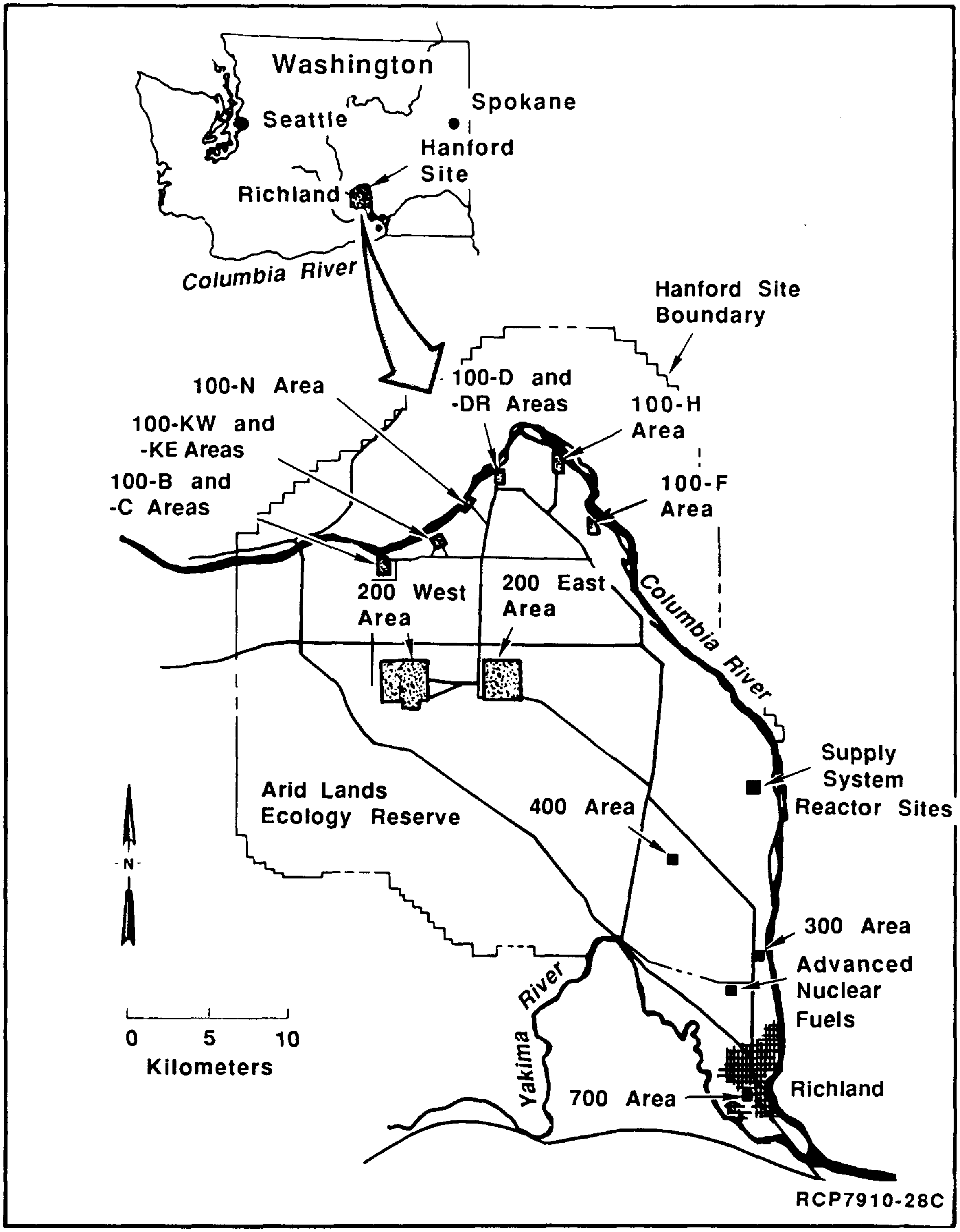


Figure 1-5. Location of the Hanford Site.

The 200 Areas plateau ranges in elevation from 190 to 245 m (620 to 800 ft) from mean sea level. Normal Columbia River elevations range from 120 m (390 ft), where the River enters the Site near the Priest Rapids Dam, to 105 m (340 ft) where it leaves the Site near the 300 Area. The 200 Areas are 3.5 km (22 mi) from the nearest residential community of Richland, at least 55 m (180 ft) above the water table, and at least 8 km (5 mi) from the Columbia River.

The average annual rainfall at Hanford is 16 cm/yr (6.3 in/yr). The terrain of the central and eastern part of the Site is relatively flat. The sediments in the central part of the Site, including the 200 Area plateau, have undergone minimal erosion since formation by flood waters about 13,000 yr ago. The unconfined aquifer, contained within the sediments, underlies the waste sites by 55 to 100 m (180 to 330 ft) in the 200 Areas. Because of the aridity, the productivity of both plants and animals is relatively low. The dominant plants on the 200 Area plateau are sagebrush, rabbitbrush, cheatgrass, and bluegrass. With the exception of occasional high winds, there are no unusual or severe meteorological conditions that would hinder waste treatment, storage, and disposal operations. Chapter 4.0 of the Final Environmental Impact Statement: Disposal of Hanford Defense High-Level, Transuranic, and Tank Wastes (HDW-EIS) provides a general description of the Hanford Site and surrounding areas (DOE 1987).

All the facilities associated with regulated waste that are part of the Waste Management Program at the Hanford Site are located in or near the 200 West and 200 East Areas. The 100 Areas contain the production reactors, eight of which are surplus facilities consigned to decontamination and decommissioning (D&D) and one of which is N Reactor, currently in a standby mode. The 300 Area contains research facilities. The Fast Flux Test Facility (FFTF) is a DOE research reactor located in the 400 Area.

A portion of the Hanford Site is leased to the Washington Public Power Supply System (Supply System). The Supply System facilities include one operating reactor and a second partially completed reactor. Additionally, a portion of the 200 Areas plateau has been leased to Washington State for use as a disposal site for commercial low-level waste (LLW).

The 200 West Area, shown in Figure 1-6, and the 200 East Area, shown in Figure 1-7, contain nearly all the facilities that are described in Sections 2.0 and 3.0. Two facilities are not shown: the 616 Nonradioactive Dangerous Waste Storage Facility located midway between 200 West and 200 East and the Nonradioactive Dangerous Waste Landfill located about 7 km (4 mi) southeast of the 200 East Area. Both are discussed in Section 3.0. Figures 1-6 and 1-7 do not show all of the facilities in the 200 East and 200 West Areas.

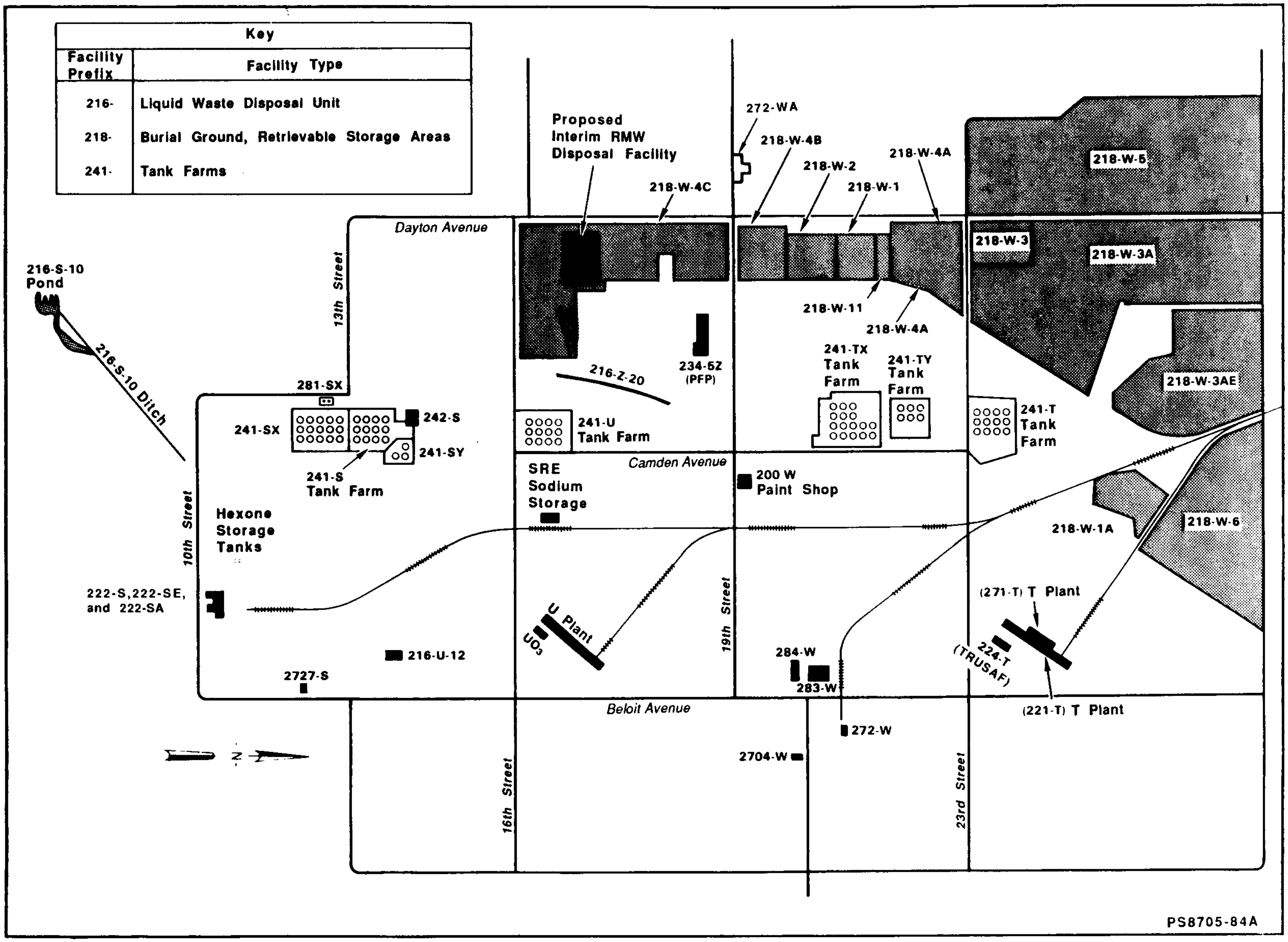


Figure 1-6. The 200 West Area at the Hanford Site.

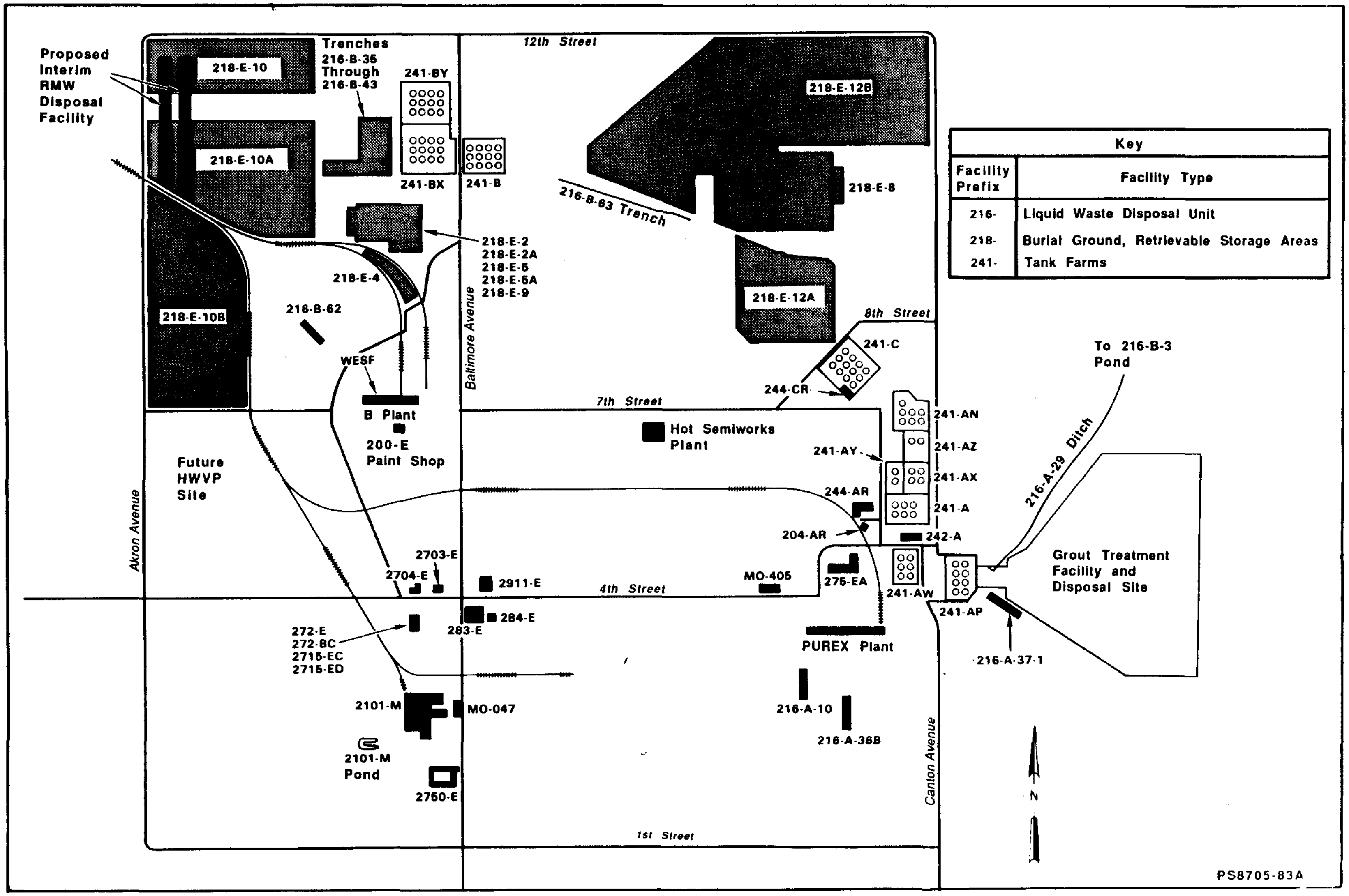


Figure 1-7. The 200 East Area at the Hanford Site.

This page intentionally left blank.

2.0 RADIOACTIVE AND MIXED WASTE

Radioactive and mixed wastes at Hanford are managed as HLW, transuranic (TRU) waste, or LLW in compliance with the requirements for these categories in DOE Order 5820.2A. Due to chemical processing operations, a significant portion of these wastes contain designated hazardous constituents and are, therefore, considered MW. Figure 2-1 illustrates an overview of the storage, treatment, and disposal of regulated waste at the Hanford Site. The category of tank wastes as addressed here and in the HDW-EIS refers to those wastes in double-shell tanks (DST) and single-shell tanks (SST) in which HLW, TRU waste, and LLW are stored. Nevertheless, all tank wastes are managed as HLW. Treatment methods are being developed and evaluated to partition these wastes as necessary into streams acceptable for near-surface disposal and other streams for which geologic disposal will be necessary.

2.1 HIGH-LEVEL WASTE AND OTHER WASTE MANAGED AS HIGH-LEVEL WASTE

Hanford HLW and other wastes managed for convenience in the same manner as HLW include the following:

- Encapsulated cesium and strontium (Section 2.1.1)
- DST waste (Section 2.1.2)
- SST waste (Section 2.1.3).

The encapsulated fission products of cesium and strontium are available as byproducts for beneficial uses. When the uses for the capsules are expended in approximately 20 yr, they will be treated as necessary to produce a waste form acceptable for geologic disposal.

There are six basic types of DST wastes stored in segregated tanks: neutralized current acid waste (NCAW), neutralized cladding removal waste (NCRW), complexant concentrate (CC), Plutonium Finishing Plant (PFP) waste, double-shell slurry (DSS), and phosphate-sulfate waste (PSW). The PSW is LLW and is being immobilized in grout and disposed of in near-surface vaults. The DSS (including a slightly dilute form of DSS called double-shell slurry feed or DSSF) is considered to be LLW and will also be immobilized in grout and disposed of in near-surface vaults once it is verified that it is LLW. In this document, DSS includes DSSF. Pretreatment processes are being developed and evaluated for the other four waste types. One product from pretreatment is a HLW (or TRU waste) fraction that will be further treated to a waste form acceptable for geologic disposal. The other product from pretreatment is a LLW fraction which will be further treated to a waste form acceptable for near-surface disposal. Section 2.3.1 presents a discussion of the treatment, storage, and disposal of the LLW fraction, PSW, DSS and supernatants from NCRW and PFP waste.

The SST waste is being managed in the same manner as HLW pending further characterization of the waste. The characterization will be accomplished over a period of approximately 15 yr. As currently defined, the Waste Management Program is only concerned with the interim operations, that is the storage, surveillance, stabilization and isolation of the SST waste and the routine maintenance of the SST farm system. Any actions associated with the characterization, treatment, storage after treatment, and disposal of SST waste are funded by the ER Program and are not within the scope of this document.

Geologic disposal or the geologic repository refer to the disposal facility resulting from compliance with the Nuclear Waste Policy Act (PL 97-425) as amended. The DOE DP will fulfill fee requirements as specified in the Act in order to dispose of defense waste with civilian waste in the selected repository.

2.1.1 Encapsulated Waste

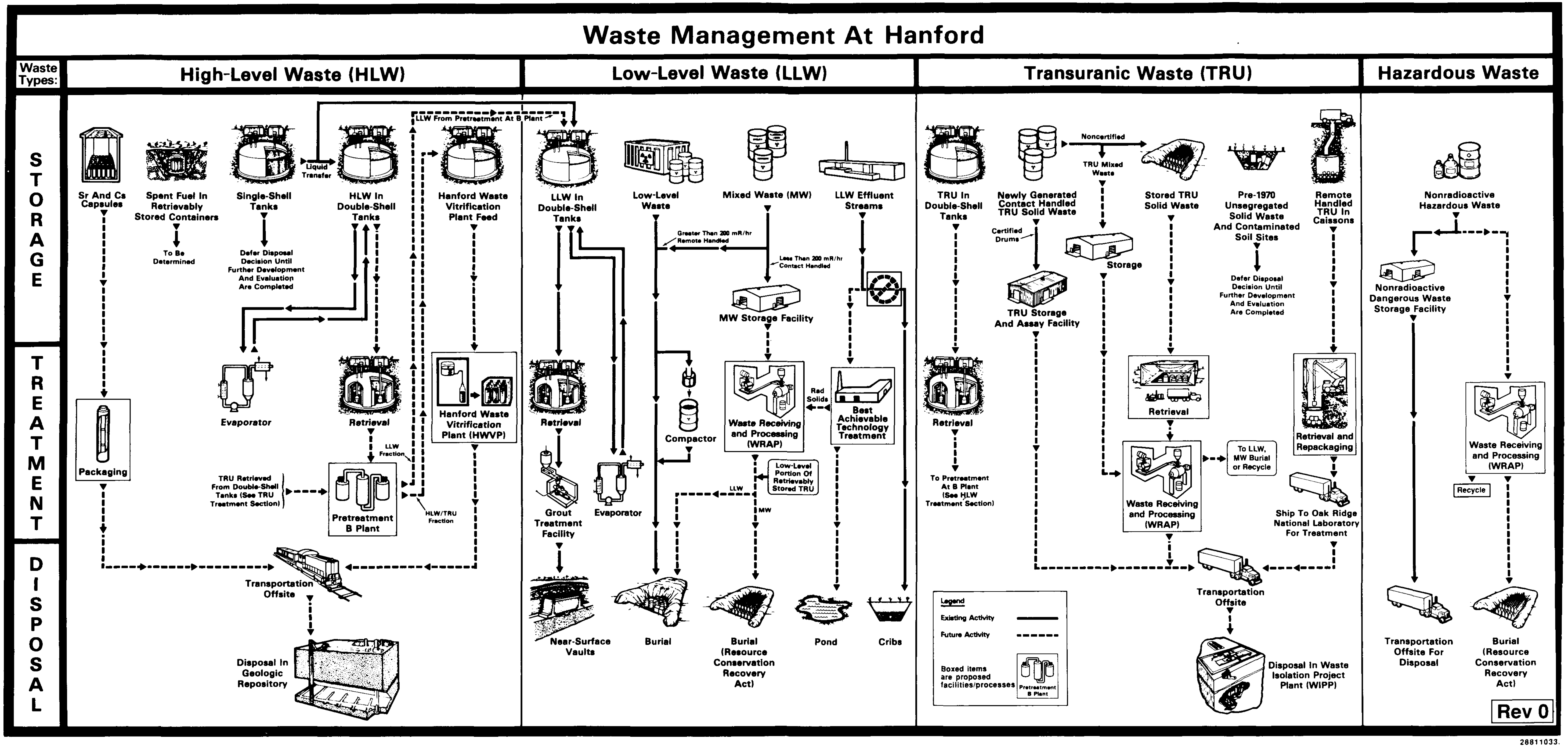
2.1.1.1 System and Facility Description.

2.1.1.1.1 Overview of Treatment, Storage, and Disposal System. Due to the decay heat associated with ^{137}Cs and ^{90}Sr from reprocessing irradiated fuel, the liquid wastes were prevented from cooling; thus, it was not practical to concentrate and solidify the wastes to conserve in-tank storage. In order to minimize the construction of new storage tanks, use of a fractionization process in B Plant recovered ^{137}Cs from the liquid portion of the aging wastes. The Plutonium-Uranium Extraction (PUREX) Plant sludge, containing the bulk of the ^{90}Sr, was removed from tanks by hydraulic mining (also referred to as sluicing), dissolved in acid, and fed to a solvent extraction process where the ^{90}Sr was separated.

Solutions of the recovered ^{137}Cs and ^{90}Sr were purified and sent to the Waste Encapsulation and Solidification Facility (WESF). The remaining low-heat wastes from fractionization were neutralized and transferred to the tank storage system for subsequent concentration and solidification. In the WESF, the separated ^{137}Cs and ^{90}Sr were solidified, sealed in double-walled metal capsules and stored under water in stainless-steel lined pools. The encapsulation process was completed in 1985. There were 1,576 cesium capsules and 640 strontium capsules produced. Inventory data for the encapsulated waste are contained in Table 2-1. No further fractionization or encapsulation activities are planned.

2.1.1.1.2 Waste Characteristics. The capsules are designed as shown in Figure 2-2. The cesium is in the form of cesium chloride, a crystalline salt with a melting point of 646 ^{0}C. The strontium is in the form of strontium fluoride, a crystalline salt with a melting point of 1400 ^{0}C. The radioactivity as of December 1987 (DOE 1988a) is 142 MCi for the cesium capsules (^{137}Cs-^{137m}Ba) and 62 MCi for the strontium capsules (^{90}Sr-^{90}Y).

2.1.1.1.3 Facility Description. Capsules that are not currently on lease or otherwise used are stored in WESF, identified as Building 225-B in Figure 2-3. The facility layout is shown in Figure 2-4 and the capsules are stored in a series of water-filled pools shown on the right side of the

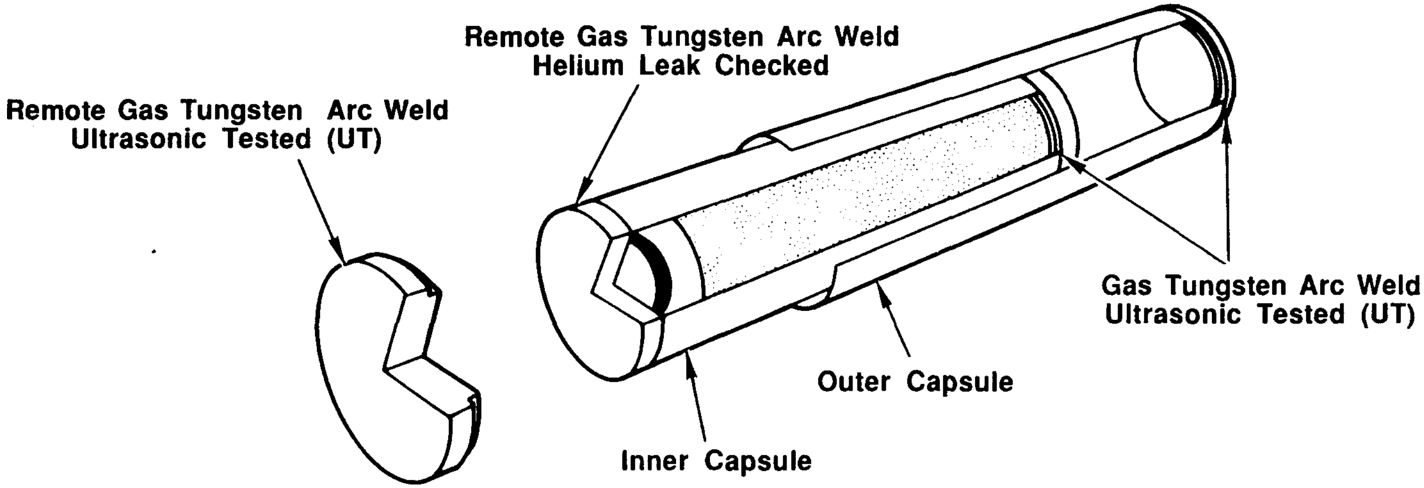


Note:

1. The spent fuel in retrievably stored containers, shown in HLW storage, is stored in waste trenches and addressed in Section 2.2.1.
2. All radioactive waste, mixed or separate, will be required to meet Waste Acceptance Criteria before disposal in a disposal facility.
3. The BAT Treatment, shown in LLW Treatment, will lead to a Treated Effluent Disposal Facility (see Section 2.3.2). Future disposal, shown as a pond, is yet to be determined.
4. The HLW is assumed to be MW unless demonstrated to the contrary.

Figure 2-1. Overview of Treatment, Storage, and Disposal of Hanford Site Waste.

	Form	Loading	Percent of Theoretical Density Based on Total Void Space of Capsule	Temperature			
				Air		Water	
				Center Line	Surface	Center Line	Surface
Strontium Fluoride	Compacted Powder	150 kCi (Max)	68	860 °C	430 °C	660 °C	71°C
Cesium Chloride	Melt-Cast	70 kCi	65	450 °C	200 °C	327 °C	58°C



	Capsule									
	Inner					Outer				
	Material	Wall Thickness	Outside Diameter	Total Length	Total Cap Thickness	Material	Wall Thickness	Outside Diameter	Total Length	Total Cap Thickness
Strontium Fluoride	Hastelloy C-276 (UT)	0.305 (UT)	5.72	48.39	1.02	Stainless Steel 316-L (UT)	0.277 (UT)	6.67	51.05	1.02
Cesium Chloride	Stainless Steel 316-L (UT)	0.241 (UT)	5.72	50.10	1.02	Stainless Steel 316-L (UT)	0.277 (UT)	6.67	52.77	1.02
Note: All Dimensions are in cm										

RCP7911-15

Figure 2-2. Capsule Design Information for Encapsulated Waste.

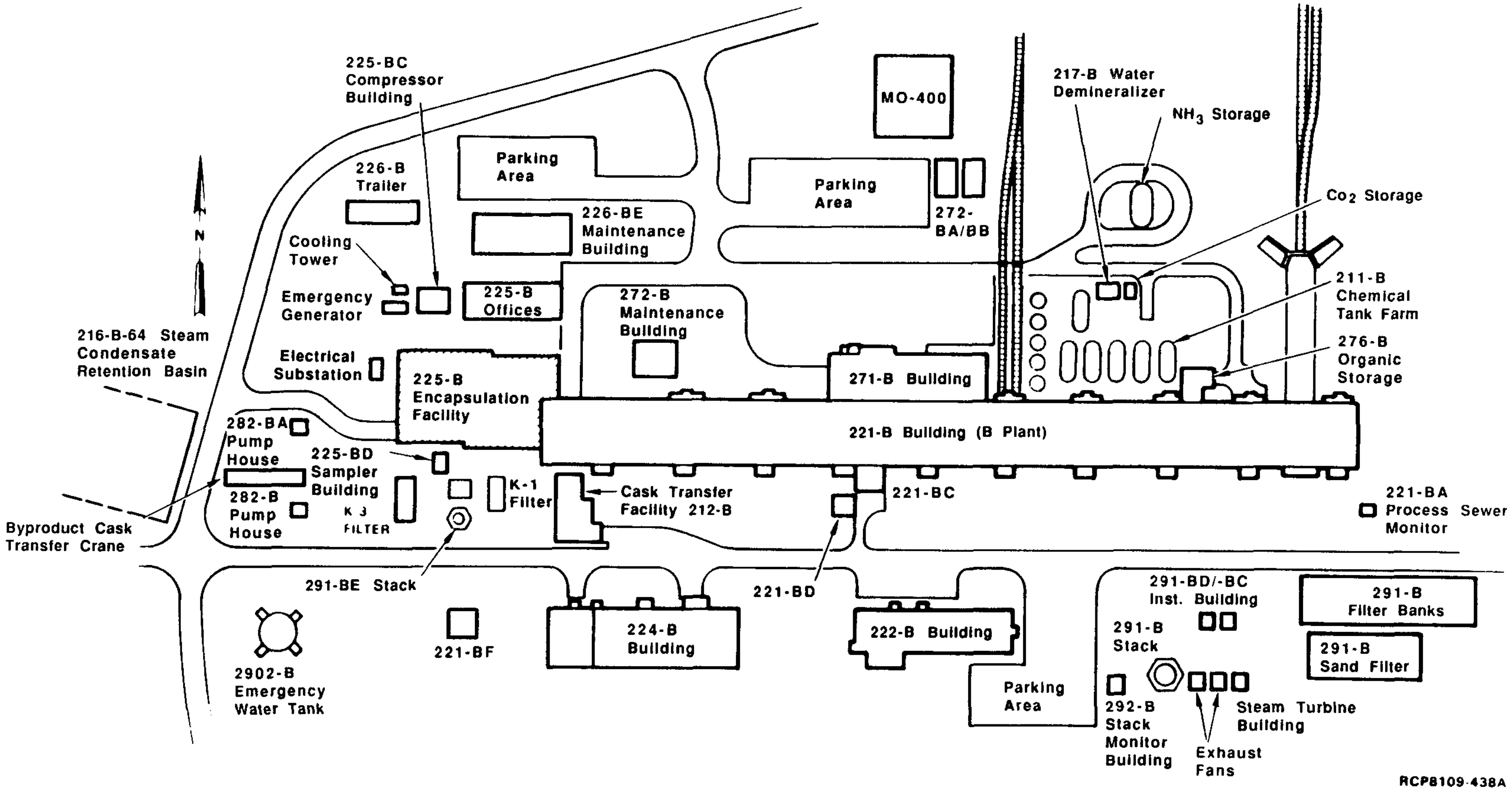


Figure 2-3. Location of Waste Encapsulation and Solidification Facility.

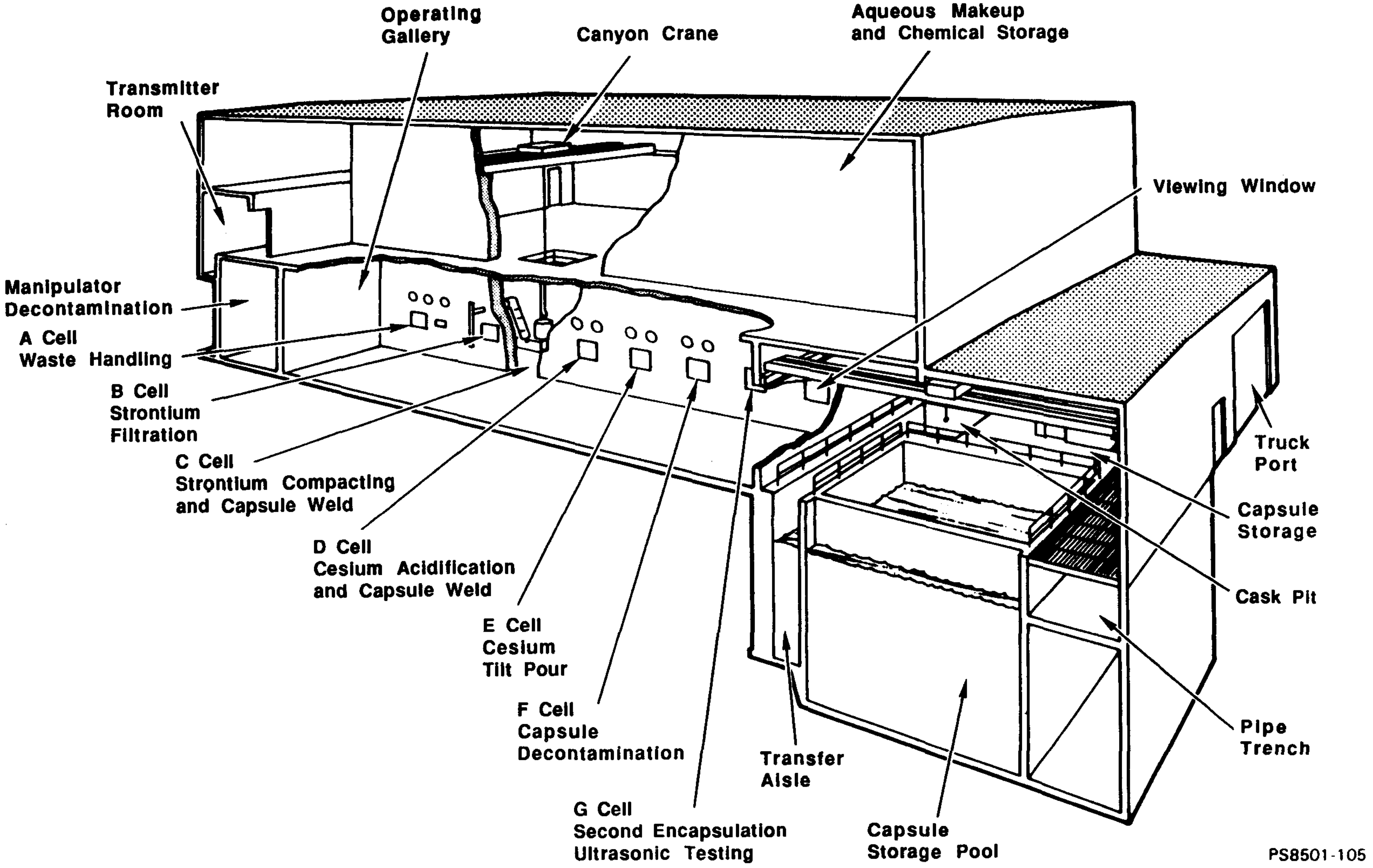


Figure 2-4. Waste Encapsulation and Solidification Facility Layout.

Table 2-1. Encapsulated Cesium and Strontium Inventory Data.

Activity	Cesium	Strontium	Total
Manufactured	1,576	640	2,216
Leased for commercial uses	-766	-0	-766
Noncommercial uses	-267[a]	-43[b]	-310
WESF inventory (10/1/88)	543	597	1,140
Expected for eventual disposal	1,341	597	1,938

[a] Of this total, 32 capsules will be returned. The remaining 235 capsules have been cut open and the cesium chloride was removed and will not be returned.

[b] No strontium capsules will be returned; 39 capsules have been opened and the strontium fluoride removed and 4 capsules are implanted in a Greater Confinement Disposal Demonstration at the Nevada Test Site.

sketch. Storage of the capsules is a continuing activity that requires cooling water, makeup water, ventilation and facility maintenance.

It has been determined that the WESF does not require a hazardous waste permit for the storage of the capsules as the encapsulated cesium and strontium is byproduct and not subject to RCRA regulations.

2.1.1.2 Current and Future Plans. Current plans are to supply the capsules for beneficial uses and store the remaining inventory in the WESF. Those capsules that will be returned will provide beneficial uses for 15 to 20 yr. The remaining capsule inventory can be safely stored in the WESF pools during this time. Alternatives for disposal of the encapsulated waste were considered in the HDW-EIS. The Record of Decision (ROD) states that the DOE has decided to dispose of the capsules in a geologic repository.

Regarding cesium capsules, a major problem occurred in FY 1988 and is being resolved. On June 6, Radiation Sterilizers, Inc. (RSI), in Decatur, Georgia, detected increased levels of radiation above the irradiator pool that stores leased cesium capsules from the Hanford Site. Capsules have been leased to RSI for commercial applications. A special team of technical personnel, including safety and quality assurance representatives, was assembled to provide support to a capsule recovery effort. A plan was developed and inspection of the capsules and pools at the two RSI irradiator facilities at Decatur and Westerville, Ohio, was completed. In addition three suspect capsules were shipped from the Decatur facility to the Oak Ridge National Laboratory (ORNL) for evaluation and testing. A work plan has been developed. All RSI leased capsules will be returned to the Hanford Site in FY 1989.

Future plans for the disposal of encapsulated waste are shown in Figure 2-5 and include the following:

- Continued storage of capsules in the WESF pools and routine maintenance and upgrades to WESF as required

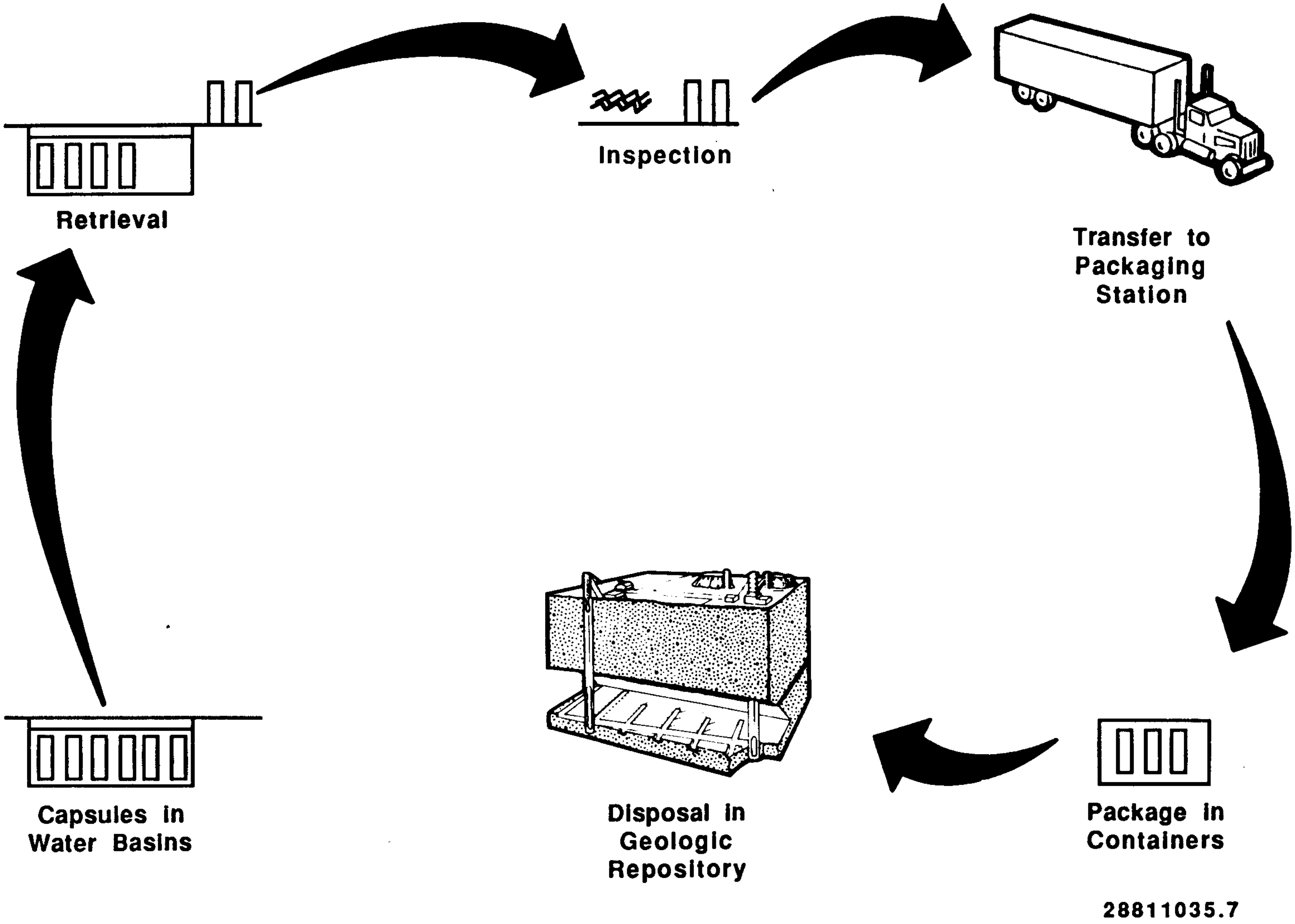


Figure 2-5. Plan for Disposal of Encapsulated Wastes.

- Acceptance of capsules at the conclusion of the lease period
- Modification of WESF to support dry packaging activities (or construction of a capsule packaging facility)
- Removal of the capsules from the pools, inspection, and packaging into canisters
- If necessary, treatment to an acceptable waste form and shipment to a geologic repository for final disposal. Transportation to a geologic repository and the impacts associated with transportation are discussed in the HDW-EIS (DOE 1987).

Technology issues include the following:

- Disposal criteria and standards
- Integrity of capsule container system
- Compliance with repository requirements.

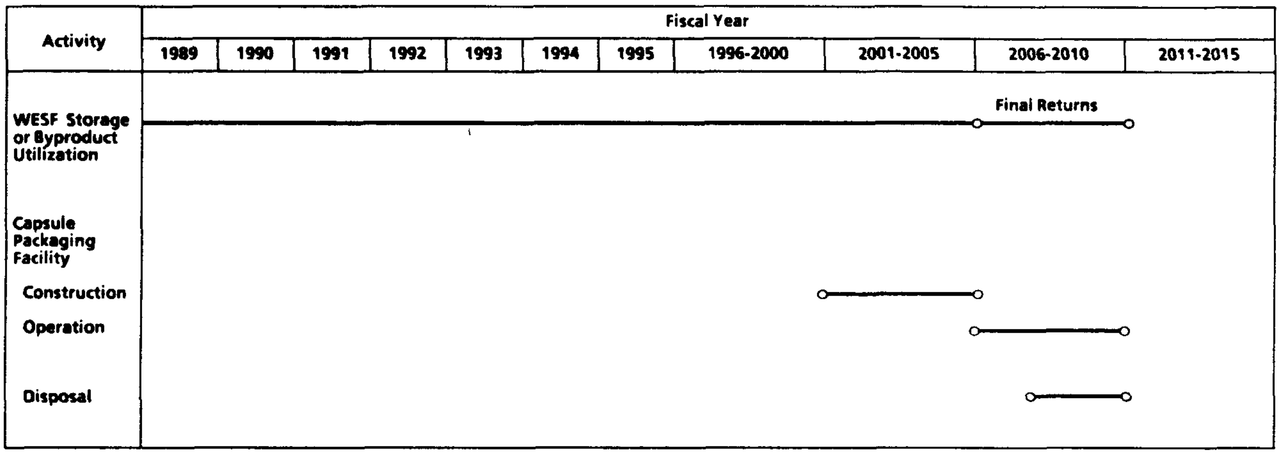
These technology issues are discussed in detail in the Hanford Waste Management Technology Plan (WHC 1988e). The schedule for encapsulated cesium and strontium management and disposal is shown in Figure 2-6. The projected costs are shown in Table 2-2.

2.1.2 Double-Shell Tank Waste, High-Level Waste (or Transuranic Waste) Fraction

2.1.2.1 System and Facility Description.

2.1.2.1.1 Overview of Treatment, Storage, and Disposal System. A flowchart for DST waste treatment, storage, and disposal is shown in Figure 2-7. Four streams are planned for pretreatment at B Plant. These streams include the NCAW from the PUREX Plant process, NCRW from the head-end of the PUREX Plant process, CC resulting mostly from fractionization processes at B Plant, and PFP waste from plutonium reclamation and processing at the PFP. The potential B Plant processes include solid-liquid separation and sludge washing, ion exchange, TRU extraction (TRUEX), cesium removal, selective leaching and organic destruction.

The B Plant processing will result in a HLW (or TRU waste) fraction of relatively low volume for feed to the HWVP and a LLW fraction of relatively large volume for feed to the GTF. The fraction for HWVP will be further treated by combining it with glass-forming materials, thereby immobilizing the waste in a glass matrix, and packaging the glass in special canistered containers for disposal in a geologic repository. The LLW fraction will be further treated in the GTF and disposed of in near-surface grout vaults.



PS89 3071 2 6

Figure 2-6. Schedule for Encapsulated Cesium and Strontium Management and Disposal.

Table 2-2. Projected Costs for Encapsulated Cesium and Strontium Management and Disposal.

Activity	Fiscal year												
	1988	1989	1990	1991	1992	1993	1994	1995	1996-2000	2001-2005	2006-2010	2011-2015	Total
Storage and Surveillance	2.9	3.3	3.8	5.0	5.2	5.2	5.0	5.0	25.2	25.2	13.0	0.0	99.0
Technology and Operations	0.2	0.0	0.0	0.0	0.0	0.0	0.0	9.6	48.1	48.9	114.2	0.0	220.9
CENRTC and Construction	3.0	0.3	0.3	0.7	0.5	0.4	0.4	0.4	1.9	15.9	2.0	0.0	25.7
Total	6.1	3.7	4.1	5.8	5.8	5.6	5.5	15.0	75.2	89.9	129.2	0.0	345.7

NOTE: All expense and CENRTC costs (millions of dollars) escalated through FY 1990. Construction costs escalated to midpoint of construction.

PST89-3071-2-2

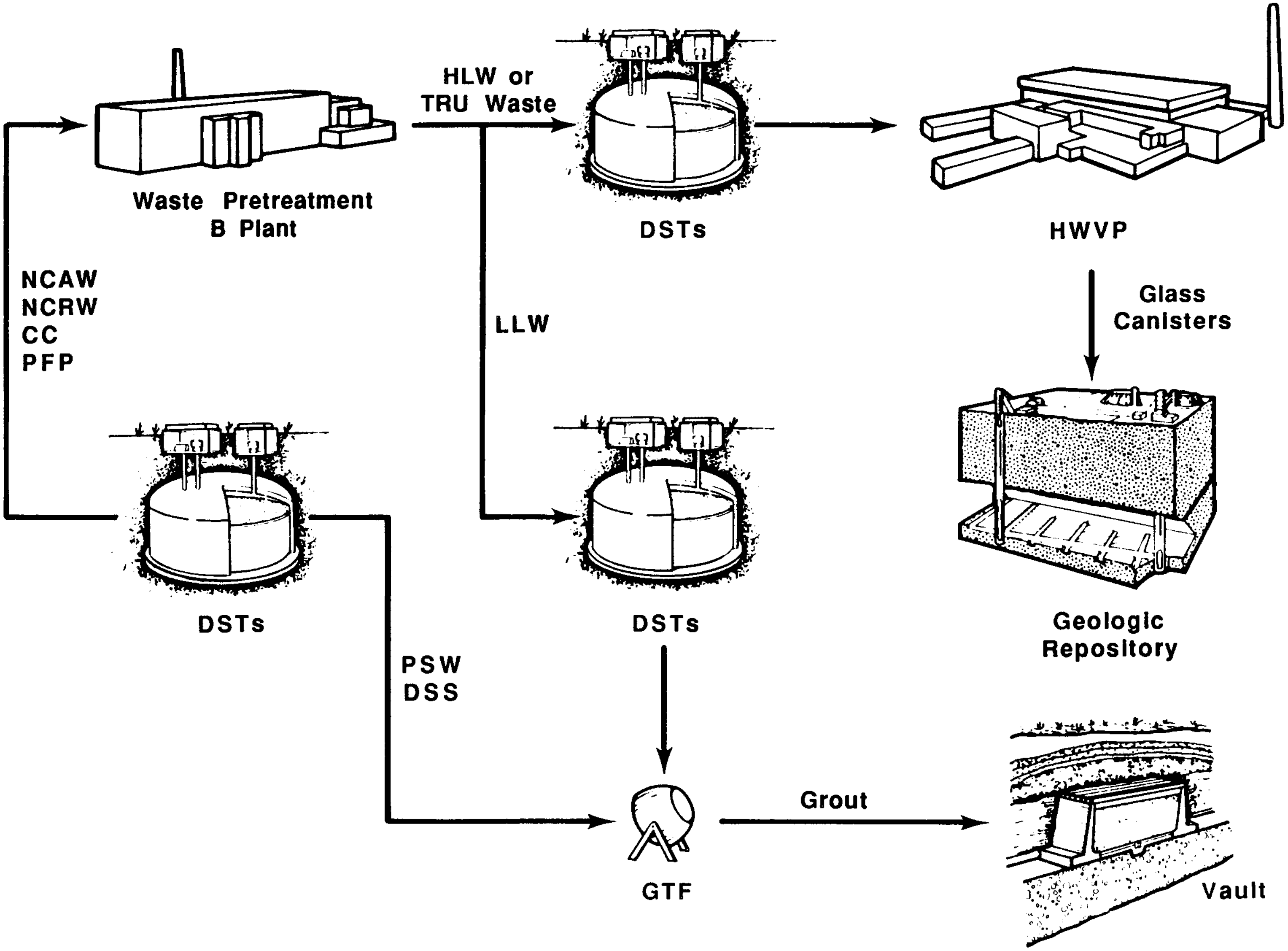


Figure 2-7. Double-Shell Tank Waste Treatment, Storage, and Disposal Flowchart.

2.1.2.1.2 Waste Characteristics. The NCAW is a two-phase waste consisting of solids and supernatant liquids. The solid phase (sludge of insoluble material) consists mostly of hydroxides or hydrated oxides. The supernatant consists of an aqueous solution of sodium nitrate, sodium nitrite, sodium sulfate, sodium hydroxide, and sodium aluminate. The sludge contains some of the fission products and virtually all of TRU elements. The supernatant liquid contains most of the cesium and technetium and some of the iodine and ruthenium fission products. The bulk of the radionuclides are in the solid phase.

The NCRW is also a two-phase waste resulting from the chemical dissolution of the zirconium alloy used to clad the uranium fuel elements. The chemicals also attack a small portion of the uranium causing some radioactive contamination of the NCRW. The solid phase consists mostly of a hydrated oxide precipitate of the zirconium and also contains the bulk of the actinides and fission products. The supernatant liquid is a dilute aqueous solution of nitrates and hydroxides. The pre-1991 NCRW will require pretreatment. After 1991, the PUREX Plant is expected to remove TRU to yield a LLW stream.

The CC contains a number of organic compounds that were used by the chemical processing facilities. Due to the thermal and radiolytic history of the waste, it is likely that a significant fraction of the organic materials has volatilized, decomposed, or polymerized. Most of the organic compounds found in the CC waste were introduced as chelating agents during strontium recovery processing at B Plant and now consist of degradation products of the chelating agents. As these solutions containing chelating agents were intermixed with other waste, complexes were formed between the chelates and actinides.

Wastes from the PFP originate from several sources: a solvent extraction process used to reclaim and purify plutonium, ion exchange processes, plutonium nitrate to plutonium metal conversion, and laboratory activities. The waste is in the form of a settled sludge consisting mostly of sodium nitrate and sodium hydroxide with lesser amounts of iron, calcium, magnesium, and aluminum hydroxides. A variety of other chemical species are present at dilute concentrations. The settled sludge contains the bulk of the TRU contaminants.

The PSW is a nonhazardous stream containing sodium phosphate, sodium sulfate, and low levels of radioactive contamination. The DSS is the concentrated product from an evaporation process. The feed for the evaporation process comes from several LLW sources, the supernatant from NCAW after ^{137}Cs removal, the supernatant from NCRW and PFP waste, 'and liquids from SSTs. These streams are discussed in Section 2.3.1.

The DSTs contain 73,400 m^3 of waste with an activity of 116 MCi as of December 1987 (DOE 1988a).

2.1.2.1.3 Facility Descriptions. A cutaway sketch of a DST is shown in Figure 2-8. Twenty-eight tanks are in service with the following capacities:

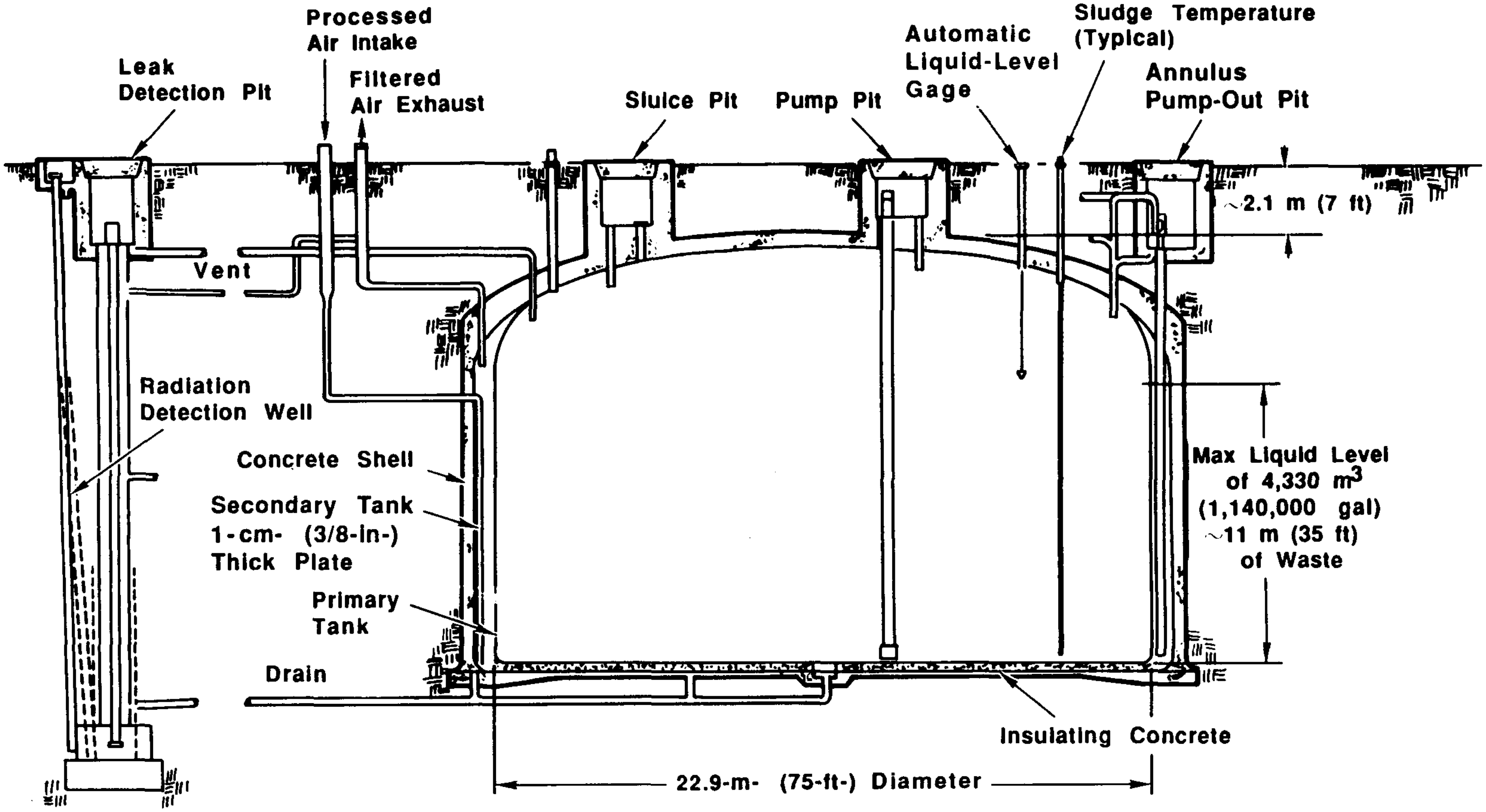
Tank farm	Number of tanks	Capacity (m³)	
		Each tank	Total
241-AN	7	4,300	30,100
241-AP	8	4,300	34,400
241-AW	6	4,300	25,800
241-AY	2	3,800	7,600
241-AZ	2	3,800	7,600
241-SY	3	4,300	12,900
Total	28	—	118,400

PST89-3071

Surveillance and monitoring of DSTs is required to provide identification of failure of containment or excessive thermal conditions. Monitoring and leak detection systems are incorporated in the engineered system to serve this purpose. Liquid-level monitoring is used as the primary means of leak detection. Radiation detectors and leak detection pits are provided as part of the annulus monitoring in the event of leakage to this backup containment system. Area radiation monitors are located within the tank farms to provide indication of a gross loss of confinement which would represent an immediate radiation hazard to personnel. All DSTs are exhausted through high-efficiency particulate air (HEPA) filters and these exhaust streams are continuously monitored. Sludge temperatures are taken to detect unfavorable temperatures.

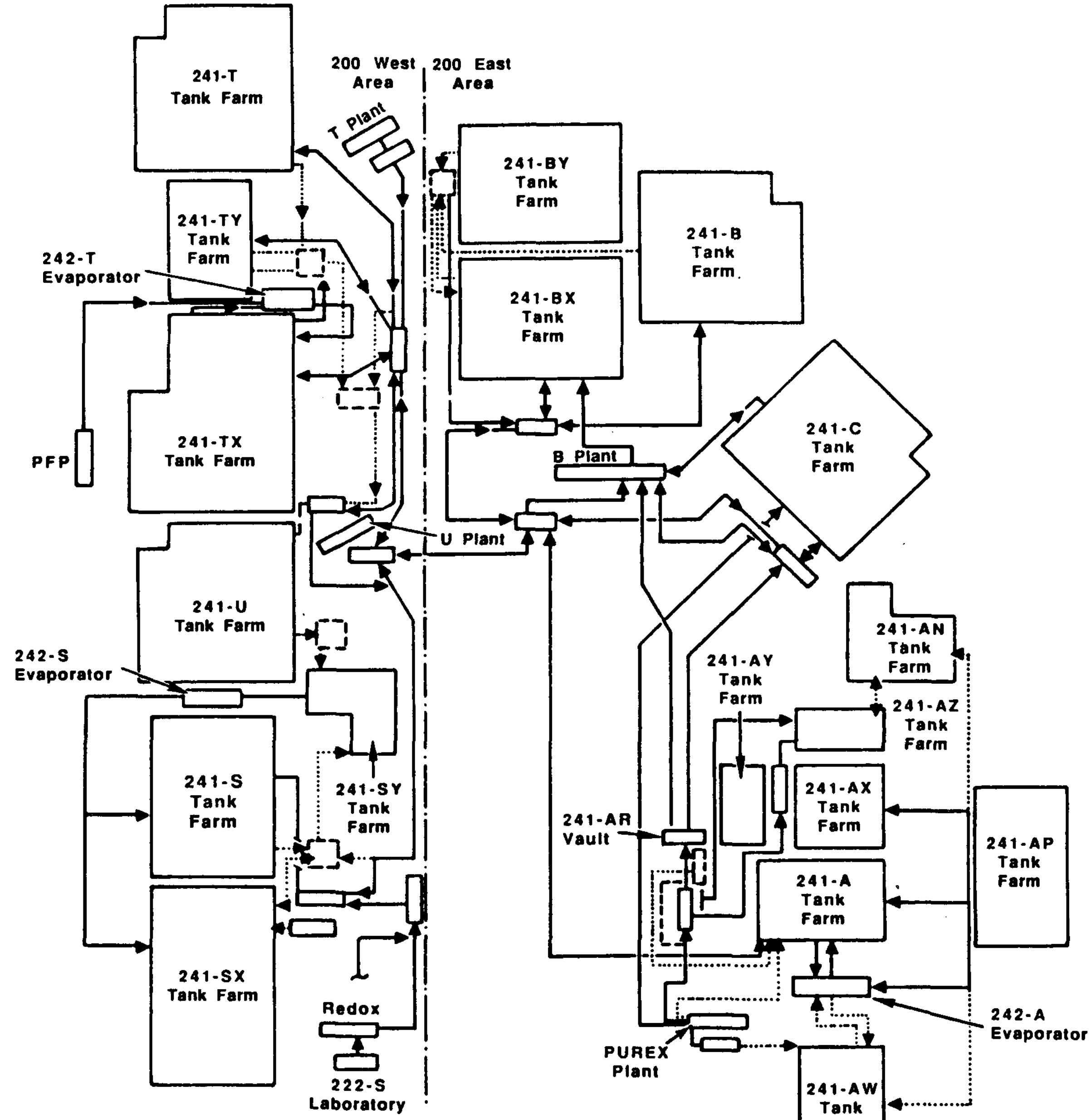
A schematic representation of the tank farm facilities is illustrated in Figure 2-9. The NCAW storage facilities consist of four aging waste tanks: two in the 241-AY Tank Farm and two in the 241-AZ Tank Farm. The PFP waste is stored in one of three nonaging waste tanks in the 241-SY Tank Farm in 200 West Area. The remaining 21 tanks are nonaging waste tanks located in 200 East Area in the 241-AN, 241-AP, and 241-AW Tank Farms. Both the CC and NCRW wastes are stored in six select tanks within these tank farms. The remaining DSTs either store DSS, are used for staging material transfers, or are designated as spares. The remaining tank farms identified in Figure 2-9 contain SSTs which are discussed in Section 2.1.3.

The NCAW is stored in aging waste tanks equipped with air-lift circulators to control boiling of the waste until heat from radiolytic decay declines. Circulators are necessary to prevent pressure surges and to minimize entrainment of radionuclides in the offgas caused by uneven boiling. Circulators also serve to prevent overheating of tanks from sludge hot spots. The nonaging waste tanks are not equipped with circulators.



RCP7911-16A

Figure 2-8. Cutaway View of a Double-Shell Tank.



Note: **Not to scale. The 200 Areas are about 10 km apart**

Figure 2-9. Schematic of Hanford Tank Farm Facilities.

The pretreatment of NCAW, NCRW, CC, and PFP waste will be undertaken in the canyon facility located at B Plant, shown as Building 221-B in Figure 2-3. A typical cross-section of the 221-B canyon structure and the adjoining 271-B service building is shown in Figure 2-10. The HLW (and TRU waste) fraction from pretreatment will be further treated in the HWVP by immobilizing the waste in a glass matrix and packaging the glass in special canistered containers. Current plans are to locate the HWVP close to the B Plant complex as illustrated in Figure 1-7. The reference conceptual facility design configuration is shown in Figure 2-11. The process flowsheet for the HWVP is shown in Figure 2-12. The LLW fraction from pretreatment will be further treated in the GTF located in 200 East Area (see Section 2.3.1).

The process flowsheet for NCAW pretreatment is illustrated in Figure 2-13. The waste is pump transferred to B Plant through underground transfer lines. To reduce the volume of material that will be disposed of as glass, the TRU- and strontium-bearing sludge will be separated from the bulk of the NCAW by solid-liquid separation and sludge washing steps. The TRU-free supernatant liquids will be stripped of cesium before disposal in grout. The cesium concentrate will be combined with the sludge and eventually immobilized as glass. Cesium removal is considered necessary in part to ensure a LLW fraction in which the amount of heat that can be dissipated from the grout monolith is controlled.

The process flowsheet for NCRW waste pretreatment is illustrated in Figure 2-14. Once the supernatant is removed for evaporation to DSS, hydraulic sluicing will be required to suspend the sludge for pump transfer to B Plant. The solids from the solid-liquid separation are acidified to dissolve the solids. This acidified stream is then fed to the TRUEX process to separate the bulk of the TRU elements from the waste. The TRU concentrate and undissolved solids are immobilized in glass and the supernatant is neutralized and immobilized in grout.

The process flowsheet for CC waste pretreatment is illustrated in Figure 2-15. Hydraulic sluicing will be required to suspend the waste for pump transfer to B Plant. The waste will be acidified and treated by solid-liquid separation to produce supernatant and solid phases. The supernatant phase is then fed to the TRUEX process to separate the bulk of the TRU elements from the waste. The TRU concentrate and CC solids are immobilized in glass and the supernatant is neutralized and immobilized in grout. Also, optional processes that will decompose or destroy the complexants are being evaluated.

The process flowsheet for PFP waste pretreatment is illustrated in Figure 2-16. Once the supernatant is removed for evaporation to DSS, hydraulic sluicing will be required to suspend the sludge for pump transfer. The solids from the solid-liquid separation are acidified to dissolve the solids. This acidified stream is then fed to the TRUEX process to separate the bulk of the TRU elements from the waste. The TRU concentrate and undissolved solids are immobilized in glass and the supernatant is neutralized and immobilized in grout.

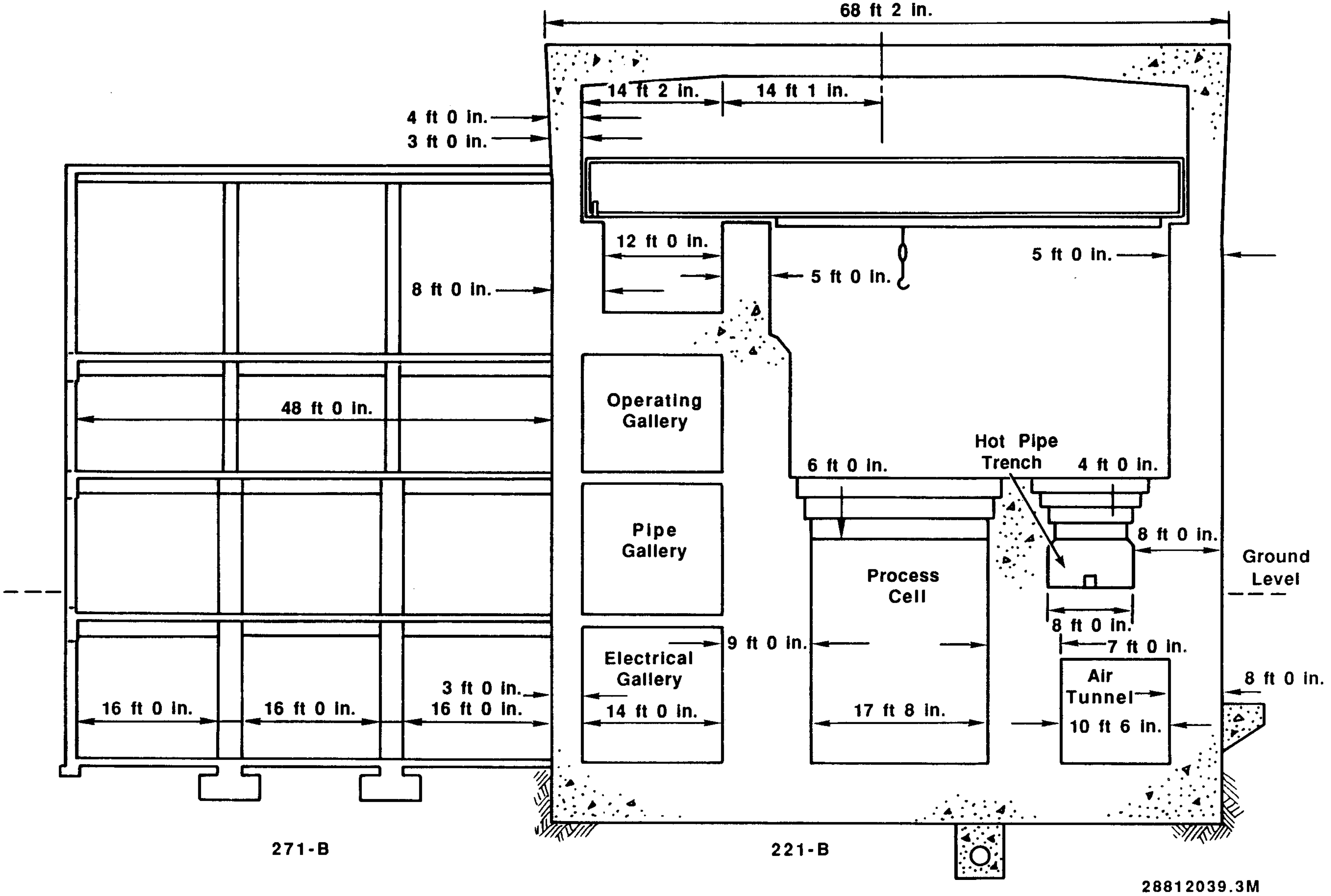


Figure 2-10. Typical Cross-Section of Buildings 221-B and 271-B.

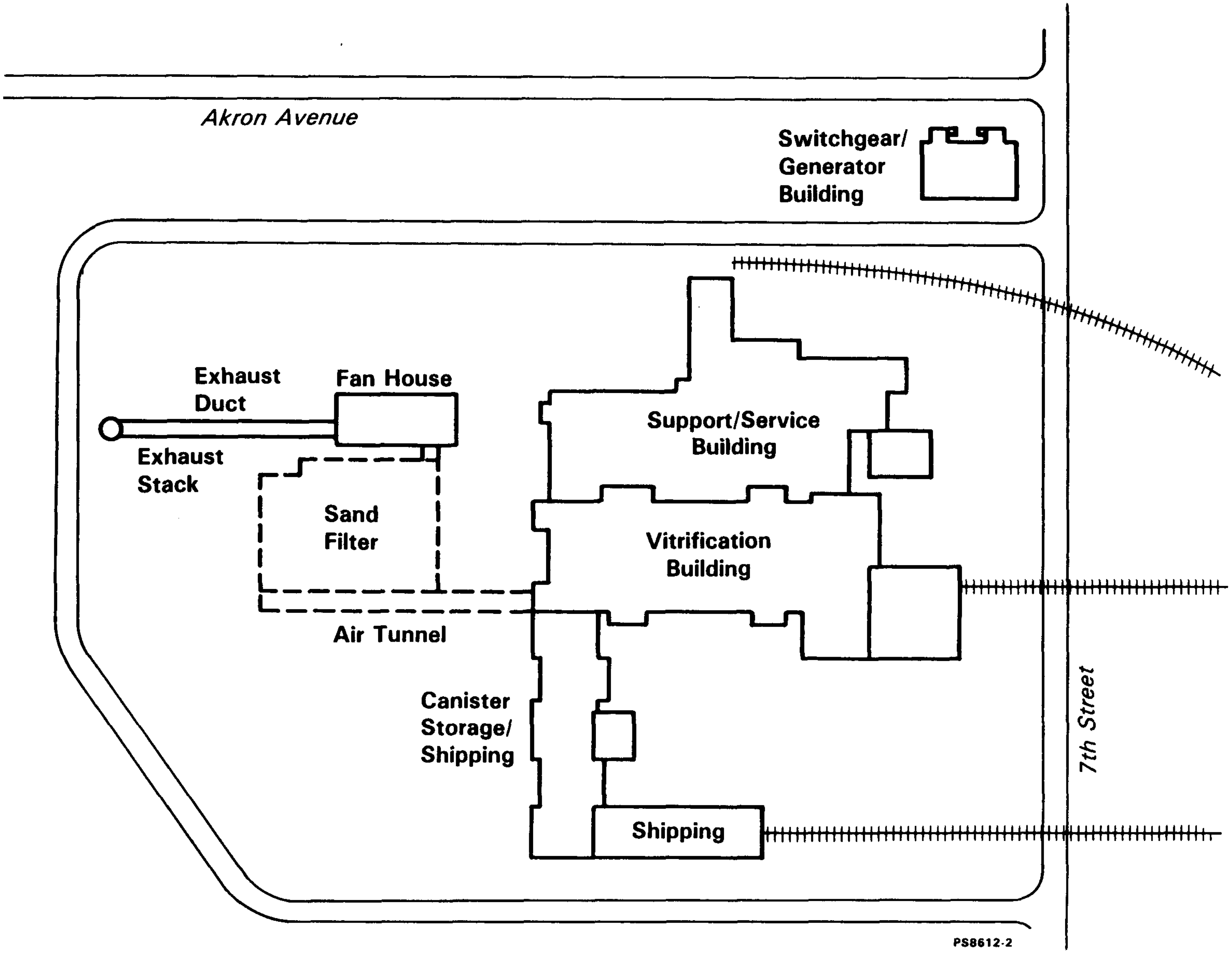


Figure 2-11. Hanford Waste Vitrification Plant.

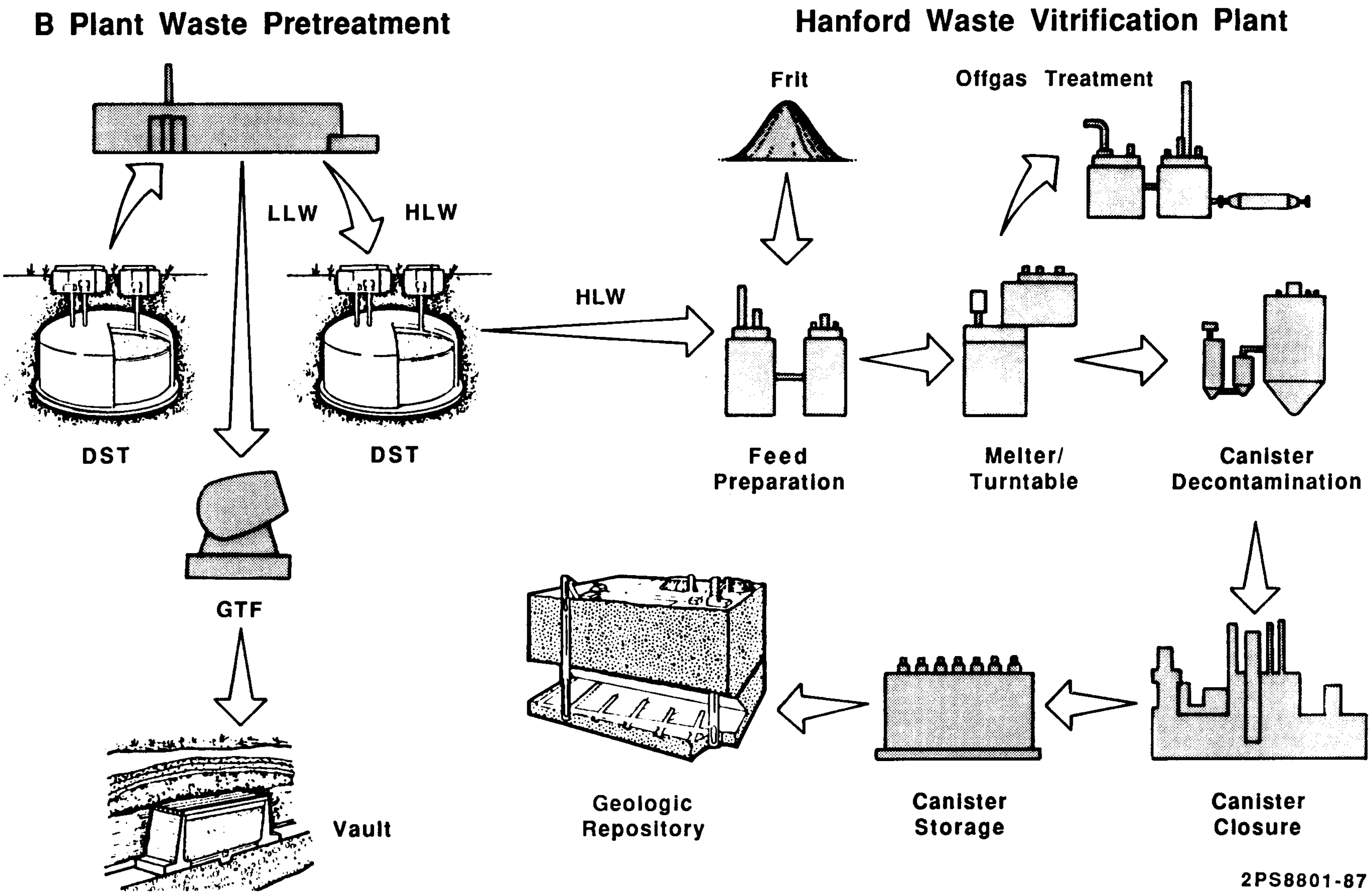


Figure 2-12. Hanford Waste Vitrification Plant Process Flowsheet.

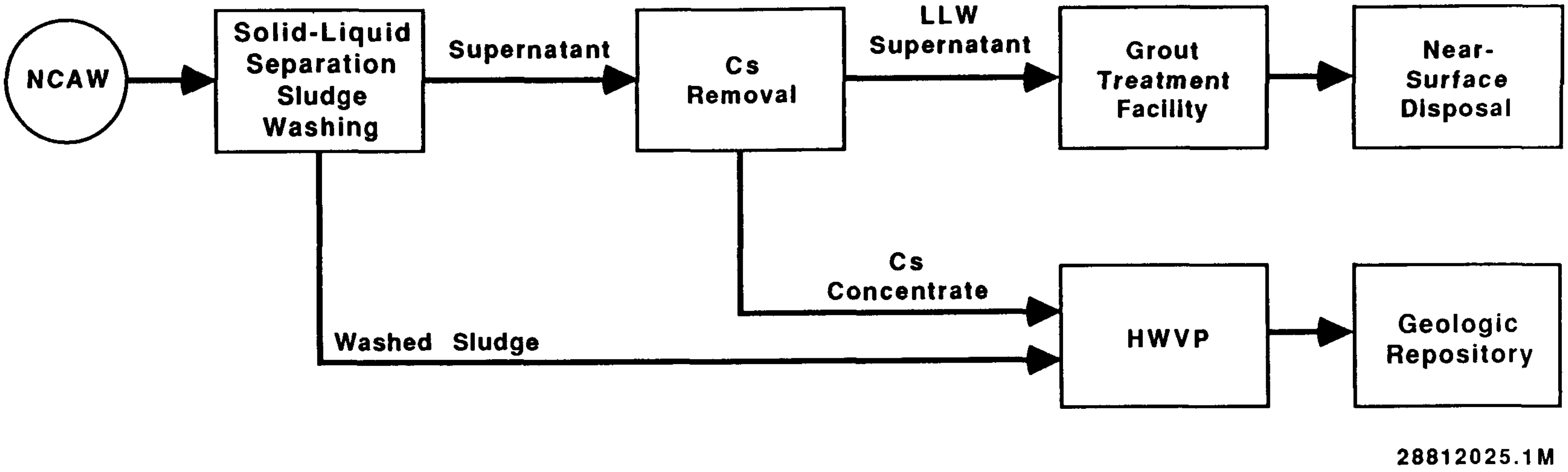


Figure 2-13. Neutralized Current Acid Waste Pretreatment Process Flowsheet.

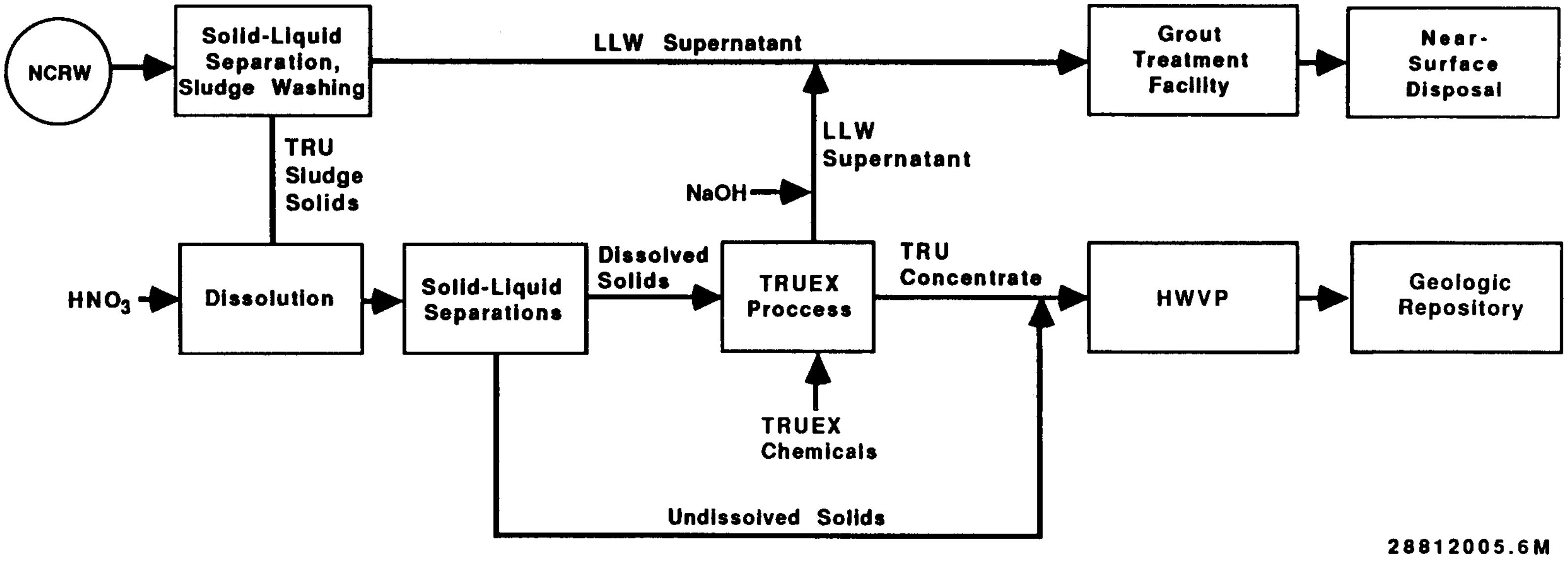


Figure 2-14. Neutralized Cladding Removal Waste Pretreatment Process Flowsheet.

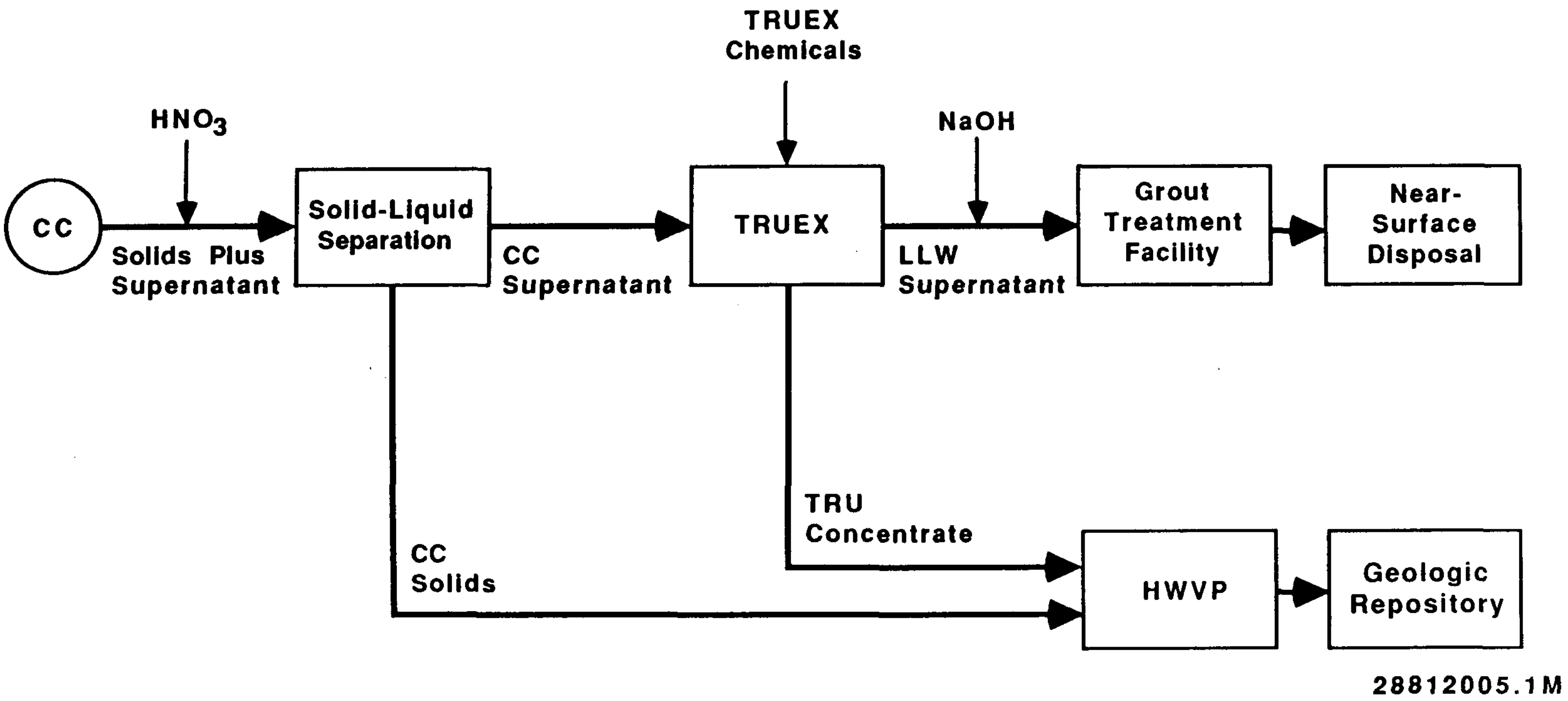


Figure 2-15. Complexant Concentrate Waste Pretreatment Process Flowsheet.

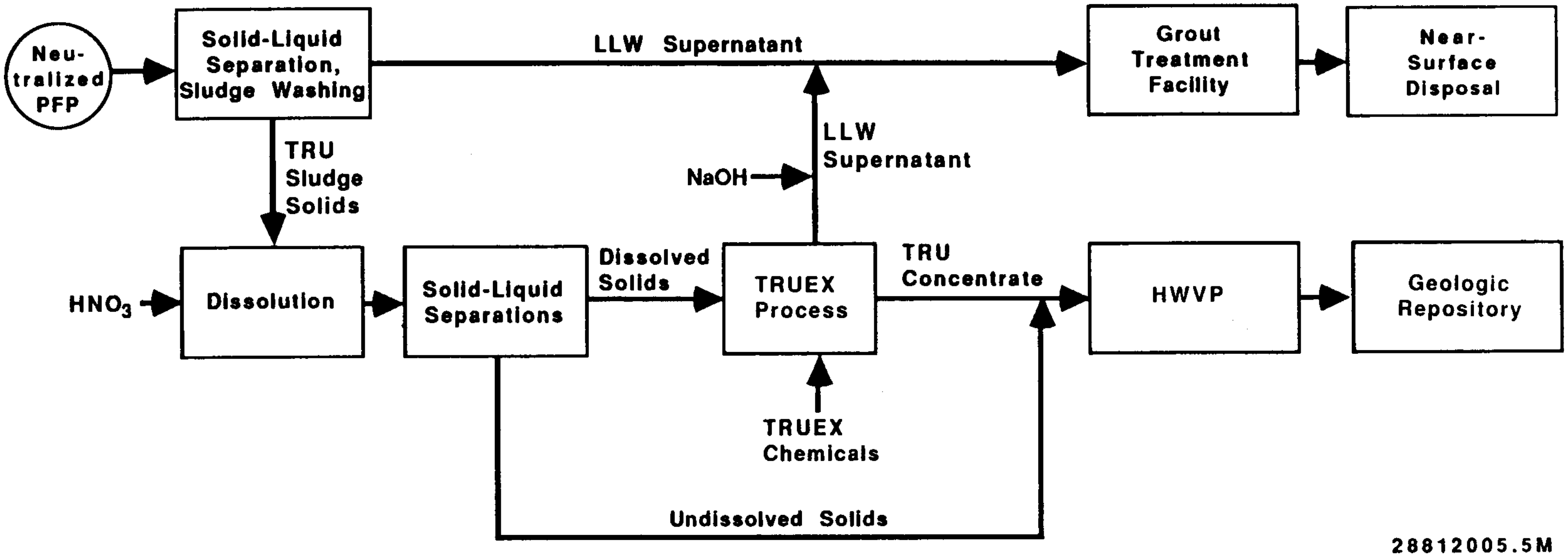


Figure 2-16. Plutonium Finishing Plant Waste Pretreatment Process Flowsheet.

Regulatory permit applications, Part B permits in all cases, are being prepared for the WDOE in compliance with WAC 173-303. Applications for five facilities associated with the DST waste have been or are being prepared: (1) waste storage in DSTs, (2) waste treatment in the 242-A Evaporator-Crystallizer, (3) waste treatment at B Plant, (4) waste treatment and disposal at GTF (submitted) and (5) waste treatment at HWVP. Priorities are being established in the Tri-Party Agreement for preparing the required Part B operating permit applications. Part A permit applications for current operations have been submitted as required.

2.1.2.2 Current and Future Plans. Current plans include safe operation and maintenance of the DST farm system, receiving and storing liquid waste, performing volume reduction by evaporation of the liquid waste inventories, and continuing the operation of the GTF. Alternatives for disposal of the DST waste were considered in the HDW-EIS. The ROD states that the DOE has decided to proceed with disposal activities for the DST wastes.

Future plans, illustrated in Figure 2-17, involve the processing of existing and future wastes from the DSTs for final disposal. To implement this plan, the DOE will design, construct, and operate the HWVP, complete the necessary pretreatment modifications and operate the pretreatment facility currently planned to be at B Plant, and utilize the GTF. The HLW (or TRU waste) fraction will be processed into a borosilicate glass waste form and stored at the HWVP until a geologic repository is built and ready to receive this waste. Transportation to a geologic repository and the impacts associated with transportation are discussed in the HDW-EIS (DOE 1987). Existing and future DST waste will be characterized for hazardous chemical constituents, as well as other chemical constituents that might affect glass formulation. A protective barrier and marker system will be placed over the empty tanks and grout vaults as part of final closure. The MW disposal will conform with applicable RCRA requirements.

Several technical issues remain to be resolved before implementing the plan to retrieve and immobilize the DST wastes. These issues are summarized below:

- Disposal criteria and standards
- TRU separation from cladding removal waste
- Characterization
- Retrieval
- Feed preparation
- Immobilization (glass)
- Immobilization (grout)
- TRU removal from aqueous PFP waste.

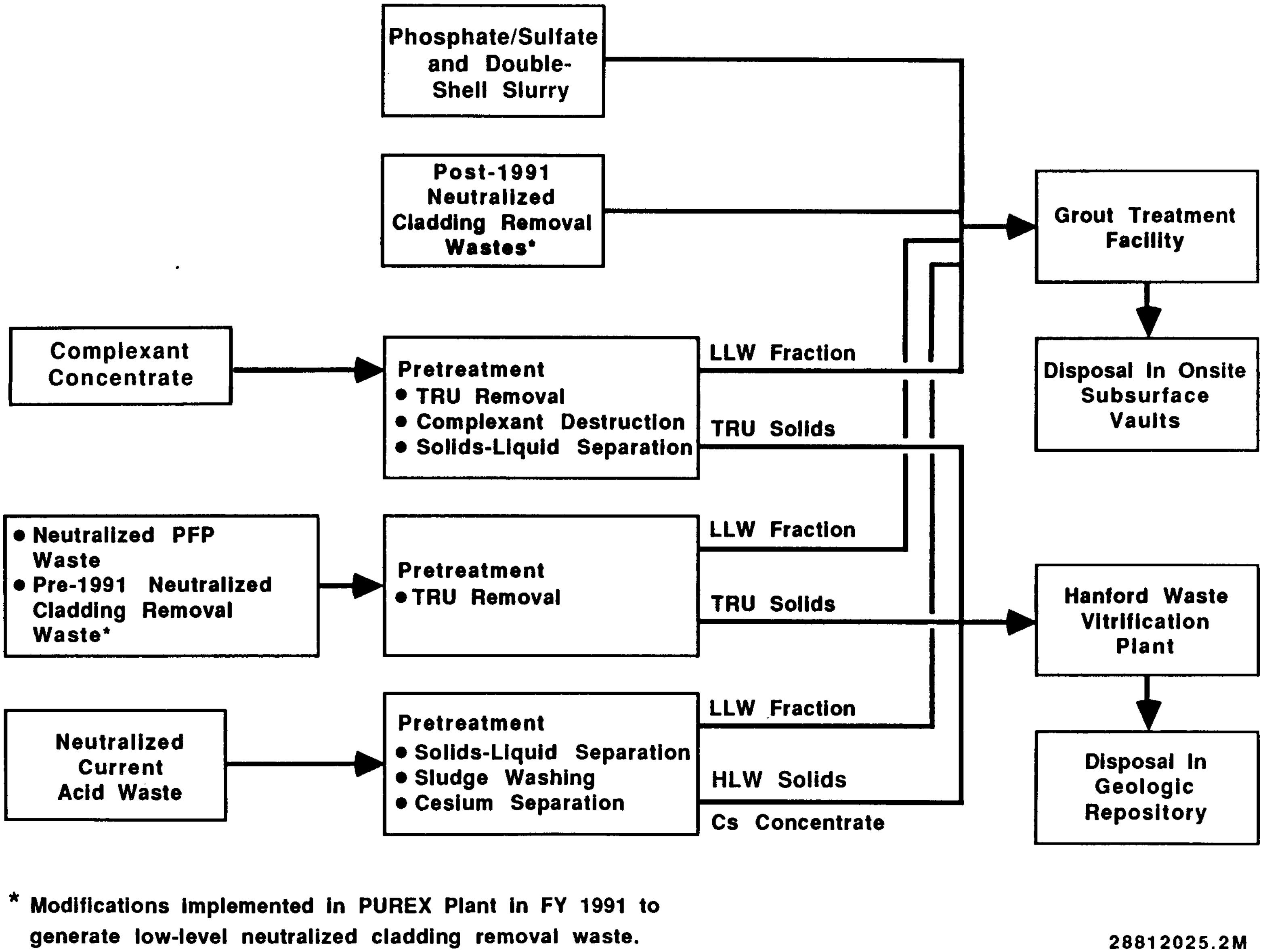


Figure 2-17. Future Plans for Processing Double-Shell Tank Wastes for Final Disposal.

These technical issues are discussed in detail in the HWMTP (WHC 1988e). The schedule for DST management and disposal is shown in Figure 2-18. The projected costs for the HLW (and TRU waste) fraction of DST waste management and disposal, excluding the grout operations which are considered as LLW disposal, are shown in Table 2-3. The costs include the production of an estimated 1,560 glass canisters, shipping of the canisters, and a fee of $350,000 per canister as estimated in the Federal Register (FR) of August 20, 1987 (52 FR 31508).

2.1.3 Single-Shell Tank Waste

2.1.3.1 System and Facility Description.

2.1.3.1.1 Overview of Treatment, Storage, and Disposal System. The Waste Management Program is funding the storage and surveillance and the interim stabilization and isolation of the SST waste; all other activities, primarily technology in support of future disposal, are funded by the ER Program and thus are outside the scope of this document. Interim stabilization includes salt well pumping of interstitial liquid and heat management of high-heat tanks. There are about 139,000 m^3 of waste, consisting of damp salt cake and sludge contained in 149 underground storage tanks. The waste represents an accumulation from 1944, the initiation of operations at the Hanford Site, until 1980 when active use of the tanks ceased.

Previous treatment included removal of water by pumping supernatant from the tanks for evaporation and returning the concentrated salt solution back to the tanks. The earliest fuel reprocessing flowsheets, before REDOX and the PUREX Plant, did not remove uranium and it was sent to the tanks. During the late 1950s, a major program was undertaken to recover the uranium. Programs implemented in the late 1960s removed the bulk of the ^{137}Cs and ^{90}Sr for encapsulation.

2.1.3.1.2 Waste Characteristics. The SST may contain two layers: (1) a bottom layer of sludge produced from components that precipitated when the waste was neutralized and (2) a top layer salt cake produced when waste supernatant liquids were concentrated beyond the solubility limit of a major component. The sludge volume is estimated at 46,000 m^3, and the salt cake volume is estimated at 93,000 m^3. Not all tanks contain both layers. Volumes and compositions of waste in individual tanks or tank farms vary considerably, depending on the waste source and on past waste management practices at the respective tanks farms. Waste has been concentrated by evaporation to form crystalline salt cake and thus minimize releases to surrounding soil in the event of tank leakage. In some cases, a small amount of residual liquid remains on top of the solids. This residual liquid and other liquid contained in the interstices of the sludge and salt cake, are being pumped from salt wells to DSTs to the extent practical. After pumping is completed in FY 1996, an estimated 210,000 t of chemicals will remain in the tanks consisting mostly of sodium nitrate and sodium hydroxide. The SSTs contain 139,000 m^3 with an radioactivity of 161.7 MCi as of December 1987 (DOE 1988a).

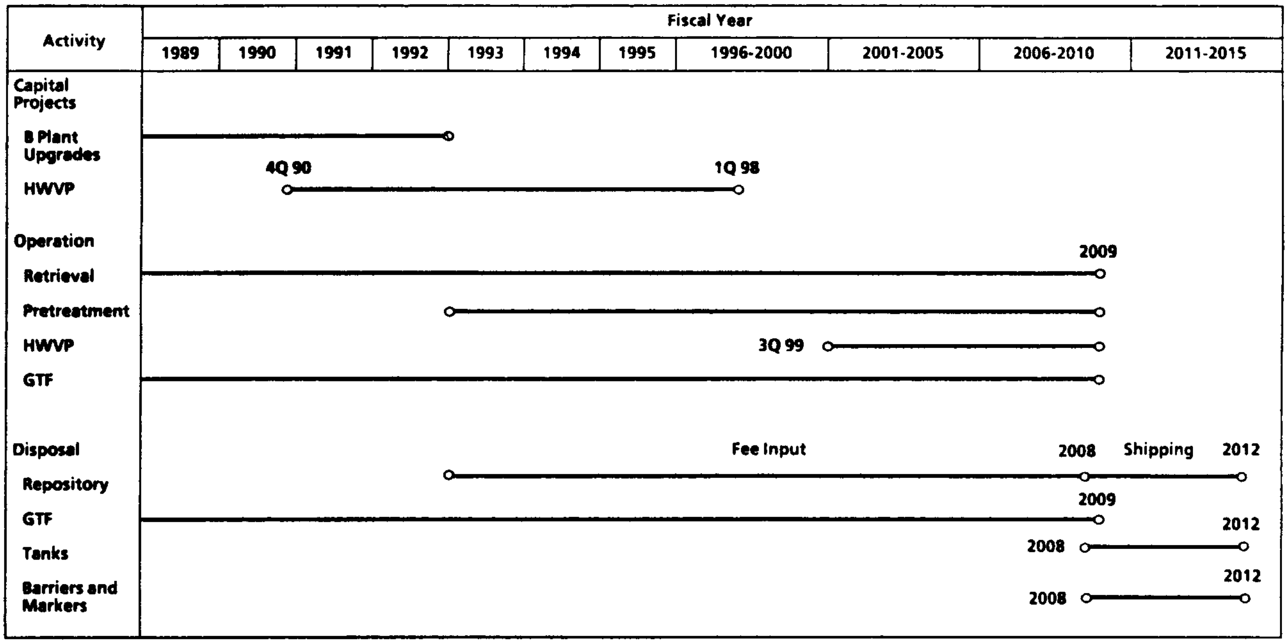


Figure 2-18. Schedule for Double-Shell Tank Waste Management and Disposal.

Table 2-3. Projected Costs for Double-Shell Tank Waste Management and Disposal, High-Level Waste (and Transuranic Waste) Fraction.

Activity	Fiscal year												
	1988	1989	1990	1991	1992	1993	1994	1995	1996-2000	2001-2005	2006-2010	2011-2015	Total
Storage and Surveillance	34.4	43.8	46.8	58.2	62.7	19.8	0.8	0.8	3.5	2.2	0.9	0.0	273.9
Technology and Operations	15.1	12.7	19.1	14.3	14.8	59.4	82.2	78.3	549.1	522.9	458.4	73.3	1,899.5
CENRTC and Construction	9.9	30.7	57.7	120.6	157.2	239.7	227.8	123.0	167.0	63.9	55.8	7.5	1,260.9
Total	59.3	87.2	123.6	193.2	234.7	319.0	310.8	202.1	719.5	589.0	515.1	80.8	3,434.3

NOTE: All expense and CENRTC costs (millions of dollars) escalated through FY 1990. Construction costs escalated to midpoint of construction.

PST89-3071-2-3

2.1.3.1.3 Facility Descriptions. The SST farms are illustrated on Figure 2-9 as 241-A, -AX, -B, -BX, -BY, -C, -S, -SX, -T, -TX, -TY, and -U. A cross-sectional view of the four types of SSTs at the Hanford Site is presented in Figure 2-19. There are 16 type I tanks, 60 type II tanks, 48 type III tanks, and 25 type IV tanks.

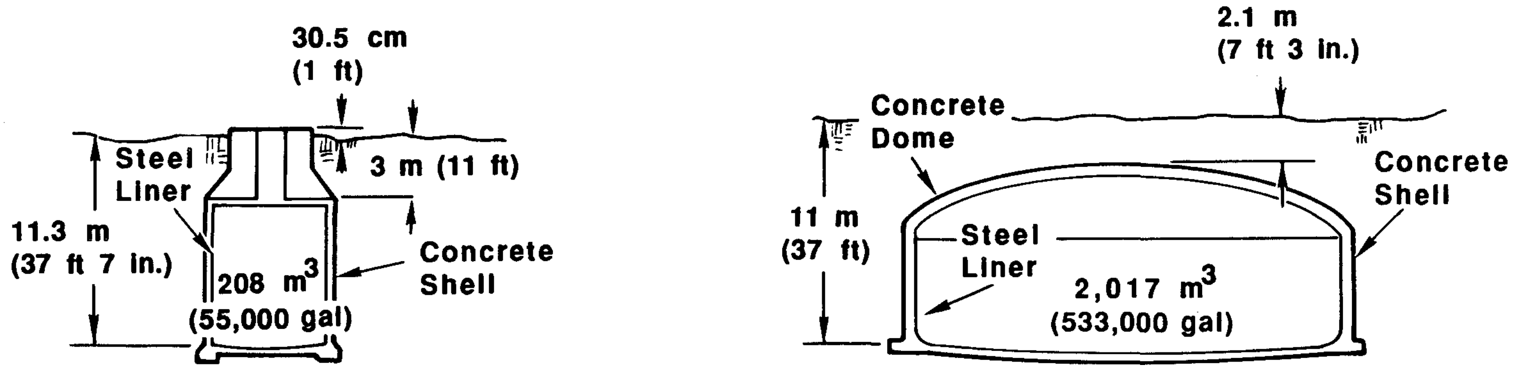
Surveillance is required to provide identification of failure of containment. Monitoring and leak detection systems are incorporated to serve this purpose. Liquid level monitoring, where a liquid surface exists, is used as the primary means of leak detection. Where the tanks do not have a liquid surface, liquid observation wells have been installed to monitor interstitial liquid. A series of drywells located external to the tanks is routinely monitored to detect any radiation source that may be present. Tanks in which unfavorably high temperatures could occur are equipped with thermocouples which provide continuous temperature recordings.

Area radiation monitors are located within the tank farms to provide indication of a gross loss of confinement which would represent an immediate radiation hazard to personnel. Forced ventilation currently provides cooling for 16 tanks containing materials which, through radioactive decay, generate heat that could exceed established concrete temperature limits. Single-stage HEPA filters allow atmospheric breathing for tanks that do not require cooling. Gases generated by radiolytic decomposition disperse in this manner. All engineered systems undergo preventive maintenance, inspection, and calibration in accordance with approved procedures.

The transfer of pumpable liquids from SSTs to DSTs is part of the interim operations. The void spaces in the salt cake and sludge contain interstitial liquids which are removed by salt well pumps. A pump is inserted into a salt well screen that reaches to the bottom of the tank as shown in Figure 2-20.

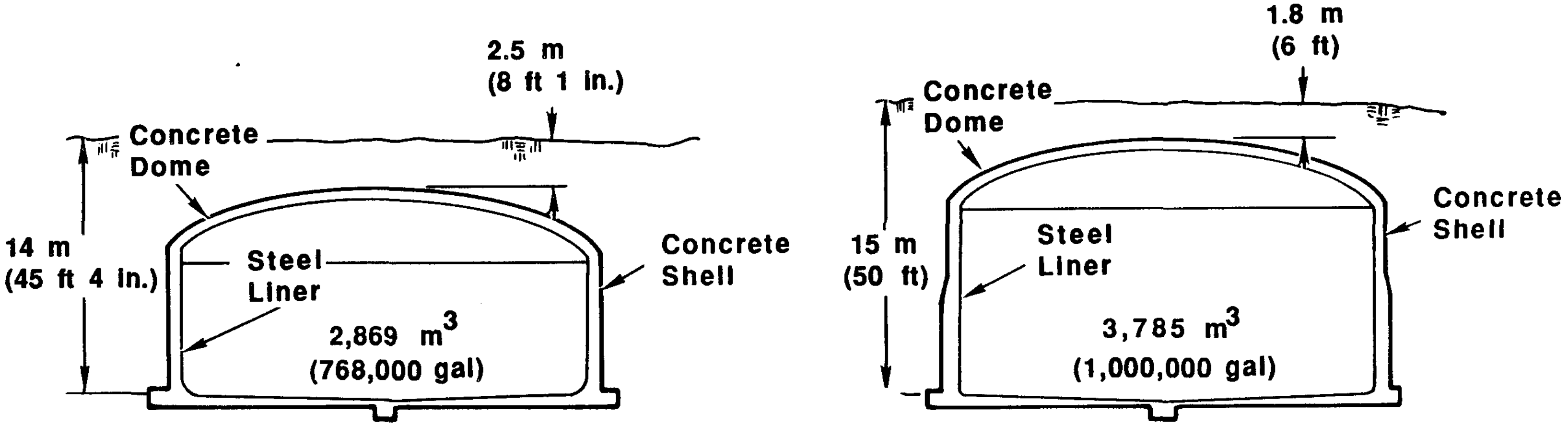
Permitting activities for SSTs were initiated in FY 1988. A Compliance Work Plan for SSTs, containing actions and schedules leading to the completion of a closure/post-closure plan, is planned for issuance to WDOE at the end of FY 1989.

2.1.3.2 Current and Future Plans. Current plans for SST surveillance include continuing monitoring and leak detection. In addition, groundwater monitoring wells are being installed and monitored as part of a site-wide system. Major activities will continue: (1) collection of surface-level and temperature data, (2) analysis of data and resolution of anomalies, (3) in-tank photography, (4) operations of tank ventilation systems, (5) maintenance of SST farm equipment and instruments, and (6) removal of interstitial liquid by pumping. Heat management will continue for certain tanks, especially Tanks 241-C-105 and 241-C-106. Core sampling and waste characterization is being undertaken by the ER Program.



6.1-m- (20-ft-) Diameter Single-Shell Tank
Type I

22.9-m- (75-ft-) Diameter Single-Shell Tank
Type II

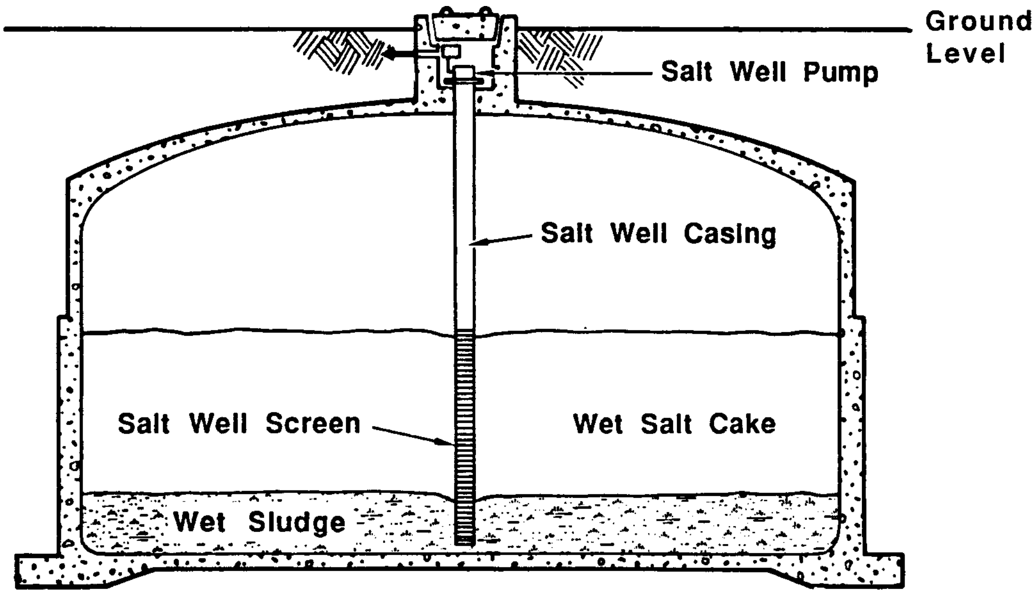


22.9-m- (75-ft-) Diameter Single-Shell Tank
Type III

22.9-m- (75-ft-) Diameter Single-Shell Tank
Type IV

RCP7911-17

Figure 2-19. Cross-Sectional Views of Hanford Single-Shell Tanks.



RCP8005-147

Figure 2-20. Pumping of Solutions from Single-Shell Tanks.

Future plans include completion of interim stabilization and isolation by FY 1996. Technology issues as discussed in the HWMTP (WHC 1988e) are concerned with final disposal and not the interim stabilization and isolation activities. The projected costs for SST surveillance activities are shown in Table 2-4.

Table 2-4. Projected Costs for Single-Shell Tank Waste Interim Operations.

Activity	Fiscal year												
	1988	1989	1990	1991	1992	1993	1994	1995	1996-2000	2001-2005	2006-2010	2011-2015	Total
Storage and Surveillance	10.3	12.5	15.3	18.4	17.8	17.1	19.8	19.8	59.8	50.0	45.0	40.0	325.7
Technology and Operations	--	--	--	--	--	--	--	--	--	--	--	--	--
CENRTC and Construction	0.6	1.4	1.7	3.9	4.2	4.3	1.1	1.1	5.4	5.4	5.4	5.4	39.7
Total	10.9	14.0	16.9	22.2	22.0	21.5	20.9	20.9	65.2	55.4	50.4	45.4	365.4

NOTE: All expense and CENRTC costs (millions of dollars) escalated through FY 1990. Construction costs escalated to midpoint of construction. Technology and Operations is funded by the Environmental Restoration Program and thus are not shown here.

PST89-3071-2-4

2.2 TRANSURANIC WASTE

The category for TRU waste was established in 1970 and defined as "waste with known or detectable contamination of transuranium nuclides." Interim guidance promulgated at that time was that material contaminated to 10 nCi/g or more of TRU radionuclides should be placed in storage. Before 1970, there was no distinction between solid TRU waste and solid LLW. All pre-1970 solid LLW was placed in shallow trenches and covered with approximately 1.2 m of soil. Before 1973, there was no distinction between liquid TRU waste and liquid LLW. Most of the pre-1973 liquid LLW was placed in engineered structures in the soil (cribs and tile fields); a small amount was sent to the underground storage tanks.

Since 1970, solid TRU waste has been stored for ultimate transfer to a designated disposal facility. In the early 1980s, the Waste Isolation Pilot Plant (WIPP) was designated as such a facility for waste that is defined as TRU waste in DOE Order 5820.2A. The definition promulgated in 1982 specifies waste contaminated with alpha-emitting transuranium radionuclides with half-lives greater than 20 yr and concentrations greater than 100 nCi/g at the time of assay. Most of the TRU waste is stored on asphalt pads and requires treatment and certification before WIPP disposal. Some TRU waste, approximately 1 vol%, is already certified and is being stored for shipment to WIPP. Certification capabilities are being provided for all future TRU waste.

Since 1973, liquid streams containing TRU waste have been collected in the underground tanks. The PFP waste and NCRW represent virtually all of these post-1973 streams. From 1973 through 1980, the PFP waste was split between DSTs and SSTs; after 1980, the PFP waste was routed to DSTs in 200 West Area. Since PUREX Plant startup in 1983, the NCRW has been stored in designated DSTs. As discussed in Section 2.1.2, the PFP waste and NCRW in DSTs will be pretreated in B Plant.

In addition to the TRU solid waste stored for disposal in WIPP, there are nine pre-1970 solid waste sites and 24 contaminated soil sites that are suspected of containing concentrations in excess of 100 nCi/g. As stated in the recent ROD for the HDW-EIS, the DOE has decided to undertake further development and evaluation of 32 of these sites in the interest of determining which remedial action options to implement. The remaining site, designated 618-11, is located away from the 200 Areas plateau and will be exhumed for treatment and disposal (see Section 2.2.2). Development and evaluation associated with all but the 618-11 site are funded by the ER Program and are not within the scope of this document.

2.2.1 Retrievably Stored Transuranic Solid Waste

2.2.1.1 System and Facility Description.

2.2.1.1.1 Overview of Treatment, Storage, and Disposal System. The current inventory of stored TRU waste includes 15,300 m^3 of contact-handled (CH) waste and 24 m^3 of remote-handled (RH) caisson waste. The CH waste is defined as waste that has a dose rate at the container surface of less than 200 mrem/h. An overview of the treatment, storage, and disposal is illustrated in Figure 2-21. The stored TRU waste accumulated from 1970 through 1985 will remain in storage awaiting treatment at the WRAP facility which is scheduled to initiate operations in the mid-1990s.

Small amounts of metallurgical samples are considered part of the stored RH TRU waste and will be treated in the WRAP facility. These wastes are located in designated trenches or in the caissons containing RH waste.

Treatment of TRU waste at the WRAP facility will result in three waste streams: certified TRU waste for shipment to the WIPP, LLMW for onsite landfill disposal, and nonhazardous LLW also for onsite disposal. It is projected that these operations will be completed by FY 2013.

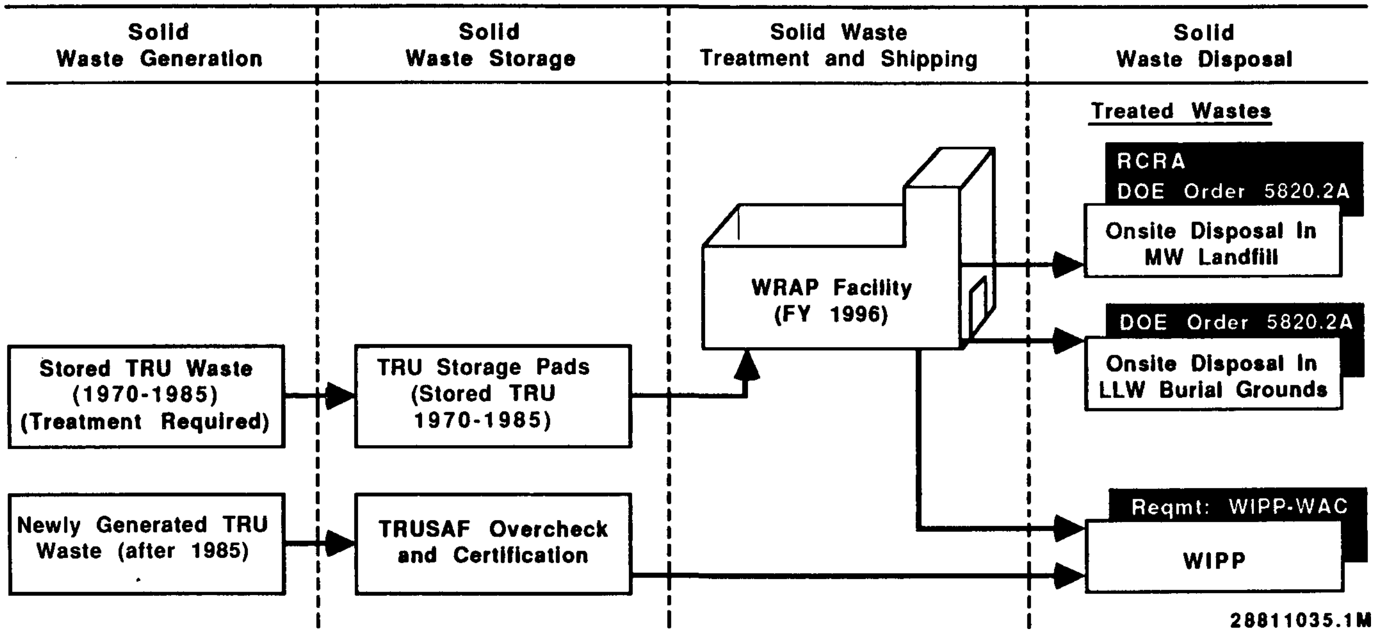


Figure 2-21. Treatment, Storage, and Disposal Overview for Solid Transuranic Waste.

2.2.1.1.2 Waste Characteristics. The waste includes bulk quantities of trash, failed equipment, and laboratory and process waste. Much of the waste is combustible, consisting of wood, cloth, plastics, paper, absorbents, rubber, and rags. Noncombustibles include failed machinery, hoods and gloveboxes, tanks, tools, glass, concrete, plumbing, and soils.

The CH waste consists of 59 concrete containers, 202 fiberglass-reinforced polyester (FRP) boxes, 320 metal boxes, 96 plywood boxes, 456 miscellaneous containers, and 36,600 55-gal drums (all data as of December 31, 1987). The TRU content is estimated as 448 kg. There is virtually no information on the quantities of hazardous constituents present. It is known that there are some quantities of antifreeze, asbestos, beryllium, cadmium, copper, lead (for shielding and for other purposes), zirconium, sorbed organic liquids, polychlorinated biphenyl (PCB) oils, sodium hydroxide, sodium nitrate, and solvents such as toluene and xylene.

Approximately 90 vol% of the RH waste is contained in 1-gal paint cans in one of five underground caissons reserved for RH waste. The remaining 10 vol% is in 5-gal paint cans. All RH caisson waste is derived from hot cell operations in the 300 Area.

A separate category of solid waste is research reactor fuels that are stored in the burial grounds. Currently there are 37 casks in storage containing 119 m^3 and an additional 48 m^3 are projected as future receipts.

2.2.1.1.3 Facility Descriptions. Over 97 vol% of the CH TRU waste is stored on asphalt pads or in earthen trenches as illustrated in Figure 2-22. The modules that are assembled on the asphalt pads contain 144 55-gal drums per layer, and generally four layers for a total of 576 drums per module. This is the case only when no boxes are included in the module structure. Usually small boxes of waste are interspersed among the drums. The asphalt pads are approximately 200 m in length and contain several modules. As illustrated, once a module is assembled it is covered over with plywood, a vinyl covering, and 1.2 m of soil. The remainder (less than 3 vol%) of the CH waste, mostly in large boxes, is stored in inactive or above-grade facilities.

About 24 m^3 of the RH TRU waste is stored in below-grade, concrete caissons as illustrated in Figure 2-23. The waste was transported in specially designed casks by truck from the 300 Area. The casks, containing either 1-gal or 5-gal cans of the waste, are positioned over the charging chutes and the cans are allowed to tumble into the caissons. The caissons will not be used beyond FY 1989 as the one generator of RH waste will have the capability to certify and store the waste for WIPP at the generating facility.

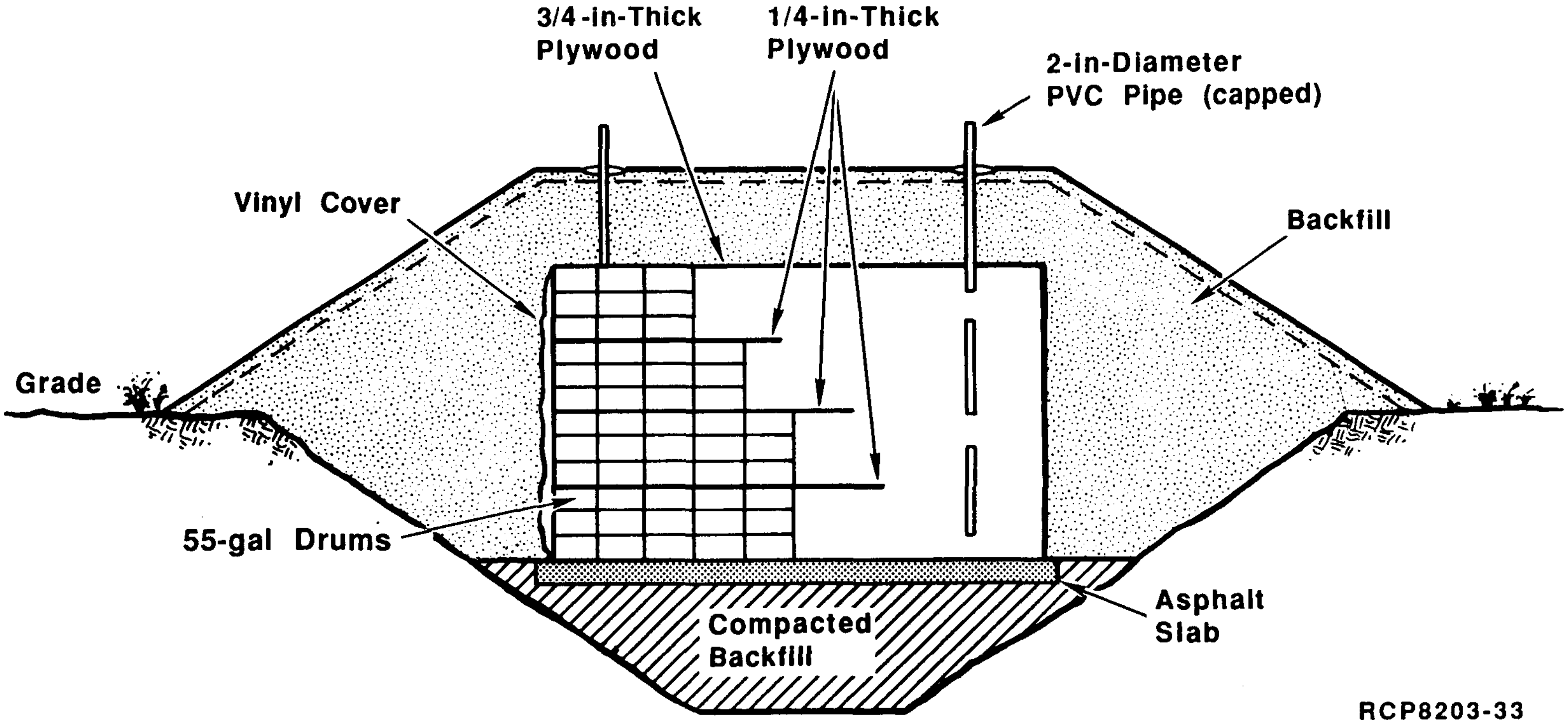


Figure 2-22. Contact-Handled Transuranic Waste Storage Module.

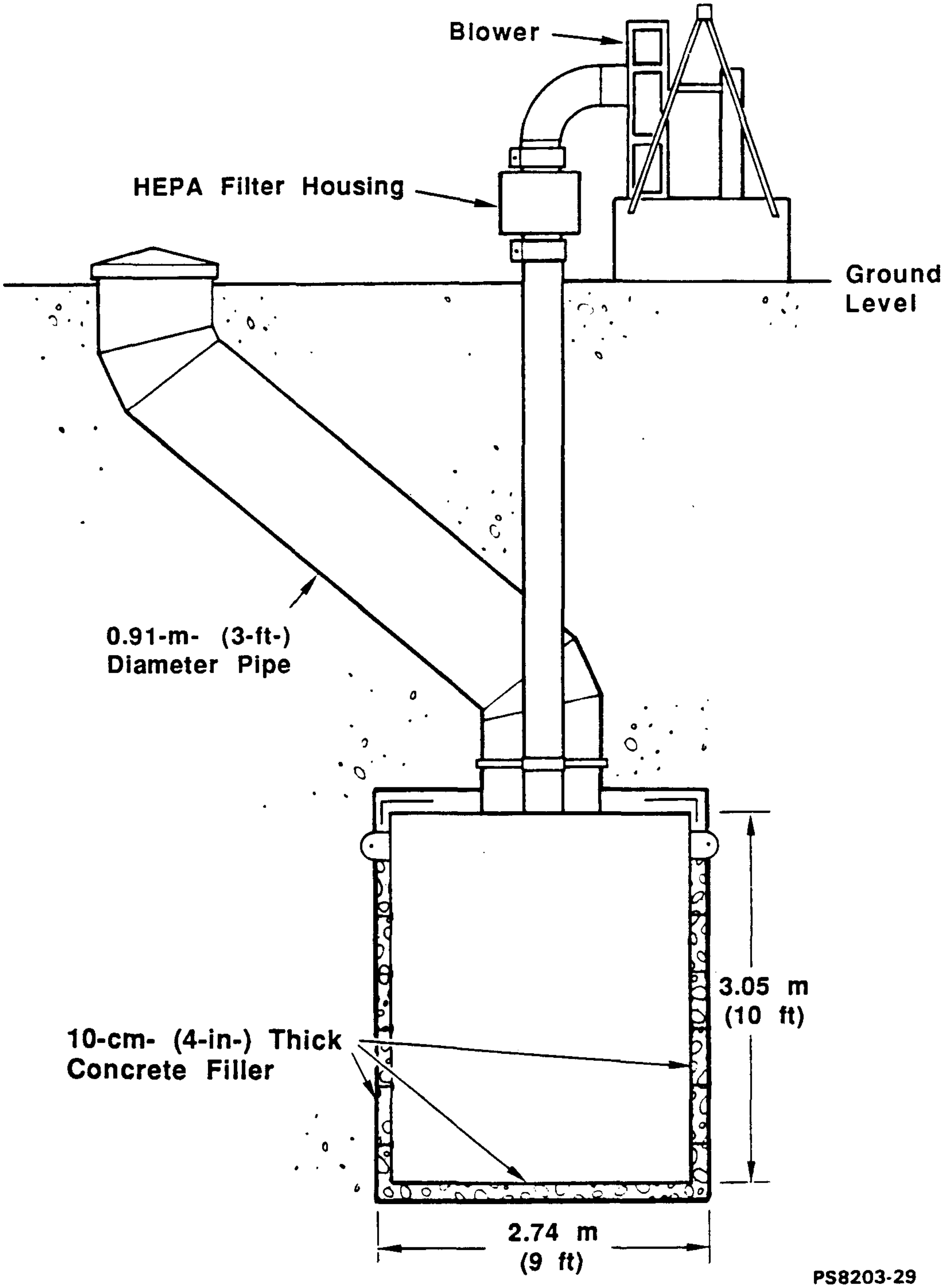


Figure 2-23. Caisson for Remote-Handled Transuranic Waste Storage.

The WRAP facility was conceptually designed to support examination, treatment, and packaging of the CH TRU waste in preparation for shipment to the WIPP facility. The WRAP facility mission is currently undergoing conceptual changes that will include several other feed streams, including the RH TRU waste, LLMW and LLW, as discussed below in Current and Future Plans.

Approximately 15,300 m^3 of TRU waste is expected to be treated in WRAP. It has been estimated that about 40 vol% of the waste will be reclassified as LLMW or LLW after assaying. Treatment will result in further reductions such that less than 10,000 m^3 of waste is expected for WIPP disposal.

The Part A permit application has been submitted for the burial grounds, which include the retrievably stored TRU waste; the Part B permit application is planned for submission in late FY 1989. Funding is being identified and a priority established for preparing the required Part B operating permit application for treatment of TRU and LLW in the WRAP facility.

2.2.1.2 Current and Future Plans. Current plans for the stored TRU waste, both CH and RH, include storage, surveillance, and maintenance of the facilities until the WRAP facility is available to treat the waste. Current plans also include defining the WRAP facility mission to proceed with line item funding as soon as practical.

The emerging strategy for the WRAP facility is to provide examination and processing capabilities for all solid waste requiring treatment. Besides the TRU waste, other stored wastes include nonradioactive hazardous waste, LLMW, and LLW. The capabilities planned include waste package inspection, assaying, repackaging, size reduction, compaction, sorting, shredding, and waste immobilization in grout. Incineration will be implemented as an additional process step between shredding and grouting if deemed appropriate. As a result of this strategy, two modules of a capital line item (or two line items) are being proposed: one to provide inspection, opening and sorting, waste segregation, compaction, repackaging and certification and the second to provide remaining treatment processes.

This approach is in response to several requirements that have been recently imposed:

- CH LLMW can no longer be placed in burial grounds.
- Closure plans will be required for burial grounds and the presence of LLMW must be addressed.
- LLMW and nonradioactive hazardous waste will be prohibited from land disposal unless treated in accordance with Best Available Technology (BAT).
- Treatment and certification of LLW will be required.
- Performance assessments will be required for LLMW to demonstrate that waste forms are acceptable for disposal.

An artist's conception of the Hanford Central Waste Complex is presented in Figure 2-24; this complex includes the modified WRAP facility and several supporting facilities. The identified location is in the west portion of the 200 West Area where the bulk of the stored waste is located.

Future plans for stored TRU waste include treatment in WRAP and disposal in WIPP. Transportation to WIPP and the impacts associated with transportation are discussed in the HDW-EIS (DOE 1987). Several technical issues remain to be resolved before implementing the plans. These issues are summarized below.

- Provide nondestructive assay and examination of closed drums and boxes to ensure compliance with WIPP WAC.
- Determine what equipment is required to retrieve CH waste for transport to the WRAP facility.
- Identify the treatment steps required in the WRAP facility considering the expanded mission, that is, the inclusion of all solid waste: stored and to-be-generated.
- Define the optimum strategy for disposing of RH TRU solid waste and identify the technology that is required to implement such strategy.
- Ensure that containers being developed for transport to the offsite treatment or disposal systems are compatible with the transportation systems being designed for shipments.
- Evaluate disposal options for the research reactor fuels.

These technical issues are discussed in detail in the HWMTP (WHC 1988e). The schedule for stored TRU waste disposal is shown in Figure 2-25 and the projected costs are shown in Table 2-5. Newly generated TRU waste which is discussed below is included in the schedule and projected costs.

2.2.2 Newly Generated Transuranic Waste

2.2.2.1 System and Facility Description.

2.2.2.1.1 Overview of Treatment, Storage, and Disposal System. Newly generated TRU waste receipts are expected to be about 500 m^3 yr through the conclusion of PUREX and PFP operations in the late 1990s. Volumes for terminal cleanouts have not been estimated. An overview of the treatment, storage, and disposal is illustrated in Figure 2-21. Practices are either in place or are being developed that will allow the TRU solid waste generator to prepare a certified waste package acceptable for direct shipment to WIPP. Once the WRAP facility is operational, all certified TRU solid waste packages will be shipped to the interim storage area of the WRAP facility and periodically loaded onto the Transuranium Package Transporter (TRUPACT) for shipment to WIPP.

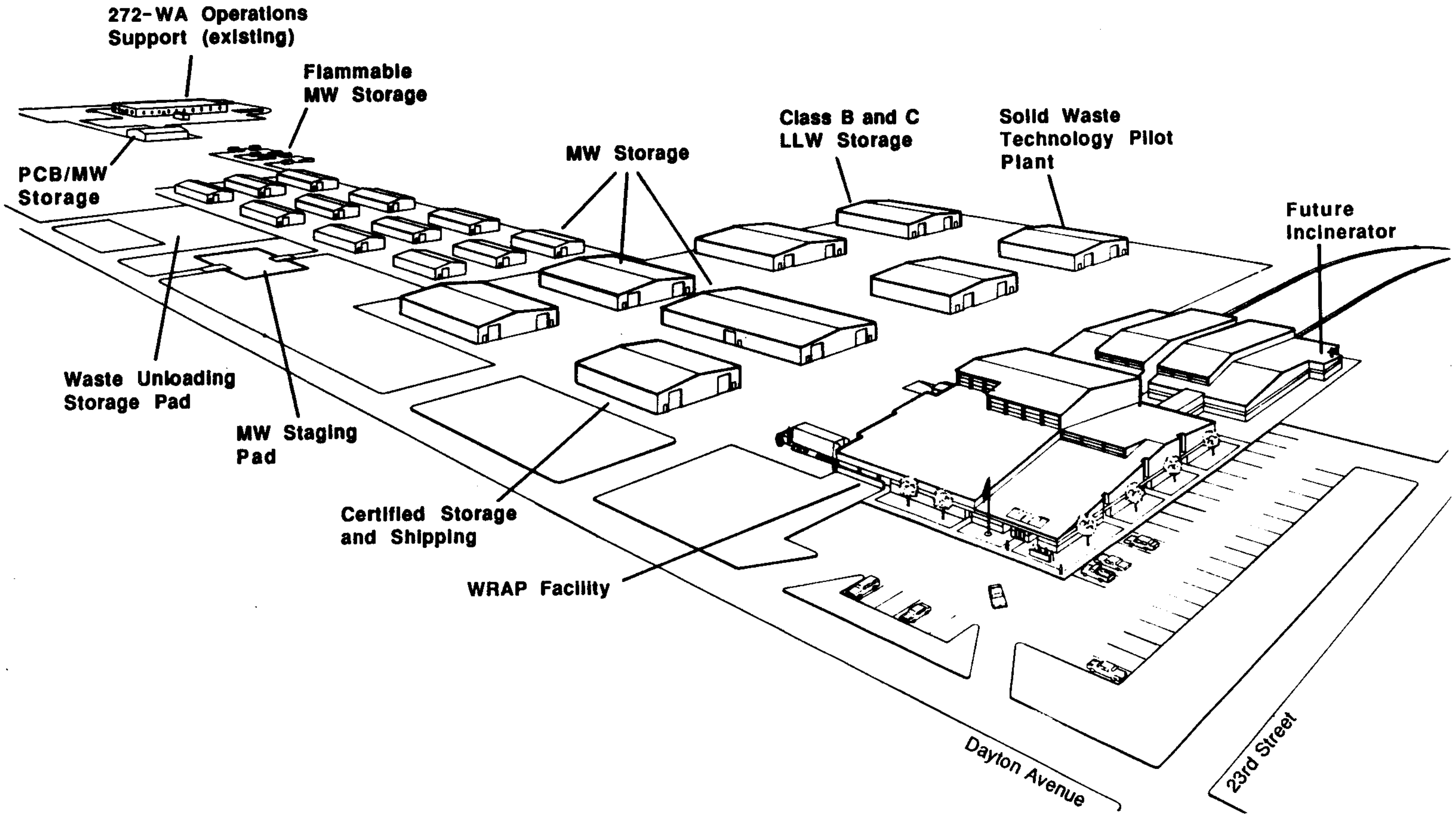


Figure 2-24. Artist's Conception of Proposed Hanford Central Waste Complex.

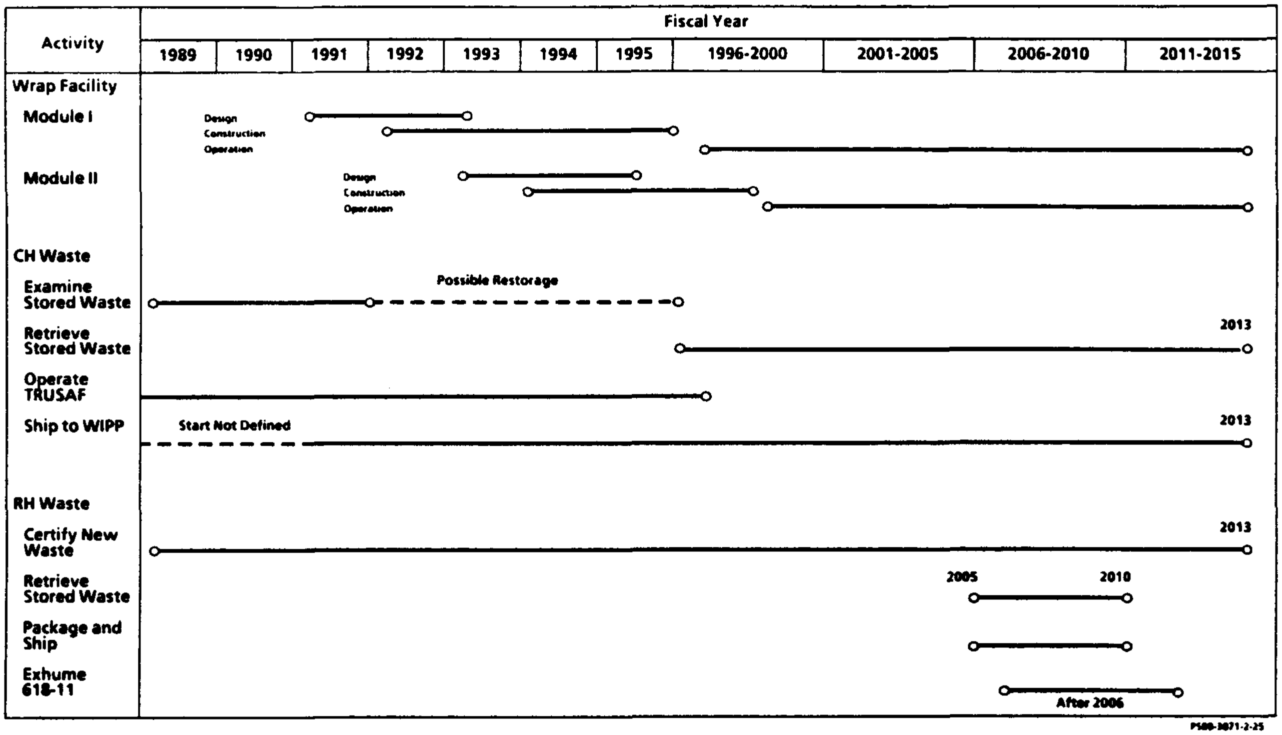


Figure 2-25. Schedule for Stored and Newly Generated Transuranic Solid Waste Management and Disposal.

Table 2-5. Projected Costs for Solid Transuranic Waste Management and Disposal.

Activity	Fiscal year												
	1988	1989	1990	1991	1992	1993	1994	1995	1996-2000	2001-2005	2006-2010	2011-2015	Total
Storage and Surveillance	1.7	2.0	2.3	6.3	4.1	5.3	1.8	5.0	25.2	25.2	13.0	0.0	91.9
Technology and Operations	0.1	0.3	2.7	2.8	3.2	1.8	4.7	5.3	47.5	47.0	51.9	22.4	189.5
CENRTC and Construction	0.4	1.0	0.9	10.1	20.7	25.4	20.4	0.4	2.1	21.0	1.0	0.0	103.4
Total	2.1	3.3	5.9	19.2	27.9	32.5	26.9	10.7	74.7	98.1	65.9	22.4	384.8

NOTE: All expense and CENRTC costs (millions of dollars) escalated through FY 1990. Construction costs escalated to midpoint of construction.

PST89-3071-2-5

Interim examination and assaying capabilities for CH TRU waste is provided at the Transuranic Storage and Assay Facility (TRUSAF). The only generator of newly generated, RH TRU waste will be certifying the waste at the source in late FY 1989. The CH certified waste is stored at TRUSAF and retained in a manner that will sustain certification until WIPP is ready to accept Hanford waste. The 618-11 site will be exhumed and treated as newly generated, RH waste.

2.2.2.1.2 Waste Characteristics. Similar to the stored TRU waste, the newly generated waste includes bulk quantities of trash, failed equipment, and laboratory and process waste. Much of the waste is combustible, consisting of wood, cloth, plastics, paper, absorbents, rubber, and rags. Noncombustibles include failed machinery, tanks, tools, glass, concrete, plumbing, and soils. The 24 m^3 of caisson waste and the estimated 75 m^3 in the 618-11 site is derived from research activities in 300 Area hot cells, and consists of much of the same material as noted above.

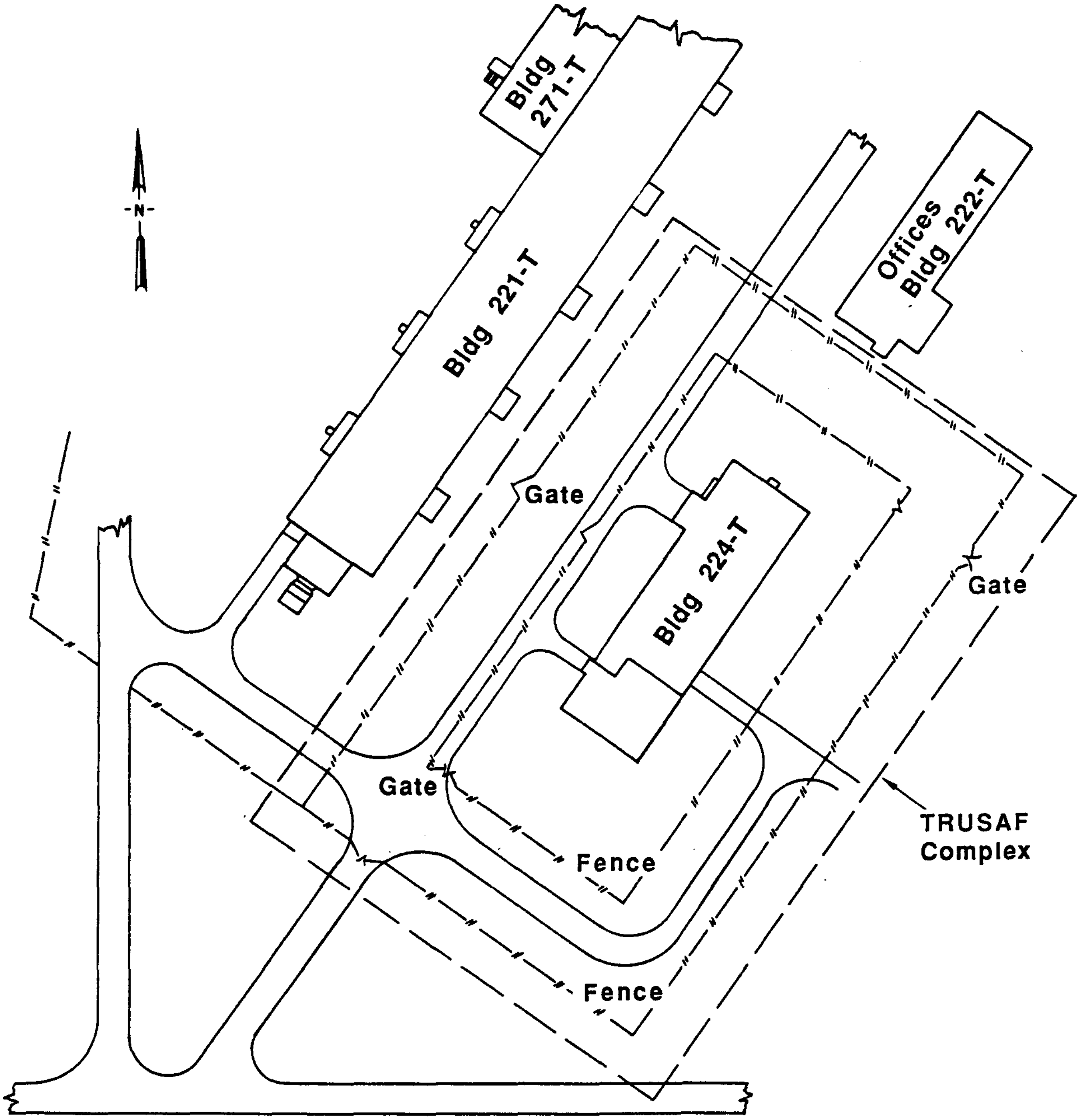
2.2.2.1.3 Facility Descriptions. The TRUSAF is located in Building 224-T in the 200 West Area as depicted in Figures 1-6 and 2-26. The TRUSAF process flow is illustrated in Figure 2-27 which is a plan view of the first floor of Building 224-T. The second and third floor provide storage for the drums of waste that have been certified for WIPP disposal.

A shipment of drums is received at TRUSAF and checked for acceptability. Each drum passes through the real-time radiography (RTR) operation where it is X-rayed to visually overview the waste and ensure that what can be identified is in general agreement with the accompanying container documentation. The TRU waste assayer is used to determine if the drum contents are TRU or LLW as determined by the 100 nCi/g standard. The containers and associated paperwork undergo a thorough visual examination. Waste and container systems found to be unacceptable are returned to the generator. The LLW is disposed of as such.

Funding is being identified and a priority established for preparing the required Part B operating permit application for storage in TRUSAF.

2.2.2.2 Current and Future Plans. Current plans are to operate TRUSAF for examination of CH TRU waste and storage of certified waste until WIPP can accept Hanford Site waste. The two large TRU generators at the Hanford Site, PUREX Plant and PFP, are not yet capable of fully certifying TRU drums and TRUSAF will provide that function until they are certified. Many of the small generators will rely on TRUSAF for continuing certification.

The RH waste is being generated at hot cell facilities in the 300 Area. The generators are expected to have full certifying capabilities by late FY 1989 and will be providing storage for the certified containers until WIPP is in a position to accept this waste.



RCP8207-9A

Figure 2-26. Transuranic Storage and Assay Facility Location at Building 224-T.

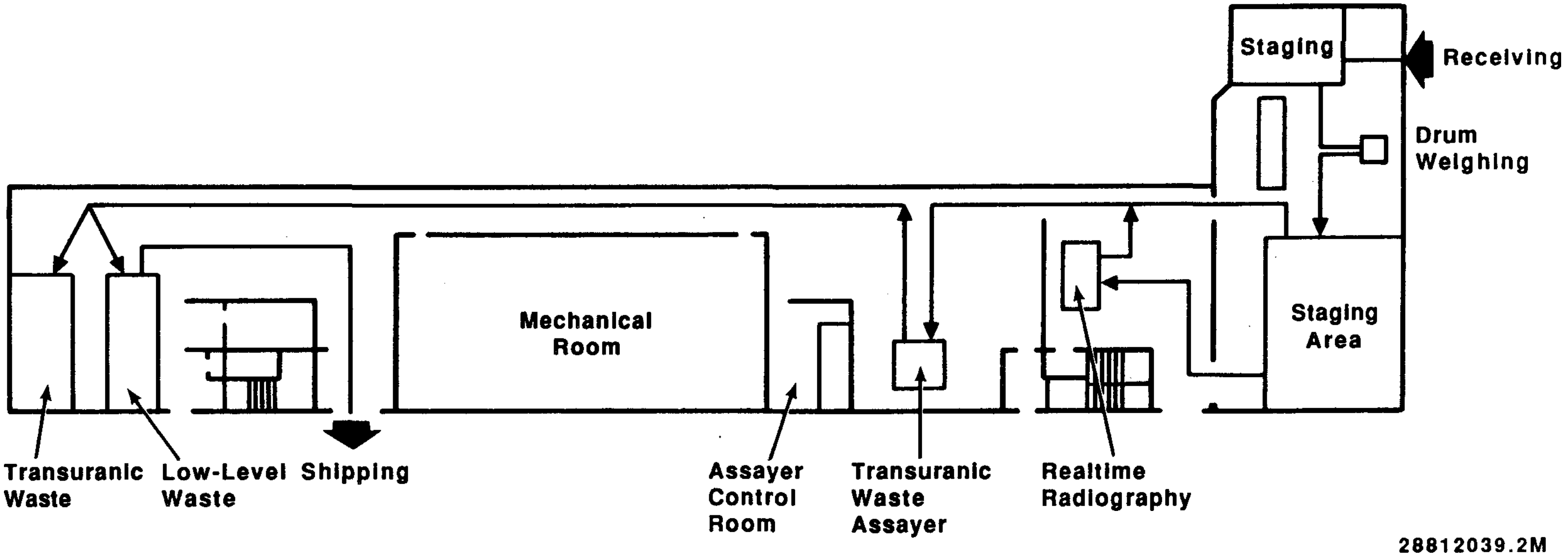


Figure 2-27. Transuranic Storage and Assay Facility Process Flow.

Future plans include (1) full certification capabilities at the large-generator facilities and possibly at certain small generator facilities, (2) construction and operation of the WRAP facility at which time the TRUSAF operations will be transferred to the WRAP facility, and (3) exhumation of the 618-11 site and subsequent treatment or packaging of this waste at the WRAP facility. Transportation to WIPP and the impacts associated with transportation are discussed in the HDW-EIS (DOE 1987).

For the RH waste contained in caissons in the 618-11 site, there are no near-term plans. Surveillance will continue for a decade or more and technology studies will be completed before any retrieval efforts. An option that will be analyzed is to ship all Hanford RH waste to the ORNL for treatment. This option is being considered because of the relatively large volume of RH waste at ORNL.

The only other issue associated with the newly generated waste involves design of interim storage capabilities in the event that Building 224-T storage capacity is exceeded. This technical issue is discussed in detail in the HWMTP (WHC 1988e). The schedule for newly generated TRU waste management and disposal is shown in Figure 2-25 and the projected costs are incorporated in Table 2-5. Stored TRU waste which is discussed above is also included in the schedule and projected costs.

2.3 LOW-LEVEL WASTE

The LLW is defined as waste that contains radioactivity and is not classified as HLW, TRU waste, mill tailings, or spent nuclear fuel as defined by DOE Order 5820.2A. Test specimens of fissionable material irradiated for R&D only, and not for the production of power or plutonium, may be classified as LLW, provided the as-disposed concentration of TRU is less than 100 nCi/g. The first part of this definition applies to a broad category of both liquid and solid wastes at the Hanford Site. The second part of this definition regarding test specimens may apply to much of the waste received from the hot cells in the 300 Area and contained in alpha caissons at 218-W-4B and the drum caissons at 618-11.

The LLW category includes (1) waste containing hazardous constituents referred to as LLMW and (2) waste which contains no hazardous constituents referred to as nonhazardous LLW. Any LLW, LLMW or nonhazardous LLW, which was placed in landfills that were declared inactive before March 1, 1987, is the responsibility of the ER Program and is not within the scope of this plan.

This section is divided into three parts:

- The nonhazardous PSW stream, DSS, and the LLW fractions yielded from pretreatment of NCAW, NCRW, CC, and PFP wastes for near-surface disposal (Section 2.3.1)

- LLW that is liquid, including organic liquids, or aqueous streams that were or are discarded to the soil column (Section 2.3.2).

- LLW that is solid, including LLMW and nonhazardous waste (Section 2.3.3).

2.3.1 Double-Shell Tank Waste for Near-Surface Disposal

The DST waste and the DST system is managed in the same manner as HLW in compliance with the requirements in DOE Order 5820.2A. This section addresses those DST waste streams, or the LLW fraction of certain DST waste streams, that are being considered for near-surface disposal.

2.3.1.1 System and Facility Description.

2.3.1.1.1 Overview of Treatment, Storage, and Disposal System. Liquid LLW is received from several operating facilities and stored in the DST system. The waste is in the form of a dilute aqueous solution or slurry. The facilities include N Reactor in the 100 Areas; laboratories, T Plant, B Plant, and PUREX Plant in the 200 Areas; and R&D facilities in the 300 Area. The 100 and 300 Area waste is transported by railroad tank cars and unloaded at the 204-AR unloading facility in 200 East Area. The tank car waste arriving at the 204-AR facility can be treated at the facility to conform with DST storage specifications. Except for the nonhazardous PSW stream, the supernatant associated with these dilute aqueous waste streams, along with other supernatant streams, is evaporated in the 242-A evaporator-crystallizer located in 200 East Area. The concentrated waste along with the interstitial liquid from SSTs is considered DSS.

The PSW stream, DSS, and the LLW fractions yielded from pretreatment will be combined with cementitious grout and disposed of in near-surface vaults in 200 East Area in the GTF. A grouted waste slurry is formed by blending liquid wastes with grout-forming solids. The grout slurry is pumped into the disposal vaults where it is solidified into large monoliths.

Figure 2-28 represents a schematic of the grout process. A Dry-Materials Facility (DMF) is used to blend the grout-forming solids. The blended solids are combined with the waste in the transportable grout equipment (TGE) where they are mixed and then pumped as a slurry to the disposal vaults. When monitoring efforts confirm that a stable disposal system exists, a protective barrier system will be placed over the vaults.

2.3.1.1.2 Waste Characteristics. Several million liters of dilute aqueous LLW are received in the DST system each year. Each stream or batch is chemically adjusted at the source, or possibly at 204-AR in the case of railcar waste, to meet specifications for DST storage. The tank specifications require strict limits for the sodium hydroxide, sodium nitrate, and sodium nitrite content. It is these chemicals that constitute most of the makeup and most of the soluble constituents in these dilute wastes.

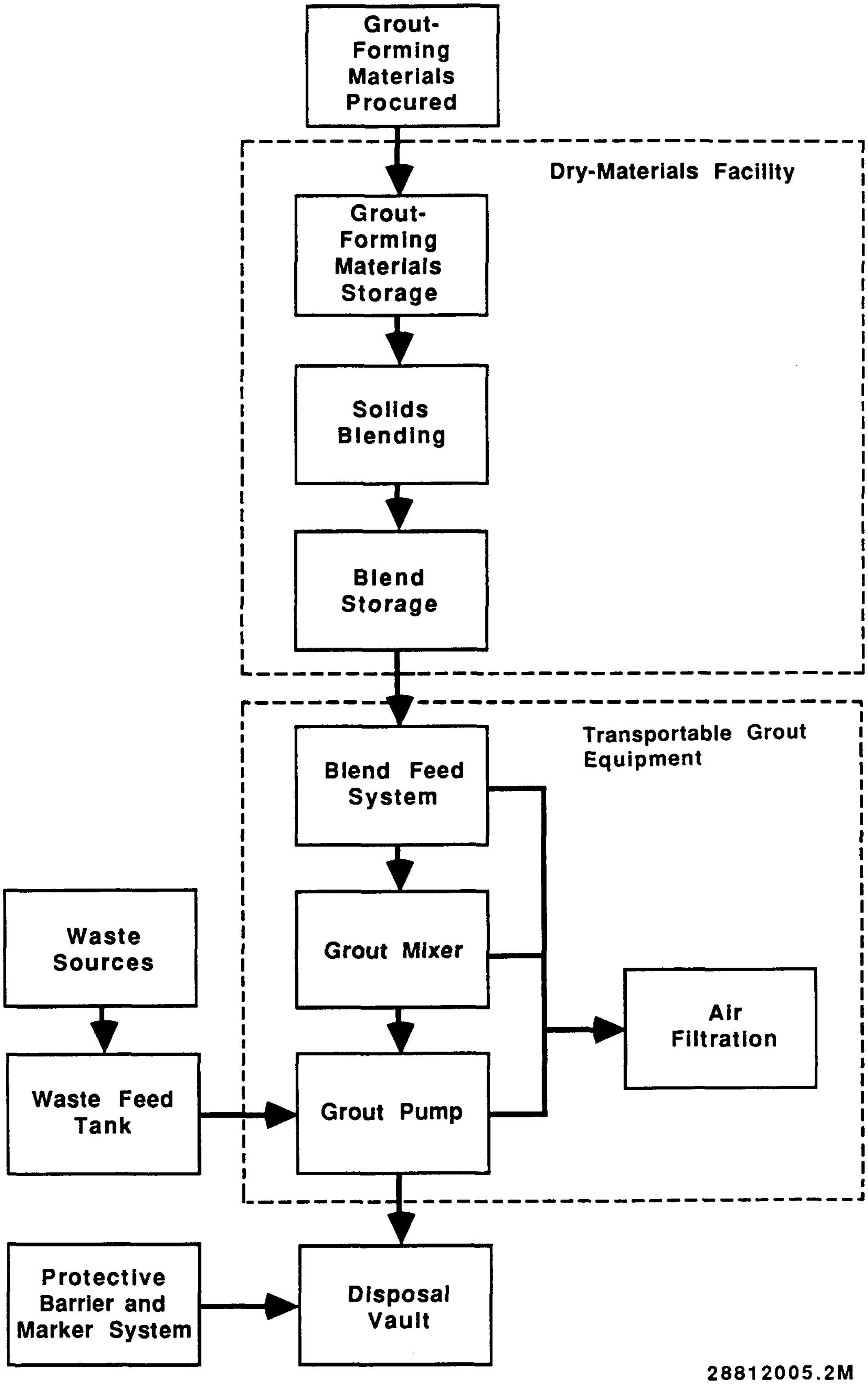


Figure 2-28. Schematic of the Grout Treatment Process.

The candidate waste streams for grout disposal will be treated in the following order: the PSW, the DSS, the NCAW supernatant with the bulk of the cesium removed and the LLW fractions from CC, NCRW, and PFP waste. The PSW is a dilute aqueous solution containing sodium phosphate and sodium sulfate. The stream contains low-level concentrations of fission and activation products and results from decontamination of process piping and equipment at the N Reactor. The PSW is nonhazardous and provides an easily handled feed for this first operation of the GTF. A brief description of the remaining waste types can be found in Section 2.1.2. With regard to the wastes for which pretreatment is required, several technical issues need to be resolved before the waste characteristics of the grout feeds can be defined. These technical issues are briefly discussed below under Current and Future Plans.

2.3.1.1.3 Facility Descriptions. A description of the DSTs and DST system is discussed in Section 2.1.2.

The liquid LLW destined for DST storage from the 100-N and 300 Areas is transported in four 76,000-L (20,000-gal) capacity stainless steel railroad tank cars of standard commercial design. The cars are unloaded at the 204-AR facility in 200 East Area. A cutaway of the facility is illustrated in Figure 2-29. The structure permits tank cars to be received in a fully enclosed, heated, and ventilated building. It is a versatile facility that allows not only pumpout to a DST receiver tank but also chemical adjustment, sampling, and sluicing of the tank cars to remove undesired sludge buildups. Piping and vessels are not subject to freezing and all routine operations can be performed remotely thereby minimizing personnel radiation exposure.

Aqueous waste stored in underground tanks has been routinely evaporated to allow for more storage volume in the tanks. The 242-A evaporator-crystallizer located in 200 East Area is currently used for this task. The process employs a conventional forced-circulation, vacuum evaporation system to concentrate the radioactive waste solution. Main process components of the system are located in the 242-A facility and consist of a reboiler, a vapor-liquid separator, a recirculation pump and pipe loop, a slurry product pump, a primary condenser, a jet vacuum system, a condensate collection tank, and an ion exchange system. Figure 2-30 presents a simplified schematic of the evaporator-crystallizer.

The GTF is located in the 200 East Area. The disposal vaults are sited in an extension on the east side of the 200 East Area. Features of the GTF are illustrated in Figure 2-31. The GTF consists of the DMF, where the grout-forming solids are blended, and the TGE, where the blended solids are mixed with liquid waste and from which the resulting slurry is pumped to the disposal site. A DST will serve as the liquid feed tank for the grout process.

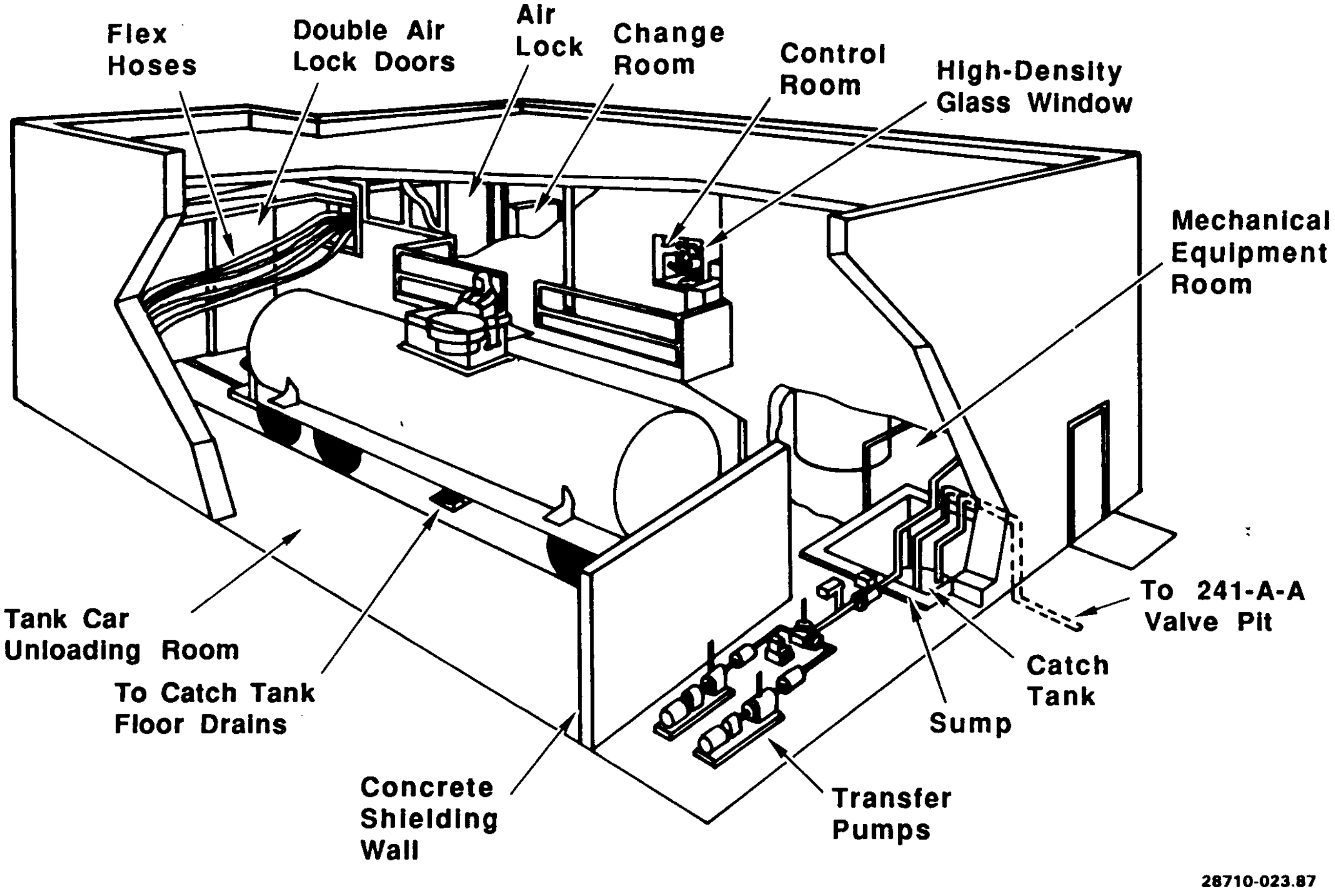


Figure 2-29. 204-AR Unloading Facility.

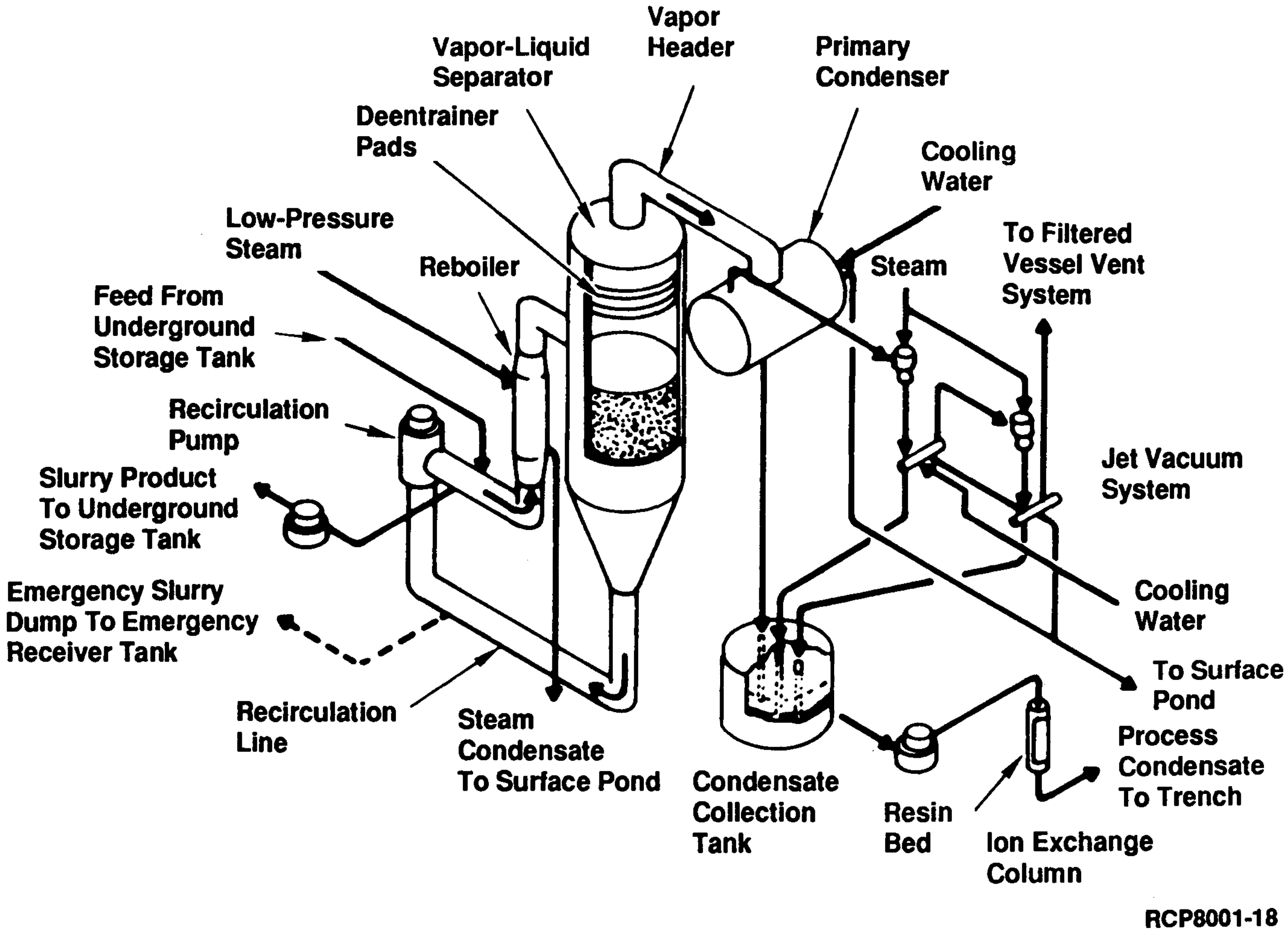


Figure 2-30. The 242-A Evaporator/Crystallizer Simplified Schematic.

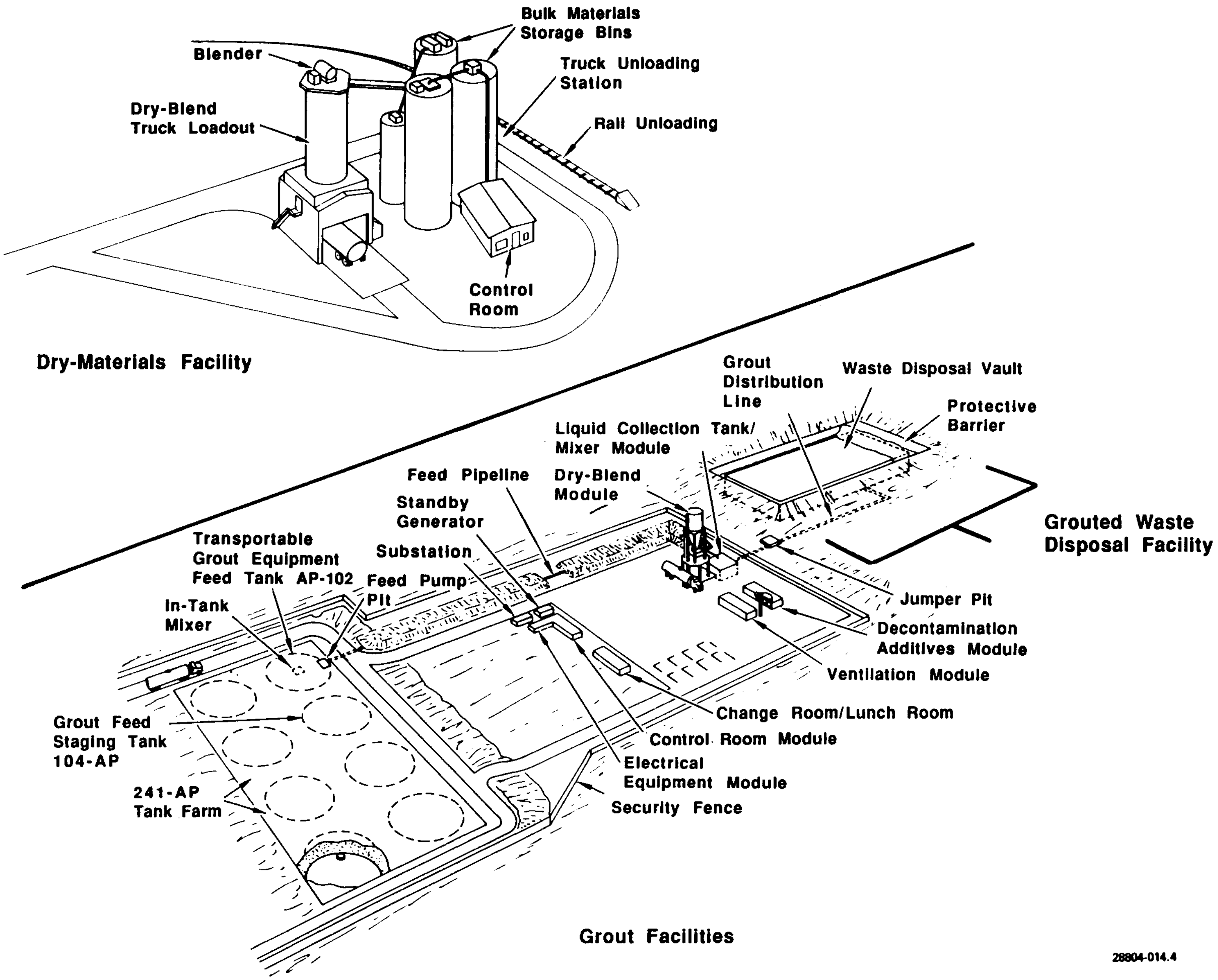


Figure 2-31. Grout Treatment Facility.

The DMF includes stationary equipment for storing and blending grout-forming solids such as Portland cement, blast-furnace slag, fly-ash and clays. Equipment associated with the DMF includes a rail car unloading station, storage silos, solids conveyers, solids blending system, and truck loading station. All DMF equipment is operated in a nonradioactive mode. Trucks transport the blended grout-forming solids from the DMF to the TGE.

The TGE consists of modules to mix blended solids with liquid waste from current and future operations, including LLW from the pretreatment facility and the HWVP. The resulting slurry is then pumped into the disposal sites. The TGE includes a blended solids feed system for providing solids to the grout mixer, a grout mixing and pumping system, offgas exhauster and filters for removing contaminants from process offgas, tanks for additives and decontamination solution, a standby electric generator, and a control room.

The grout slurry is disposed of in disposal vaults as depicted in Figure 2-32. To ensure long-term protection of the public and the environment, a unique disposal system was developed. The design features that were incorporated are based on guidance from the EPA and extensive technology development. Natural analogues such as gravel and sand are used to enhance defensibility of the design features. Design features currently being incorporated to provide the required isolation, as well as meet applicable regulatory requirements associated with hazardous waste disposal, include the following:

- A reinforced concrete vault with a structural cover, a soil or gravel shielding cover, and a double-liner leachate collection system.
- A gravel diffusion barrier surrounding the concrete vault to retard the release of radionuclides and hazardous chemicals from the disposal system.
- A multilayered protective barrier to reduce the amount of infiltrating water that can reach the waste form.

Part A permits for treatment facilities were submitted to WDOE and EPA in December 1987 for the 204-AR facility and in November 1987 for the 242-A evaporator-crystallizer. The preparation of Part B permits for these facilities is being planned and will be included in the Tri-Party Agreement. A Part B permit application for GTF was submitted to WDOE and EPA in November 1988.

2.3.1.2 Current and Future Plans. The 204-AR facility will continue to receive LLW from the 100-N and 300 Areas. The 242-A facility will not operate for most of FY 1990 and part of FY 1991 to accommodate upgrades under project B-534. Current plans are primarily concerned with the continuing operations of the GTF for the disposal of PSW. Other current plans include formulation development, waste form verification, regulatory conformance, and design and construction of vaults for the immobilization of DST waste in grout.

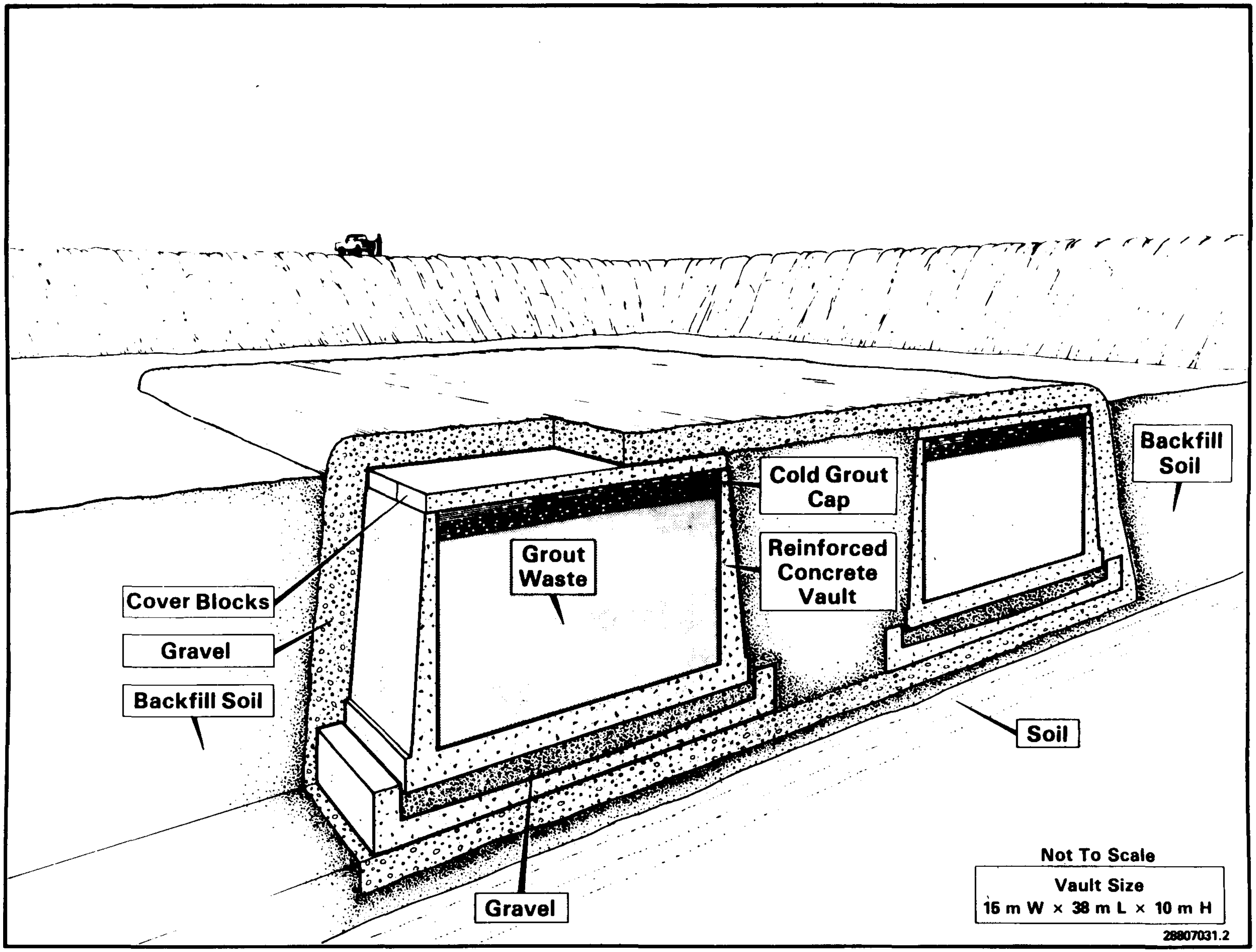


Figure 2-32. Grouted Waste Disposal Vaults.

Future plans will focus on the technical issues listed in Section 2.1.2.2. There is some urgency in proceeding with certain technical issues that influence the continuation of disposing of waste in grout. The urgency is caused by space availability in DSTs. There is a strong cost incentive to accelerate actions leading to disposal to free up space to prevent construction of new tanks.

Preliminary plans have been identified to terminate many of the processing facilities at the Hanford Site. Preceding or in conjunction with facility D&D, terminal cleanout operations will generate liquid LLW (decontamination waste) that will be disposed of in grout.

The barrier installation over grout vaults may be delayed until all grout operations are completed. If the decision is made not to retrieve SST waste, completion of grouting operations is projected to occur around FY 2010. The retrieval, treatment, and disposal of SST waste is expected to extend grout operations by 20 to 30 yr.

The technical issues are discussed in detail in the HWMTP (WHC 1988e). The schedule for DST disposal is shown in Figure 2-18. The projected costs for the disposal of DST waste that is immobilized as grout is shown in Table 2-6.

Table 2-6. Projected Costs for Double-Shell Tank Waste Management and Disposal, Low-Level Fraction.

Activity	Fiscal year												
	1988	1989	1990	1991	1992	1993	1994	1995	1996-2000	2001-2005	2006-2010	2011-2015	Total
Storage and Surveillance	23.4	26.1	27.0	33.3	32.3	29.5	25.4	23.9	97.5	60.5	21.1	0.0	400.0
Technology and Operations	15.6	19.2	26.8	28.3	29.2	40.0	43.5	43.1	216.0	204.0	269.7	72.2	1,007.6
CENRTC and Construction	10.7	7.5	7.9	9.8	9.1	8.3	15.1	12.0	25.1	25.1	22.0	3.0	155.5
Total	49.7	52.8	61.7	71.4	70.7	77.8	84.0	79.0	338.5	289.5	312.8	75.2	1,563.1

NOTE: All expense and CENRTC costs (millions of dollars) escalated through FY 1990. Construction costs escalated to midpoint of construction.

PST89-3071-2-6

2.3.2 Liquid Low-Level Waste

2.3.2.1 System and Facility Description.

2.3.2.1.1 Overview of Treatment, Storage, and Disposal System. Apart from liquid LLW stored in DSTs, liquid LLW is derived from several sources. Former sources include two bulk storage tanks in 200 West Area containing

120,000 L of hexone from the deactivated REDOX facility and several liquid effluent disposal sites. Current and continuing sources include discharges of effluents to the soil, liquid organic waste that is held by a sorbent material such as vermiculite and disposed of as a solid waste (see Section 2.3.3) and PCBs in hydraulic oils.

In the event that one of the hexone tanks develops a leak, empty railroad tank cars equipped for transporting flammable solvents are positioned near the hexone tanks and pumping capabilities are in place to empty the tanks. Current plans for the treatment and disposal of the hexone involve distillation followed by incineration of the distillate in a separate portable facility. The bottoms from the distillation unit will be packaged for disposal at WIPP.

For the inactive liquid disposal sites deactivated after March 1, 1987, closure/post-closure permit applications are being prepared. Groundwater monitoring wells are being installed in compliance with applicable environmental regulations.

For the active liquid effluent disposal sites, a comprehensive program is underway to discontinue the use of soil columns as identified in the Plan and Schedule to Discontinue Discharges of Contaminated Liquids into the Soil Column at the Hanford Site (DOE-RL 1987). An updated status of this plan and schedule has been recently issued (WHC 1988a). To date, the program has identified 33 effluent streams for which action is required: 13 of the effluent streams are associated with Waste Management facilities and corrective actions are funded by the Waste Management Program; 20 effluent streams are associated with Defense Reactor or Chemical Processing facilities and are partially funded by the Waste Management Program. Overall management for all the streams is provided by the Waste Management Program.

In the strategy that has been developed, the effluent streams were ranked by priority into Phase I and Phase II. The higher priority Phase I effluents would have BAT end-of-pipe treatment facility modifications implemented by FY 1995. Phase II effluents would follow. Six Waste Management effluents are considered in Phase I and seven in Phase II. The treatment, storage, and disposal system, as depicted in Figure 2-33, includes a primary treatment for the Phase I effluents, a secondary waste disposal system (other than WRAP/WIPP or GTF) for all secondary wastes and, finally, a treated effluent disposal system.

Each of the Phase I effluents will undergo a primary treatment step using BAT. The type of treatment will be identified through a BAT evaluation (WHC 1988b). This treatment step may consist of facility modification or end-of-pipe treatment systems. During the past year significant progress was made on the design of the primary treatment systems.

The primary treatment systems will produce secondary waste streams that contain the removed contaminants. The need for further treatment of the secondary wastes will depend on whether they are liquid or solid and on the nature and level of their radioactive and/or chemical contamination. The purpose of the treated-effluent disposal system is to provide for the disposal

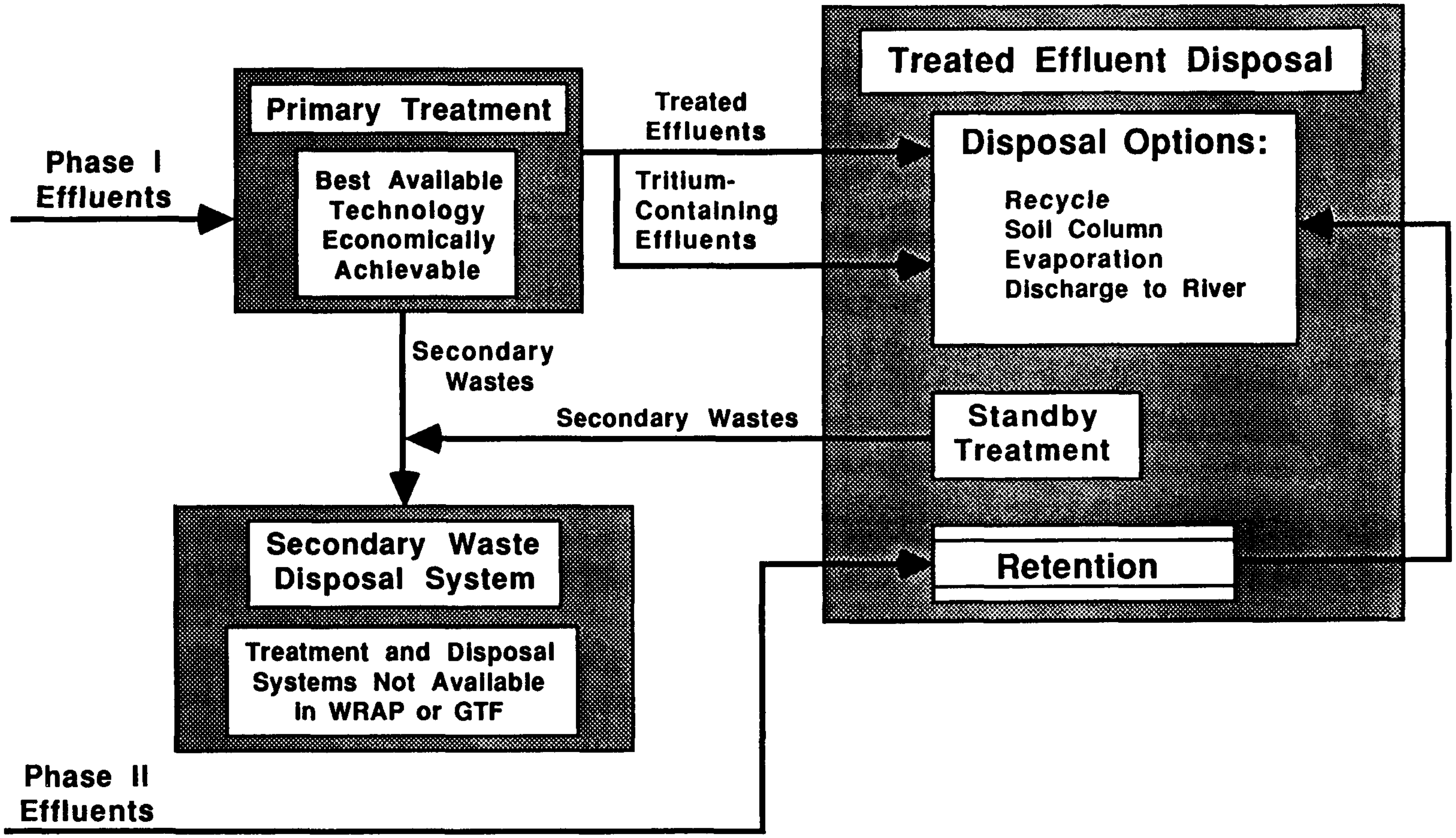


Figure 2-33. Alternative Treatment and Disposal for Soil Column Discharges.

of the treated-liquid effluents that result from the primary treatment of the Phase I effluents and for the disposal of the Phase II effluents.

2.3.2.1.2 Waste Characteristics. The chemical name for hexone is methyl isobutyl ketone. One tank contains pure hexone. The second tank contains hexone with a smaller quantities of another solvent, normal paraffin hydrocarbon, and an extractant, tributyl phosphate. Small amounts of water and rust have accumulated at the bottom of each tank. The radionuclide content for each tank is estimated at 2 Ci of beta.

To date, the following soil column facilities have been retired: the 216-A-10 crib, the 216-U-12 crib, the 216-A-36B crib, and the 1301-N crib. Details are provided in the HAZWMP (DOE-RL 1988a).

A total of 33 Phase I and Phase II liquid streams are associated with the liquid effluent disposal sites. In all cases, the streams are dilute aqueous wastes with low levels of contamination. Details are provided in the Annual Status Report of the Plan and Schedule to Discontinue Disposal of Contaminated Liquids into the Soil Column at the Hanford Site (WHC 1988a).

Hydraulic oils contaminated with both plutonium and PCBs are located in the PFP but specialized treatment is being evaluated to remove the plutonium. One-time disposal of PCB-contaminated oils is being pursued at other DOE facilities. The techniques developed will be applied at the Hanford Site or arrangements may be made to transport PCBs to other DOE treatment facilities.

2.3.2.1.3 Facility Description. The two hexone tanks, designated 276-S-141 and 276-S-142, are located near the deactivated REDOX facility in 200 West Area. Each tank is 12 ft in diameter and 23 ft in length. The tanks are buried 3 ft below grade. Routine radiation surveys and visual inspections are performed. Tank liquid levels are routinely monitored. A portable, modular distillation unit is being constructed to treat the hexone. An incineration unit will be leased to cleanly combust the purified hexone.

Liquid wastes containing low levels of radionuclides have been discharged to cribs, ponds, ditches, and other subsurface engineered structures. Cribs are liquid dispersal systems used for the disposal of process wastes, steam and process condensates, and laboratory wastes. An example of crib construction is shown in Figure 2-34. Ponds are natural or diked surface depressions which allow the liquid effluent to percolate into the underlying sediment. Ditches are excavations used for conveying the liquid waste to the ponds. All effluents discharged to cribs, ponds, and ditches are monitored for radionuclide content.

The status of regulatory permitting is as follows:

- For the hexone tanks, a Part A permit application for storage was submitted to the WDOE in December 1987. Permit applications for the distillation and incineration units are being evaluated.

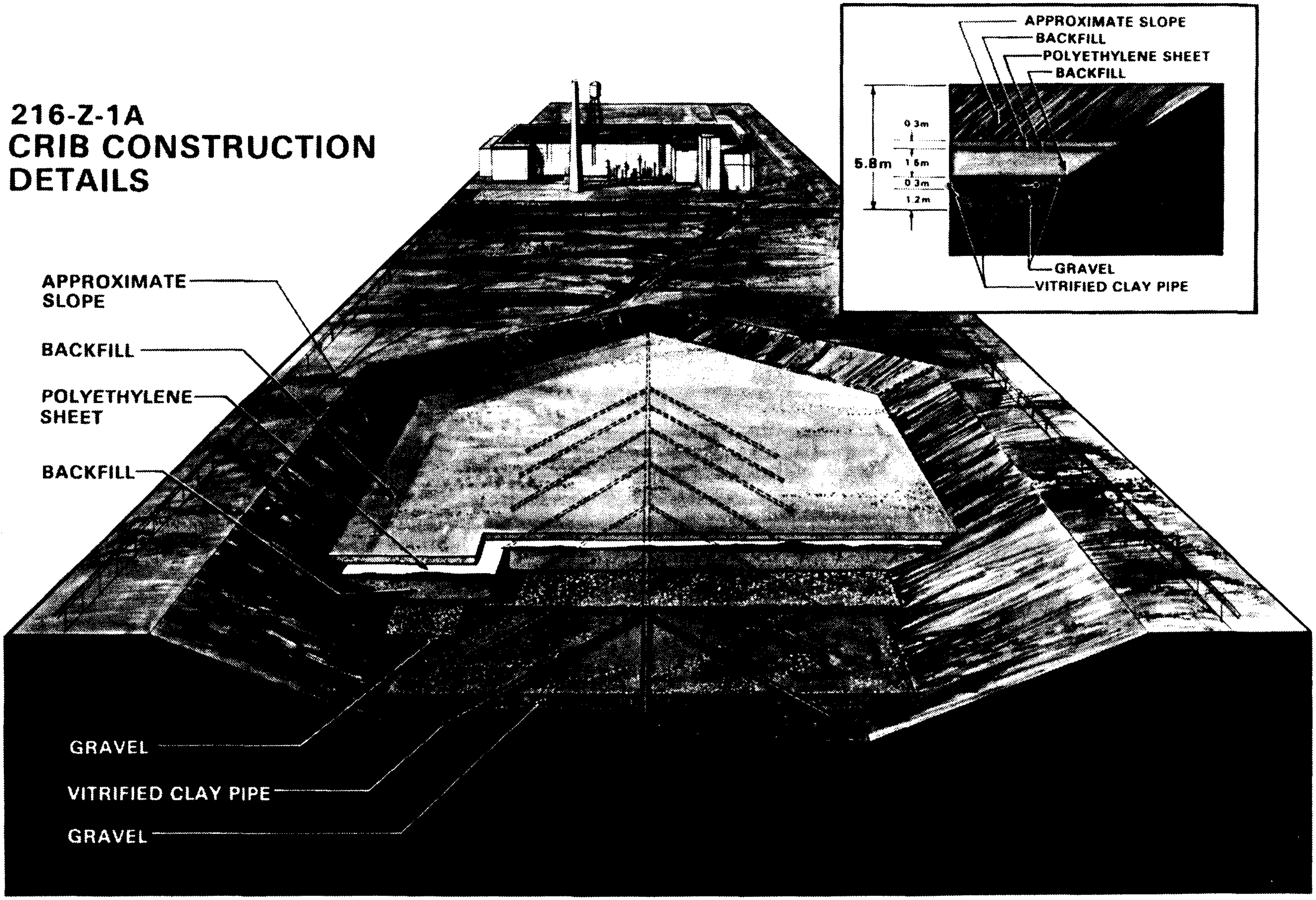


Figure 2-34. Example of Crib Construction.

- For the 1301-N crib, closure plans were submitted in April 1987.
- For the 216-A-10 crib, the 216-U-12 crib, and the 216-A-36B crib, closure plans are being prepared.

2.3.2.2 Current and Future Plans. Current plans for hexone waste are to continue safe storage and surveillance. For the inactive liquid effluent disposal sites, the preparation and submittal of closure/post-closure permits will continue.

Future plans for hexone include distillation followed by incineration of the distillate. Funding is being provided by the Hazardous Waste Remedial Action Program (HAZWRAP) and completion is scheduled for mid-FY 1991.

Future plans for liquid effluent disposal are well defined. Several studies have been completed including a BAT evaluation for the B Plant process condensate (BCP). These studies and other supporting studies to be completed in FY 1989 will allow the initiation of conceptual and definitive design for treatment and disposal projects. Completion and operation of all alternative disposal systems for liquid effluents is planned for FY 1995. The projects and associated funding for these alternative disposal systems are part of the Hanford Environmental Compliance Project (see Section 6.4).

The schedule for liquid LLW disposal is shown in Figure 2-35 and the projected costs are shown in Table 2-7. Significant scheduling accomplishments were made between the baseline plan and schedule in March 1987 (DOE-RL 1987) and the current status (WHC 1988a) for discontinuing liquid effluents to the soil column. Phase I was accelerated by 2 yr from FY 1995 to FY 1993. Phase II was accelerated by 15 yr from FY 2010 to FY 1995.

2.3.3 Solid Low-Level Waste

2.3.3.1 System and Facility Description.

2.3.3.1.1 Overview of Treatment, Storage, and Disposal System. A comprehensive program has been implemented at Hanford for all solid waste to attain full compliance with the RCRA and the Washington State Dangerous Waste Regulations, WAC 173-303. The program was initiated in early FY 1987. The principal focus of the program has been on instituting procedures and practices at generator facilities to segregate the waste according to hazardous characteristics and minimize the quantity of waste.

The current forecast for nonhazardous LLW generation is 400,000 m^3 from FY 1989 through FY 2017. Nonhazardous LLW, when properly certified, may not require treatment and is currently being disposed of in earth-covered trenches (landfills) in accordance with applicable environmental regulations

The current forecast for LLMW generation is 9,060 m^3 from FY 1989 through FY 2017. The LLMW is being segregated at the generator facilities and stored for future treatment in the WRAP facility. Temporary storage areas will be

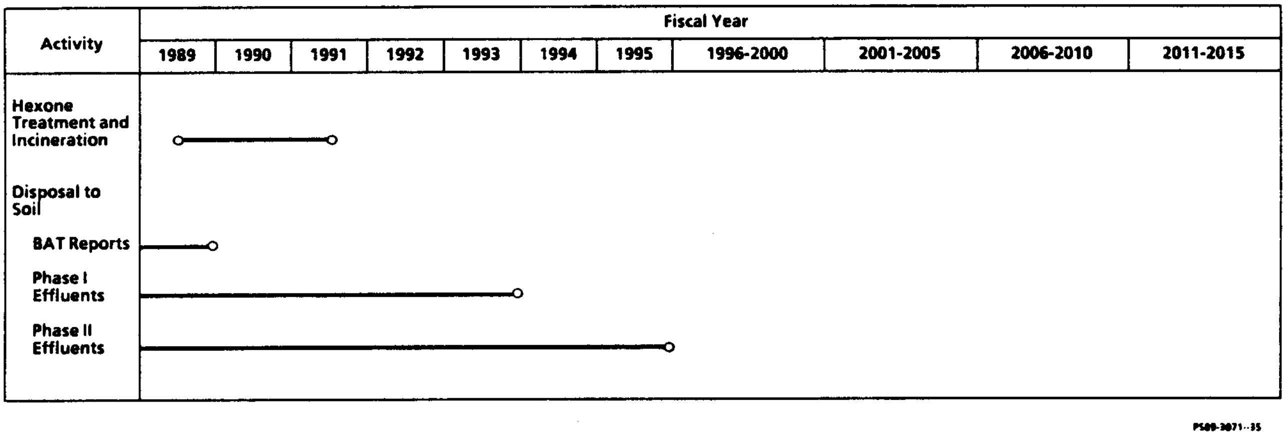


Figure 2-35. Schedule for Liquid Low-Level Waste Management and Disposal.

Table 2-7. Projected Costs for Liquid Low-Level Waste Management and Disposal.

Activity	Fiscal year												
	1988	1989	1990	1991	1992	1993	1994	1995	1996-2000	2001-2005	2006-2010	2011-2015	Total
Storage and Surveillance	8.7	10.3	11.4	17.6	17.3	15.7	15.4	15.4	0.5	0.5	0.5	0.5	113.8
Technology and Operations	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0	30.0
CENRTC and Construction	0.8	5.6	16.5	33.6	42.7	33.3	20.0	2.1	0.5	0.5	0.5	0.5	156.7
Total	9.5	14.5	21.8	34.0	39.1	32.0	26.4	17.5	1.0	1.0	1.0	31.0	300.5

NOTE: All expense and CENRTC costs (millions of dollars) escalated through FY 1990. Construction costs escalated to midpoint of construction.

PST89-3071-2-7

used through FY 1990. A 14,850 m^2 (160,000 ft^2) MW storage facility is being constructed and will be available in late FY 1990. The modified mission for WRAP (see Section 2.2.1.1.) will include treatment capabilities for LLMW. A schematic of the treatment, storage, and disposal system is shown in Figure 2-36.

More than 1,000 t of alkali metal, primarily sodium with lesser amounts of potassium, lithium, and mixtures of these elements, are stored at the Hanford Site. Most of the stored alkali metal is associated with the operation of the FFTF and is not considered waste. Other quantities (about 140 t) are surplus from deactivated research reactor facilities. The surplus quantities are being safely stored but efforts are underway to either sell the alkali metal to commercial sources or convert the metal to a hydroxide form for recycling within the DOE complex.

Other than Hanford Site waste, the reactor cores from deactivated nuclear vessels are received from the U.S. Department of the Navy and disposed of in designated trenches. In addition, DOE LLW is sent to Hanford for storage or disposal. An example is the core of the Shippingport reactor which is currently being shipped to the Hanford Site.

2.3.3.1.2 Waste Characteristics. Identifying the characteristics of LLW, both nonhazardous and MW, is the subject of an extensive training program that has been implemented at all generating facilities at the Hanford Site. It is the responsibility of the generator to determine both the hazardous constituents and radionuclides that are contained in a waste package. Utilizing established waste minimization guidelines, it is important to segregate the nonradioactive hazardous waste from the MW in an attempt to minimize the latter.

Examples of hazardous wastes, both nonradioactive and LLMW, that result from maintenance and processing activities at the Hanford Site are listed below:

- Toxic metals (e.g., mercury, lead, cadmium, chromium, beryllium, sodium, silver, zinc)
- Chemical sorbed materials (paper, mop heads, rags, and gloves)
- Spray cans (lubricants, rust retardants, solvents, cleaners, and regulated empty containers)
- Paint related materials (generally oil-based paints and not latex, brushes, solvents, and regulated empty containers)
- Equipment or equipment fluids (toxic constituents, flammables, PCBs)
- Spilled chemicals and related absorbent materials
- Excess chemicals
- Batteries

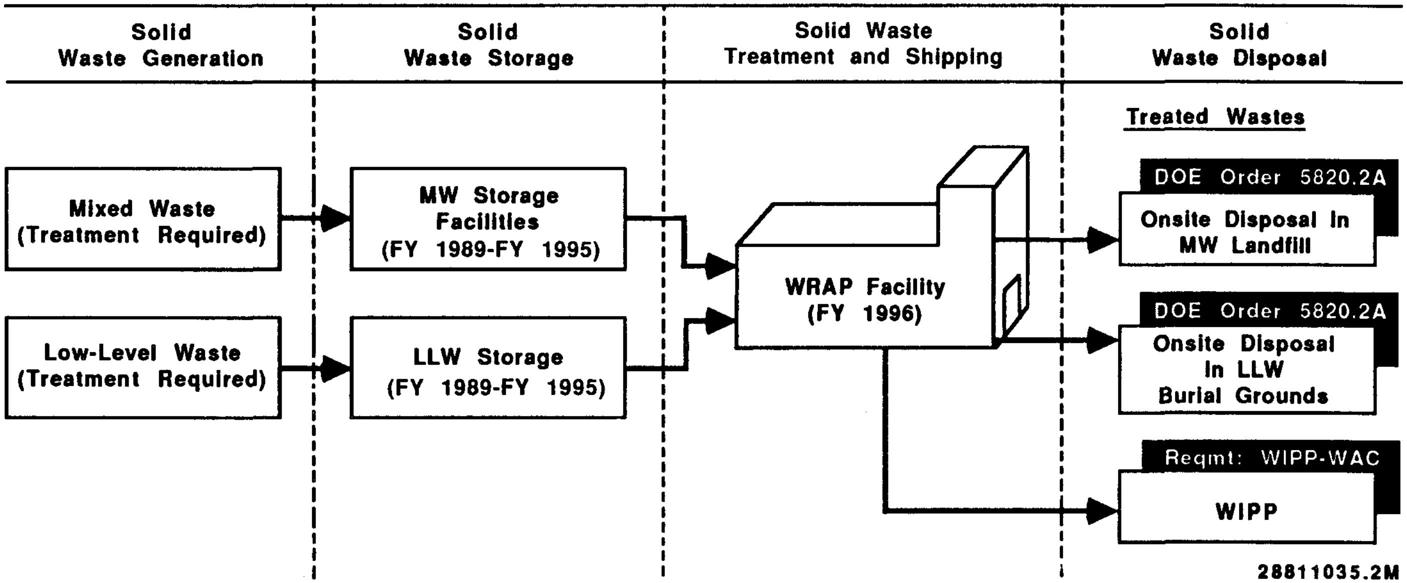


Figure 2-36. Schematic of Solid Low-Level Waste Treatment, Storage and Disposal.

- Lamps and light tubes (sodium, mercury vapor, fluorescent tubes, ballasts)

- Process wastes (ion exchange column resins, filters, residues).

2.3.3.1.3 Facility Descriptions. The nonhazardous LLW is placed in earth trenches (landfills) and covered with 2.4 m of soil. Industrial trenches accommodate large pieces of waste such as 5-m-long burial boxes from canyon facilities. Dry waste burial trenches accommodate smaller containers such as fiberboard boxes and rubble from the D&D of surplus facilities.

Temporary facilities for the storage of LLMW provide segregation according to the hazardous characteristics: ignitability, corrosivity, reactivity, and toxicity. The corrugated-metal structures contain sealed concrete slabs with curbing and a sump where accumulated spills can be cleaned.

The Radioactive Mixed Waste (RMW) Storage Facility (project W-016) consists of four separate buildings with a total floor space of 14,850 m^2 (160,000 ft^2), the equivalent of 56,000 55-gal drums of LLMW. The buildings will be a slab-on-grade, pre-engineered metal structure. No insulation will be provided and heating and cooling is not required. The buildings will store newly generated solid MW from FY 1990 through FY 1995, at which time the WRAP facility will come on line and start working off the stored inventory.

The WRAP facility will be used when treatment of LLMW is required. The facility is described in Section 2.2.1.1.

The need for regulatory permits for these facilities is being addressed as part of an overall permitting strategy and will be included in the Tri-Party Agreement.

2.3.3.2 Current and Future Plans. Goals established for each generator facility for FY 1989 include the following:

- Implement a waste characterization plan

- Implement waste minimization and segregation plans

- Implement an approved solid waste management program

- Certify each solid waste container.

The treatment, storage, and disposal facility operators are trained and instructed to accept only LLW, both nonhazardous and LLMW, certified in accordance with applicable requirements contained in DOE Order 5820.2A and WAC 173-303.

Temporary LLMW storage facilities are being constructed and will continue to accommodate the different classes of LLMW. In FY 1989, design will be initiated for the RMW Storage Facility, a structure with an estimated cost of $8.7 million and a startup date of FY 1990.

Future plans will focus on the need for effective treatment for the various categories of LLMW in the WRAP facility and the disposal of certified LLMW either at Hanford or a DOE facility other than Hanford. A disposal facility for dragoff LLMW (project W-031) is in the early stages of design.

The schedule for solid LLW disposal is shown in Figure 2-37 and the projected costs are shown in Table 2-8.

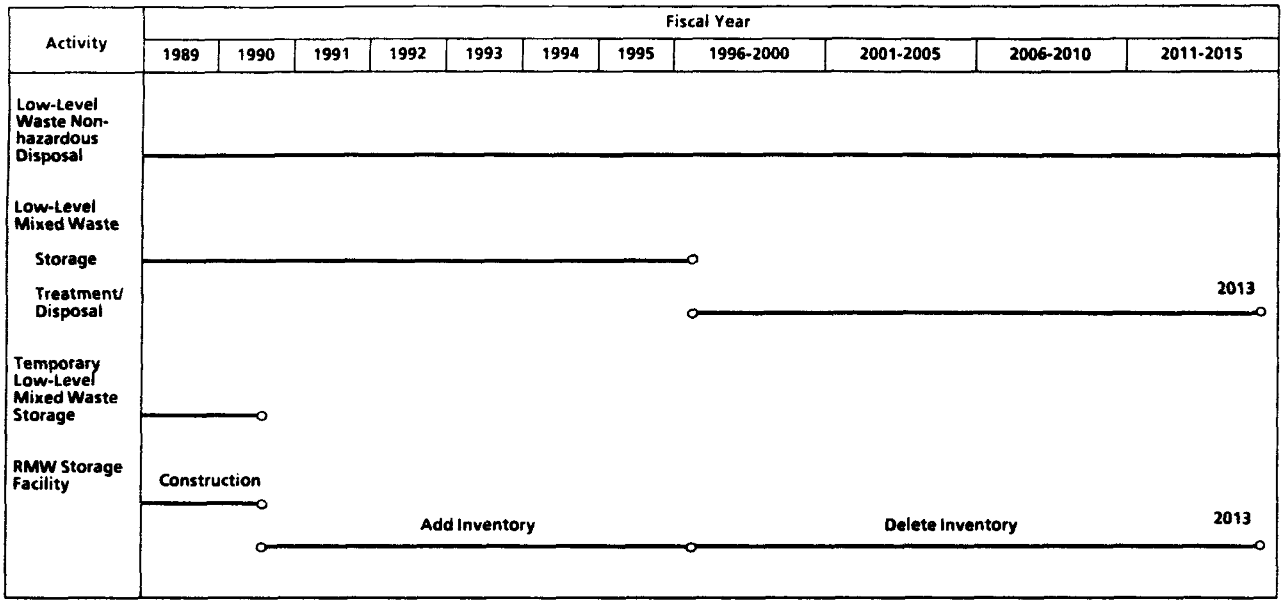


Figure 2-37. Schedule for Solid Low-Level Waste Management and Disposal.

Table 2-8. Projected Costs for Solid Low-Level Waste Management and Disposal.

Activity	Fiscal year												
	1988	1989	1990	1991	1992	1993	1994	1995	1996-2000	2001-2005	2006-2010	2011-2015	Total
Storage and Surveillance	1.1	1.7	2.2	4.9	4.7	4.5	3.9	3.9	19.7	19.7	19.7	9.9	96.1
Technology and Operations	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.0	57.0
CENRTC and Construction	0.4	1.3	3.9	3.7	5.8	5.4	0.4	0.4	2.1	2.1	2.1	1.0	28.5
Total	1.5	3.0	6.1	8.6	10.4	9.9	4.4	4.4	21.8	21.8	21.8	41.0	181.6

NOTE: All expense and CENRTC costs (millions of dollars) escalated through FY 1990. Construction costs escalated to midpoint of construction.

PST89-3071-2-8

This page intentionally left blank.

3.0 HAZARDOUS WASTE MANAGEMENT

3.1 HAZARDOUS WASTE

In 1986 the DOE issued notice DOE N 5400.1 (DOE 1986) establishing a policy to conduct its operations "in compliance with the letter and spirit of applicable environmental statutes, regulations and standards." Regulations were promulgated by the EPA pursuant to Subtitle C of the RCRA as amended. Hazardous wastes were designated by the lists and characteristics shown in the corresponding RCRA regulations at 40 CFR 261.

As a result of authorization requested and received from the EPA, the WDOE has the responsibility to regulate all aspects of handling hazardous waste: the generation, transportation, treatment, storage, and disposal. Those wastes for which EPA retains exclusive authority are included in Hazardous Solid Waste Amendment (HSWA) of 1984 to RCRA. Regulations more stringent than those identified by the EPA have been promulgated for "dangerous waste" in the WAC Chapter 173-303 (WDOE 1987), established pursuant to the Washington State Hazardous Waste Management Act of 1976.

Dangerous waste (DW) and extremely hazardous waste (EHW) are wastes designated in accordance with procedures specified in WAC 173-303-070 to -103. The EHW includes the category of acutely hazardous waste and is a subcategory of dangerous wastes. The categories of DW and EHW established in WAC 173-303 identify a broader range of wastes than the RCRA regulations.

This section discusses the treatment, storage, and disposal of DP waste associated with DP facilities only.

3.2 SYSTEM AND FACILITY DESCRIPTIONS

3.2.1 Overview of Treatment, Storage, and Disposal System

3.2.1.1 Treatment. One treatment process that provides site-wide service and is conducted by the Waste Management Program involves the detonation of shock-sensitive or potentially explosive chemicals at one of three locations. These locations are isolated from any building, other structures, and all traffic. A Part B permit application was submitted to WDOE and EPA in November 1985.

Other than the demolition sites, there are no centralized treatment systems for hazardous wastes associated with the Waste Management Program at the Hanford Site. Each generator facility may perform specialized processing to minimize or recycle certain waste streams but these processes do not qualify as treatment as defined by regulations.

Options for treatment of hazardous waste are being evaluated as part of the HAZWRAP at the ORNL. Treatment at the WRAP facility at Hanford, described in Section 2.2.1, versus treatment at other DOE sites is an option under consideration.

3.2.1.2 Storage. Storage of hazardous waste for all of the Hanford Site's operations is conducted at the 616 Nonradioactive Dangerous Waste Storage Facility (NRDWSF). Although the NRDWSF is operated by the Waste Management Program, the operating costs are liquidated to the generators. It is located midway between 200 East and 200 West Areas and began operations in September of 1986 under a Part A application. The NRDWSF stores dangerous waste before offsite shipment.

Packages are inspected three times before arrival at the NRDWSF: (1) the generator inspects the container and prepares the package according to the Department of Transportation (DOT) requirements, (2) an engineering representative inspects the completed package (external inspection) for compliance with packaging instructions before approving the shipment, and (3) the transporter inspects the packages before accepting the waste to ensure that the shipment is consistent with the approved Uniform Hazardous Waste Manifest (Figure 3-1). The transporter then delivers the packaged waste to the NRDWSF. It is staffed with fully trained operators instructed to accept waste that is accompanied by a completed manifest.

Before opening the 616 Facility, a storage area designated the 2727-S Building was used on a temporary basis and is now declared a surplus facility. It is located in the south end of 200 West Area. A closure plan has been prepared for this building.

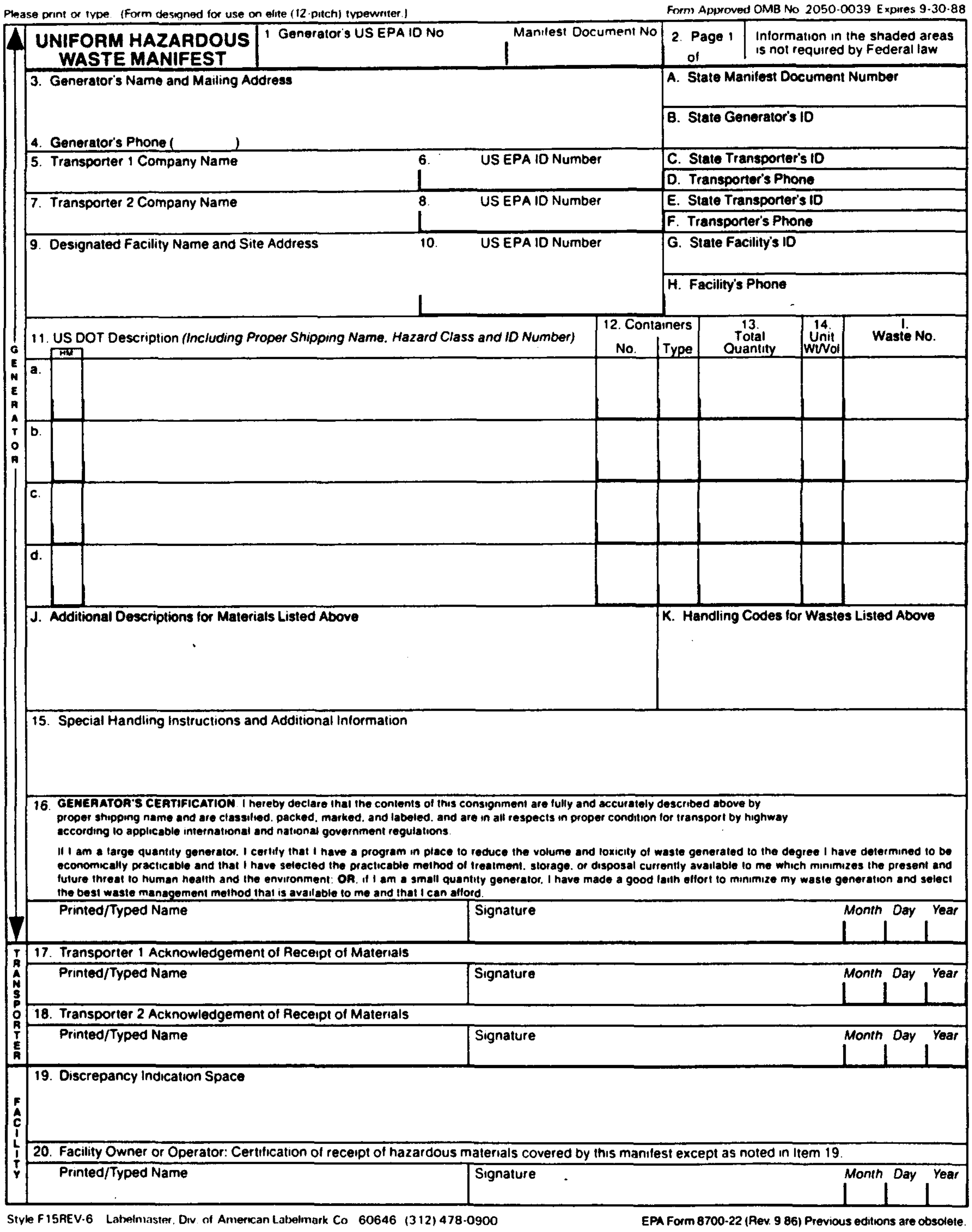
3.2.1.3 Disposal. Disposal of nonradioactive hazardous waste is currently undertaken through private commercial enterprises. One inactive disposal site, the Nonradioactive Dangerous Waste Landfill (NRDWL), is closed while an evaluation is being made to determine if reactivating the site is desirable and if additional actions are required for reactivation. There are no other disposal sites at the Hanford Site and none planned.

Waste containing asbestos is disposed of in a designated landfill facility in compliance with regulations pursuant to the Federal Clean Air Act. An annual report is submitted to the WDOE and the EPA, as required, describing the packaging and record keeping.

3.2.2 Waste Characteristics

As with MW, identifying the characteristics of hazardous waste is the subject of an extensive training program that has been implemented at all generating facilities at the Hanford Site. It is the responsibility of the generator to determine both the hazardous constituents and radionuclides that are contained in a waste package. Nonradioactive hazardous waste is segregated from the MW utilizing established waste minimization guidelines.

Examples of hazardous wastes, both nonradioactive and MW, that result from maintenance and processing activities at the Hanford Site are shown in Section 2.3.2.1.2.



Please print or type (Form designed for use on elite (12-pitch) typewriter.)

Form Approved OMB No 2050-0039 Expires 9-30-88

UNIFORM HAZARDOUS WASTE MANIFEST

1 Generator's US EPA ID No

Manifest Document No

2. Page 1 of

Information in the shaded areas is not required by Federal law

3. Generator's Name and Mailing Address

4. Generator's Phone ( )

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name

6. US EPA ID Number

C. State Transporter's ID

D. Transporter's Phone

7. Transporter 2 Company Name

8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address

10. US EPA ID Number

G. State Facility's ID

H. Facility's Phone

11. US DOT Description *(Including Proper Shipping Name, Hazard Class and ID Number)*	HM	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a.						
b.						
c.						
d.						

G E N E R A T O R

J. Additional Descriptions for Materials Listed Above

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

16. **GENERATOR'S CERTIFICATION** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; **OR**, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name | Signature | *Month Day Year*

T R A N S P O R T E R

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | *Month Day Year*

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | *Month Day Year*

F A C I L I T Y

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name | Signature | *Month Day Year*

Style F15REV-6 Labelmaster, Div. of American Labelmark Co 60646 (312) 478-0900

EPA Form 8700-22 (Rev. 9 86) Previous editions are obsolete.

Figure 3-1. Uniform Hazardous Waste Manifest.

3.2.3 Facility Description

The 616 NRDWSF is the only active facility for the RCRA storage of hazardous waste for which the Waste Management Program is responsible. The design of the NRDWSF meets the requirements of the applicable codes, standards, and regulations for the safe handling, storage, packaging, and sampling of dangerous wastes. It is a permanent structure constructed of precast concrete.

Six storage cells are provided, as shown in Figure 3-2, for the interim storage of dangerous wastes. The cells are designated by waste type. The designation of these cells is not totally fixed, and some flexibility exists to redesignate cells as waste types and volumes change. The 1-A and 1-B flammable liquid wastes must be stored in their designated cells because of the unique fire and explosive characteristics of the waste. The 1-A cell may store 1-B liquids but the 1-B cell may not store the 1-A liquids. Class 1-A flammable liquids have flash points below 22.8 ^{o}C (73 ^{o}F) and boiling points below 37.8 ^{o}C (100 ^{o}F). Class 1-B flammable liquids have flash points below 22.8 ^{o}C (73 ^{o}F) and boiling points at or above 37.8 ^{o}C (100 ^{o}F). A proposal has been made to designate the other four cells for any of the additional waste types.

The storage cells have liquid-tight slabs sloped to a collection trench for the accumulation of spilled or leaking liquids. Each collection trench is covered by a removable steel grate for personnel protection. A curb surrounds each cell with a sloped ramp on one end for access. All of the storage cells are provided with emergency exit doors and surface-mounted industrial fluorescent light fixtures.

3.3 CURRENT AND FUTURE PLANS

The treatment, storage, and disposal for hazardous waste disposal is not expected to change from the current practice described above. The permit process will be completed for the 616 NRDWSF. Closure will be implemented for Building 2727-S.

Because current practices will be maintained, a schedule is not presented for hazardous waste. Projected costs are shown in Table 3-1 and the majority of this funding is associated with site-wide RCRA groundwater monitoring rather than treatment, storage, and disposal.

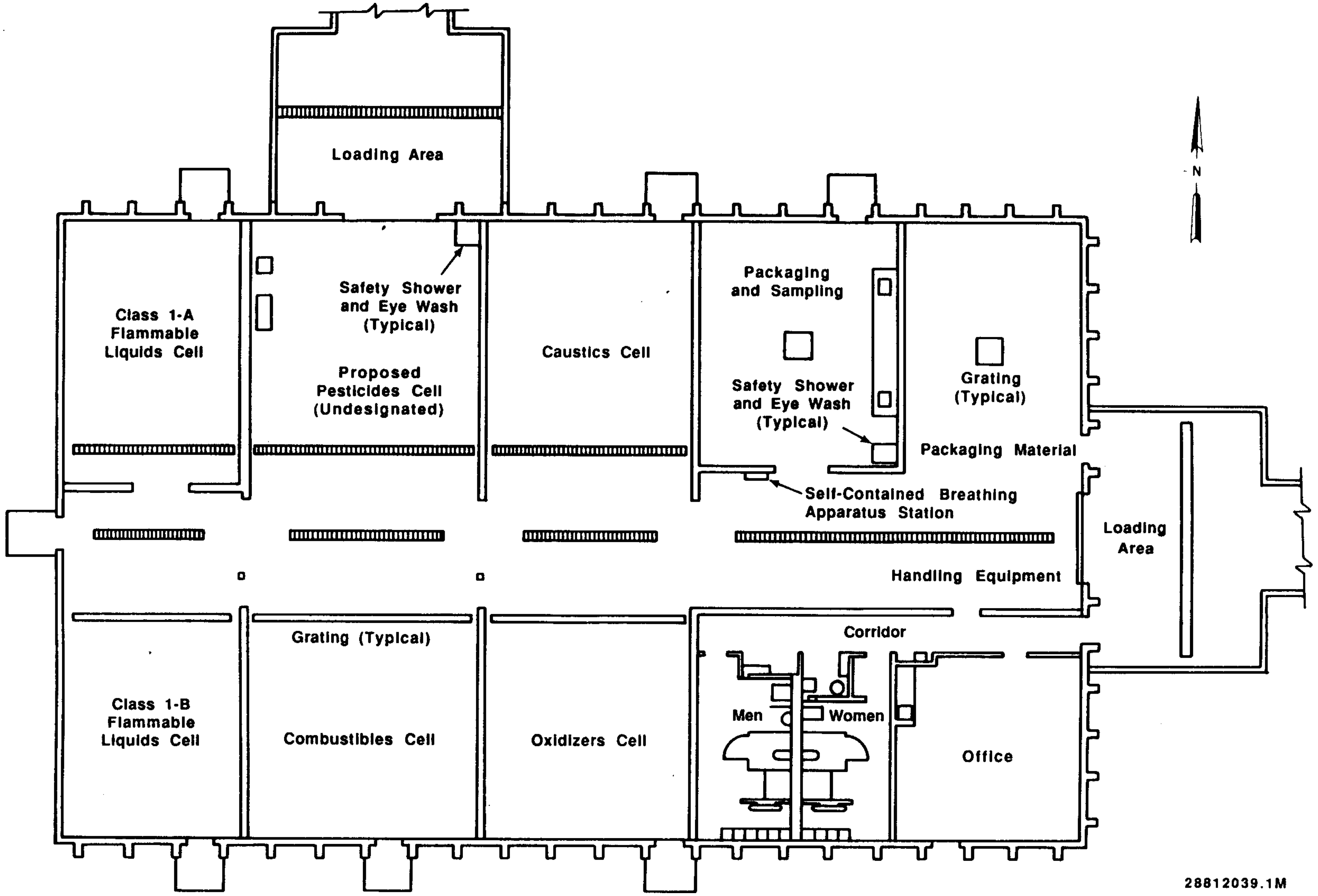


Figure 3-2. Nonradioactive Dangerous Waste Storage Facility Floor Plan.

Table 3-1. Projected Costs for Hazardous Waste Disposal.

Activity	Fiscal year												
	1988	1989	1990	1991	1992	1993	1994	1995	1996-2000	2001-2005	2006-2010	2011-2015	Total
Storage and Surveillance	0.4	0.5	0.6	1.2	1.2	1.3	1.2	1.2	5.9	5.9	5.9	3.0	28.3
Technology and Operations	1.6	2.1	2.6	4.8	4.9	5.0	4.7	4.7	23.6	23.6	23.6	12.0	113.1
CENRTC and Construction	0.5	1.1	1.2	2.3	1.4	0.7	0.6	0.6	3.0	3.0	3.0	1.5	18.9
Total	2.4	3.7	4.4	8.3	7.6	7.0	6.5	6.5	32.5	32.5	32.5	16.5	160.3

NOTE: All expense and CENRTC costs (millions of dollars) escalated through FY 1990. Construction costs escalated to midpoint of construction.

PST89-3071-3-1

4.0 COST AND SCHEDULE SUMMARY

This section provides the following: (1) the current fiscal year (FY 1989) costs and operational schedules for the Waste Management Program and (2) a 5-yr cost and schedule projection with major milestones to be accomplished during that period.

4.1 FISCAL YEAR 1989 COSTS AND OPERATIONAL SCHEDULES

In accordance with the most recent planning guidance, the following costs are projected for FY 1989 for the Waste Management Program:

Operating and Expense	$134.1 million
Capital Equipment and Construction	47.8 million
Total	$181.9 million

The operating schedule for FY 1989 is shown in Figure 4-1 and is organized according to the waste categories discussed in Sections 2.0 and 3.0.

4.2 COST AND SCHEDULE PROJECTIONS FOR FISCAL YEARS 1990 THROUGH 1994

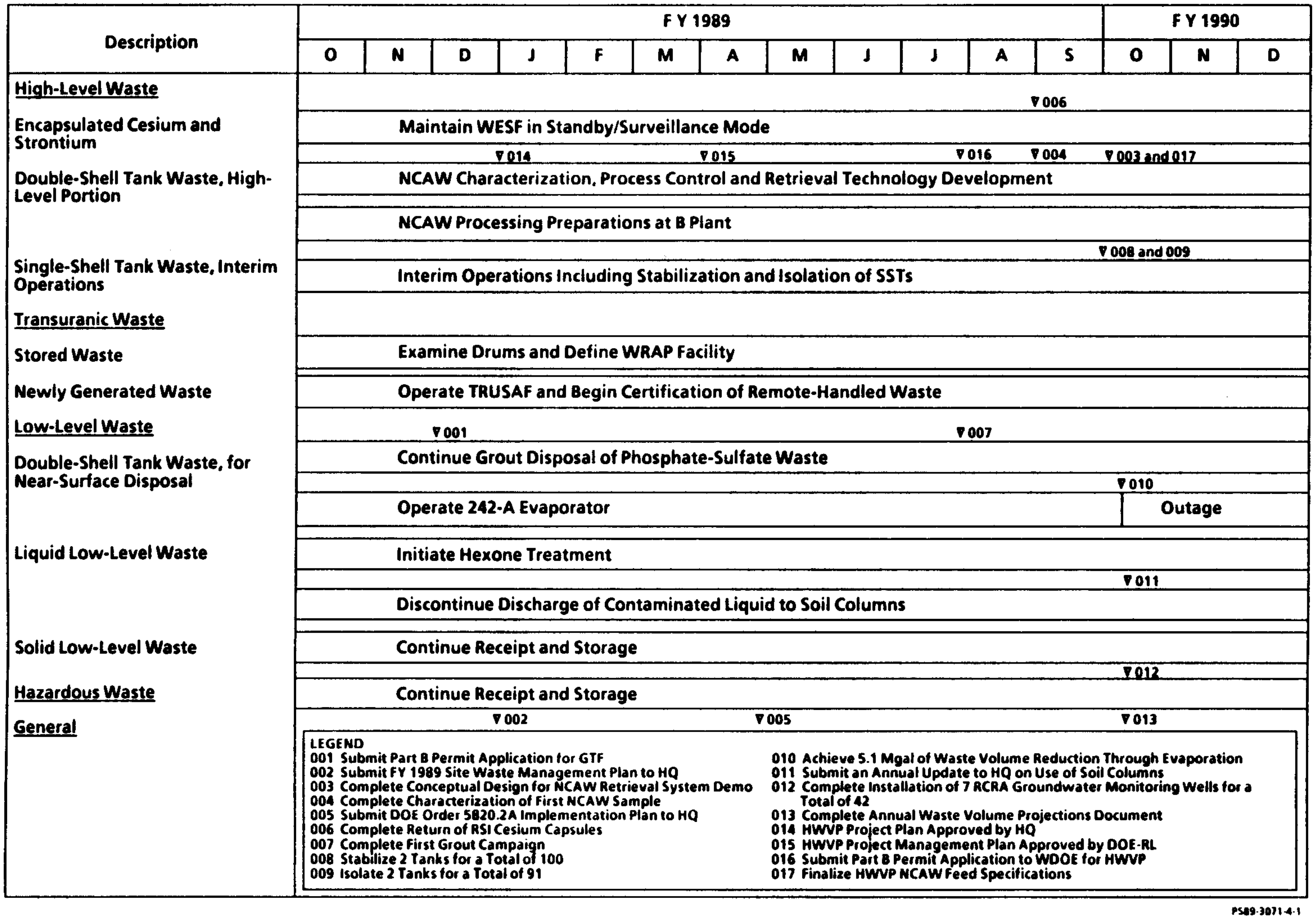
In accordance with the FY 1990 Budget Submittal, the costs for the Waste Management Program for the FY 1990 through 1994 period are shown in Table 4-1. The corresponding schedule is shown in Figure 4-2 and is organized according to the waste categories discussed in Sections 2.0 and 3.0.

Table 4-1. Projected Costs for the Hanford Waste Management Program (FY 1990 Through FY 1994).

Activity	Fiscal year				
	1990	1991	1992	1993	1994
Storage and Surveillance	109.4	145.0	145.2	98.4	73.4
Technology and Operations	51.2	50.1	52.1	106.2	135.1
Capital Equipment and Construction	84.0	167.6	220.8	300.6	276.8
Total	244.5	362.7	418.1	505.2	485.3

NOTE: All expense and Capital equipment costs (millions of dollars) escalated through FY 1990. Construction costs escalated to midpoint of construction.

PST89-3071-4-1



LEGEND

001 Submit Part B Permit Application for GTF
002 Submit FY 1989 Site Waste Management Plan to HQ
003 Complete Conceptual Design for NCAW Retrieval System Demo
004 Complete Characterization of First NCAW Sample
005 Submit DOE Order 5820.2A Implementation Plan to HQ
006 Complete Return of RSI Cesium Capsules
007 Complete First Grout Campaign
008 Stabilize 2 Tanks for a Total of 100
009 Isolate 2 Tanks for a Total of 91
010 Achieve 5.1 Mgal of Waste Volume Reduction Through Evaporation
011 Submit an Annual Update to HQ on Use of Soil Columns
012 Complete Installation of 7 RCRA Groundwater Monitoring Wells for a Total of 42
013 Complete Annual Waste Volume Projections Document
014 HWVP Project Plan Approved by HQ
015 HWVP Project Management Plan Approved by DOE-RL
016 Submit Part B Permit Application to WDOE for HWVP
017 Finalize HWVP NCAW Feed Specifications

Figure 4-1. Waste Management Program Operating Schedule for FY 1989.

Description	Fiscal Year				
	1990	1991	1992	1993	1994
High-Level Waste					
Encapsulated Cesium and Strontium	Maintain WESF in Standby/Surveillance Mode				
Double-Shell Tank Waste, High-Level Portion	Pretreatment Technology Development and Pilot Test (CC, PFP, NCRW)				
	NCAW Processing Preparations at B Plant			Demonstration	Outage for Crane
Single-Shell Tank Waste, Interim Operations	Interim Operations Including Stabilization and Isolation				
Transuranic Waste					
Stored Waste	WRAP Facility Design and Construction (Modules I and II)				
Newly Generated Waste	TRUSAF Operations and Prepare for Shipments to WIPP				
Low-Level Waste					
Double-Shell Tank Waste for Near-Surface Disposal	Grout Startup Preparations	Disposal of Acceptable Fraction From Double-Shell Tank Waste			
	242-A Outage	242-A Evaporator Operations			
Liquid Low-Level Waste	Hexone Treatment/Disposal				
	Discontinue Discharge of Contaminated Liquid to Soil Columns				
Solid Low-Level Waste	Use RMW Storage Facility (Project W-016)				
Hazardous Waste	Continue Receipt and Storage; Disposal Through Commercial Enterprises				

PS89-3071-4.2

Figure 4-2. Schedule for Waste Management Program (FY 1990-1994).

Major milestones currently identified for this time period are as follows:

Obtain approval to commence HWVP Detailed Design (Title II)	2Q FY90
Obtain approval of HWVP Preliminary Safety Analysis Report	2Q FY90
Submit HWVP Clean Air Act Permit Application to EPA/WDOE	07/90
EPA/WDOE Issue Clean Air Act Permit for HWVP	4Q FY90
Approval to commence construction of HWVP	4Q FY90
Complete Capital Funded Design for HWVP	2Q FY93
Grout Treatment Facility Operational (DST Waste)	1Q FY91
Complete Preparation for B Plant Demonstration of NCAW Processing	4Q FY93
Complete 13 Grout Campaigns	4Q FY93*
Complete B Plant Demonstration of NCAW Processing and submit report	4Q FY94

---

*Although the program goal is to complete 13 campaigns, current funding at the target level will only support 10 campaigns by 4Q 1993.

5.0 ENVIRONMENTAL MONITORING PROGRAMS

5.1 OVERVIEW

Extensive environmental monitoring programs are maintained at the Hanford Site as part of the HEMP, established to facilitate compliance with the applicable environmental statutes, regulations, and standards. The HEMP Plan (DOE-RL 1986) was prepared as a strategic planning document to guide the HEMP. Four basic program objectives are identified in the HEMP Plan:

- Establish ongoing monitoring to ensure that Hanford Site operations comply with environmental requirements.
- Attain regulatory compliance through the modification of activities.
- Mitigate any environmental consequences.
- Minimize the environmental impacts of future operations at the Hanford Site.

Westinghouse Hanford has prepared a HIP (WHC 1988d) describing the implementation of its assigned HEMP responsibilities, which relate to environmental operations and controlling and monitoring releases to the environment. Within the HIP, the Hanford Site environmental monitoring programs are integrated with all other environmental activities on the Hanford Site. The HIP is divided into eight activity plans, each addressing an area of environmental or HEMP management concern, as follows.

- Activity Plan I. Integrated Environmental Management--Outlines environmental programs and responsibilities, with an emphasis on integration and oversight.
- Activity Plan II. Gaseous Effluent Management--Addresses the Hanford Site's airborne emissions.
- Activity Plan III. Liquid Effluent Management--Addresses liquid effluents from Hanford Site facilities and areas, and specific potable water sources.
- Activity Plan IV. Solid Waste Management--Addresses, in general, all wastes that are neither permitted atmospheric releases nor liquid effluent discharges at active facilities.
- Activity Plan V. Toxic and Hazardous Material Utilization--Addresses toxic and hazardous material usage.
- Activity Plan VI. Inactive Site Management--Addresses inactive waste sites and surplus facilities.
- Activity Plan VII. Environmental Monitoring and Reporting--Addresses Hanford Site monitoring and reporting.

- Activity Plan VIII. Environmental Data Resources--Summarizes the most commonly used environmental data resources, including computerized environmental data bases and written reports.

5.2 ENVIRONMENTAL MONITORING AND REPORTING

The HIP Activity Plan VII is of primary interest here, and is summarized in the following paragraphs. Further details can be found in the HIP. The site-wide monitoring and reporting program reporting directly to DOE-EH, and carried out by the R&D contractor, PNL, is not covered in the HIP and is not described here, except as necessary for clarity.

Current Hanford Site monitoring and reporting activities are divided into three categories in the HIP:

- Airborne effluent monitoring
- Liquid effluent monitoring
- Environmental monitoring and surveillance.

The purpose of the airborne and liquid effluent monitoring programs is to ensure that all release sources are monitored and to determine if allowable limits set for the release of gaseous and liquid effluents to the environment are exceeded. The monitoring and sampling systems located at effluent sources also aid in determining the effectiveness of effluent treatment and control systems.

The various radioactive and nonradioactive airborne effluents at the Hanford Site that are monitored are described in Activity Plan VII of the HIP. The results of the airborne effluent monitoring programs are reported annually to DOE-RL, with results from selected operations reported more frequently. The numbers of gaseous effluent streams being monitored on a site-wide basis are summarized in Table 5-1.

Table 5-1. Monitoring of Effluent Streams on the Hanford Site.

Hanford area	Number of airborne effluent streams monitored routinely		Number of liquid effluent streams monitored routinely	
	Radioactive	Nonradioactive	Radioactive	Nonradioactive
100	15	1	4	8
200	75	7	25	20
300	10	10	2	2
400	4	0	0	0

PST89-3071-5-1

Liquid effluents are monitored and sampled for both radioactive and nonradioactive constituents, depending on the potential contents of the effluents. Liquid effluent monitoring details are described in Activity Plan VII of the HIP. Table 5-1 includes a summary of the numbers of liquid effluent streams being monitored on a site-wide basis.

Results from the airborne and liquid effluent monitoring programs are regularly reported on at least an annual basis, as detailed in Activity Plan VII of the HIP.

Environmental monitoring and surveillance of the Hanford Site is conducted by both Westinghouse Hanford and PNL. There are four major objectives of the combined programs: (1) the detection of radionuclides in identified radiological release pathways, (2) the detection and evaluation of changes in radionuclide concentrations discharged in the environment, (3) the evaluation of the performance of radioactive waste confinement systems, and (4) the estimation of the offsite radiological dose to the public. The environmental monitoring and surveillance programs include the following:

- Ambient Air Monitoring--Determine baseline concentrations of radionuclides in the immediate environment and assess the impact of site operations on the environment.
- Surface Water Monitoring--Determine the accumulation of radionuclides in the sample media.
- Groundwater Monitoring--Determine and evaluate the impact of Hanford Site operations on the groundwater beneath the site.
- Soil and Biota Sampling--Evaluate the distribution of radionuclides and the long-term trends in environmental accumulation of radioactivity from site releases.
- Radiological Surveys--Determine changes in the radiological status of the environment.
- External Radiation Monitoring--Establish baseline exposure rates for use in determining the contribution from site operations and in evaluate the potential impacts to employees.

Results from the environmental monitoring programs in the various Hanford areas are published at least annually. Additional details on each of these activities are provided in Activity Plan VII of the HIP.

5.3 COMPLIANCE STATUS

The status of environmental monitoring and reporting activities at the Hanford Site with respect to applicable rules and regulations is summarized in Activity Plan VII of the HIP. The first step in the process of verifying or achieving compliance in the monitoring and reporting activities is to assess current regulatory programs to determine applicability. At present, major operations at the Hanford Site are undergoing such assessments. When completed, these assessments can be compared to current practices to identify any deficiencies. When deficiencies are identified, they will be prioritized, and strategies will be developed for mitigation.

Activity Plan VII of the HIP focuses on two areas that could potentially provide improvements in environmental monitoring and reporting: effluent monitoring plans and groundwater monitoring network upgrades.

The compliance status of the current effluent monitoring and sampling systems is being evaluated through the development of facility-specific effluent monitoring plans (FEMPs). The FEMPs are being prepared for all gaseous and liquid effluent streams that are currently being routinely monitored, and for additional streams judged to be candidates for routine monitoring. The FEMPs are part of a site Environmental Monitoring Plan (EMP) which will also include sections on analytical laboratory procedures, quality assurance requirements, environmental surveillance programs, and reporting requirements.

The EMP will document the following:

- A description and assessment of the Westinghouse Hanford near-facility environmental surveillance program.
- A characterization of the concentrations and quantities of radioactive and nonradioactive hazardous substances in liquid and gaseous effluent streams during routine operations and potential upset conditions.
- Based on a comparison of the characterization and regulatory limits, an assessment of the adequacy of current effluent monitoring and sampling and analysis systems.
- An assessment of the compliance of the design and operation of sampling systems with the requirements and recommendations of DOE Orders.
- A description and assessment of the environmental analytical laboratory procedures with respect to the requirements and recommendations of DOE Orders.
- A quality assurance plan for environmental surveillance and effluent monitoring programs.
- A verification that required records are maintained and that the reports necessary for compliance assessment are being generated.
- Implementation plans with schedules for completion of those aspects of the monitoring and surveillance programs which do not comply with the requirements and recommendations of the DOE environmental Orders.

In addition to the network of groundwater monitoring wells already in place at the Hanford Site, an additional system of groundwater monitoring wells is being constructed in the 200 Areas to meet groundwater monitoring requirements at all RCRA regulated waste sites within the Waste Management Program. Projects involving the construction of 35 monitoring wells were completed in FY 1988. Work continues on construction of additional RCRA wells, with construction of currently identified wells scheduled for completion by the end of FY 1992.

This page intentionally left blank.

6.0 RELATED SUBJECTS

The following subjects have been selected for inclusion in this section:

- Quality Assurance In the Waste Management Program
- Training in the Waste Management Program
- Documentation Responsive to the National Environmental Policy Act (NEPA)
- The Hanford Environmental Compliance Project
- The HWMTP.

These subjects are considered to be of significant interest to, and to have influence on, the Waste Management Program and the treatment, storage, and disposal of regulated waste at the Hanford Site as a result of FY 1988 activities. Other subjects suggested in the DOE Order 5820.2A guidance for this plan are not judged to be of significant influence at this time.

6.1 QUALITY ASSURANCE IN THE WASTE MANAGEMENT PROGRAM

The contractors at Hanford have developed quality assurance (QA) programs responsive to DOE-RL Order 5700.1A, Quality Assurance. These QA programs use as their basis the requirements of American National Standards Institute (ANSI) and American Society of Mechanical Engineers (ASME) NQA-1, Quality Assurance Program Requirements for Nuclear Facilities.

These QA programs apply to the activities affecting the quality of waste management at Hanford and also apply to the organizations which implement such activities. During FY 1989, facility-specific QA plans are being updated for B Plant operations, tank farm operations, and solid waste storage and disposal operations.

The Safety, Quality Assurance, and Security Department within Westinghouse Hanford provides QA oversight for the treatment, storage, and disposal of regulated waste. Organizationally, QA at Westinghouse Hanford is divided into technology programs quality engineering, operational quality engineering, and operational quality control.

The Quality Assurance Department within PNL provides QA oversight. Organizationally, QA at PNL is divided into QA systems and audits, quality engineering, and quality control.

The Quality Assurance Division in DOE-RL provides QA oversight for all of Hanford. Quality Assurance Engineers within the Division conduct periodic audits and surveillance on the QA programs of each Hanford contractor and all major facilities.

6.2 TRAINING IN THE WASTE MANAGEMENT PROGRAM

A training program is in effect at Hanford to address requirements in applicable Federal and State regulations and DOE Orders. Changes and modifications to these regulations and DOE Orders are monitored to upgrade the training program.

6.2.1 Accomplishments in Fiscal Year 1988

A training program for nuclear process operators assigned to the GTF was implemented before startup of this facility in August 1988. The training consisted of classroom instruction and on-the-job training while conducting cold runs.

The Hazardous Waste Generator Course underwent substantial modification in FY 1988. Learning objectives were made more specific and the overall applicability of the class to the users was enhanced. Feedback from attendees indicated an improvement over the first generation course.

The Hazardous Waste Coordinators' Course has been upgraded and extended from 16 to 20 h of instructions.

A training program to comply with Occupational Safety and Health Administration (OSHA) requirements titled Hazardous Waste Site Operator Training was developed for application in FY 1989.

6.2.2 Goals in Fiscal Year 1989

Development of the Hazardous Waste Site Operator Training program will continue with phased implementation starting in January 1989.

Westinghouse Hanford will conduct a comprehensive job analysis of nuclear process operator positions in Waste Management operations. Data from the analyses will be used to reconstruct and improve training and certification programs in the tank farms and solid waste storage and disposal system.

A supervisor training program will be implemented for Waste Management operations' supervisors and managers. The key objective is to improve the conduct of operations through effective supervision in both the administrative and technical areas.

Training to instruct operators on contact handling of TRU waste will be developed and implemented to support a program for drum retrievability.

Additional courses in compliance with OSHA requirements will be developed or modified and implemented as hazardous waste site training modules: (1) a basic 24-h course, (2) an advanced 40-h course, and (3) supervisors training.

6.3 DOCUMENTATION RESPONSIVE TO THE NATIONAL ENVIRONMENTAL POLICY ACT

A draft EIS was prepared and issued on the Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes in which alternatives for disposal were developed for public and governmental agency comment. Based on analyses and reviews of those comments, a preferred alternative was identified in the final EIS (DOE 1987). In the ROD published in April 1987, the DOE has stated its decision to implement the preferred alternative and initiate disposal of DST wastes, retrievably stored and newly generated TRU waste, the only pre-1970 buried suspect TRU-contaminated solid waste site not located on the central plateau and encapsulated cesium and strontium waste. As further implementation of the preferred alternative, DOE will conduct additional development and evaluation before making final disposal decision on the remainder of the wastes: the SST waste, the TRU-contaminated soil sites and the pre-1970 buried suspect TRU contaminated solid waste sites.

A plan was prepared (DOE-RL 1988b) outlining the steps necessary to implement the ROD on the HDW-EIS (DOE 1987).

As stated in Sections 2.1.2 and 2.3.1 of this plan for DST waste, the DOE will proceed with disposal actions which include pretreating and vitrifying the HLW fraction and disposing of it in a deep geologic repository. The remaining LLW fraction will be solidified as a cementitious grout and disposed of in near-surface vaults. Plans have been developed showing completion of disposal around FY 2015.

As stated in Section 2.2 of this plan for stored and newly generated TRU waste, DOE will proceed with shipment to the WIPP, a repository designated by law for defense TRU waste disposal. Newly generated TRU waste is being certified for disposal whereas the retrievably stored TRU waste will require examination and possible treatment before shipment. The one site not located on the central plateau is exhumed and treated with newly generated TRU waste. Plans have been developed showing completion of disposal actions in FY 2013.

As stated in Section 2.1.1 of this plan for cesium and strontium capsules, DOE will proceed with disposal but delay implementation because many of the capsules are being used as radiation sources by various enterprises on a lease basis. Plans have been developed showing disposal concluding in FY 2010.

For SST waste, TRU-contaminated soil sites, and the pre-1970 buried, suspect TRU-contaminated solid waste sites, the DOE has decided to conduct additional development and evaluation before making decisions on disposal or remediations, including environmental documentation with public and governmental agency input. For SSTs this development and evaluation period is projected to take approximately 10 yr and include the preparation and issuance of a supplemental EIS for public and governmental agency review. For TRU-contaminated soil sites and pre-1970 buried, suspect TRU-contaminated solid waste, this development and evaluation period is projected to conclude as early as the mid-1990s. The ER Program is responsible for this effort for all three of these waste types.

Compliance with the NEPA is a continuing effort at Hanford based on the requirements contained in DOE Order 5440.1C. The need for major NEPA documentation, other than the HDW-EIS and the forthcoming SST waste supplement, is being reviewed, and NEPA documentation will be prepared as appropriate.

6.4 HANFORD ENVIRONMENTAL COMPLIANCE PROJECT

The Hanford Environmental Compliance (HEC) Project is a compilation of subprojects supporting Hanford's intent to achieve site wide compliance with Washington State and Federal environmental regulations. The HEC Project is driven by the Hanford Environmental Management Program Plan (DOE-RL 1986) and the Plan And Schedule To Discontinue Discharge Of Contaminated Liquids To The Soil At The Hanford Site (DOE-RL 1987).

The HEC subprojects have several objectives:

- Discontinue practices that use the soil column to treat or retain contaminated liquids.
- Provide the capabilities for analysis to ensure environmental standards are met.
- Enhance treatment, storage and disposal of waste.
- Minimize quantities of waste.
- Minimize future environmental impact from Hanford operations.

The DOE has declared that the HEC Project is a major project to be managed in accordance with DOE Orders 4700.1 and 5700.2. It is comprised of a total of 15 subprojects with a total estimate for completion (TEC) of $180 million. Table 6-1 provides a listing of the line item numbers, titles and funding associated with each. The phrase "FY 1989 Starts" indicates the fiscal year in which design and construction are initiated. The design is preceded by engineering studies, functional design criteria, conceptual design, and the validation process.

The FY 1989 and FY 1990 subprojects have been validated for a TEC of approximately $87.5 million. The subprojects beyond FY 1990 are based on preliminary assessments and engineering studies. The TEC is currently estimated at approximately $92.5 million but will be refined through better project definition.

The purpose, scope, and status of each subproject is further defined as follows.

Table 6-1. Hanford Environmental Compliance Subprojects.
(Costs shown in thousands of dollars)

Subproject	Starts	FY 1989	FY 1990	FY 1991	FY 1992 and beyond	TEC
FY 1989						
W-017H	Groundwater monitoring wells	3,300	2,900	3,000	2,800	12,000
W-007H	BCP Treatment Facility	2,600	7,500	3,900	700	14,700
W-020H	Cathodic protection	4,200	2,500	--	--	6,700
V-791H	300/400 Area waste water facilities	1,500	--	--	--	1,500
W-016H	RMW storage facilities	400	2,900	1,800	3,600	8,700
FY 1990						
B-680H	PFP liquid LLW system modification	--	1,500	4,000	300	5,800
C-031H	PFP liquid effluent treatment w/TRUEX	--	3,200	8,100	6,700	18,000
W-010H	B Plant Environmental Compliance Upgrades	--	800	2,700	--	3,500
W-011H	Environmental Support Facility	--	6,300	10,300	--	16,600
FY 1991						
W-024H	B Plant radiological and containment upgrades	--	--	2,100	3,900	6,000
W-041H	Environmental hot cell expansion	--	--	2,400	13,800	116,200
C-018H	PUREX liquid effluent treatment	--	--	1,500	11,500	13,000
FY 1992						
W-046H	242-A condensate treatment	--	--	--	17,000	17,000
L-045H	300 Area treated effluent disposal facility	--	--	--	10,000	10,000
W-049H	200 Area treated effluent disposal facility-Phase I	--	--	--	30,300	30,000
Total		12,000	27,600	39,800	100,600	180,000

NOTE: Those subprojects which respond to the plan and schedule to discontinue discharge of contaminated liquids to the soil column include W-007H, B-680H, W-010H, C-018H, W-046H, L-045H and W-049H. Those subprojects that are included within the Waste Management Program are designated with an "W" in the number.

6.4.1 W-017H, Groundwater Monitoring Wells

The purpose is to provide groundwater monitoring wells for all sites, active and inactive, in compliance with environmental regulations. The TEC is $12.0 million. Approximately 165 wells will be installed throughout the Hanford Site. The wells will have an average depth of 91.3 m (300 ft) and consist of stainless steel casings with screens designed and installed to meet RCRA requirements. This subproject is validated and authorization has been requested.

6.4.2 W-007H, B Plant Process Condensate Treatment Facility

The purpose is to provide a BAT treatment system for treating B Plant process condensate (BCP) before disposal and ensure environmental compliance before full pretreatment operations of NCAW in FY 1993. The TEC is $14.7 million. The subproject involves construction of a system to treat 150 L/min (40 gal/min) of BCP to BAT standards and provides space for future incorporation of equipment for treatment of steam condensate (BCS). Treatment may include the following options: filtration, ion exchange, or reverse osmosis. The subproject has been validated and authorization has been requested. The conceptual design was completed in October 1988. Definitive design will be initiated in January 1989.

6.4.3 W-020H, Cathodic Protection

The purpose is to protect active underground piping systems to ensure environmentally safe, continuous, and economical operation. It is further necessary to satisfy RCRA cathodic protection requirements for underground hazardous waste tanks, new underground storage tanks, and pipelines. The TEC is $6.7 million. The subproject is the second phase of an overall cathodic protection upgrade for the 200 East and 200 West areas. The subproject has been validated and authorization has been requested.

6.4.4 V-791H, 300/400 Area Waste Water Facilities

The propose is to provide upgrades to the 400 area sanitary sewage system and the 300 area water treatment system. The TEC is $1.5 million and includes replacing the 400 Area septic tank and drain field with a new waste treatment plant for sanitary waste and constructing a new settling pond for disposal of 300 Area water filter plant backwash. This subproject has been validated and authorization has been requested.

6.4.5 W-061H, Radioactive Mixed Waste Storage Facilities

The purpose is to provide the capability to store RMW before treatment and disposal in accordance with WAC 173-303 dangerous waste regulations. The TEC is $8.7 million. The subproject involves providing four metal buildings capable of storing 7 yr of expected RMW generation with a projected volume of 4450 m^3 (157,000 ft^3). The subproject has been validated and authorization has been requested.

6.4.6 B-680H, Plutonium Finishing Plant Liquid Low-Level Waste System Modification

The purpose is to reduce the potential for radionuclide discharges to the soil column and cut back the 216-Z-20 crib flow by 80%. The TEC is $5.8 million. The subproject eliminates process equipment cooling water effluent by providing closed loop cooling. It provides a LLW treatment facility for drains and relines existing chemical sewer to preclude movement of contamination to the soil column. The subproject has been validated. Waste stream characterization will continue in FY 1989.

6.4.7 C-031H, Plutonium Finishing Plant Liquid Effluent Treatment with TRUEX

The purpose is to eliminate quantities of TRU from discharge to waste tank storage. It involves upgrading the waste retention facility and recovering plutonium currently discarded as waste. The TEC is $18.1 million. The subproject will upgrade the 241-Z tank storage area with double-containment storage and treatment tanks and associated piping. It will replace existing transfer lines with double-wall piping and leak detection, and install the TRUEX process in Building 234-5Z. This subproject has been validated. Technology transfer is ongoing with Argonne National Laboratory. Solids and liquid technology studies are planned in FY 1989.

6.4.8 W-010H, B Plant Environmental Compliance Upgrades

The purpose is to provide engineered barriers reducing the potential for reportable releases of hazardous materials from the B Plant complex, enable B Plant to use and dispose of chemicals required in support of the HWVP and GTF and reduce the potential for exposure to airborne radioactivity from the 221-B canyon. The TEC is $3.5 million. The subproject will provide spill containment and general upgrades for 211-B chemical tank farm, provide drain/overflow system and general upgrades for 221-B scale tanks and upgrade ventilation and monitoring system and seal exterior wall openings at 271-B. The subproject has been validated.

6.4.9 W-011H, Environmental Support Facility

The purpose is to provide a laboratory facility for the performance of new, full-range, low-level environmental sample analyses needed to meet regulatory requirements. The TEC is $16.6 million. The subproject provides 1670 m^2 (18,000 ft^2) of lab space for environmental analysis and 370 m^2 (4,000 ft^2) for a shielded low-level radiochemistry laboratory. It includes all necessary support facilities, services and utilities. This subproject is validated and an advanced conceptual design planned in FY 1989.

6.4.10 W-024H, B Plant Radiological and Containment Upgrades

The purpose is to restore a suspect cell drain system, eliminate potential contamination sources to the chemical sewer from the vessel vent system and eliminate a contaminated discharge to B Pond from the vessel vent system. The TEC is $6.0 million. The subproject involves the installation of an in situ liner in the cell drain system, the installation of control dampers and instrumentation on supply air system, and replacing the vessel ventilation system and rerouting the condensate system. The engineering study and functional design criteria (FDC) are in review and scheduled for release in early FY 1989. The conceptual design report (CDR) is scheduled for submittal to the DOE in February 1989.

6.4.11 W-041H, Environmental Hot Cell Expansion

The purpose is to provide laboratory capability for regulatory compliance activities to support waste characterization, sampling and site characterization, and to provide analytical support for HWVP and GTF. The TEC is $16.2 million. The subproject involves the construction of a new hot cell facility adjacent to the 222-S Laboratory. The engineering study and FDC are in review and scheduled for release in early FY 1989. The CDR is scheduled for submittal to the DOE in January 1989.

6.4.12 C-018H, PUREX Plant Liquid Effluent Treatment

The purpose is to provide BAT treatment for radionuclides and chemical constituents of liquid effluents. The TEC is $13.0 million. The proposed treatment may include the following options: filtration, carbon absorption, reverse osmosis or ion-exchange. The conceptual design is on hold while the FDC and BAT documentation are being reevaluated. The decision on whether or not to proceed is scheduled for early FY 1989.

6.4.13 W-046H, 242-A Condensate Treatment

The purpose is to provide BAT primary treatment for the phase I process condensate and steam condensate liquid effluent streams for the 242-A evaporator. The TEC is $17.0 million. The proposed treatment may include the following options: filtration, carbon absorption, reverse osmosis, or ion-exchange. The engineering study is scheduled for release in January 1989; the FDC is scheduled for transmittal to DOE in June 1989; the CDR is scheduled for transmittal to the DOE in February 1990.

6.4.14 L-045H, 300 Area Treated Effluent Disposal Facility

The purpose is to provide treatment of 30 effluent streams which are currently disposed of in the 300 Area trenches and are targeted for priority closure. The TEC is $10.0 million. The subproject will likely include facility modifications or standby treatment. The engineering study is scheduled for release in January 1989; the FDC is scheduled for release in June 1989; the CDR is scheduled for transmittal to DOE in February 1990. Expense support for FY 1989 needs to be provided.

6.4.15 W-049H, 200 Area Treated Effluent Disposal Facility

The purpose is to provide the disposal of treated-liquid effluents that result from primary treatment and provide disposal of secondary effluents. The TEC is $30.3 million. The treatment system may include the following features: standby treatment, retention basins, soil column disposal, recycling, discharge to Columbia River, sampling and diversion. The engineering study is scheduled for release in January 1989; the FDC is scheduled for transmittal to DOE in June 1989; the CDR is scheduled for transmittal to DOE in February 1990.

6.4.16 Additional Subprojects

Several additional candidate subprojects beyond the above $180 million TEC are identified in Table 6-2.

Table 6-2. Additional Candidate Subprojects.

Subproject number	Subproject title	Estimate ($ millions)
W-XXX	200 Area treated effluent disposal	4.7
W-047H	Final disposal systems	21.7
W-044H	Underground storage tanks environmental compliance	5.0
W-048H	RMW disposal facilities (drag-off)	6.0
W-051	LLW class B/C storage facilities	9.0
W-XXX	LLW class B/C advanced waste disposal facilities	40.0
Total		87.1

PST89-3071-6-2

The first two subprojects respond to the plan and schedule to discontinue discharge of contaminated liquids to the soil column. Efforts will continue to better define these additional subprojects during FY 1989.

Issues associated with the HEC project include the following:

- Evolving environmental requirements
- Minimal definition of line items beyond FY 1990
- Availability of sufficient expense funding to support pre-authorization activities.

6.5 HANFORD WASTE MANAGEMENT TECHNOLOGY PLAN

The HWMTP (WHC 1988e) provides an overview of the technology issues required to implement the long-term plans described in Section 2.0 and 3.0 of this document. The HWMTP also includes technical issues associated with the ER Program. Implementation of final waste disposal requires that various open technical issues be satisfactorily resolved. The principal purpose of the HWMTP is to define the various open technical issues and to present detailed descriptions, including cost and schedule projections, of the tasks that must be performed to develop the technology required for resolution of the technical issues.

The technical issues and related technology development tasks are organized so as to address the following functional and waste categories:

- Disposal Criteria and Standards
- Single Shell Tank Waste (Section 2.1.3 of this plan)
- Contaminated Soil Sites (Section 2.3.2 of this plan)
- Solid Waste Burial Sites (Section 2.3.3 of this plan)
- Double-Shell Tank Waste (Sections 2.1.2 and 2.3.1 of this plan)
- Encapsulated Waste (Section 2.1.1 of this plan)
- Solid Waste Generation
- Solid Waste Treatment (Sections 2.2 and 2.3.3 of this plan)
- Solid Waste Storage (Sections 2.2 and 2.3.3 of this plan)
- Solid Waste Disposal (Sections 2.2 and 2.3.3 of this plan)
- Enhanced Technology Base.

The contaminated soil sites and solid waste burial sites include both active and inactive sites. Sites inactivated before March 1, 1987, are not included in the HWMP. The solid waste categories, including generation and treatment, storage, and disposal, are the result of an expanded solid waste planning activity established in FY 1988. The expanded activity includes both TRU waste and LLW.

The schedules for resolution of technical issues are consistent with significant program dates shown in this plan and are contingent upon future program direction. Although current projections show a remaining time span for resolution of all technology tasks of about 25 to 30 yr, those in later years are associated with the ER Program.

The estimated total cost for identified technical issues is $1,200 million. However, it should be noted that some of the estimates are necessarily of a preconceptual nature and are expected to change with the development of improved planning data. Further, the planning horizon does not extend through completion for all technical issues (e.g., those associated with the ER Program).

Included within the task descriptions are estimates of task duration, work content (workyears), costs, and predecessor task relationships. These provide the essential elements for networking the various tasks such that several types of analyses including critical path, resource loading, and change impact can be readily performed from the networked database. The predecessor definitions shown in the 1988 HWMTP are improved somewhat with the addition of identifiers such as finish-to-finish and finish-to-start. Further work is required in this area and will be pursued for the next issuance of the HWMTP in conjunction with the computerized networking activity which was initiated this past year.

This page intentionally left blank.

7.0 REFERENCES

DOE, 1986, Environmental Policy Statement, DOE N 5400-1, U.S. Department of Energy, Washington, D.C. (January 8).

DOE, 1987, Final Environmental Impact Statement: Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes, DOE/EIS-0113, U.S. Department of Energy, Washington, D.C.

DOE, 1988a, Integrated Date Base for 1988: Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics, DOE/RW-0006, Rev. 4, U.S. Department of Energy, Washington, D.C.

DOE, 1988b, Radioactive Waste Management, DOE Order 5820.2A, U.S. Department of Energy, Washington, D.C. (September 26).

DOE-RL, 1986, Hanford Environmental Management Program Plan, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1987, Plan and Schedule to Discontinue Disposal of Contaminated Liquids into the Soil Column at the Hanford Site, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1988a, Hazardous Waste Management Plan, DOE/RL 88-01, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1988b, Implementation Plan for the Record of Decision for Disposal of Hanford High-Level, Transuranic, and Tank Wastes, DOE-RL 88-13, U.S. Department of Energy, Richland Operation Office, Richland, Washington

WDOE, 1987, Dangerous Waste Regulations, WAC 173-303, Washington State Department of Ecology, Olympia, Washington.

WHC, 1988a, Annual Status Report of the Plan and Schedule to Discontinue Disposal of Contaminated Liquids into the Soil Column at the Hanford Site, WHC-EP-0196-1, Westinghouse Hanford Company, Richland, Washington.

WHC, 1988b, Best Available Technology (BAT) Guidance Document, WHC-EP-0137, Westinghouse Hanford Company, Richland, Washington.

WHC, 1988c, 1988 Tank Farm Waste Volume Projections, WHC-EP-0197, Westinghouse Hanford Company, Richland, Washington.

WHC, 1988d, Hanford Environmental Management Program Implementation Plan, WHC-EP-0180, Westinghouse Hanford Company, Richland, Washington.

WHC, 1988e, Hanford Waste Management Technology Plan, WHC-EP-0212, Westinghouse Hanford Company, Richland, Washington (scheduled issue date December 1988).

WHC, 1988, Environmental Restoration Field Office Work Plan, WHC-SP-0383, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

WASTE MANAGEMENT DOCUMENTATION REQUIREMENTS

This appendix provides a brief description of documents that are referenced in this plan. These documents are in response to requirements in environmental regulations and DOE Orders.

WHC, 1988a, Annual Status Report of the Plan and Schedule to Discontinue Disposal of Contaminated Liquids into the Soil Column at the Hanford Site, WHC-EP-0196-1, Westinghouse Hanford Company, Richland, Washington.

This report provides the status of the Plan and Schedule (DOE-RL 1987), along with a description of the current strategy, to discontinue the use of soil columns for the disposal of radionuclides and nonradioactive material. Since the issuance of the Plan and Schedule, progress has been made toward the implementation of the recommended actions, and several modifications have been made to the implementation strategy to account for altered facility missions and experience gained thus far during the implementation of the Plan and Schedule. Details are presented in Section 2.3.2.

DOE-RL, 1987, Plan and Schedule to Discontinue Disposal of Contaminated Liquids into the Soil Column at the Hanford Site, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

This document was prepared in response to a Congressional requirement to provide a plan and schedule to discontinue the use of soil columns to dispose of contaminated liquids at the Hanford Site. Congress requested such a plan within 120 d of the enactment of the 1987 Budget Appropriations Bill. The implementation schedule presented in the plan is based on a two-phased prioritization system for liquid effluents, with implementation of appropriate treatment technologies for the higher priority (Phase I) effluent streams by FY 1995. Details are presented in Section 2.3.2.

WHC, 1988b, Best Available Technology Guidance Document, WHC-EP-0137, Westinghouse Hanford Company, Richland, Washington.

This document provides a step-by-step procedure for the identification and documentation of the BAT economically achievable for treating liquid effluents on the Hanford Site. The BAT determination is a key element in the strategy to discontinue the use of soil columns for the disposal of radionuclides and nonradioactive materials. Following application of BAT treatment, a liquid effluent is considered suitable for discharge to the environment.

DOE, 1987, Final Environmental Impact Statement: Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes, DOE/EIS-0113, U.S. Department of Energy, Washington, D.C.

The purpose of this EIS is to provide environmental input into the selection and implementation of final disposal actions for high-level, TRU and tank wastes located at the Hanford Site, and into the construction, operation and decommissioning of waste treatment facilities that will be required in implementing waste disposal alternatives. Specifically evaluated are the HWVP, GTF, and WRAP. An evaluation is also presented to assist in determining whether any additional action should be taken in terms of long-term environmental protection for waste that was disposed of at Hanford before 1970 as LLW.

DOE-RL, 1988a, Hazardous Waste Management Plan, DOE/RL 88-01, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

This report is the DOE-RL plan for identifying and tracking the actions required to achieve and maintain compliance of DOE-RL operating and standby facilities with Federal and State regulations regarding generation, transportation, treatment, storage, and disposal of hazardous wastes. Closure plans for inactive facilities are also included. The Federal and State regulations considered are applicable to both nonradioactive wastes and radioactive (mixed) wastes.

DOE, 1988, Integrated Date Base for 1988: Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics, DOE/RW-0006, Rev. 4, U.S. Department of Energy, Washington, D.C.

This report summarizes the total DOE data base for inventories, projections, and characteristics of domestic spent nuclear fuel and radioactive waste. It is updated annually to keep abreast of continual changes. The primary purpose of this document is to provide background information for program planning.

WHC, 1988c, 1988 Tank Farm Waste Volume Projections, WHC-EP-0197, Westinghouse Hanford Company, Richland, Washington.

This report projects the DST space requirements for radioactive liquid wastes at the Hanford Site to the FY 2015. The projections are based on operational and waste generation assumptions developed from the major Hanford waste generating facilities. Suggestions are presented to alleviate potential tank space shortages. This document establishes "base case" data for use in studies throughout the year.

WHC, 1988d, Hanford Environmental Management Program Implementation Plan, WHC-EP-0180, Westinghouse Hanford Company, Richland, Washington.

The HIP describes the strategies, methods, and systems to be used by the Hanford OEC, Westinghouse Hanford, to fulfill their responsibilities under the HEMP. These responsibilities include assisting DOE-RL in planning facility operations, resolving compliance issues, completing required reports to regulatory agencies, and monitoring of schedule performance for environmental activities. (See DOE-RL 1986.)

WHC, 1988e, Hanford Waste Management Technology Plan, WHC-EP-0212, Westinghouse Hanford Company, Richland, Washington.

The HWMTP describes the technology needed to implement final waste disposal, as presented in the HWMP, of existing and certain future radioactive and hazardous defense wastes at the Hanford Site. Schedules and estimated costs presented for development of the needed technology elements become the basis for input to Hanford program planning. This document is further defined in Section 6.4.

DOE-RL, 1986, Hanford Environmental Management Program Plan, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

The HEMP Plan serves as the strategic planning document guiding the HEMP, which was established to facilitate compliance with the applicable environmental statutes, regulations, and standards. The HEMP Plan identifies four basic program objectives: (1) establish ongoing monitoring to ensure that Hanford Site operations comply with environmental requirements, (2) attain regulatory compliance through the modification of activities, (3) mitigate any environmental consequences, and (4) minimize the environmental impacts of future operations at the Hanford Site.

Rockwell, 1987, Hanford Site Transuranic Waste Inventory Work Off Plan, RHO-WM-PL-14 REV 1 P, Rockwell Hanford Operations, Richland, Washington.

The purpose of this document is to present the plans for permanent disposal of all Hanford Site TRU wastes, with emphasis on defining the work-off strategies and schedules for shipment of retrievably stored and newly generated solid TRU wastes to the WIPP. The disposal plans for TRU waste described in this document are consistent with the reference disposal plans described in the HDW-EIS and the ROD.

DOE-RL, 1988b, U.S. Department of Energy-Richland Operations Office 1988 Biennial Waste Minimization Report, DOE/RL 88-05, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

This biennial report was prepared to meet the March 1,1988, EPA milestone for documentation of the Hanford Site's waste minimization activities and accomplishments. The report addresses activities which were undertaken at the Hanford Site to reduce the quantity or volume and toxicity of waste generated in support of Hanford's ongoing waste management programs.

This page intentionally left blank.

APPENDIX B

HANFORD ENVIRONMENTAL RESTORATION REMEDIAL ACTION PROGRAM

The DOE ER Remedial Action Program performs environmental work involving inactive sites identification, investigation, technology development and demonstration, and remedial activities including cleanup of past contamination by hazardous (mixed, hazardous, and radioactive) substances. The primary objective of the DOE ER Remedial Action Program is to bring all known inactive hazardous waste sites (those that ceased operation before March 1, 1987) at DP Installations into compliance with applicable Federal, State, and local environmental laws and regulations. Secondary objectives include the following:

- Provide identification, emphasis, and accountability for all ER needs resulting from past DP hazardous waste activities.
- Provide an identifiable, coherent program by which all activities supporting ER can be coordinated and reported.
- Focus the budgeting and scheduling of the CERCLA/SARA, RCRA 3004(u), and treatment, storage, and disposal closure activities for all DP.

The recently issued Field Office Work Plan (FOWP) (WHC 1988f) provides a plan for managing and administering ER tasks. The FOWP provides a summary description of the ER Remedial Action Program, a listing of the assumptions used in cost and schedule planning, and a detailed ER Remedial Action Program schedule. In addition, the FOWP provides specific task descriptions, priority lists, justifications, milestones, and budgetary planning for ER Remedial Action Program work. A listing of the individual hazardous waste sites is also included. The FOWP addresses all ER Remedial Action Program work being performed in the current year and the work scheduled for the ensuing 6 yr. The FOWP will be a working document which will be updated annually.

The ER Remedial Action Program provides an integrated Hanford Site response to the requirements of RCRA 3004(u), CERCLA/SARA, and treatment, storage, and disposal units requiring closure. A summary description of the tasks associated with the ER Remedial Action Program follows.

B.1 MANAGEMENT, PLANNING, AND COMMUNITY RELATIONS

This task includes the program management and planning support for the Hanford ER Remedial Action Program. Included in this activity are the preparation of three Hanford ER Remedial Action Program documents: the FOWP; the Field Office Long-Range Plan (FOLRP) which includes an overview of the Hanford ER Remedial Action Program scope, schedule, and cost through program completion; and the Field Office Management Plan (FOMP). Community relations, quality assurance, records and data management and the NEPA requirements are activities funded by this task.

B.2 PRELIMINARY ASSESSMENT AND SITE INSPECTION

This task supported the proposed nomination of the Hanford Site to the National Priorities List (NPL) and completion of the informational requirements of the Federal Agency Docket. This task will provide for the updated documentation of the Hazard Ranking System (HRS) Evaluation of CERCLA Inactive Waste Sites at Hanford. The activities in this task are complete, except for the evaluation of new information as it becomes available. Wells were completed and sampled in November 1988 and sampling will continue.

B.3 100 AREA CHARACTERIZATION AND ASSESSMENT

This task includes all characterization and assessment activities for the 100 Areas which are within the scope of the ER Program. One of the high-priority groups of sites identified in the hazard ranking in the Preliminary Assessment process is the 100-H Reactor operations waste area group (WAG) near the Columbia River on the northern border of the Hanford Site. This group consists of 22 sites, grouped into two Operable Units (OU), associated with the operation of the retired 100-H Reactor. Work has been initiated on a Remedial Investigation/Feasibility Study (RI/FS) Work Plan for the OUs in FY 1989. In subsequent years, additional 100 Area OU RI/FS and remedial activities will be initiated.

B.4 300 AREA CHARACTERIZATION AND ASSESSMENT

This task includes all 300 and 400 Area characterization and assessment activities which are within the scope of the ER Program and are included as one WAG which has been divided into four OUs. The South and North Process Ponds in the 300 Area (Hanford Laboratory and Fuel Fabrication Area) were high-priority sites identified in the hazard ranking in the PA process. They were also among the highest ranked sites in the nation as ranked by the HAZWRAP. The RI/FS Work Plan for these sites was initiated in FY 1988 and will be completed in FY 1989.

B.5 1100/600 AREA CHARACTERIZATION AND ASSESSMENT

This task includes all characterization and assessment activities for the 1100 Area which are within the scope of the ER Program and consists of one WAG in the 1100 Area which has been divided into three OUs. Any additional WAGs dealing with waste sites not included in 100, 200, or 300 Areas may be included in this task. This will include 600 Area Burial Grounds, sanitary sewers, and construction pits. The 1100 Area includes three sites used for disposal of battery acids, paints, thinners, solvents, degreasers, and antifreeze. The high priority for this RI/FS work is related to the 1100 Area being at the north boundary of the City of Richland. The draft RI/FS Work Plan for this OU was initiated in FY 1988 and is to be completed in FY 1989. Preliminary field activities are to be initiated in FY 1989.

B.6 200 AREA (NON-SINGLE-SHELL TANK) CHARACTERIZATION AND ASSESSMENT

This task includes characterization and assessment activities in the 200 East and 200 West Areas which are within the scope of the ER Program. The 200 Areas include nine WAGs, which include several OUs each. A high priority for initiating RI/FS work in this Aggregate Waste Grouping is the cribs associated with the chemical separations activities in the 200 East Area. A number of specific activities are being undertaken within this task associated with 200 Area RCRA closures. These activities include preparation of closure plans, partial closures, and characterization work at RCRA sites. Additionally, an RI/FS work plan for one of the OUs is in preparation and is to be completed in FY 1989.

B.7 200 AREA (SINGLE-SHELL TANK) CHARACTERIZATION AND ASSESSMENT

This task includes all facility investigations and FSs for corrective measures required for SSTs. The SSTs have been determined by the DOE-RL, the EPA Region X, and the WDOE to be RCRA storage units requiring a closure plan to be prepared and implemented. All of these tanks stopped receiving waste in FY 1980 and are being addressed as part of the interim stabilization and isolation activities funded by the Waste Management Program. As indicated in the HDW-EIS ROD released in April 1988, additional development and evaluation will be conducted before making a final disposal decision on SST waste.

Key activities requiring additional development and evaluation are waste characterization, barrier development, waste retrieval, waste processing, and criteria and standards development. Waste characterization will be conducted in a manner agreed to by regulating agencies. Initial activities will assess the application of hazardous waste characterization protocols to characterize radioactive wastes. Variances to these protocols will be negotiated with the regulators before initiating a full-scale characterization program.

Criteria and standards based on applicable or guidance regulations will be developed to provide measures of performance. Eventually, the criteria and standards will provide the basis for making a final disposal recommendation for the SST waste. Support will be provided for interfacing on SST characterization and other tasks with the National Academy of Sciences (NAS) panel on SST waste disposal technology.

B.8 TECHNOLOGY DEVELOPMENT AND DEMONSTRATION

All of the activities within this task directly support the preceding tasks on characterization and assessment. This task involves technology for treatment of contaminated soil sites and solid waste burial grounds.

Technology needs may involve sampling, characterization, waste treatment and demonstration, decontamination, disposal systems, and long-term monitoring. In the near term, this activity provides for the initial steps in conducting preliminary assessments for LLW sites. Cost-effective technology will be developed or demonstrated for characterizing Hanford Site solid waste sites, including measuring aquifer levels and analyzing well water samples. Subsurface characterization technologies and crib and other buried waste stabilization technologies will be investigated. Several of these technologies are being developed in cooperation with PNL's Northwest Hazardous Waste Research, Development, and Demonstration Center (NHWRDDC).

Several other activities are being undertaken within this task to gather information necessary for proceeding with restoration work either under CERCLA or RCRA closures. Hanford Site groundwater flow and contaminant transport model development will be continued to improve and validate the model's capabilities. The models are necessary for analyzing the implications of alternative disposal actions considered as part of the RI/FS work. The preliminary assessments comprehensive data base activity will provide a computerized, quality-controlled data base of performance assessment data such as soil hydraulic conductivity. Such a data base supporting the many OU activities will ensure consistency of RI/FS and remedial actions.

Barrier development and evaluation will rely on computer simulations validated by laboratory and field tests to ensure that water infiltration is controlled. The key activities are the projection of future climate variability and the testing of barrier performance using lysimeters to measure moisture migration. Additional tests such as wind tunnel erosion testing, animal intrusion testing, effects of gravel surfaces or mulches testing, and evapotranspiration testing are also conducted to measure the effects that plants, animals, and erosion control features have on barrier performance.

B.9 RADIATION AREA REDUCTION

This task provides the interim remedial actions that must be taken on inactive sites (e.g., cribs, ponds, ditches, trenches, and burial grounds) to eliminate and prevent surface contamination before implementing final restoration efforts. Examples include surface stabilization of inactive pond areas and burial grounds by adding top soil and providing vegetation, isolating and surface stabilizing inactive cribs, and decontaminating surface areas that do not overlie buried radioactive material. Also, a selective herbicide application program is in place to control the growth of deep-rooted vegetation on outdoor radiation areas reducing the potential for re-contamination via uptake of radionuclides through the root systems.

B.10 FACILITY, SYSTEMS, AND EQUIPMENT UPGRADES

The task includes the facilities, systems and equipment upgrades that are required to support the overall ER Program. In FY 1989, this activity will support upgrades in the laboratory facilities and drilling equipment necessary to respond to RI/FS characterization activities.

B.11 100 AREA REMEDIAL ACTION

This task includes the remedial action design and remedial action resulting from a ROD for OUs in the 100 Area. Additionally, it covers the final closure of any RCRA treatment, storage, and disposal units, within the ER Program scope, in the 100 Areas. This task is anticipated to become active in FY 1994.

B.12 300 AREA REMEDIAL ACTION

This task includes the remedial action design and remedial action resulting from a ROD for OUs in the 300 Area. Additionally it covers the final closure of any RCRA treatment, storage, and disposal units, within the ER Program scope, in the 300 Areas. This task is anticipated to become active in FY 1994.

B.13 1100/600 AREA REMEDIAL ACTION

This task includes the remedial action design and remedial action resulting from a ROD for OUs in the 1100/600 Area. Additionally, it covers the final closure of any RCRA treatment, storage, and disposal units, within the ER Program scope, in the 1100/600 Areas. This task is anticipated to become active in FY 1994.

B.14 200 AREA (NON-SINGLE-SHELL TANK) REMEDIAL ACTION

This task includes the remedial action design and remedial action resulting from a ROD for OUs in the 200 Area. Additionally, it covers the final closure of any RCRA treatment, storage, and disposal units, within the ER Program scope, in the 200 Areas. This task is anticipated to become active in FY 1994.

B.15 200 AREA (SINGLE-SHELL TANK) REMEDIAL ACTION

This task includes the remedial actions for the SSTs. This task is anticipated to become active beyond FY 1995.

This page intentionally left blank.

DISTRIBUTION

Number of copies

OFFSITE

5 U.S. Department of Energy-Headquarters

J. V. Antizzo
W. A. Frankhauser
C. H. George, Jr.
T. B. Hindman
L. Waldo

ONSITE

24 U.S. Department of Energy-Richland Operations Office

E. A. Bracken	A6-95
G. J. Bracken	A6-80
R. W. Brown	A5-51
R. M. Carosino	A4-52
P. K. Clark	A6-80
C. E. Collantes	A6-80
B. R. Delannoy	A6-95
R. D. Freeburg	A6-95
M. J. Furman	A6-80
R. E. Gerton	A6-93
J. R. Hunter	A6-55
R. D. Izatt	A6-50
S. K. Moy	A6-80
R. J. Nevarez	A6-80
J. E. Newson	A6-80
G. W. Rosenwald	A6-80
R. P. Saget	A5-52
R. K. Stewart	A6-95
J. J. Sutey	A5-90
M. W. Tiernan	A5-55
K. J. Wheeless	A7-75
L. C. Williams	A5-18
M. J. Zamorski	A6-55
Public Reading Room	A1-65

DISTRIBUTION (continued)

Number of copies

ONSITE

53 Pacific Northwest Laboratories

C. R. Allen	B2-02
D. W. Bennett	K5-22
A. J. Boegel	K6-25
W. F. Bonner	P7-44
D. L. Brenchley	K6-28
R. L. Brodzinski	P8-07
J. L. Buelt	P7-44
H. C. Burkholder	P7-41
D. B. Cearlock	K1-42
T. T. Claudson	K1-45
P. J. Cowley	K2-02
J. R. Divine	P8-37
J. W. Falco	K6-78
M. J. Fayer	K6-77
G. W. Gee	K6-77
C. A. Geffen	K6-55
R. E. Gephart	K6-97
M. J. Graham	K6-80
R. H. Gray	K1-30
J. M. Hales	K6-04
M. S. Hanson	K1-51
J. N. Hartley	K6-27
G. M. Holter	K6-28
C. H. Imhoff	K6-61
B. J. Kaiser	P8-03
J. F. Keller	K6-55
B. J. Kelman	P7-50
W. L. Kuhn	P7-14
D. E. Kurath	P7-41
W. W. Laity	K1-51
J. M. Latkovich	P8-08
R. C. Liikala	K1-57
D. D. Mahlum	P7-50
J. L. McElroy	P7-46
R. P. Marshall	K1-77
D. H. Mitchell	P7-44
P. J. Mitchell	K6-97
B. A. Napier	K3-54
I. C. Nelson	K3-54
M. E. Peterson	P7-44
J. V. Robinson	K3-53
P. A. Scott	P7-44
L. J. Sealock	K2-12
R. L. Skaggs	K6-77

DISTRIBUTION (continued)

Number of copies

ONSITE

Pacific Northwest Laboratories (continued)

	S. L. Stein	SE-AT
	T. L. Stewart	K2-12
	J. A. Stottlemyre	K6-94
	J. L. Straalsund	K2-15
	W. L. Templeton	K1-30
	R. L. Treat	P7-18
	M. B. Triplett	K6-27
	E. J. Wheelwright	P7-25
	R. E. Wildung	P7-50
130	Westinghouse Hanford Company	
	M. R. Adams	H4-55
	R. B. Agee	R2-75
	B. N. Anderson	B2-04
	J. N. Appel	R2-05
	F. L. Ashworth	R2-75
	B. A. Austin	R2-75
	H. Babad	H4-17
	W. B. Barton	S6-70
	R. J. Baumhardt	R2-40
	T. B. Bergman	R1-48
	L. R. Besel	N2-02
	J. B. Billetdeaux	R2-75
	R. M. Black	R2-28
	R. J. Bliss	B3-04
	D. L. Borders	R2-75
	L. E. Bourneman	H4-50
	L. C. Brown	H4-51
	J. G. Burk	B3-25
	M. A. Cahill	R3-46
	J. W. Cammann	H4-54
	G. D. Carpenter	H4-15
	R. J. Cash	L4-55
	M. A. Christie	R2-05
	F. M. Coony	T1-30
	H. F. Daugherty	R2-53
	C. Defigh-Price	H4-52
	L. P. Diediker	X0-21
	A. J. DiLiberto	R2-85
	J. J. Dorian	H4-15
	G. T. Dukelow	R1-81
	G. L. Dunford	R1-51

DISTRIBUTION (continued)

Number of copies

ONSITE

Westinghouse Hanford Company (continued)

D. M. Eder	R2-75
F. W. Ellis	L6-53
R. A. Evans	T4-10
L. R. Fitch	H5-50
D. L. Flyckt	R2-20
G. D. Forehand	R1-43
M. R. Fox	H4-51
K. A. Gasper	H4-17
C. J. Geier	H4-57
R. B. Gelman	S1-51
D. S. Gleason	N1-58
F. T. Green	H4-17
M. L. Grygiel	S6-65
S. Guttenberg	N2-53
V. W. Hall	H4-17
D. G. Harlow	R2-01
W. F. Heine	R1-15
J. M. Henderson	B2-03
R. D. Hensyel	G1-35
J. O. Honeyman	R3-63
R. D. House	R2-53
M. C. Hughes	R1-15
D. P. Hutchison	H4-50
G. W. Jackson	R2-29
W. G. Jasen	R1-51
M. T. Jansky	H4-57
K. N. Jordan	H4-17
J. D. Kaser	R3-63
N. W. Kirch	R1-10
W. J. Klover	X0-21
J. R. Knight	R2-52
R. J. Kobelski	R3-51
E. J. Kosiancic	R2-15
M. J. Kupfer	R2-11
R. J. Landon	H4-50
J. H. LaRue	B2-06
R. E. Lerch	H4-51
D. W. Lindsey	R1-51
R. Y. Lyon	R3-09
R. L. Martin	X0-03
H. E. McGuire	H4-51
D. E. McKenney	R2-11
W. J. McShane	L3-08
D. L. Merrick	R2-11

DISTRIBUTION (continued)

Number of copies

ONSITE

Westinghouse Hanford Company (continued)

L. A. Mihalik	R2-11
E. M. Mueller	H4-50
R. J. Murkowski	S6-65
G. C. Owens	L6-59
K. W. Owens	R1-10
R. A. Paasch	H4-52
J. V. Panesko	R2-11
P. C. Payne	S1-52
F. R. Petkevicius	A4-90
H. G. Powers	R2-11
L. L. Powers	H4-57
D. R. Pratt	H4-52
S. M. Price	H4-57
I. E. Reep	S4-68
D. C. Riley	R2-11
R. C. Roal	R3-63
R. J. Roberts	R1-43
F. A. Ruck	H4-57
W. G. Ruff	X0-43
J. D. Schaffer	S1-52
P. S. Schaus	A4-90
J. L. Scott	B2-10
R. A. Sexton	B2-10
K. R. Shah	B2-03
J. P. Sloughter	T6-18
A. H. Smith	R2-75
D. J. Sommer	H4-52
D. R. Speer	R2-77
R. T. Stordeur	R2-20
G. A. Tarcza	A3-11
D. A. Turner	R1-10
J. E. Van Beek	R1-48
E. C. Vogt	R2-92
J. L. Waite	H4-52
D. J. Washenfelder	R1-43
R. E. Wheeler	T1-30
S. A. Wiegman	H4-50
G. F. Williamson	R1-48
N. R. Wing	H4-54
J. A. Winterhalder	H4-55
R. M. Wirsing	H4-54
D. D. Wodrich	R2-23
R. D. Wojtasek	R2-28
B. A. Wolfe	B2-04

DISTRIBUTION (continued)

Number of copies

ONSITE

Westinghouse Hanford Company (continued)

J. C. Womack	R2-18
D. E. Wood	H4-51
J. J. Zimmer	R2-05
R. A. Zinsli	R2-53
Documentation Services (4)	L8-15
Publication Services (3)	R1-08