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Hanford Waste Management Plan

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FOREWORD

The Hanford Waste Management Plan (HWMP) discusses the actions, schedules, and costs associated with the permanent disposal of Hanford defense wastes (HDW), including the waste stored from past production and the waste being generated through fiscal year (FY) 2015. Both radioactive and hazardous waste, and combinations referred to as hazardous radioactive mixed waste (HRMW) are addressed in this plan. The disposal or remedial actions are projected to cost $9.1 billion for the lower bound and $29 billion for the upper bound. All cost projections beyond FY 1988 are represented in 1989 dollars. The lower bound represents implementation of in place stabilization and disposal for single-shell tank waste, contaminated soil sites and solid waste burial sites, and is considered as the minimum cost for any forthcoming decision on the disposal or remediation of HDW. The upper bound, in which all of the waste is exhumed for geologic disposal of a high-level fraction and hazardous chemicals considered unacceptable for near-surface disposal, is considered as the maximum cost for any forthcoming decision on the disposal or remediation of HDW.

The schedule and costs presented in the 1987 HWMP cover a range of 47 yr, from FY 1984 through FY 2030. They are derived from the following three sources: (1) actual costs incurred from FY 1984 through FY 1986, (2) the FY 1989 Budget Submittal from the Waste Management Division, Richland Operations Office (Hanford Site) of the U.S. Department of Energy (DOE) to the DOE Headquarters Office of Defense Waste and Environmental Restoration, Office of Defense Programs from FY 1987 through FY 1993, and (3) engineering estimates from FY 1994 through FY 2030. The FY 1989 Budget Submittal forms a baseline for costs and schedules developed in the 1987 HWMP.

The FY 1989 Budget Submittal, prepared and submitted in accordance with DOE Order 5700.7B by the Waste Management Division, Richland Operations Office in April, 1987, provides input to the overall DOE budget submittal and the continuing Federal budget cycle. The April 1987 submittal contains the appropriation for FY 1987, the guidance for FY 1988, and four contrasting levels from FY 1989 through FY 1993. The target level is used in the 1987 HWMP from FY 1989 through FY 1993. April is the designated time when all the budget categories are represented in a single, unified submittal; thereby allowing a baseline in time.

The FY 1988 guidance presented in the FY 1989 Budget Submittal, and represented in this issuance of the HWMP without modification, has undergone some changes at the Hanford Site as a result of the passage of the December, 1987, Congressional appropriation bill for FY 1988 Federal funding. For example, the FY 1988 guidance represented here for environmental restoration reflects no funding; that is, a deferral of work. Whereas the FY 1988 appropriation provides an expense budget of approximately $15 million. This funding will allow a significant acceleration of activities that will be included in the next update of the HWMP.

The issues associated with compliance to environmental regulations are represented in the 1987 HWMP to the extent that they were presented in the FY 1989 Budget Submittal. Much broader and updated presentations of these issues will be the subject of planning documents from the Hanford Environmental Management Program (HEMP) to be released during FY 1988. They will be broader in the sense that all programs at the Hanford Site will be included, not just Waste Management. They will be updated to include FY 1988 appropriations and FY 1989 guidance.

In the 1987 HWMP, peak cost projections occur in FY 1994 influenced mostly by construction projects, and again in FY 2008 influenced by disposal operations and the initiation of shipments to a geologic repository. Cost projections gradually decline until FY 2017. Between FY 2017 and FY 2030, cost projections for the lower bound are minimal, influenced by surveillance of the high-heat tanks left in place. For the upper bound, it is assumed that disposal is complete by FY 2015. The perpetuating costs for site surveillance are not projected as the emphasis of the HWMP is on the disposal and remediation of HDW.

The HWMP does not include nondefense wastes and surplus facilities such as the defense reactors that have been removed from service.

The 1987 HWMP is the fourth update and fifth issuance of this document. It is accompanied by two other documents which collectively respond to the annual reporting requirements put forth in DOE Order 5820.2. These other documents are the Hanford Waste Management Technology Plan DOE/RL 87-14 and the Implementation Plan for Hanford Site Compliance to DOE Order 5820.2, DOE/RL 87-15. The HWMP will continue to be updated annually using the most recent DOE Richland Operations Office Budget Submittal as a baseline.

The significant changes in the Hanford defense program that have occurred since the last revision of this document in 1986 are as follows.

1. Comments received on the draft Hanford Defense Waste Environmental Impact Statement were reviewed by DOE and, based on consideration of these comments, a preferred alternative has been identified. In the preferred alternative, DOE proposes to initiate disposal of double-shell tank waste, retrievably stored and newly generated TRU waste, one pre-1970 TRU solid waste site near the Columbia River and encapsulated cesium and strontium waste. For the remainder of the waste classes covered in the draft HDW-EIS (single-shell tank waste, TRU-contaminated soil and pre-1970 buried suspect TRU-contaminated solid waste), the DOE proposes to continue present actions in the near term while it conducts additional development and evaluation before making final disposal decisions. This development and evaluation effort will focus both on methods to retrieve and process wastes for geologic disposal as well as methods to stabilize or isolate the wastes near surface. Results from this work will be publicly available and final disposal alternatives will be presented for public review in subsequent environmental documentation.

2. The Hanford Environmental Management Program (HEMP) is fully operative. Where it has been established that compliance with regulations must be undertaken and technology is not required, efforts are underway. Examples include permitting treatment, storage and disposal (TSD) facilities and installing groundwater monitoring wells. Where the mission is not well defined, that is, where implementing regulations and DOE Orders are being developed, strategic planning is being undertaken in order to attain compliance with all Federal and State laws. A construction line item request, estimated at $180 million, was included in the FY 1989 budget submittal to fund several capital improvements in order to achieve compliance with applicable environmental requirements.

3. Costs for double-shell tank waste disposal increased from $4.1 billion to $6.0 billion. The following elements contribute to this increase:

   - The estimated number of glass canisters increased from 1765 to 2078 primarily due to the determination that neutralized cladding removal waste (NCRW) generated through December 1987, will need to be pretreated and the high-level fraction vitrified.

   - The estimate on the repository fee for disposing of each defense waste canister in the civilian repository increased from $200,000 to $350,000.

   - The Hanford Waste Vitrification Plant (HWVP) operational period is lengthened two yr due to the NCRW for an increase of $100 million.

   - The operating cost for the Transportable Grout Facility (TGF) is increased 40% based on an updated estimate and the disposal period is extended from FY 2006 to FY 2014 for an overall increase of $330 million.

   - For capital expenditures, the HWVP construction costs increased by $290 million, General Plant Projects (GPPs) and capital equipment increased by $240 million and many other smaller increases occurred.

   - Numerous smaller increases are now projected due to extended surveillance, extended operations at B Plant and updated technology requirements.

The costs for disposal of HDW are identified in four major categories in the HWMP: waste storage and surveillance, technology development, disposal operations and capital expenditures. Table 1 summarizes the total costs from the 1986 HWMP and the 1987 HWMP, and briefly describes the major causes for the cost changes. Table 2 breaks down the costs changes from table 1 into seven waste categories. Table 3 includes technology and capital costs that do not clearly fit into the waste categories. Table 2 includes a category called hazardous and miscellaneous radioactive mixed waste. It is intended to represent the nonradioactive, hazardous waste and the HRMW that is not included in the other six categories, and only those wastes generated or accepted by the Hanford Waste Management Program.

Table 1. Total Costs for Implementing the Hanford Waste Management Plan.

	1986 HWMP (billions of dollars)	1987 HWMP (billions of dollars)	Difference (billions of dollars)	Primary factors causing changes[c]
Waste storage and surveillance[a]	1.3	1.6	+ 0.3	Additional canisters, increases to waste concentration budget and extended operations
Technology development[b]	0.4	0.7	+ 0.3	Single-shell tank and buried waste retrieval and treatment development, and double-shell tank waste feed preparation
Disposal operations[d]	3.5	4.4	+ 0.9	Additional canisters extending operations and increased repository fees
Capital expenditures[e]	1.3	2.0	+ 0.7	HWVP, capital equipment, GPPs, and many small changes
Escalation at 4.9%	--	0.4	+ 0.4	
Total	6.5	9.1[f]	+ 2.6	

[a]Accounts for costs associated with maintaining waste storage operations, such as environmental monitoring and control, tank farm and burial ground operations, laboratory operations, etc.

[b]Includes all costs associated with development of methods for final waste disposal, such as waste characterization, protective barrier design, development of appropriate glass formulations, etc.

[c]See each waste category for detailed information.

[d]Summarizes projected costs incurred to accomplish final disposal, including waste pretreatment, grouting and vitrification operations, placement of protective barriers, and repository disposal. Operations technology support is also included.

[e]Includes all construction projects, capital work orders, and capital equipment not related to construction (CENRTC) including HWVP construction and subsequent melter replacement.

[f]This total represents implementation of in-place stabilization and disposal for single-shell tank waste, contaminated soil sites and solid waste burial sites, and is considered the lower bound of any forthcoming decision on the disposal of these three waste categories. The upper bound, in which all of the HDW is exhumed for geologic disposal of the high-level fraction and hazardous chemicals considered unacceptable for near surface disposal, is estimated to cost $29 billion.

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Table 2. Costs by Waste Category. (sheet 1 of 4)

	1986 HWMP (millions of dollars)	1987 HWMP (millions of dollars)	Difference (millions of dollars)	Primary factors causing changes
Single-shell tanks[a]				
Waste storage and surveillance	266.2	263.2	-3.0	Outyear budget projections from FY 89 Budget Submittal are slightly reduced
Technology development	45.5	161.2	+ 115.7	Added scope related to evaluation of retrieval, processing and disposal methods
Disposal operations	234.4	299.3	+ 64.9	Escalation rates were not applied correctly in 1986. No changes occurred
Capital expenditures	26.9	73.9	+ 47.0	Allocations due to environmental regulations and extending capital work orders through the disposal period
Totals	573.0	797.6	+ 224.6	
Contaminated soil sites[b]				
Waste storage and surveillance	140.8	99.9	-40.9	Allocations from the low-level effluent program were changed
Technology development	12.2	84.6	+ 72.4	Added scope related to evaluation of retrieval, processing and disposal methods
Disposal operations	479.3	490.9	+ 11.6	No significant change
Capital expenditures	29.5	95.0	+ 64.5	Allocations due to environmental regulations and extending capital work orders through the disposal period
Totals	661.8	769.4	+ 107.6	

NOTE: The 1986 HWMP costs are in FY 1988 dollars and the 1987 HWMP costs are in FY 1989 dollars.

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Table 2. Costs by Waste Category. (sheet 2 of 4)

	1986 HWMP (millions of dollars)	1987 HWMP (millions of dollars)	Difference (millions of dollars)	Primary factors causing changes
Solid waste burial sites[c]				
Waste storage and surveillance	46.4	56.1	+ 9.7	Allocations due to environmental regulations
Technology development	10.5	13.3	+ 2.8	Same as contaminated soil sites
Disposal operations	323.7	352.7	+ 29.0	No significant change
Capital expenditures	8.5	35.6	+ 27.1	Allocations due to environmental regulations and extending capital work orders through the disposal period
Totals	389.1	457.7	+ 68.6	
Double-shell tanks				
Waste storage and surveillance	685.6	985.8	+ 300.2	Additional canisters, increases to waste concentration budget and extending operations 3 yr
Technology development	279.7	333.8	+ 54.1	Increased scope for feed preparation including TRUEX. Updates and increases for glass technology and for waste characterization
Disposal operations	2,114.2	3,105.9	+ 991.7	Additional canisters, extending operations 3 yr and increased repository fees[d]
Capital expenditures	1,051.7	1,584.9	+ 533.2	HWVP, capital equipment, GPPs, and many small changes
Totals	4,131.2	6,010.4	+ 1,879.2	

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Table 2. Costs by Waste Category. (sheet 3 of 4)

	1986 HWMP (millions of dollars)	1987 HWMP (millions of dollars)	Difference (millions of dollars)	Primary factors causing changes
Capsules				
Waste storage and surveillance	139.6	177.5	+ 37.9	Slight annual increase and 5 yr extension of outyear allocations due to delay in repository opening
Technology development	1.8	2.0	+ 0.2	No significant change
Disposal operations	143.1	192.1	+ 49.0	The estimate on the repository fee increased 60%
Capital expenditures	29.6	36.1	+ 6.5	No significant change
Totals	314.1	407.7	+ 93.6	
Retrievably stored and newly-generated TRU waste				
Waste storage and surveillance	5.0	0.1	-4.9	Proper credit was not formerly taken for liquidating routine costs
Technology development	31.0	29.1	-1.9	No significant change
Disposal operations	165.1	175.8	+ 10.7	Cancelling treatment of RH is offset by packaging/shipping
Capital expenditures	100.8	84.3	-16.5	The RH-WRAP is cancelled in favor of treatment at ORNL
Totals	301.9	289.3	-12.6	

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Table 2. Costs by Waste Category. (sheet 4 of 4)

	1986 HWMP (millions of dollars)	1987 HWMP (millions of dollars)	Difference (millions of dollars)	Primary factors causing changes
Hazardous and miscellaneous radioactive mixed waste				
Waste storage and surveillance	0	38.9	+ 38.9	Allocations due to compliance of environmental regulations
Technology development	1.8	1.8	0	Liquid organic waste only; to be updated in next issuance of the HWMP
Disposal operations	0	0	0	Undergoing development; to be incorporated in next issuance of the HWMP
Capital expenditures	0	84.1	+ 84.1	Part of line item representing capital improvements necessary to achieve compliance with applicable environmental regulations
Totals	1.8	124.8	+ 123.0	

[a]The totals shown here represent implementation of in-place stabilization and disposal which is considered the lower bound of any forthcoming decision on disposal of single-shell tank waste. The upper bound, in which all of the waste is exhumed and treated for geologic repository disposal, is estimated to cost approximately $10 billion.

[b]The totals shown here represent implementation of in-place stabilization and disposal which is considered the lower bound of any forthcoming decision on disposal of contaminated soil sites. The upper bound, in which all of the waste is exhumed and treated for geologic repository disposal, is estimated to cost approximately $5.5 billion. Solid waste burial sites will also benefit from the results of the technology development increases.

[c]The totals shown here represent implementation of in-place stabilization and disposal which is considered the lower bound of any forthcoming decision on disposal of solid waste burial sites. The upper bound, in which all of the waste is exhumed and treated for geologic repository disposal, is estimated to cost approximately $6.6 billion.

[d]The number of glass canisters increased from 1765 to 2078 primarily due to the addition of NCRW. The HWVP operational period is lengthened 2 yr due to the added canisters. The operating cost for the TGF is increased 40% based on an updated estimate and the disposal period being extended from 2006 to 2014. The estimate on the repository fee is increased 60% based on new fee analysis.

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Table 3. Costs Not Included in Waste Categories.

	1986 HWMP (millions of dollars)	1987 HWMP (millions of dollars)	Difference (millions of dollars)	Primary factors causing changes
Disposal criteria and standards and NEPA	35.3	54.6	+ 19.3	Extended projections from FY 2000 to FY 2014
Program management and planning	21.7	63.4	+ 41.7	Extended projections from FY 2000 to FY 2014
Public information	6.9	28.8	+ 21.9	Extended projections from FY 2000 to FY 2014
Enhanced technology base	3.5	3.7	+ 0.2	No significant change.
Unspecified GPPs	101.1	115.5	+ 14.4	Period extended 5 yr
Total	168.5	265.9	+ 97.4	

NOTE: Public information is included in the grand total for disposal operations. Unspecified GPPs are included in the grand total for capital. The remaining costs are included in the grand total for technology.

PST88-3012-3

I. INTRODUCTION

A. OVERVIEW

The purpose of the Hanford Waste Management Plan (HWMP) is to provide an integrated plan for the safe storage, interim management, and disposal of existing waste sites and current and future waste streams at the Hanford Site. The emphasis of this plan is, however, on the disposal of Hanford Site waste. The plans presented in the HWMP are consistent with the preferred alternative which is based on consideration of comments received from the public and agencies on the draft Hanford Defense Waste Environmental Impact Statement (HDW-EIS). Low-level waste was not included in the draft HDW-EIS whereas it is included in this plan. The preferred alternative includes disposal of double-shell tank waste, retrievably stored and newly generated TRU waste, one pre-1970 TRU solid waste site near the Columbia River and encapsulated cesium and strontium waste.

For the remainder of the waste classes covered in the draft HDW-EIS (single-shell tank waste, TRU-contaminated soil and pre-1970 TRU solid waste), present actions would be continued in the near term while additional development and evaluation are conducted before making final disposal decisions. The disposal decisions that will eventually be implemented will be bounded by geologic disposal and in place stabilization and disposal. Accordingly, these bounding costs are presented in this plan. The lower bound costs and timing for implementation have been developed with some detail. The upper bound costs and timing, on the other hand, are rough, order-of-magnitude estimates at this time.

Technology required to implement the preferred plan has been identified. It is briefly presented here and elaborated on in the Hanford Waste Management Technology Plan, DOE/RL 87-14 a companion document to this plan.

B. OBJECTIVES

The key waste management objectives addressed by this plan are listed below.

- Continue the safe storage of existing and new wastes until their disposal.
- Assess the uses, storage, and disposal of hazardous materials, and develop program plans to comply with existing or emerging criteria and regulations.
- Minimize waste volume and dispersion; as practical, store and/or dispose of all Hanford Site waste on the 200 Area plateau.

- Dispose of new waste in conformance with existing or emerging criteria and regulations. At the earliest practical time, build or modify waste handling systems so that wastes are properly prepared for disposal.

- Dispose of existing waste based on safety, environmental, cost, and social considerations of both present and future generations.

- Separate selected radioisotopes and/or chemicals from waste if waste storage or disposal costs are lowered.

- Aid byproduct utilization by cooperating with potential users. Maintain byproduct separation capability for future wastes.

- Conduct waste management activities in a manner that promotes public confidence.

- Minimize budget peaks and total costs to the extent practical.

C. SCOPE

This plan covers radioactive and nonradioactive hazardous waste at the Hanford Site. The following are existing wastes included in the scope of this plan:

- Salt cakes, sludges, and residual liquids stored in single-shell tanks

- Contaminated soils and structures within contaminated soil sites

- Radioactive and hazardous materials in solid waste burial sites

- Liquids, sludges, and slurries stored in double-shell tanks

- Encapsulated cesium and strontium stored in water basins or leased as part of the byproducts utilization program (recently changed to the advanced radiation technology program)

- Retrievably stored and new generated transuranic (TRU) solid wastes

- Hazardous wastes generated (by treating or handling other waste) or accepted by waste management facilities and miscellaneous radioactive mixed waste not included above.

The following are future Hanford Defense Wastes (HDW) included in the scope of this plan:

- Liquid high-level, low-level, and TRU wastes to be produced by PUREX and Plutonium Finishing Plant (PFP) operations

- Hanford Facility Wastes (HFW) and other low-level wastes from Hanford Site operations
- Solid low-level and TRU wastes generated as a result of PUREX, PFP, and other chemical and waste processing operations
- Low-level liquid effluents disposed of to the soil column through FY 1995 (soil column disposal is planned to be discontinued)
- Wastes from offsite generators
- Hazardous wastes generated (by treating or handling other wastes) or accepted by waste management facilities.

Wastes to be generated by some future chemical processing activities and post-1998 PUREX operations will be included in later revisions of the HWMP as their processing plans become more complete. Hazardous chemical components may be inextricably intertwined with the radioactive wastes and will also be handled during the course of interim storage, processing, and disposal operations. Existing or emerging criteria are being evaluated and plans are being formulated to dispose of these wastes safely and in accordance with applicable State and Federal regulations.

D. KEY ASSUMPTIONS

The following key assumptions guide the preparation of the Hanford Waste Management Plan.

1. An active institutional control period of at least 100 yr after completion of disposal actions is assumed for the Hanford Site in this plan. The U.S. Department of Energy (DOE) plans to maintain ownership of the Hanford Site in perpetuity. Passive institutional control after the 100-yr action control period is assumed to exist.

2. Hanford Site defense wastes will be disposed of in accordance with plans stated in the national Defense Waste Management Plan (DWMP) and consistent with applicable State and Federal regulations.

3. Operation of the N Reactor is planned to be discontinued at the end of FY 1995 resulting in conclusion of spent fuel reprocessing at PUREX during FY 1998.

4. The Hanford Site will be ready to begin shipping waste to the Waste Isolation Pilot Plant (WIPP) starting in FY 1989.

5. Surveillance systems will be maintained and upgraded to assure that radionuclide and toxic emissions are within regulatory limits.

6. The cladding removal waste (CRW) pretreated at PUREX after December 1987 will be received as low-level waste (LLW) for interim storage in double-shell tanks.

7. B Plant will be available for demonstration of pretreatment operations in FY 1989.

8. The Transportable Grout Facility (TGF) will begin operation in FY 1988 and the Hanford Waste Vitrification Plant (HWVP) will begin operation in FY 1999.

9. The Federal high-level repository will be operational in 2003, although canister shipments from the Hanford Site may be delayed until 2008.

10. Shear/leach processing of Fast Flux Test Facility (FFTF) fuel and Pressurized Water Reactor (PWR) core II fuel will begin at the Process Facility Modification (PFM) in FY 1994. N Reactor fuel will continue to be decladded chemically.

E. WASTE MANAGEMENT DOCUMENT TREE

The Waste Management Document Tree (fig. I-1) illustrates the hierarchy of documentation that guides and supports the Hanford waste management program. The major elements in the tree and their relationships are described in the following paragraphs.

1. Statutes

The National Environment Policy Act (NEPA) of 1969 (PL 91-190), as amended, requires federal agencies to prepare an Environmental Impact Statement (EIS) early in the decision making process for any major federal actions which significantly affect the quality of the human environment. The Atomic Energy Act of 1954 (PL 83-703) as amended by the Energy Reorganization Act of 1974 authorizes the Department of Energy (DOE) to conduct nuclear materials production, research and development, and associated activities. The Act authorizes the agency to regulate its research, development, and production activity and to adopt such orders and standards as it may deem necessary to protect health and safety. The Acts to Authorize Appropriations are enacted by Congress each fiscal year providing funds for the various DOE programs. The appropriations bill enacted in 1982, Public Law 97-90, contained an added request that the President submit a report "which sets forth his plans for the permanent disposal of high-level and transuranic wastes resulting from atomic energy defense activities." The bill further requested an estimate of expenditures and "an explicit schedule for decisions regarding the further processing and permanent disposal of such wastes."

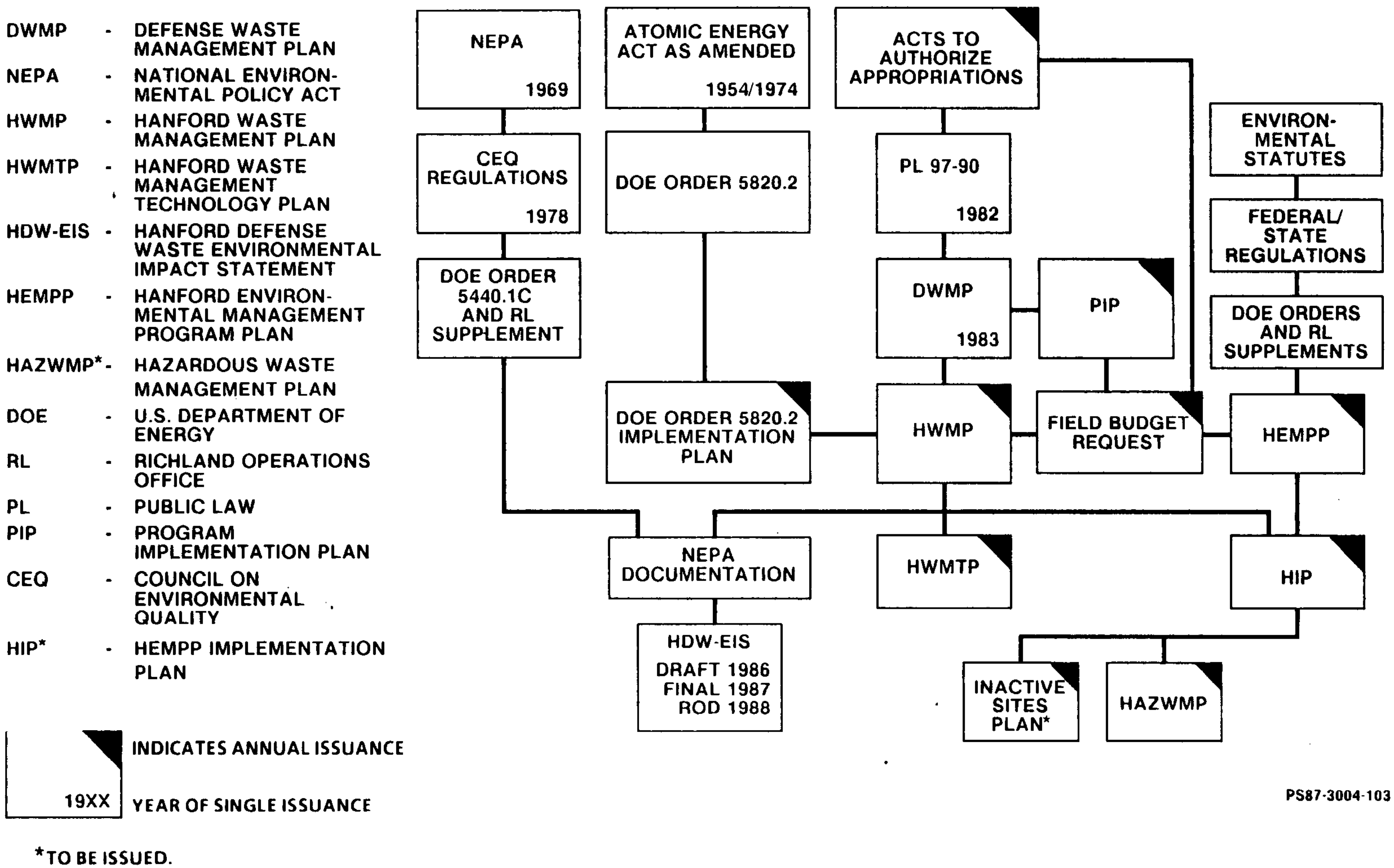

Figure I-1. Waste Management Document Tree for the Hanford Site.

The Environmental Statutes are numerous. The principal ones applicable to ongoing operations at the Hanford Site include the Clean Air Act (PL 91-604), the Clean Water Act (PL 92-500), the Resource Conservation and Recovery Act (PL (94-580) and 1984 amendments, the Comprehensive Environmental Response, Compensation and Liability Act (PL 96-510) and 1986 amendments, the Safe Drinking Water Act (PL 93-523) and the applicable State of Washington environmental statutes implementing the Federal statutes.

2. Regulations and Department of Energy Orders

In accordance with NEPA, as amended, implementing regulations were prepared by the Council on Environmental Quality and published in the Code of Federal Regulations (CFR) in 40 CFR part 1500. Further delineation as it applies to DOE-operated facilities is contained in DOE Order 5440.1C and the corresponding Richland Operations (RL) supplement 5440.1A.

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

The U.S. Environmental Protection Agency (EPA) is authorized to promulgate environmental regulations through chapter 40 of the Code of Federal Regulations 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, regulates air quality and emissions on a regional basis. Limits set forth by State and Local governments are approved or authorized by the EPA. Where regulations and standards require further interpretation and clarification, both DOE Headquarters and Field Offices prepare orders for internal and contractor compliance. More details on environmental statutes, regulations and DOE orders can be found in the Hanford Environmental Management Program Plan which is described below.

3. The Defense Waste Management Plan and Program Implementation Plan

The Defense Waste Management Plan (DWMP), DOE/DP-0015, was prepared in 1983 in response to public law 97-90 in which the U.S. Congress requested that the executive branch prepare a report setting forth the plans for the permanent disposal of high-level and TRU wastes resulting from atomic energy defense activities. The report, dated June 1983, was submitted as requested and included input from five other defense sites: the Idaho National Engineering Laboratory, the Los Alamos National Laboratory, the Nevada Test Site, the Oak Ridge National Laboratory, and the Savannah River Plant.

The progress on the DWMP is updated periodically by the DOE Office of Defense Waste and Transportation Management and is referred to as the Program Implementation Plan (PIP). The PIP summarizes the progress of each of the defense sites in implementing the DWMP. Costs presented in the PIP include the outyears presented in the most recent Field Budget Request but do not extend to FY 2015 as in the DWMP.

4. The Budget Cycle

The Field Budget Requests are submitted to DOE Headquarters approximately 18 months before the onset of the fiscal year. The requests from all DOE field offices are integrated by Headquarters according to an established prioritization methodology. The Office of Management and Budget (OMB) adjusts the budget request in conformance with the President's economic and programmatic objectives. This forms the President's budget which is submitted to Congress during the enactment phase. Based on the final appropriation bills enacted, budget execution or spending at the congressionally appropriated level begins with the start of the fiscal year on October 1. An Approved Funding Program (AFP) is issued by DOE Headquarters providing funding levels and authorized work scope.

5. Annually Issued Documents

Paragraph 7i(2) of DOE Order 5820.2 requires each field organization to prepare an annual update of waste management plans for all operations under their cognizance according to a prescribed format appended to the Order. These plans are to be submitted at the end of each fiscal year and distributed to the DOE Offices of Defense Programs (DP) and Environmental Health (EH) and other appropriate Headquarters Program Offices for review and comment. As a result of the implementation of the byproduct rulemaking, 52 Federal Register 15937, May 1, 1987, hazardous and mixed waste are to be included in these plans. Three of the annually issued documents, identified on the document tree and described below, fulfill the requirements of paragraph 7i(2) of DOE Order 5820.2.

The DOE Order 5820.2 Implementation Plan provides an assessment of the current status of compliance with the Order [required for paragraph 7i(2)].

The Hanford Waste Management Plan (HWMP) describes the costs, schedules and actions needed to implement the intent of national policy as outlined in the DWMP. [required for paragraph 7i(2)].

The Hanford Waste Management Technology Plan (HWMTP) is a companion document to 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 the HWMP. Similar technology needed at other defense sites is being developed sequentially in such a way that experience gained at the first site will be applied at other sites [required for paragraph 7i(2)].

Three other annually issued documents, identified on the document tree but not directly associated with the requirements of paragraph 7i(2) of DOE Order 5820.2, are described below.

The Hazardous Waste Management Plan (HAZWMP) provides an integrated plan for the safe storage, transport, treatment, and disposal of current and future hazardous waste generated on or received by the Hanford Site. The plan includes non-radioactive hazardous waste and low-level mixed waste, that is waste defined as low-level radioactive waste but containing hazardous components. The first issuance of the HAZWMP is scheduled for FY 1988.

The Inactive Sites Plan provides an integrated plan for preliminary assessment/site investigation and remedial investigation/feasibility study for sites considered inactive. The plan is an extension of former studies in response to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the corresponding DOE Order 5480.14. Both were redirected upon enactment of the CERCLA amendment, the Superfund Amendments and Reauthorization Act of 1986. The plan addresses sites containing hazardous waste, radioactive mixed waste or radioactive waste only including the waste in single-shell tanks and any soil disposal or unplanned releases. The Inactive Sites Plan is scheduled for issuance in FY 1988.

The Hanford Environmental Management Program Plan (HEMPP) states the policies, objectives, scope and processes involved in implementing the environmental management program at Hanford.

The HEMPP Implementation Plan (HIP) describes the costs, schedules, and actions needed to implement the policy as outlined in the HEMPP. The first issuance of the HIP is scheduled for FY 1988.

6. NEPA Documentation

The draft environmental impact statement, Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes (HDW-EIS), DOE/EIS-0113, evaluates environmental impacts and the resulting consequences from implementing several alternatives for the permanent disposal of Hanford high-level, transuranic and tank wastes. The draft was issued in April 1986 and the public comment period was concluded in August 1986. A preferred alternative was developed based on consideration of these comments. The plans presented in the 1987 HWMP are consistent with the preferred alternative.

The HDW-EIS will support implementation of a significant portion of the disposal activities for the Hanford Site waste management program. Other NEPA environmental documentation will be prepared to evaluate alternatives and processes to implement waste disposal, as appropriate. The final HDW-EIS Record of Decision will be identified in the next update of the HWMP. The levels of any additional environmental documentation for current and proposed waste management operations will be tiered from the final HDW-EIS or from the Final Environmental Statement for Waste Management Operations at the Hanford Reservation (ERDA 1538) issued in December 1975.

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II. WASTE MANAGEMENT STRATEGY

A. STRATEGIC OVERVIEW AND WASTE MANAGEMENT PRIORITIES

The basic waste management strategy is to carry out the following:

- Continue safe operation of interim waste management activities including safe storage, surveillance, and maintenance of Hanford defense wastes.
- Assess the uses, storage, and disposal of hazardous materials, and develop program plans in compliance with existing or emerging criteria and regulations.
- Proceed with disposal of double-shell tank waste, retrievably stored and newly generated TRU waste, one pre-1970 TRU solid waste site near the Columbia River and encapsulated cesium and strontium waste.
- Continue present actions for the near term on single-shell tank waste, TRU-contaminated soil and pre-1970 TRU solid waste while conducting additional development and evaluation before making final disposal or remedial action decisions.
- Maintain an active program to inform the public, other agencies, and State and local governments about the Hanford Site's waste management plans.

In order to assure a balanced decision making process, it is important to continue to evaluate alternatives and close out key technology issues. Experience has shown that considerable time elapses between identifying the need for new technology and beneficial application. Therefore, technological support programs must be vigorously pursued and funded to assure that the necessary technologies will be developed and available when needed.

The preferred plan presented in this document is designed to meet the intent of national plans as outlined in the DWMP and to complete disposal of HDW within the next few decades. The preferred plan is consistent with, but an expansion of, the preferred alternative identified from the draft HDW-EIS comment period. The expansion consists of the addition of low-level waste. In the preferred plan, disposal of double-shell tank waste, retrievably stored and newly generated transuranic waste, the only pre-1970 buried suspect TRU-contaminated solid waste site near the Columbia River and encapsulated strontium and cesium waste is initiated. For the remainder of the waste categories (single-shell tank waste, contaminated soil sites, solid waste burial sites, and hazardous and miscellaneous radioactive mixed waste) additional development and evaluation will be conducted before making final disposal decisions. Action is being undertaken according to the the following priorities:

Initiate Disposal	Conduct Development/Evaluation
1. Double-shell tank waste	1. Single-shell tank waste
2. Retrievably stored and newly generated TRU solid wastes	2. Contaminated soil sites
3. Pre-1970 site	3. Hazardous waste and miscellaneous HRMW
4. Encapsulated wastes	4. Solid waste burial sites

Considering those waste categories for which disposal actions will be initiated, the highest priority is given to double-shell tank wastes to minimize the need for new tank construction. A major objective of the waste management program is to dispose of new wastes, such as PUREX Cladding Removal Waste (CRW) and neutralized current acid waste (NCAW), as quickly after their production as possible. Stored and new TRU solid wastes are next in priority. National policy has already been established, a disposal site has been selected, and a schedule has been prepared for TRU waste disposal. Hanford Site disposal plans are being made to fit within the scope of the national policy. The pre-1970 site is the only site in this waste class that is not located on the 200 Area plateau. To consolidate the waste, the waste in that site will be removed to the 200 Areas and processed as newly generated TRU solid waste. It is monitored routinely and considered to be safe for several years. The strontium and cesium capsules are considered stable and safely stored for years and perhaps decades.

Considering those waste categories for which disposal actions are deferred, the highest priority is given to single-shell tanks due to uncertainties in the radioactive and hazardous constituents, the release pathways of these constituents, and unresolved technical issues related to retrieval, processing, and disposal methods. Contaminated soil sites are next in priority due to the potential of contaminants being transported to the underground aquifer. Based on preliminary investigations under CERCLA, it does not appear necessary to place priority on hazardous waste sites, miscellaneous HRMW-sites and solid waste burial sites.

B. DECISION PROCESS

The Waste Management Logic Diagram (fig. II-1) illustrates the decision-making process that will be used for waste disposal at the Hanford Site.

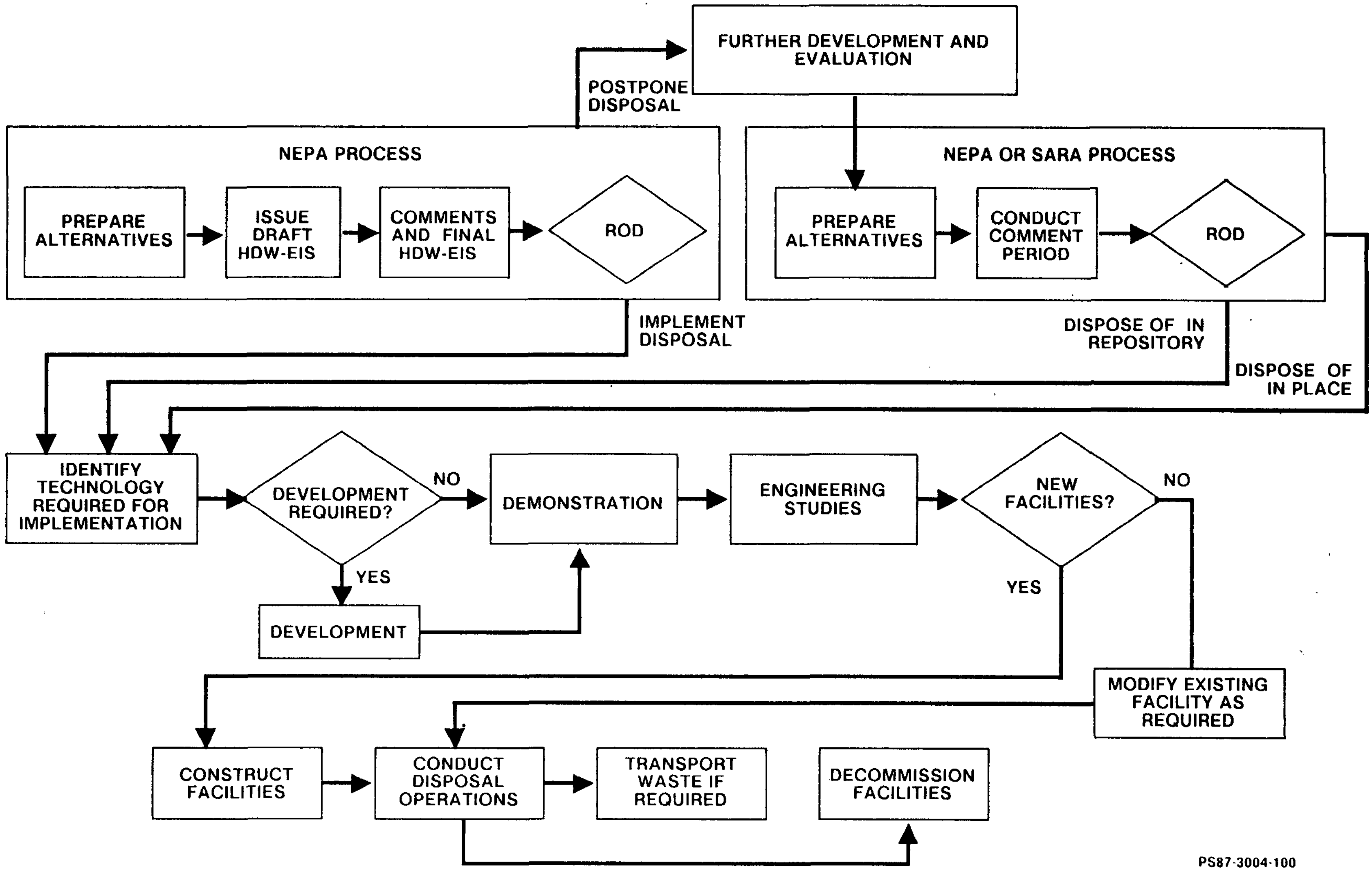

Figure II-1. Waste Management Logic Diagram for the Hanford Site.

An evaluation of the draft HDW-EIS alternatives provides the basis for the preferred plan in this document. Additional technology development will be necessary to support a record of decision for single-shell tank wastes, buried solid wastes, and contaminated soil sites and to provide a more definitive Hanford Waste Management Plan.

Now that a preferred plan is identified, resources will be focused on a comprehensive technology program to dispose of the waste. As waste disposal technology is successfully developed, demonstrated, and assessed, new process facilities will be constructed or existing ones modified and/or upgraded if necessary. Waste retrieval, immobilization, packaging, and disposal operations will continue until all waste types are converted to final waste forms or are disposed of in accordance with the preferred plan and subsequent environmental documentation.

C. THE DRAFT HDW-EIS PROGRAMMATIC ALTERNATIVES

The purpose of the draft HDW-EIS, in accordance with NEPA, was to provide environmental input to the decision on the proposed selection and implementation of a disposal program for defense high-level, TRU, and tank wastes. Excluded from consideration in the draft HDW-EIS are LLW previously disposed of in burial grounds and soil sites; LLW generated through current site operations; wastes generated by decontamination and decommissioning after the year 1983; and wastes generated from future operating programs, except PUREX and PFP. Low-level waste (LLW) generated as a result of disposal operations is included as is the decontamination and decommissioning of facilities required for disposal. The alternatives evaluated in the draft HDW-EIS are discussed below.

1. Geologic Disposal

The existing and future tank wastes are retrieved. These tank wastes are processed to remove a fraction consisting of TRU, the radioisotopes of cesium, strontium, and technetium, and any hazardous chemicals considered unacceptable for near-surface disposal. This fraction is immobilized in borosilicate glass for repository disposal. The remaining wastes, consisting of the bulk of the original waste and considered as LLW, are disposed of as a grout in near-surface vaults. The void-space is filled with appropriate dome-supporting material. A protective barrier is placed over the tanks.

Strontium and cesium capsules are packaged for repository disposal. Retrievably stored solid TRU wastes are retrieved, examined, processed if necessary, certified, and shipped for emplacement in the WIPP. Newly generated solid TRU wastes are certified for compliance with WIPP waste acceptance criteria and eventually shipped for emplacement in the WIPP.

Those contaminated-soil sites and pre-1970 buried suspect TRU-contaminated solid wastes are treated, packaged, and shipped to a repository.

Barriers are constructed as necessary, markers are provided, and records are established.

2. In-Place Stabilization and Disposal

The single-shell tank wastes are stabilized in place, tank domes are filled, and a barrier system is placed over each of the tank farms. The double-shell tank wastes are retrieved and treated as necessary to provide a stream that can be safely and suitably disposed of as grout in near-surface vaults. The empty double-shell tanks are dome-filled and a barrier system is placed over each tank farm.

Strontium and cesium capsules are packaged and disposed of in near-surface vaults properly spaced to allow heat dissipation. Retrievably stored and newly generated solid TRU waste is compacted, grout-filled as needed, and provided with a barrier.

The contaminated-soil sites and pre-1970 buried suspect TRU-contaminated solid waste are stabilized in place and provided with a barrier system. The barriers for TRU sites will meet more stringent design criteria than LLW sites. Markers are provided, and records are established.

3. No Disposal Action

Under this alternative, the existing program of interim storage and active institutional control is continued indefinitely. Solid TRU waste storage on pads is continued, double-shell tanks are built as needed to store liquid wastes, and capsules are placed in a passive dry storage mode.

D. THE DRAFT HDW-EIS REFERENCE ALTERNATIVE

A reference alternative was developed balancing concern for environmental impacts and safety with monetary costs. Some wastes are disposed of in a geologic repository; the balance are disposed of in place or are treated and disposed of as grout in near-surface vaults.

The single-shell tank wastes are stabilized in place, the tank domes are filled, and the barrier system is placed over each tank farm. The double-shell tank wastes are retrieved and processed to remove a high-level waste fraction and hazardous chemicals considered unacceptable for near-surface disposal. This fraction is immobilized in borosilicate glass for repository disposal. The remaining wastes, consisting of the bulk of the original double-shell waste, and considered as LLW, are disposed of as grout in near-surface vaults. The void-space is filled with appropriate dome supporting material. A protective barrier is placed over the tanks.

Strontium and cesium capsules are packaged for repository disposal. Retrievably stored, solid TRU wastes are retrieved, examined, processed if necessary, certified, and shipped for emplacement in the WIPP. The newly generated solid TRU wastes are certified for compliance with WIPP waste acceptance criteria and eventually shipped for emplacement in the WIPP.

The contaminated-soil sites and most pre-1970 buried suspect TRU-contaminated solid wastes are stabilized in place and provided with a barrier system. The barriers for TRU sites will meet more stringent design criteria than LLW sites. Markers are provided and records are established.

E. METHODOLOGY FOR DEVELOPMENT OF THE REFERENCE PLAN

To develop the reference plan, previous studies and evaluations were reviewed and conclusions compared to determine overall feasibility of each criteria for each waste type. National policy and existing or emerging criteria were also examined to assure that elements of the reference plan would meet requirements established by appropriate regulatory agencies. To make a well-balanced comparison, disposal processes were selected for each waste type and alternative which represented a reasonable basis for estimating environmental releases and disposal costs. For example, the process steps for the geologic disposal (retrieve) alternative for wastes in single-shell tanks included mechanical retrieval, complexant destruction, grouting, vitrification, transportation, dome filling, etc.

The process steps selected were evaluated to assure that their selection remains a reasonable one, particularly if the choice of that process step could conceivably bias the selection of an alternative. Each process step for the reference alternative was further examined to determine what technology development must occur prior to the implementation of that process. Open technology issues are described and tracked in the Hanford Waste Management Technology Plan (HWMTP). A decision tree which illustrates the procedure followed to select the reference disposal plan is shown in figure II-2.

The reference alternatives identified for each waste type result from preliminary studies evaluating safety, long- and short-term hazards, technical feasibility, and cost of various alternatives. The selection of a reference alternative was necessary to provide a planning basis for technical progress and budget preparation. Cost estimates were included in the 1986 HWMP for those processes selected as part of the reference alternative.

F. THE HDW-EIS PREFERRED ALTERNATIVE

Comments received on the draft HDW-EIS were reviewed by DOE. Based on consideration of these comments, a preferred alternative has been identified.

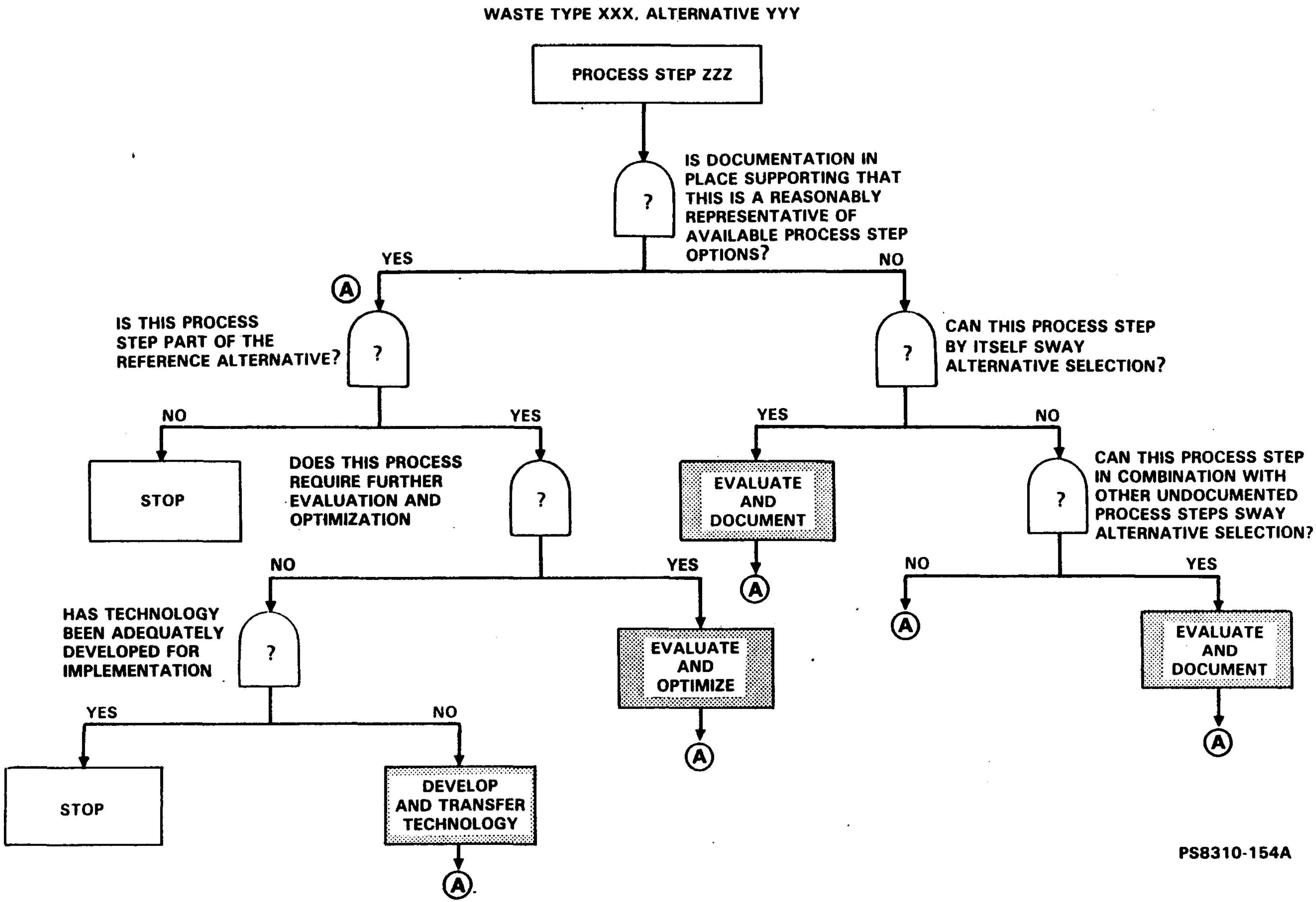

Figure II-2. Decision Tree for Selection of Reference Plan.

The preferred alternative includes disposal of double-shell tank waste, retrievably stored and newly generated TRU waste, one pre-1970 TRU solid waste site near the Columbia River, and encapsulated cesium and strontium waste. For these wastes, this issuance of the HWMP provides cost estimates and corresponding schedules consistent with the preferred alternative.

For the remainder of the waste classes covered in the draft HDW-EIS (single-shell tank waste, TRU-contaminated soil and pre-1970 buried suspect TRU-contaminated solid waste), present actions would be continued in the near term while conducting additional development and evaluation before making final disposal decisions. This development and evaluation effort will focus both on methods to retrieve and process wastes for geologic disposal as well as to stabilize or isolate the wastes near surface. For these wastes, this issuance of the HWMP provides cost estimates and corresponding schedules for the bounding disposal actions. Cost and schedules for stabilization and isolation for the wastes near surface are well developed as this was the reference plan in the previous HWMP. On the other hand, costs and schedules for retrieving and processing the waste for geologic disposal are not well developed but are presented here based on the geologic disposal alternative in the draft HDW-EIS.

Results from the development and evaluation for those wastes for which disposal decisions are deferred will be publicly available and final disposal alternatives will be presented for public review in subsequent environmental documentation.

G. ONGOING WASTE STORAGE AND SURVEILLANCE OPERATIONS

A key element of the Hanford site waste management strategy is to maintain safe storage and surveillance and to achieve compliance with applicable environmental regulations until disposal can be implemented. Key ongoing operational programs important to this goal are summarized in appendix B.

III. PREFERRED PLAN FOR DISPOSAL OF HANFORD SITE DEFENSE WASTES

This section provides a discussion of the preferred plan. Also included in this section are the bounding actions that can be taken for single-shell tank waste, contaminated soil sites, solid waste burial sites, and hazardous and miscellaneous radioactive mixed waste after the near-term preferred plan for development and evaluation on these waste categories is completed. Technical issues associated with implementation of these plans are identified. Discussion of the specific tasks and plans to resolve the technical issues is provided in the HWMTP. Schedules, costs, and capital item requirements to implement the plans are also included.

A. WASTE DISPOSAL CRITERIA, STANDARDS, AND PERFORMANCE ASSESSMENTS

Criteria and standards are being developed for disposal of various waste sites, types, and streams. The criteria and standards will be based on applicable regulations, DOE Orders, performance and risk assessments, and Hanford-specific technical work.

The criteria and standards being developed relate directly to the preferred plan presented in this document. Ultimately, the approved criteria and standards will guide the closure of the various technical issues discussed here. For example, the complexant content in single-shell tanks has been raised as an issue affecting in-place disposal. A standard will ultimately be derived that specifies complexant amounts or concentrations allowable prior to disposal of the tank.

The HWMTP identifies the tasks required to develop standards and the technology to comply with those standards prior to waste disposal. Disposal criteria and standards are required for all of the waste categories discussed in this plan. The development of criteria and standards is specifically identified as a technical issue in the HWMTP.

Performance assessments are key steps in the development of technology and methods for permanent waste disposal. Additional developments are needed to prepare defensible numerical analysis techniques for use in evaluating and selecting appropriate process steps to implement disposal alternatives. Because the required periods of waste isolation are long, numerical analyses and computer-modeled predictions are likely to be the only means to evaluate the effectiveness of some disposal systems. The HWMTP has several technical tasks related to the development of performance assessment techniques.

B. SINGLE-SHELL TANK WASTE

1. Preferred Plan

Storage of single-shell tank waste will be continued for the short term while conducting additional development and evaluation before making final disposal decisions. There are 149 single-shell tanks containing approximately 37 million gallons of sludges and salt cake. As a result of discussions with the EPA and the State of Washington Department of Ecology, a determination has been made to regulate the single-shell tanks under the Resource Conservation and Recovery Act (RCRA), as amended, with the intent of achieving closure.

Development and evaluation, both for retrieving and for leaving the waste, are illustrated in figure III-1 and include:

- Characterizing radioactive and hazardous waste components by sampling, analysis and modeling
- Establishing criteria for determining what needs to be removed for the geologic disposal option
- Performing enhanced environmental impact analyses using improved performance assessment models and data
- Demonstrating barrier performance
- Determining need and methods to improve the stability of the waste form if left near surface. Evaluating destruction and stabilization alternatives for hazardous components of the wastes
- Evaluating alternative methods for retrieving, processing and immobilizing the waste and conducting full-scale tests of the proposed methods
- Initiating a series of independent reviews of disposal alternatives by federal agencies and scientific groups such as the National Academy of Sciences
- Apply the process specified in the National Environmental Policy Act (NEPA).

At the conclusion of the development and evaluation, additional environmental analyses for waste disposal will be prepared. This documentation will present new field data and calculations to verify bounding impacts in the final HDW-EIS or supplement that document and will be available for public and agency review and input.

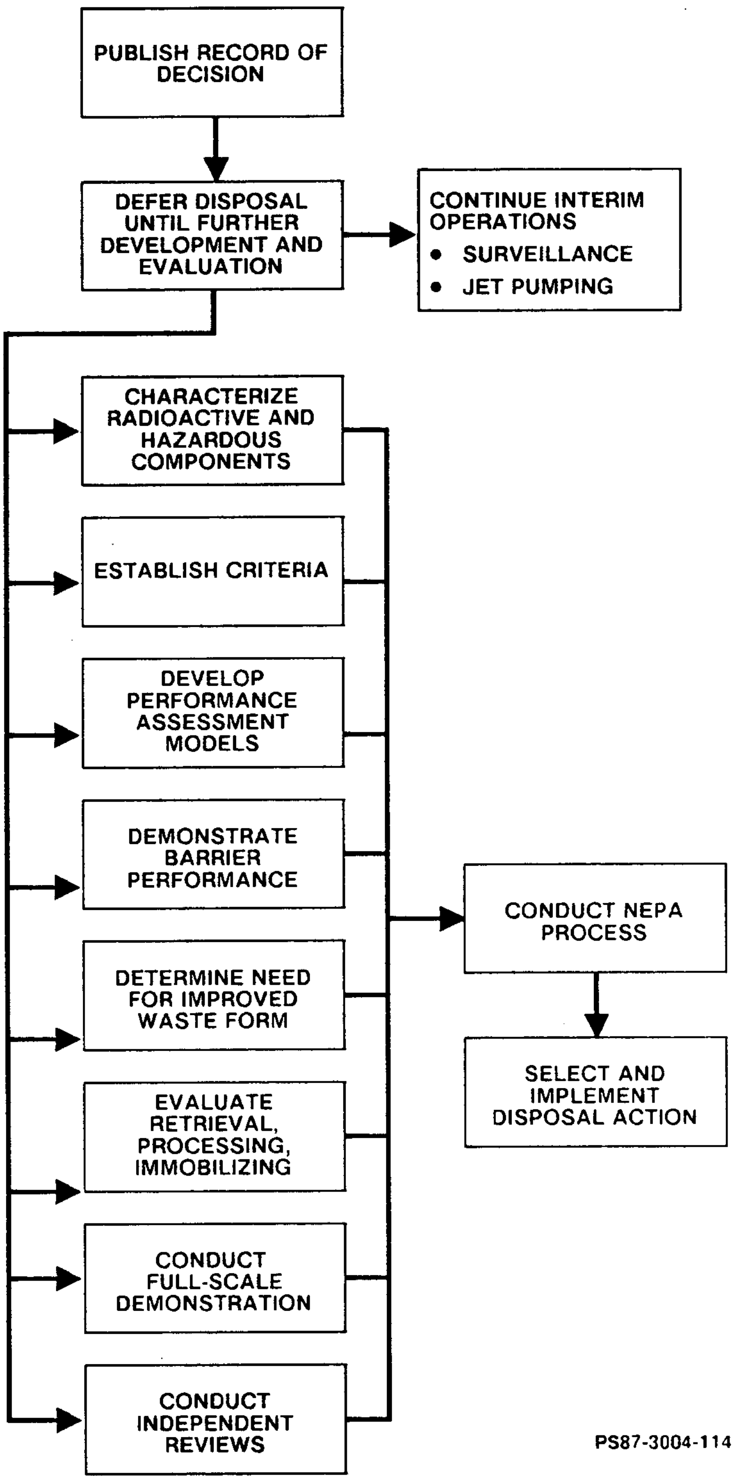

Figure III-1. Preferred Plan for Single-Shell Tank Wastes.

2. Technical Issues

There are a number of technical issues that must be addressed during the development and evaluation period. These issues include the following:

- Disposal criteria and standards
- Characterization
- Heat management
- Complexant effects
- Moisture effects
- Dome fill
- Retrieval
- Retrieved waste pretreatment
- Retrieved waste immobilization (glass)
- Retrieved waste immobilization (grout)
- Protective barriers
- Markers

Each of these technical issues is discussed in more detail in the HWMTP, DOE/RL 87-14.

3. Schedules and Costs

For single-shell tank waste, cost estimates and corresponding schedules are provided for the bounding disposal actions. Costs and schedules for in-place stabilization and isolation of the waste are well defined as this was the reference plan in the 1986 HWMP. The in-place stabilization and disposal schedule is shown in figure III-2; the costs are shown in table III-1. Costs and schedules for retrieving and treating the waste for geologic disposal are not well defined but are presented here based on the geologic disposal alternative in the draft HDW-EIS. In both bounding disposal actions, the influence of recently applicable environmental regulations is not fully known and may change cost and schedule updates.

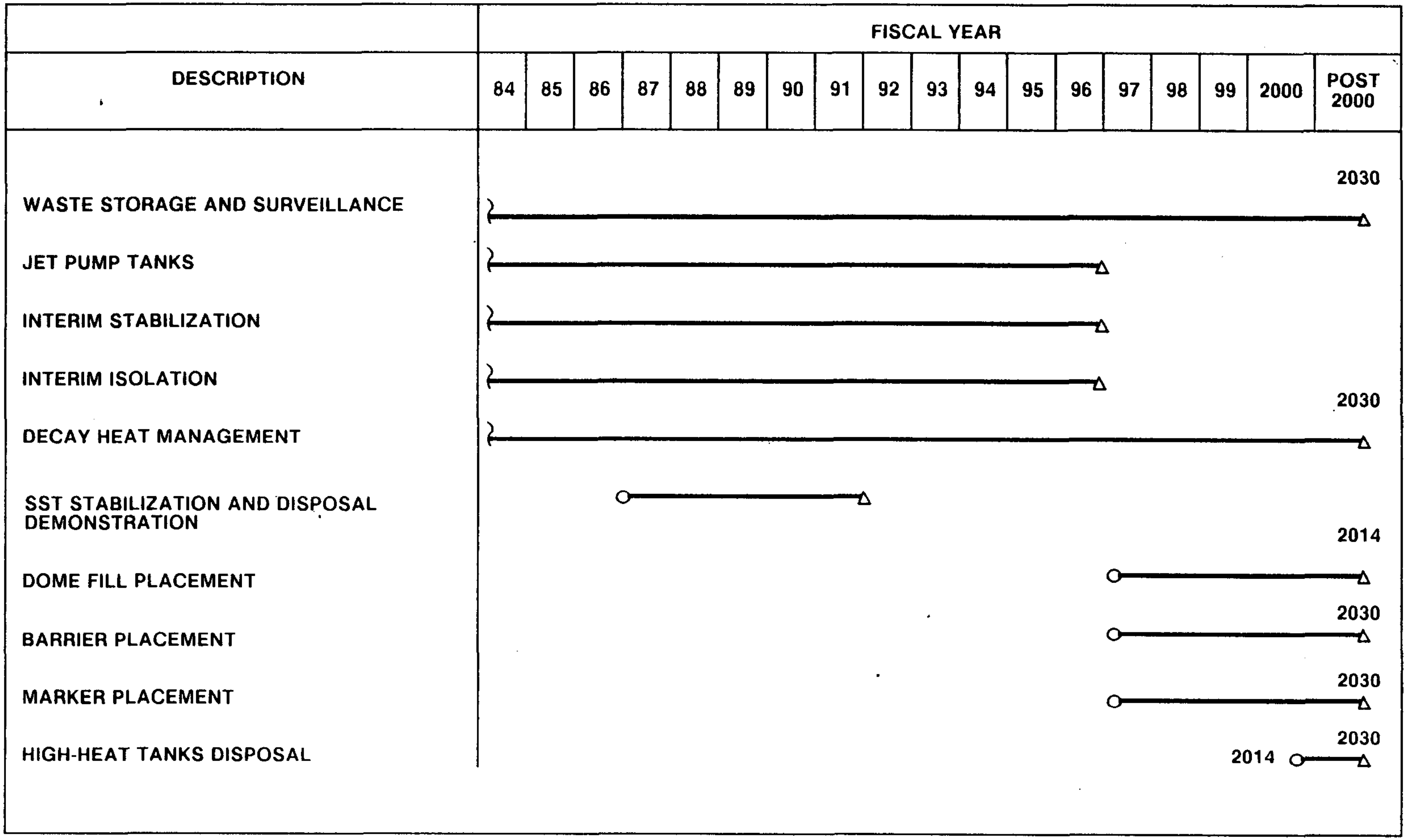

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Figure III-2. Single-Shell Tank Waste Schedule for In-Place Stabilization and Disposal.

Table III-1. Costs for Single-Shell Tank Waste Management (Millions of Dollars).

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Waste storage and surveillance	13.3	13.0	9.0	10.7	11.6	12.0	16.0	15.4	15.1	13.6	13.6	13.6	13.6	6.9	6.8	6.8
Technology development	1.6	4.2	4.1	1.0	1.5	2.5	9.1	12.0	10.6	9.8	14.5	14.0	13.2	11.2	11.2	10.8
Disposal operations														5.7	8.5	14.2
Operations technology support														0.1	0.2	0.6
Capital expenditures	2.9	2.4	1.2	1.4	0.8	2.9	5.0	7.3	6.9	4.3	4.0	3.1	1.5	1.5	1.5	1.5
Total	17.8	19.6	14.3	13.1	13.9	17.4	30.1	34.7	32.6	27.7	32.1	30.7	28.3	25.4	28.2	33.9

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Waste storage and surveillance	6.7	6.5	6.3	6.1	5.9	5.6	5.2	4.9	4.5	4.0	3.6	3.1	2.6	2.1	1.6	0.3
Technology development	5.0	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0	0.5	0.5	0.5	0.5	0.5	0.4	0.0
Disposal operations	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	2.7
Operations technology support	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.3
Capital expenditures	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0.2
Total	28.0	27.3	26.6	25.9	25.2	24.4	23.5	22.7	21.8	20.8	20.4	19.9	19.4	18.9	18.3	3.5

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Waste storage and surveillance	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	263.2
Technology development																161.2
Disposal operations	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	284.6
Operations technology support	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	14.7
Capital expenditures	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	73.9
Total	3.5	3.5	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	797.6

NOTE: All expense and CENRTC costs (millions of dollars) escalated through 1989. Construction costs escalated to midpoint of construction.

The totals shown here represent implementation of in-place stabilization and disposal, which is considered the lower bound of any forthcoming decision on disposal of single-shell tank waste. The upper bound, in which all of the waste is exhumed and treated for geologic repository disposal, is estimated to cost approximately $10 billion.

Geologic Disposal	$ million
Waste Storage and Surveillance	96
Technology Development	365
Disposal Operations	4,674
Capital Expenditures	1,891
Total	7,026

NOTE: These costs estimates do not include FY 1987 estimates for HWVP construction/operation and the increased repository fee. If included, the total would approximate $10 billion.

The schedule for retrieving and processing the single-shell tank waste for geologic disposal will include a 5-yr period for the construction phase followed by a 20-yr period for the operational phase.

4. Capital Items

Capital expenditures are shown for each of the bounding disposal actions. No major capital facilities have been identified for in place stabilization and disposal near surface. However, capital facilities for retrieving and processing the single-shell tank waste for geologic disposal include mechanical retrieval ($120 million), ozonization ($188 million), and radionuclide removal ($493 million), grout trenches, barriers and markers ($181 million), vitrification ($701 million) and barrier and marker installation over the tanks ($110 million).

C. CONTAMINATED SOIL SITES

1. Preferred Plan

No additional action beyond the present remedial program will be taken at this time. Additional development and evaluation will be conducted before making final disposal decisions.

The contaminated soil sites consist of 24 sites that are TRU-contaminated and another 316 sites that are low-level waste. All 340 sites are suspected of containing hazardous components and are subject to environmental regulations under RCRA and/or CERCLA. Presently, negotiations are being conducted with EPA on the approach to fulfilling compliance with regulations and strategic plans are being developed for an integrated Hanford environmental management program.

A decision on further remedial actions will not be made until further development and evaluation is completed. Following such further development and evaluation, it is anticipated that the portion of waste that cannot be left in-place (because of safety and regulatory issues) will be retrieved, treated and disposed of as appropriate. There may be cases where the waste can be left in-place but only in an enhanced physical form which is also the subject of the development and evaluation period.

Examples of development and evaluation are illustrated in figures III-3 and III-4 and include:

- Performing additional characterization at select sites' radioactive and hazardous waste components at select sites by sampling and analysis
- Performing enhanced environmental impact analysis as necessary using improved performance assessment models and data
- Establishing criteria to identify wastes unacceptable for in-place disposal and determine methods for processing and preparing this fraction for geologic disposal
- Demonstrating void-subsidence control
- Determining the need and methods to improve the isolation and stability of the waste form, including destruction/stabilization of the hazardous waste components
- Evaluating alternative methods for waste retrieval at specific waste sites and preparing the waste for shipment to an appropriate disposal site.

Upon completion of this development and evaluation program, data and results verifying that the environmental analyses in the final HDW-EIS are bounding, will be prepared for public review before issuing a final decision on disposal.

2. Technical Issues

There are a number of technical issues that must be addressed during the development and evaluation period. These issues include the following:

- Disposal criteria and standards
- Characterization
- Contaminated soil site subsidence control
- Waste immobilization
- Protective barriers

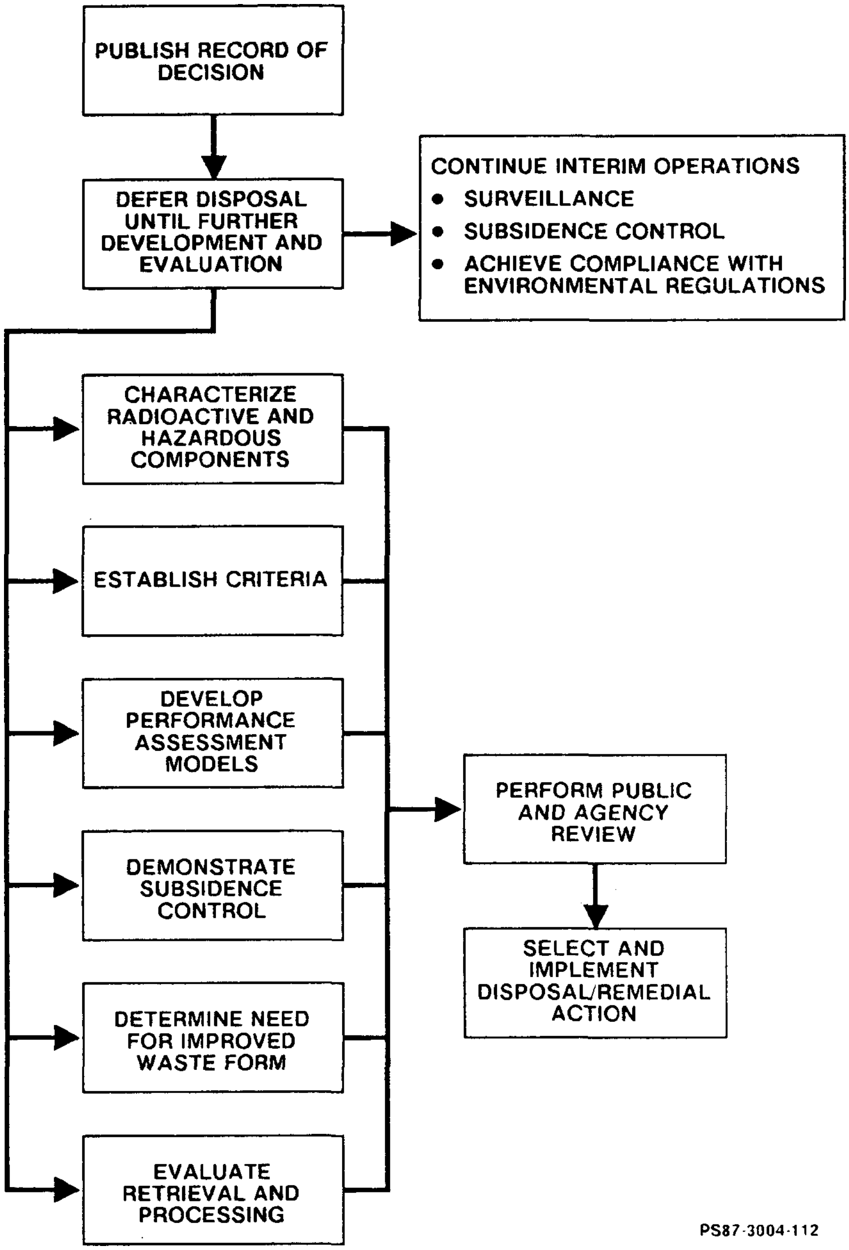

Figure III-3. Preferred Plan for TRU-Contaminated Soil Sites.

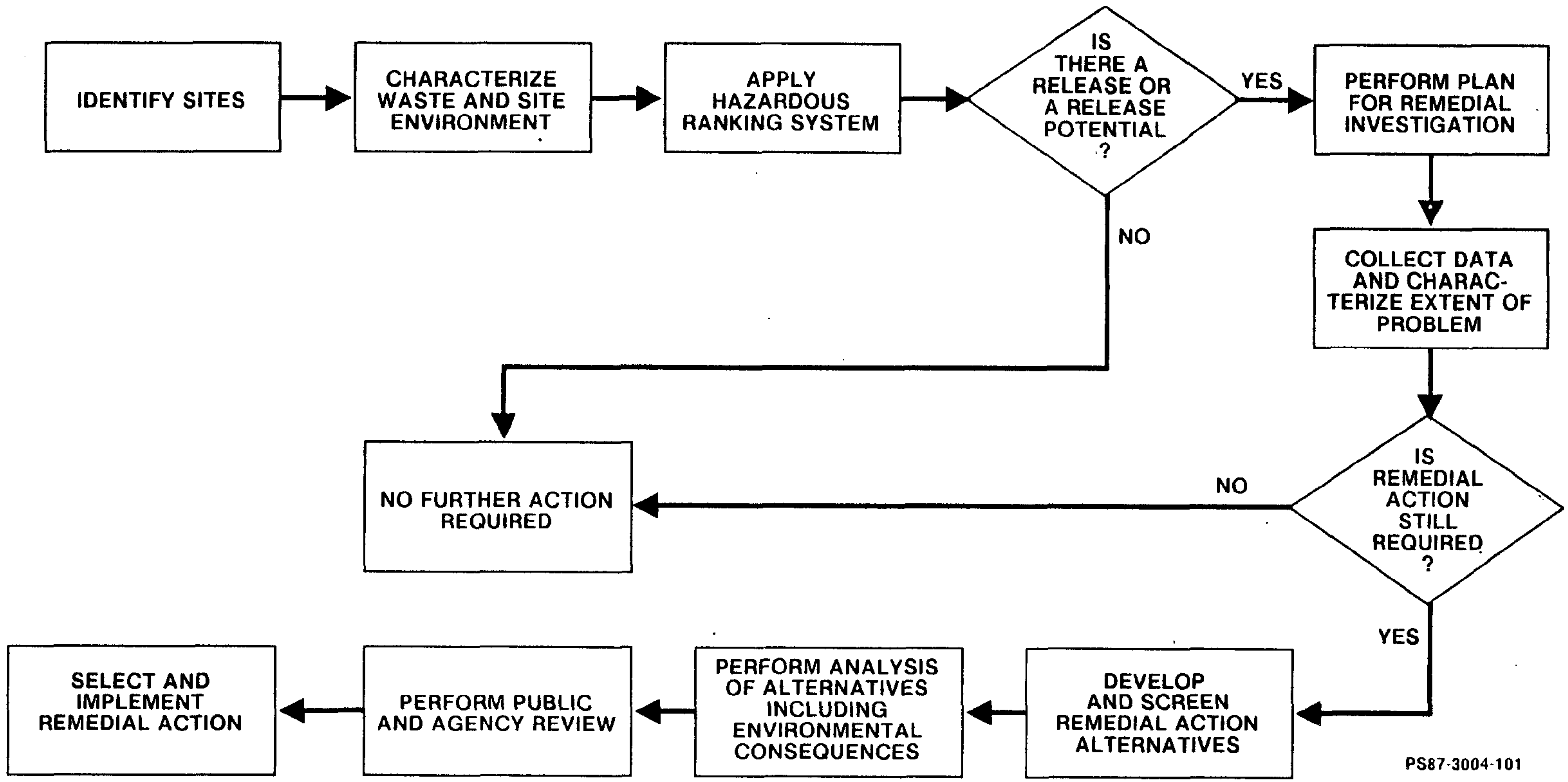

Figure III-4. Remedial Action Plan for Inactive LLW Sites.

- Markers
- Groundwater and unsaturated zone characterization, monitoring and remediation
- Contaminated soil and buried solid waste retrieval
- Retrieved waste processing.

Each of these technical issues is discussed in more detail in the HWMTP, DOE/RL 87-14.

3. Schedules and Costs

For contaminated soil sites, cost estimates and corresponding schedules are provided for the bounding remedial actions. Costs and schedules for in-place stabilization and isolation of the waste are well defined as this was the reference plan in the previous HWMP. The in-place stabilization and disposal schedule is shown in figure III-5; the costs are shown in table III-2. Costs and schedules for retrieving and treating the waste for geologic disposal are not well defined. Based on the geologic disposal alternative in the draft HDW-EIS, the costs for the TRU-contaminated soil sites only are $470 million and to implement the remedial action will require 13 yr after initiation of operations. The costs for geologic disposal of the LLW contaminated soil sites can be approximated at $5 billion using a scaling factor by volume. No time period has yet been identified for completion of the remedial action.

In summary, any further action that is taken at contaminated soil sites is expected to be bounded by a cost of approximately $700 million on the low side and $5.5 billion on the high side. In any event, it is anticipated that disposal actions will be concluded by FY 2015. In both bounding remedial actions, the influence of recently applicable environmental regulations is not fully known and may change cost and schedule updates.

4. Capital Items

Capital expenditures are shown for in place stabilization and disposal in table III-2 but no major capital facilities have been identified. For geologic disposal, approximately 60% of the total estimated costs are attributable to capital facilities based on the draft HDW-EIS.

D. SOLID WASTE BURIAL SITES

1. Preferred Plan

No additional action beyond the present remedial program will be taken at this time. Additional development and evaluation will be conducted

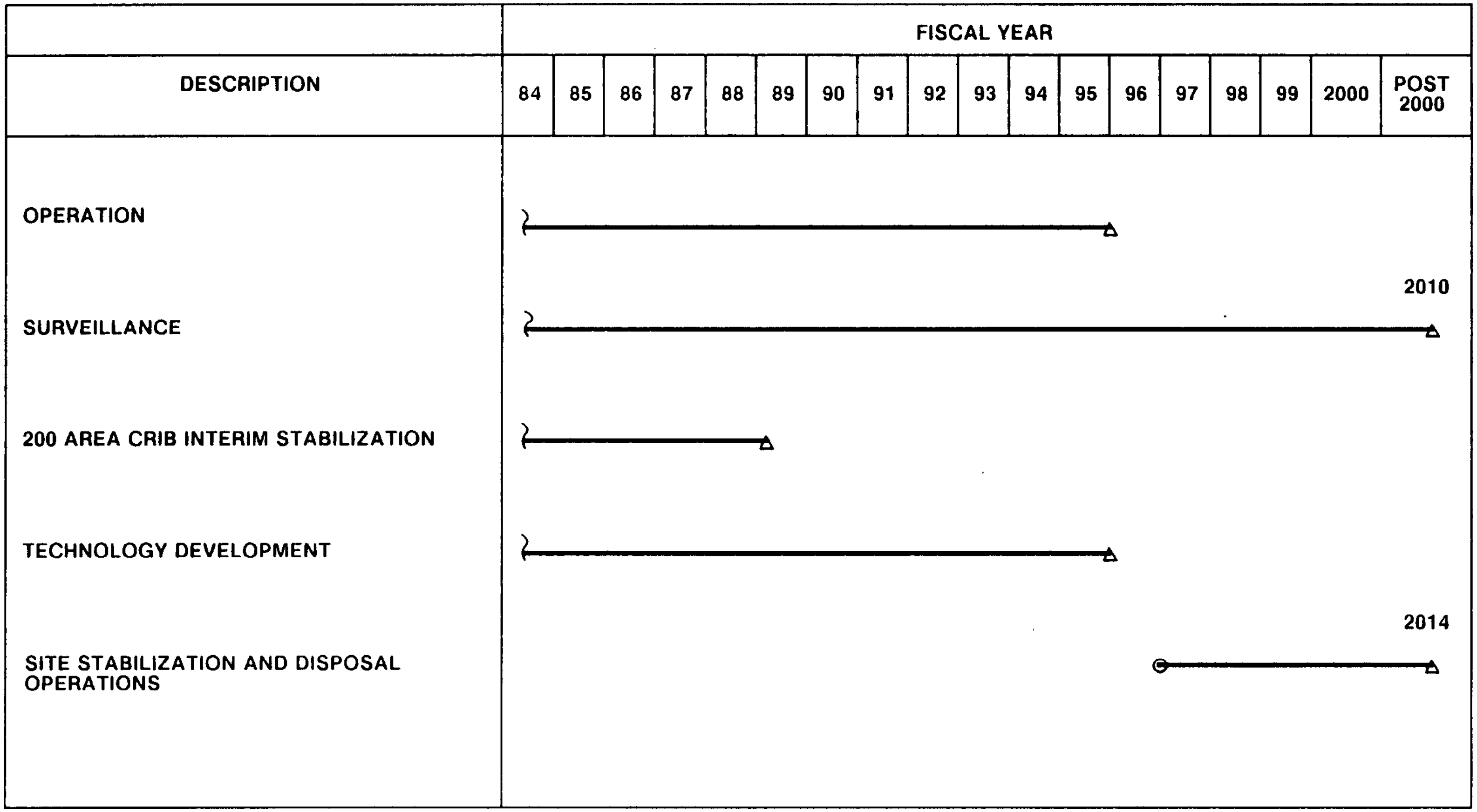

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Figure III-5. Contaminated Soil Sites Schedule for In-Place Stabilization and Disposal.

Table III-2. Costs for Contaminated Soil Site Waste Management (Millions of Dollars).

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Waste storage and surveillance	6.2	6.0	5.0	3.1	2.3	2.4	4.4	4.5	4.5	4.5	4.5	4.5	4.5	3.7	3.7	3.7
Technology development	3.4	2.0	1.2	1.7	0.7	0.2	0.8	0.9	0.8	0.8	4.7	5.3	6.4	9.0	12.0	12.0
Disposal operations														4.8	9.7	24.2
Operations technology support														0.2	0.3	0.4
Capital expenditures	1.0	1.3	0.2	1.1	1.0	5.1	12.8	15.7	15.2	12.0	10.8	7.2	0.8	0.7	0.7	0.7
Total	10.6	9.4	6.4	5.9	4.0	7.7	18.0	21.1	20.5	17.3	20.0	17.0	11.7	18.4	26.4	41.0

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Waste storage and surveillance	3.7	3.6	3.5	3.4	3.2	3.1	2.8	2.5	2.2	2.2	2.2					
Technology development	12.0	10.6														
Disposal operations	24.2	24.2	24.2	24.2	24.2	24.2	36.3	36.3	32.5	32.5	32.5	32.5	32.5	32.5	32.5	
Operations technology support	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
Capital expenditures	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7					
Total	41.0	39.5	28.8	28.7	28.5	28.4	40.2	39.9	35.8	35.8	35.8	35.8	32.9	32.9	32.9	0.0

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Waste storage and surveillance																99.9
Technology development																84.6
Disposal operations																484.0
Operations technology support																6.9
Capital expenditures																94.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	769.4

NOTE: All expense and CENRTC costs (millions of dollars) escalated through 1989. Construction costs escalated to midpoint of construction.

The totals shown here represent implementation of in-place stabilization and disposal, which is considered the lower bound of any forthcoming decision on disposal of contaminated soil sites. The upper bound, in which all of the waste is exhumed and treated for geologic repository disposal is estimated to cost approximately $5.5 billion.

before making final disposal decisions. The one exception is the pre-1970 site which is not located on the 200 Area plateau. To consolidate the waste, the waste in that site will be removed to the 200 Areas and processed as newly generated TRU solid waste.

The solid waste burial sites consist of 9 sites that are TRU contaminated and another 62 sites that are low-level waste. One TRU-contaminated site, designated 618-11, will be partially exhumed, treated, and disposed in the Waste Isolation Pilot Plant (WIPP). All 71 sites are suspected of containing hazardous components and are subject to environmental regulations under RCRA and CERCLA. Presently, negotiations are being conducted with EPA on the approach to fulfilling compliance with regulations and strategic plans are being developed for an integrated Hanford environmental management program.

A decision on further remedial actions will not be made until further development and evaluation, it is anticipated that the portion of waste that cannot be left in-place (because of safety or regulatory issues) will be retrieved, treated and disposed of as appropriate. There may be cases where the waste can be left in-place but only in an enhanced physical form which is also the subject of the development and evaluation period.

Examples of development and evaluation are illustrated in figures III-4 and III-6 and include:

- Performing additional characterization of radioactive and hazardous waste components of selected sites by sampling and analysis
- Performing enhanced environmental impact analysis as necessary using improved performance assessment models and data
- Establishing criteria to identify wastes unacceptable for in-place disposal and determine methods for processing and preparing this fraction for geologic disposal
- Demonstrating void-subsidence control
- Determining the need and methods to improve the isolation and stability of the waste form, including destruction/stabilization of the hazardous waste components
- Evaluating alternative methods for waste retrieval at specific waste sites and preparing the waste for shipment to an appropriate disposal site.

Upon completion of this development and evaluation program, data and results verifying the environmental analyses in the final HDW-EIS are bounding will be prepared for public review before issuing a final decision on disposal.

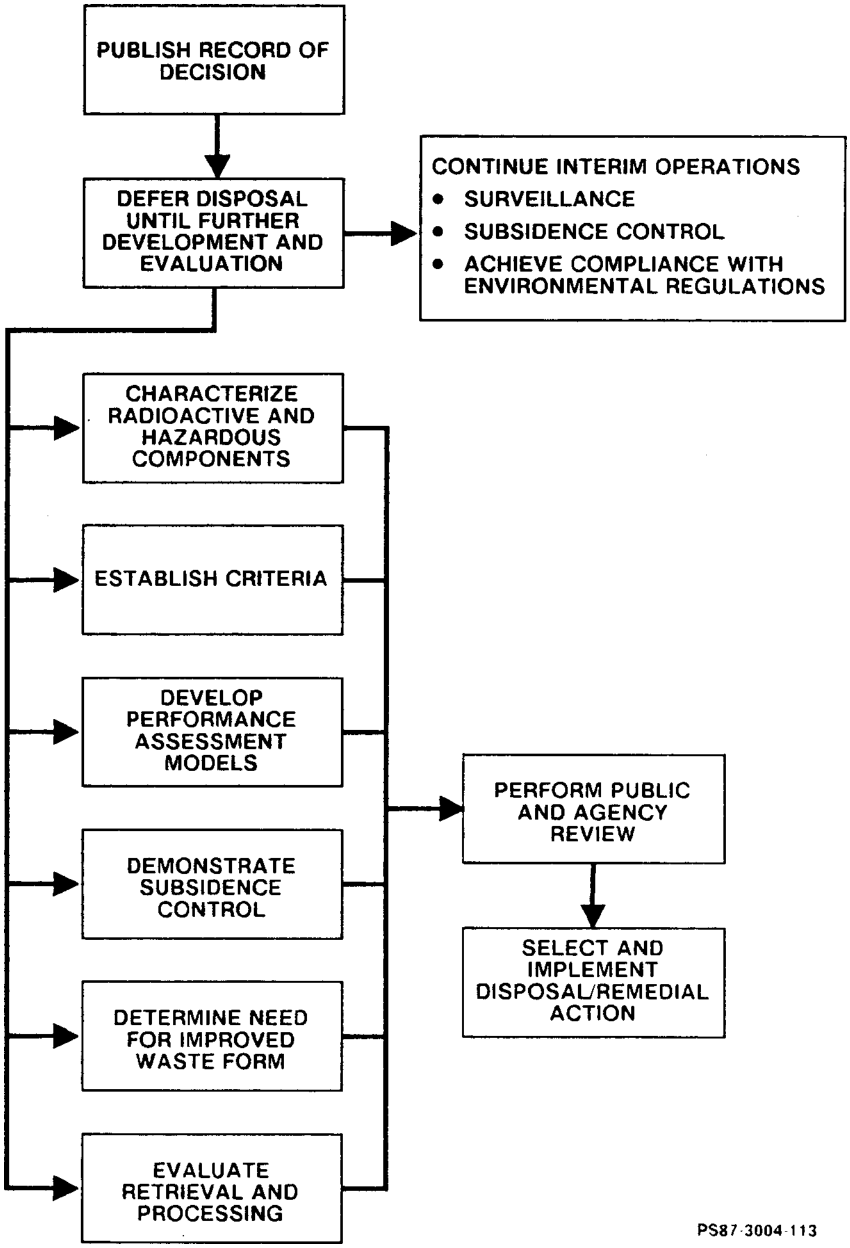

Figure III-6. Preferred Plan for Pre-1970 Buried Suspect TRU-Contaminated Solid Waste.

2. Technical Issues

There are a number of technical issues that must be addressed during the development and evaluation period. These issues include the following:

- Disposal criteria and standards
- Characterization
- Subsidence control
- Waste immobilization
- Protective barriers
- Markers
- Contaminated soil and buried solid waste retrieval
- Retrieved waste processing.

Each of these technical issues is discussed in more detail in the HWMTP, DOE/RL 87-14.

3. Schedules and Costs

For solid waste burial sites, cost estimates and corresponding schedules are provided for the bounding remedial actions. Costs and schedules for in-place stabilization and isolation of the waste are well defined as this was the reference plan in the previous HWMP. This reference plan also included the exhumation of the 618-11 site. The near-surface disposal schedule is shown in figure III-7; the costs are shown in table III-3. Costs and schedules for retrieving and treating the waste for geologic disposal are not well defined. Based on the geologic disposal alternative in the draft HDW-EIS, the costs for the TRU-contaminated solid waste burial sites only are $1.6 billion and to implement the remedial action will require 13 yr after initiation of operations. The costs for geologic disposal of the LLW solid waste burial sites can be approximated at $5 billion using a scaling factor by volume. No time period has yet been identified for completion of the remedial action.

In summary, any remedial action that is taken at solid waste burial sites is expected to be bounded by a cost of approximately $1.6 billion on the low side and $6.6 billion on the high side. In any event, it is anticipated that disposal actions will be concluded by FY 2015. In both bounding remedial actions, the influence of recently applicable environmental regulations is not fully known and may change cost and schedule updates.

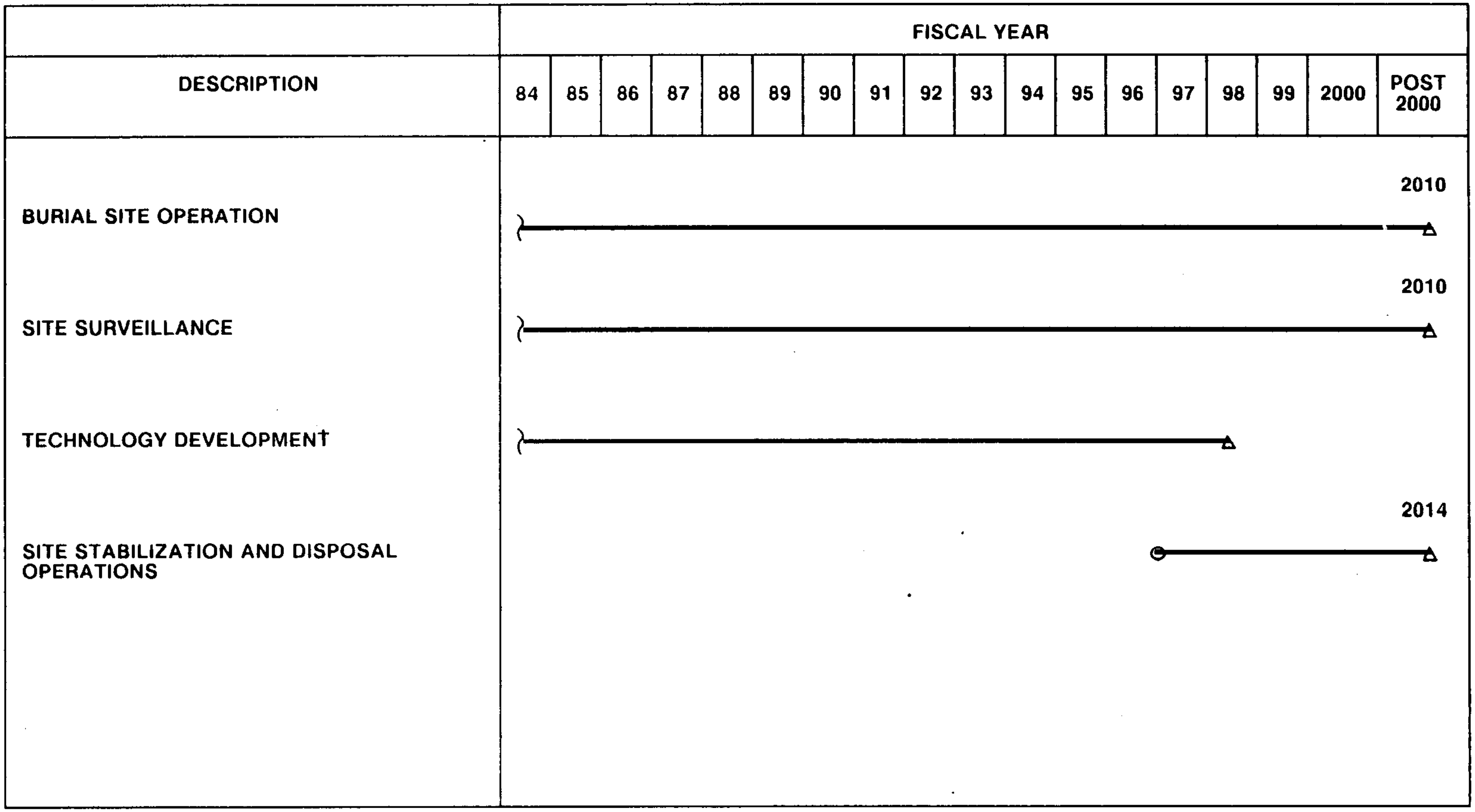

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Figure III-7. Solid Waste Burial Sites Schedule for In-Place Stabilization and Disposal.

Table III-3. Costs for Solid Waste Burial Site Management (Millions of Dollars).

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Waste storage and surveillance	3.1	2.9	3.1	3.3	2.5	2.7	4.2	4.6	5.1	5.1	5.1	5.1	5.1	0.3	0.3	0.3
Technology development	0.4	0.2	0.3	0.2	0.4	0.7	1.0	1.1	1.0	1.0	1.6	1.6	1.6	1.2	0.8	0.3
Disposal operations														3.5	6.9	13.3
Operations technology support														0.2	0.3	0.4
Capital expenditures	1.0	0.4	0.1	0.4	0.3	2.0	4.7	5.0	4.8	3.5	3.2	2.3	0.7	0.4	0.4	0.4
Total	4.5	3.4	3.5	3.9	3.2	5.4	9.9	10.7	10.6	9.6	9.9	9.0	7.4	5.6	8.7	14.7
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Waste storage and surveillance	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3					
Technology development	0.0															
Disposal operations	13.3	13.3	13.3	13.3	13.3	13.3	24.2	24.2	27.7	27.7	27.7	27.7	27.7	27.7	27.7	
Operations technology support	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
Capital expenditures	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
Total	14.4	14.4	14.4	14.4	14.4	14.4	25.3	25.3	28.8	28.8	28.8	28.5	28.5	28.5	28.5	0.0
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**Total**
Waste storage and surveillance																56.1
Technology development																13.3
Disposal operations																345.8
Operations technology support																6.9
Capital expenditures																35.6
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	457.8

NOTE: All expense and CENRTC costs (millions of dollars) escalated through 1988. Construction costs escalated to midpoint of construction.

The totals shown here represent implementation of in-place stabilization and disposal, which is considered the lower bound of any forthcoming decision on disposal of solid waste burial sites. The upper bound, in which all of the waste is exhumed and treated for geologic repository disposal, is estimated to cost approximately $6.6 billion.

4. Capital Items

Capital expenditures are shown for in place stabilization and disposal in table III-3 but no major capital facilities have been identified. For geologic disposal, approximately 60% of the total estimated costs are attributable to capital facilities based on the draft HDW-EIS.

E. DOUBLE-SHELL TANK WASTES

1. Preferred Plan

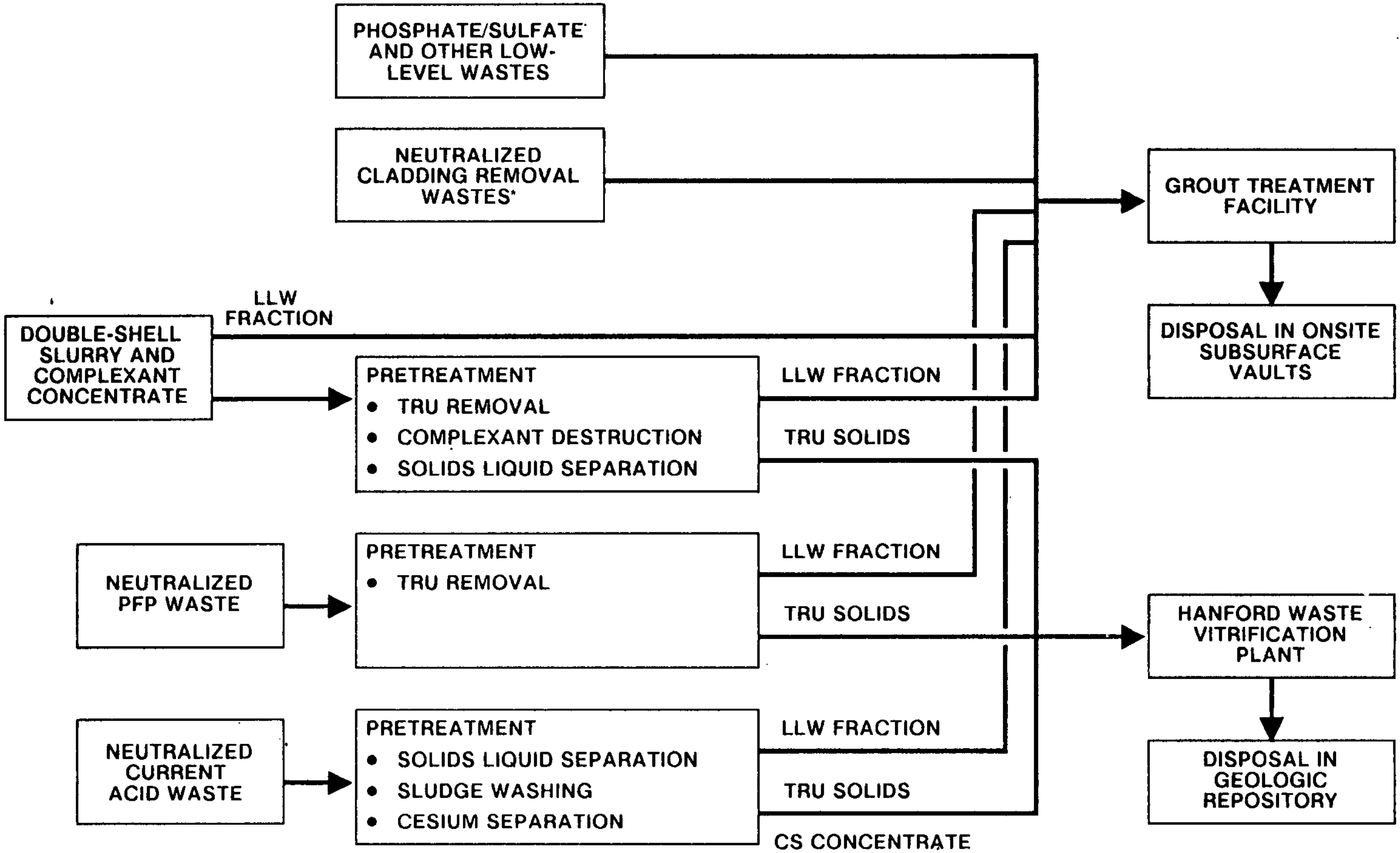
Double-shell tanks have been used to store liquid wastes (TRU, high-level, and low-level) since 1969, and have been used exclusively since 1981, when single-shell tanks were retired from service.

The preferred plan (fig. III-8) is to pretreat and vitrify the high-level and TRU waste fraction and dispose of it in a deep geologic repository and solidify the remaining low-level fraction as a cementitious grout and dispose of it in specially designed near-surface vaults meeting hazardous waste and LLW requirements.

The following work would be performed under this alternative:

- Finalize the glass formulation to ensure it meets repository waste acceptance criteria
- Finalize grout formulations to ensure they meet processing, regulatory, and environmental protection criteria
- Issue documentation for public information that verifies that the final design of the HWVP, vitrified glass waste form, and grout formulations are bounded by the HDW-EIS environmental analysis
- Complete design and construction of the HWVP and pretreatment modifications necessary to B Plant
- Construct subsurface vaults for disposing LLW and hazardous waste as grout
- Prior to the grout site final closure, develop a protective barrier that will meet the long-term environmental protection criteria. Prior to final demonstration of the protective barrier, wastes will be grouted and disposed of in vaults with leachate collection systems and caps that conform to Resource Conservation and Recovery Act (RCRA) requirements.

Some wastes transferred to double-shell tanks are concentrated to double-shell slurry (DSS) to minimize overall storage volume and costs. The DSS and settled sludge will be retrieved from double-shell tanks, diluted to allow pumping, and transferred to the Transportable Grout Facility.



*WASTES GENERATED BEFORE 1987 ARE NOT ACCEPTABLE AS GROUT FEED DUE TO TRU CONTENT. SPECIAL STUDIES REQUIRED.

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Figure III-8. Preferred Plan for Disposal of Double-Shell Tank Wastes.

Several of the wastes will require intermediate processing before they are acceptable as feed to the grout and glass processes. Complexed waste, PUREX neutralized current acid waste, and PFP wastes are examples.

Complexants are organic chelating agents found in complexant concentrate (CC) and in some DSS. These chelating agents complex the TRU elements and keep them in solution. A pretreatment method for CC is transuranic extraction (TRUEX) and solid/liquid separation. The transuranic elements are extracted from solution and the existing solids are separated and washed to minimize glass volume. The TRU fraction will then be processed in vitrification operations and the remaining waste will be processed into grout. If necessary, complexant destruction will also be performed on the low-level stream prior to grouting. Technology development to date has focused primarily on ozone oxidation, however, other processing options need to be evaluated. Consideration of other alternative processes, such as thermal degradation and destruction with a chemical oxidant (i.e., peroxide) are a part of the open technology issues that will be evaluated prior to installation of a process in B Plant.

The cladding removal waste (CRW) stream from spent fuel cladding dissolution is made suitable for low-level waste disposal by removing the TRU fraction by precipitation with lanthanum fluoride (LaF_3) prior to neutralization. As of December 1987, this process is being performed in PUREX without major modification of the equipment. The remaining supernate is neutralized and transferred to double-shell tanks for storage prior to immobilization as grout. The chop-leach process at PFM will allow the cladding to be removed as a solid waste. The chop-leach process will be applied to Fast Flux Test Facility (FFTF) fuels and Pressurized Water Reactor (PWR) Core II fuels.

Neutralized current acid waste resulting from PUREX operations is a two phase waste consisting of supernatant liquids and sludge. 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 at B Plant. The TRU-free supernatant liquids will be stripped of cesium prior to disposal as grout. The cesium crude will be combined with aging-waste solids and eventually immobilized as glass. Cesium removal is currently considered to be a necessary process step because of the limited amount of heat that can be dissipated from grout. Judicious site design and waste blending strategies may eliminate the need for cesium removal.

Wastes from the PFP originate from solvent extraction, scrap stabilization, anion exchange, plutonium nitrate to plutonium metal conversion, and laboratory activities. The PFP waste stream is characterized as a slurry. After solids settling, the dilute, noncomplexed supernate is decanted and processed as a low-level waste. The TRU solids will be stored until processed in B Plant prior to final disposal.

Low-level waste feed for the grout process is derived from various sources such as noncomplexed wastes, CRW pretreated at PUREX, NCAW supernatant liquids, Hanford Facility Waste, and other LLW. Low-level waste will be made into grout with only concentration adjustments. Grouted wastes will be disposed of below ground in concrete vaults.

Those wastes destined for geologic disposal (i.e., the NCAW sludge, crude cesium, etc.) will be blended and used as feed to the Hanford Waste Vitrification Plant glass process.

The preferred alternative was selected from over 300 other combinations of processing and disposal methods. Some of the criteria used for selection were safety, compatibility with existing facilities, technical risk involved, final waste volume produced, and total cost.

2. Technical Issues

Several technical issues remain to be resolved prior to implementing the preferred plan to retrieve and immobilize the double-shell tank wastes. These issues are listed below:

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

Each of these technical issues is discussed in more detail in the HWMTP, DOE/RL 87-14.

3. Schedule and Costs

The schedule for future and existing double-shell tank waste is presented in figure III-9. Double-shell tank waste management, processing, and disposal costs are shown in table III-4.

4. Capital Items

Major capital items required are: the Hanford Waste Vitrification Plant, the Transportable Grout Facility and its associated support projects, the AQ Tank Farm, and B Plant and transfer line upgrades. Additional major

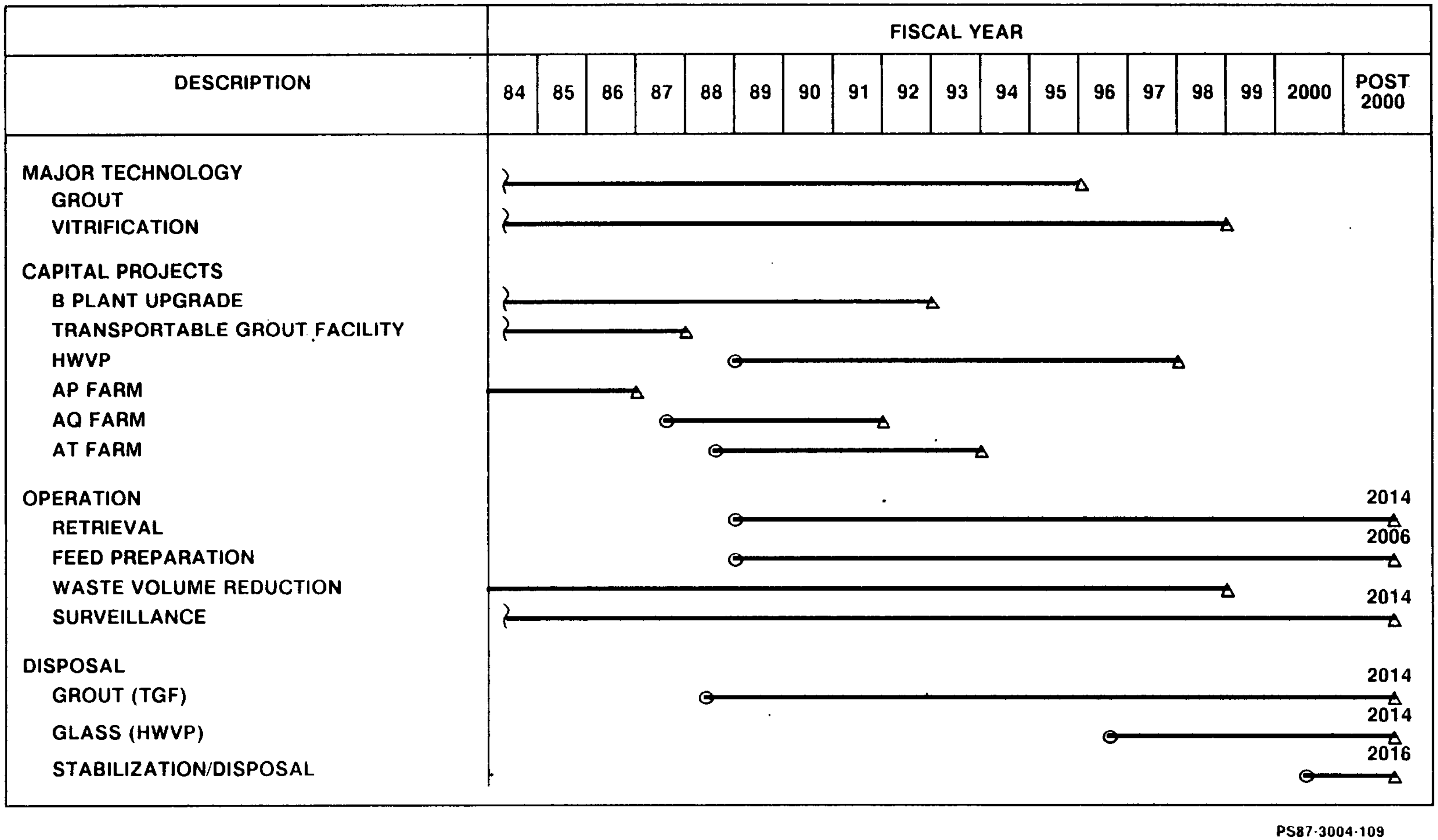

Figure III-9. Double-Shell Tank Waste Schedule.

Table III-4. Costs for Double-Shell Tank Waste Management (Millions of Dollars).

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Waste storage and surveillance	21.0	24.8	28.5	37.9	38.6	40.0	42.8	43.5	42.7	42.5	41.8	41.5	41.2	40.8	40.1	39.3
Technology development	6.5	11.9	19.4	22.7	16.8	14.1	21.2	15.9	16.4	18.8	27.2	22.9	25.2	27.9	33.1	26.1
Disposal operations			16.5	27.2	26.9	30.7	42.9	50.0	56.3	59.1	59.1	59.1	59.1	71.1	104.3	104.3
Operations technology support											2.0	2.0	2.0	2.0	2.0	2.0
Capital expenditures	41.8	11.6	15.4	18.4	46.9	49.4	75.8	101.5	174.2	217.5	335.3	132.9	62.7	39.4	16.4	16.4
Total	69.3	48.3	79.8	106.2	129.2	134.2	182.7	210.9	289.6	337.9	465.4	258.4	190.2	181.2	195.9	188.1

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Waste storage and surveillance	38.4	37.4	36.2	35.0	33.6	32.2	30.9	29.5	26.2	22.7	19.2	15.5	11.7	7.8	2.5	
Technology development	1.5	1.3	1.1	0.9	0.7	0.5	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	
Disposal operations	104.3	104.3	104.3	104.3	104.3	104.3	91.1	91.1	197.5	197.5	184.0	184.0	184.0	184.0	242.1	58.1
Operations technology support	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Capital expenditures	16.4	16.4	16.4	16.4	16.4	16.4	15.1	15.1	15.1	15.1	14.1	14.1	14.1	14.1	14.1	
Total	162.6	161.4	160.0	158.6	157.0	155.4	139.4	137.9	241.0	237.5	219.5	215.8	212.0	208.0	260.8	58.1

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Waste storage and surveillance																985.8
Technology development																333.8
Disposal operations	58.1															3,063.9
Operations technology support																42.0
Capital expenditures																1,584.9
Total	58.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6,010.4

NOTE: All expense and CENRTC costs (millions of dollars) escalated through 1989. Construction costs escalated to midpoint of construction.

laboratory and facility upgrades may be required to support double-shell and single-shell tank disposal operations.

F. CAPSULES

1. Preferred Plan

The preferred plan for disposal of capsules (cesium and strontium) includes packaging of the capsules in canisters and shipping to a geologic repository for disposal. The elements of the plan are given in figure III-10. They include the following:

- Modification of Waste Encapsulation and Storage Facility (WESF) to support dry packaging activities (or construct a capsule packaging facility)
- Storage of the capsules in the water basins until required for beneficial use or until final disposal facilities are ready
- Usage of capsules in the byproducts utilization program with subsequent return for water basin storage or overpacking
- Removal of capsules from the water basins, inspection, and packaging into canisters
- Shipment to a Federal repository for final disposal.

Prior to final implementation, evaluate whether the wastes in their present capsule form can be packaged and placed in the deep geologic repository. Finalize design of packaging of waste form to meet repository waste acceptance requirements. As this encapsulated cesium's and strontium's useful life is expected to be 20 to 30 more years, this decision may be reevaluated based on actual regulations and waste acceptance criteria at that time.

2. Technical Issues

Three technical issues remain to be resolved prior to implementing the preferred plan to package and transport the encapsulated waste. These issues are listed below:

- Disposal criteria and standards
- Corrosion of capsules
- Geologic disposal.

Each of these technical issues is discussed in more detail in the HWMTP, DOE/RL 87-14.

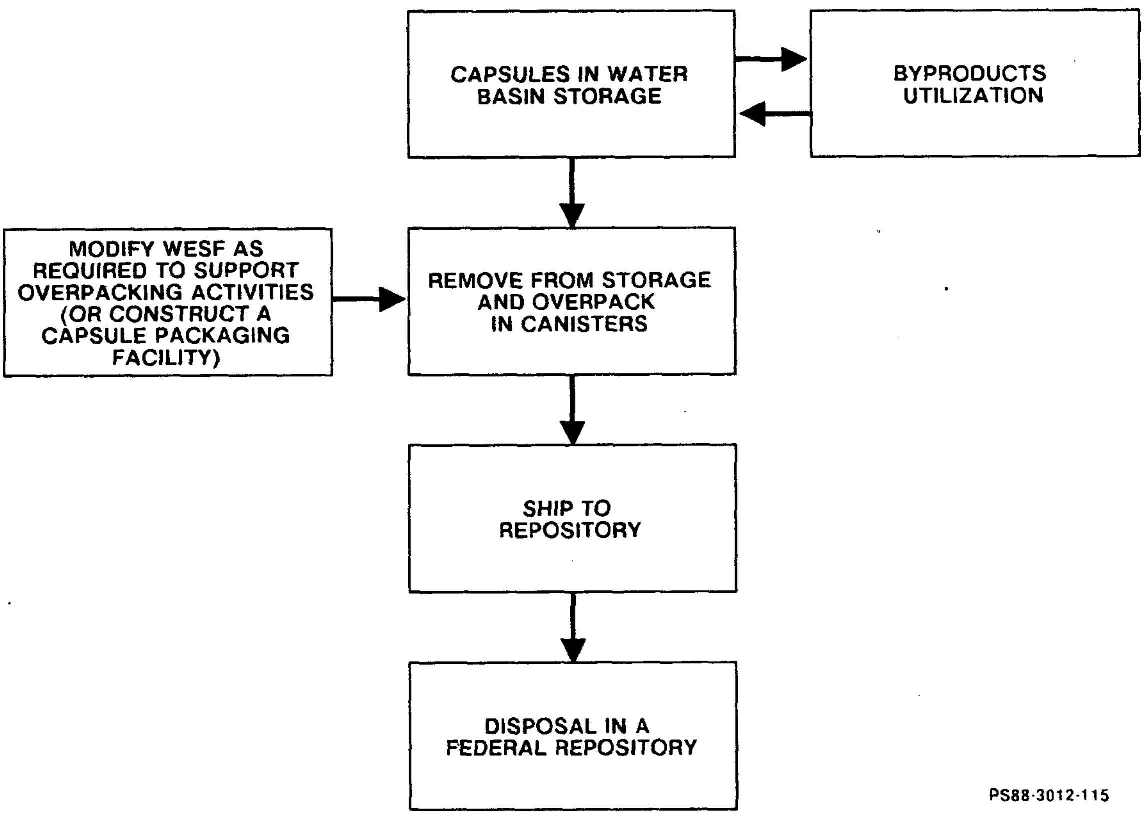

Figure III-10. Preferred Plan for Disposal of Cesium and Strontium Capsules.

3. Schedule and Costs

The schedule for capsule waste management is shown in figure III-11; the cost summary is shown in table III-5.

4. Capital Items

A capsule packaging facility is the only major capital item that has been identified.

G. RETRIEVABLY STORED AND NEWLY GENERATED TRANSURANIC SOLID WASTE

1. Preferred Plan

The preferred plan for solid TRU waste is to dispose of the waste in a geologic repository. Before implementing the plan, the following efforts must be undertaken:

- Issue documentation for public information that verifies the environmental impacts of design and construction of the Waste Receiving and Processing (WRAP) facility are bounded by the HDW-EIS environmental analysis

- Design and construct the WRAP facility.

The elements of the plan (illustrated in fig. III-12) include the following:

- Retrieval of stored contact-handled (CH) TRU waste containers and shipment to the WRAP facility

- Sorting of suspect waste to remove any waste for subsequent packaging as low-level waste or radioactive mixed waste

- Packaging of the TRU waste portion of stored waste and all newly generated (post-1984) waste in WIPP certifiable from employing shredding and grout immobilization if necessary

- Shipment to WIPP geologic repository.

Sorting and final measurement of TRU waste will use nondestructive assay equipment developed by Los Alamos National Laboratory (LANL). Those wastes not certifiable under WIPP Waste Acceptance Criteria will be shredded and grouted to assure compliance with the criteria defined for deep geologic repositories.

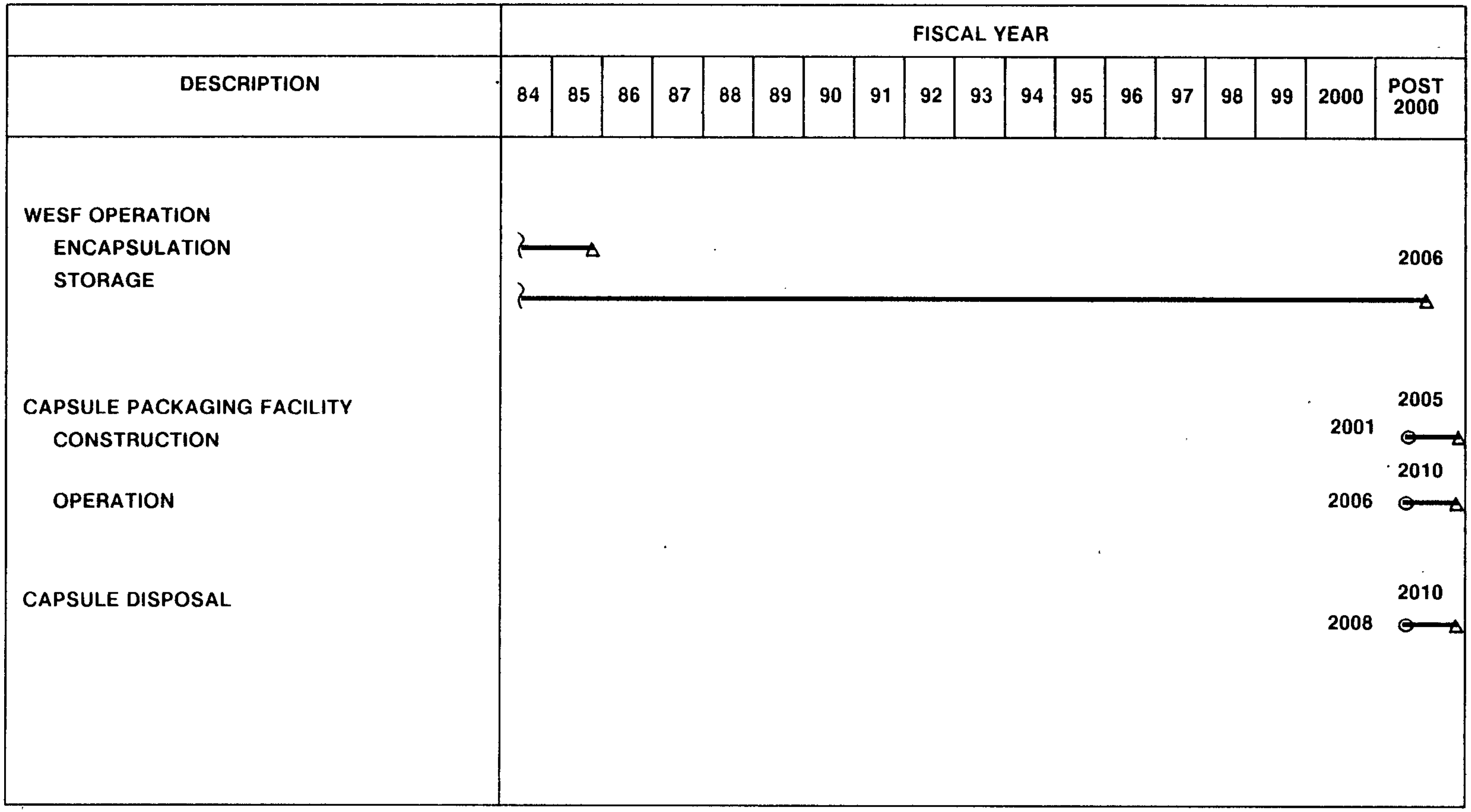

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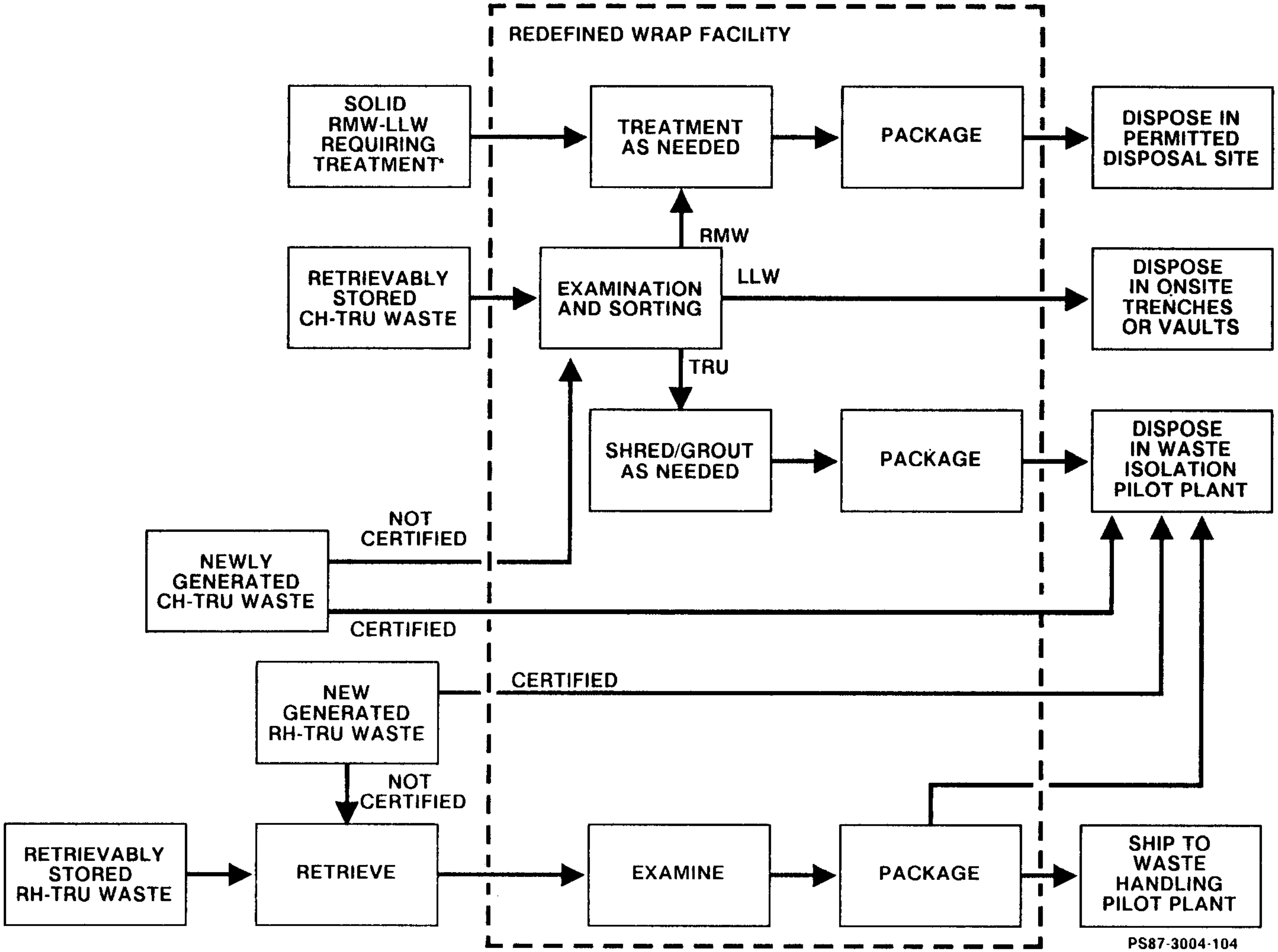
Figure III-11. Capsule Schedule.

Table III-5. Costs for Capsule Waste Management (Millions of Dollars).

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Waste storage and surveillance	25.0	22.5	4.6	4.8	4.8	5.0	5.1	5.2	5.2	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Technology development	0.2	0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Disposal operations																
Operations technology support																
Capital expenditures	2.2	2.9	0.3	0.8	0.4	0.4	1.2	1.7	1.2	1.1	0.7	0.7	0.5	0.5	0.5	0.5
Total	27.4	25.5	5.0	5.6	5.4	5.4	6.3	6.9	6.4	6.4	6.4	6.0	6.0	5.8	5.8	5.9
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Waste storage and surveillance	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3					
Technology development	0.2	0.2	0.4	0.2	0.2	0.1										
Disposal operations							10.6	10.6	56.3	56.3	56.3					
Operations technology support							0.4	0.4	0.4	0.4	0.4					
Capital expenditures	0.5	3.3	3.3	3.3	3.3	3.3	1.5	0.5	0.5	0.5	0.5					
Total	6.0	8.8	9.0	8.8	8.8	8.7	17.8	16.8	62.5	62.5	62.5	0.0	0.0	0.0	0.0	0.0
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**Total**
Waste storage and surveillance																177.5
Technology development																2.0
Disposal operations																190.1
Operations technology support																2.0
Capital expenditures																36.1
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	407.1

NOTE: All expense and CENRTC costs (millions of dollars) escalated through 1989. Construction costs escalated to midpoint of construction.



*PART OF SOLID WASTE BURIAL SITES BUT INCLUDED HERE AS A POSSIBLE INPUT STREAM TO THE REDEFINED WRAP FACILITY.

Figure III-12. Preferred Plan for Retrievably Stored and Newly Generated Transuranic Solid Waste.

Newly generated TRU waste will go directly to the repository if the waste has been packaged in compliance with acceptance criteria. If not, it will be directed to the WRAP facility for processing.

Until the WRAP facility is operational, TRU content will be verified in the TRU Storage and Assay Facility (TRUSAF). The TRUSAF is located in an existing facility (224-T) that has been modified to realize optimum storage and assay capabilities. Newly generated CH wastes have been placed in this facility since the middle of 1985. The assay equipment used in TRUSAF will be transferred to WRAP when WRAP is completed and TRUSAF will then be phased out or retained for storage as appropriate. Certified TRU waste stored in 224-T will be shipped to WIPP as early as 1989.

When remote-handled (RH) wastes are recovered from alpha caissons, a special handling and packaging facility will be required to package the waste for treatment at the Oak Ridge National Laboratory.

2. Technical Issues

Several technical issues remain to be resolved prior to implementing the preferred plan for retrievably stored and newly generated TRU waste. These issues are listed below:

- Disposal criteria and standards
- Assay and non-destructive examination
- Surface interim storage
- Stored waste retrieval - CH waste
- Stored waste processing - CH waste
- Remote handled waste
- Waste packaging and transportation

Each of these technical issues is discussed in more detail in the HWMTP, DOE/RL 87-14.

3. Schedules and Costs

The schedule for stored and new solid TRU waste management is presented in figure III-13.

Table III-6 presents a cost summary.

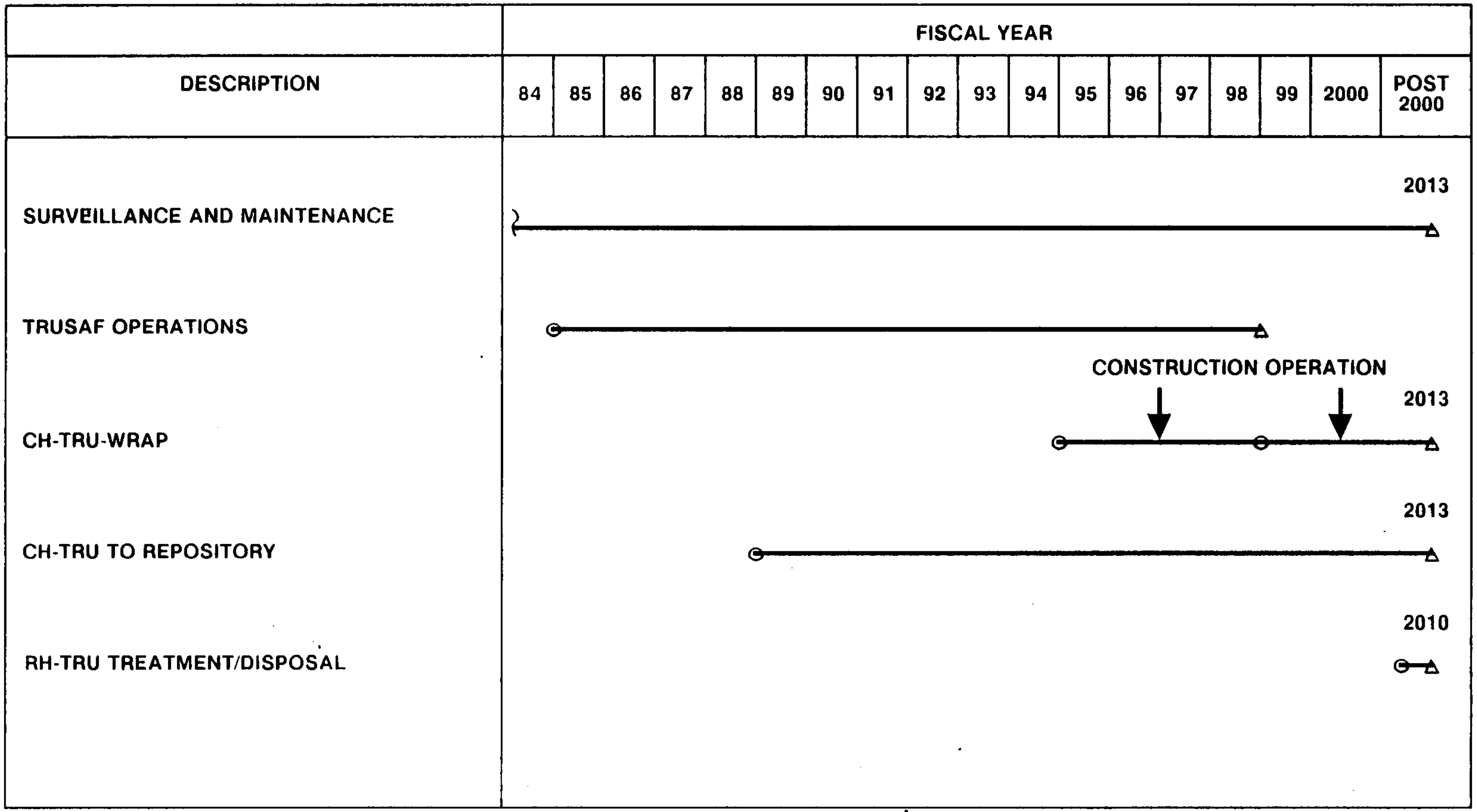


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Figure III-13. Retrievably Stored and Newly Generated Transuranic Solid Waste Schedule.

Table III-6. Costs for Stored and New Transuranic Solid Waste Management (Millions of Dollars).

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Waste storage and surveillance			0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Technology development	1.0	1.0	1.6	0.2	0.1	0.1	2.2	2.4	2.8	1.5	3.2	3.0	2.6	2.6	2.6	2.2
Disposal operations						0.2	0.5	0.4	0.4	0.3	1.6	2.8	2.8	5.8	9.5	9.8
Operations technology support										0.0	0.0	0.0	0.0	0.0	0.0	0.3
Capital expenditures		0.1	0.0	0.0	0.0	0.2	0.6	1.1	0.1	0.1	0.1	24.8	26.1	9.9	0.8	0.1
Total	1.0	1.1	1.7	0.2	0.1	0.5	3.3	3.9	3.3	1.9	4.9	30.6	31.5	18.3	12.9	12.4
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Waste storage and surveillance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Technology development	0.0															
Disposal operations	9.5	9.3	8.8	8.9	9.6	11.0	12.0	11.8	11.8	11.9	10.9	7.5	7.5	6.2	0.0	0.0
Operations technology support	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3		
Capital expenditures	0.1	0.1	0.1	6.4	6.4	6.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
Total	9.9	9.7	9.2	15.6	16.3	17.7	12.5	12.3	12.3	12.4	11.4	7.9	7.9	6.6	0.0	0.0
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**Total**
Waste storage and surveillance																0.1
Technology development																29.1
Disposal operations																170.8
Operations technology support																5.0
Capital expenditures																84.3
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	289.2

NOTE: All expense and CENRTC costs (millions of dollars) escalated through 1989. Construction costs escalated to midpoint of construction.

4. Capital Items

Major capital facilities required include the CH-WRAP facility and the RH Retrieval Facility.

H. HAZARDOUS AND MISCELLANEOUS RADIOACTIVE MIXED WASTE (HRMW)

1. Treatment, Storage and Disposal Plans

This waste category is intended to include hazardous waste that is not radioactively contaminated and radioactive mixed waste (HRMW) that is not included in the other waste categories. The representation of this waste category is not considered complete here but will be enhanced and expanded on in future updates of the HWMP. The upcoming issuance of the HAZWMP will provide more detail on the plans for this waste category.

In previous issues of the HWMP, plans and technical issues were provided for miscellaneous wastes which included sodium metal and liquid organic wastes, both of which were slightly, radioactively contaminated. The sodium is not considered a waste as plans are underway to transport the sodium metal to the Idaho National Engineering Laboratory (INEL) where the sodium would be converted to sodium hydroxide for subsequent use as a raw chemical at Hanford. The liquid organic wastes that are radioactively contaminated are considered to be HRMW.

Strategic alternatives are being considered for treatment and/or disposal on a regional basis with the region consisting of the DOE sites in the western half of the United States. The regional concept applies to both hazardous and HRMW waste, stored and currently being generated.

Liquid Organic Wastes

The immediate plan for HRMW liquid organic wastes calls for continued storage while technical issues are resolved. Small volumes of waste from various processing operations are routinely absorbed and placed in drums which are stored on asphalt pads. In addition, approximately 120,000 L of HRMW hexone (methyl isobutyl ketone) is stored in two bulk tanks in the 200 West Area.

The nonradioactive hazardous liquid organic wastes are currently being stored in an interim permitted facility and disposed of through commercial operations. Studies are being conducted to determine if commercial disposal should be discontinued in favor of disposal at DOE facilities where control can be retained.

Polychlorinated Biphenyl (PCB) contaminated oil which is also radioactively contaminated is being stored on site while treatment and disposal options are being studied. Two options involve the use of regional incinerators, one at INEL and another at the Los Alamos National Laboratory (LANL). The LANL incinerator has been permitted for treatment of PCB-contaminated waste and is in operation.

Solid Waste

The high activity HRMW solid waste, requiring remote handling, is being disposed of; however, other treatment and disposal options are being studied. Much of this waste includes jumpers with lead ballast.

The low activity HRMW solid waste that is classified as dangerous waste is being disposed of in HRMW burial sites with an interim permit. The low activity HRMW solid waste that is classified as extremely hazardous or banned waste is being stored while treatment and disposal options are being studied.

The options being studied include an expanded mission for the Waste Receiving and Processing (WRAP) facility. Existing engineering studies on the WRAP facility examine only the retrievably stored TRU waste as a feed stream and the generation of either TRU waste certified for WIPP disposal or LLW for onsite disposal. The expanded mission will consider HRMW as a feed and outgoing stream, lead treatment, incineration and compaction. In studying incineration in the WRAP facility, consideration is being given to regional incineration at INEL, for example, as a more cost effective option.

The reactor cores from nuclear naval vessels are being disposed of in a specially designed trench.

The nonradioactive hazardous solid wastes are currently being stored in an interim permitted facility and disposed of through commercial operations. Studies are being conducted to determine if commercial disposal should be discontinued in favor of disposal at DOE facilities where control can be retained. The low activity HRMW solid waste that is classified as extremely hazardous or banned waste is being stored while treatment and disposal options are being studied.

2. Technical Issues

Technical issues on hazardous and miscellaneous radioactive mixed waste are discussed in the HWMTP, DOE/RL 87-14.

3. Schedule and Costs

The schedule is currently limited to liquid organic waste technology as shown in figure III-14. The upcoming issuance of HAZWMP will provide more details on the schedule and costs for this waste category. Costs derived

DESCRIPTION	FISCAL YEAR																	
	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	2000	POST 2000
TECHNOLOGY HAZARDOUS AND MISCELLANEOUS RADIOACTIVE MIXED WASTES																		TBD

TBD: TO BE DETERMINED

NOTE: A DEFINITIVE SCHEDULE HAS NOT BEEN DEVELOPED FOR HAZARDOUS AND MISCELLANEOUS RADIOACTIVE MIXED WASTE. THE UPCOMING ISSUANCE OF THE HAZWMP, SCHEDULED FOR FY 1988, MAY PROVIDE MORE SCHEDULE INFORMATION. FUTURE UPDATES OF THE HWMP WILL EXPAND UPON SCHEDULES AS THEY ARE DEVELOPED.

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Figure III-14. Schedule for Resolving Liquid Organic Waste Technical Issues.

Table III-7. Costs for Hazardous and Miscellaneous Radioactive Mixed Waste (Millions of Dollars).

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Waste storage and surveillance			3.2	0.7	0.0	0.0	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Technology development											0.6	0.6	0.6			
Disposal operations																
Operations technology support																
Capital expenditures			0.0	0.8	0.9	5.2	12.0	14.4	14.4	11.6	10.4	6.8	0.4	0.4	0.4	0.4
Total	0.0	0.0	3.2	1.5	0.9	5.2	13.4	15.8	15.8	13.0	12.4	8.8	2.4	1.8	1.8	1.8
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Waste storage and surveillance	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	0.0
Technology development																
Disposal operations																
Operations technology support																
Capital expenditures	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.0
Total	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	0.0
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**Total**
Waste storage and surveillance																38.9
Technology development																1.8
Disposal operations																0.0
Operations technology support																0.0
Capital expenditures																84.1
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	124.8

NOTE: All expense and CENRTC costs (millions of dollars) escalated through 1989. Construction costs escalated to midpoint of construction.

from the Hanford Environmental Management Program are shown in table III-7. Future issuances of the HWMP will provide more details on schedules and costs.

4. Capital Items

A construction line item request was submitted in February 1987, estimated at $180 million, to fund several capital improvement in order to meet criteria established by applicable environmental regulations.

IV. SCHEDULE AND COST SUMMARY

A. SUMMARY OF MAJOR MILESTONES

Major waste management operational milestones, facility construction milestones, and milestones indicating when the needed technology will be in place are listed in table IV-1. The milestones coincide with schedules prepared for each waste category in section III. A master schedule displayed in figure IV-1, provides an overview of the currently planned waste management effort.

B. OTHER WASTE MANAGEMENT COSTS

Waste management costs for tasks not related to specific waste categories are summarized in table IV-2. The tasks include disposal criteria and standards, NEPA, management and planning, external affairs, technology for other alternatives, enhanced technology base, technology for miscellaneous waste, waste volume projections and unspecified general plant projects (GPPs). A schedule for the completion of these tasks is presented in figure IV-2. Task details may be found in the HWMTP.

C. SUMMARY OF PROGRAM COSTS

The total shown in table IV-3 represents the implementation of in place stabilization and disposal of single-shell tank waste, contaminated soil sites and solid waste burial sites, and is considered to be the lower bound of any forthcoming decision on the disposal of these waste categories. The upper bound, in which these three waste categories are exhumed and treated for geologic disposal of the high-level fraction, is estimated to cost $29 billion. The spending pattern for the lower bounding case is shown graphically in figure IV-3; the spending patterns for Waste Storage and Surveillance, Technology Development, Disposal Operations, and Capital costs are displayed graphically in figures IV-4 through IV-7.

Note that these tables do not include those costs associated with Hanford Site services (road and truck maintenance, Patrol operations, etc.). Costs associated with surveillance and storage of each specific waste type and site type are included.

D. CAPITAL PROJECT SUMMARY

The capital project, which includes capital equipment not related to construction, GPPs, and line items planned to support the Waste Management Program, is summarized in table IV-4.

Table IV-1. Major Hanford Waste Management Milestones. (sheet 1 of 2)

SINGLE-SHELL TANK WASTES

FY 1992	Conduct single-shell tank stabilization and disposal demonstration (TY farm)
FY 1996	Complete interim stabilization of all single-shell tanks
FY 1996	Complete interim isolation of all single-shell tanks

CONTAMINATED SOIL SITES

FY 1987	Conduct test of in situ vitrification of a transuranic (TRU) contaminated soil site
FY 1998	Complete 200 Area crib interim surface stabilization program

SOLID WASTE BURIAL SITES

FY 1990	Complete solid-waste burial site characterization methods development

DOUBLE-SHELL TANK WASTE

FY 1988	Complete transportable grout facility design and construction--begin operations
FY 1991	Complete neutralized current acid waste (NCAW) processing demo
FY 1993	Complete AQ tank farm construction--begin operation
FY 1998	Complete Hanford Waste Vitrification Plant (HWVP) design and construction
FY 1999	Start HWVP operations
Post 2000	Complete grout operations
Post 2000	Complete HWVP operations

Table IV-1. Major Hanford Waste Management Milestones. (sheet 2 of 2)

ENCAPSULATED WASTES

FY 1985	Complete encapsulation of ^{90}Sr
FY 2005	Complete construction of capsule packaging facility or complete Waste Encapsulation and Storage Facility (WESF) modifications
FY 2005-2010	Package and transport capsules to repository

STORED AND NEW TRU SOLID WASTES

FY 1985	Start TRU Storage and Assay Facility (TRUSAF) assay operations
FY 1989	Start shipping certified TRU waste to the Waste Isolation Pilot Plant (WIPP)
FY 1998	Complete contact-handled Waste Receiving and Packaging (CH-WRAP) construction
FY 1999	Begin CH-WRAP operations
FY 1999-2013	Conduct recovery, processing and disposal operations for CH-TRU waste
FY 2006	Complete caisson retrieval facility design and construction
FY 2006-2010	Conduct packaging and shipping of RH waste to the Waste Handling Pilot Plant (WHPP) at the Oak Ridge National Laboratory

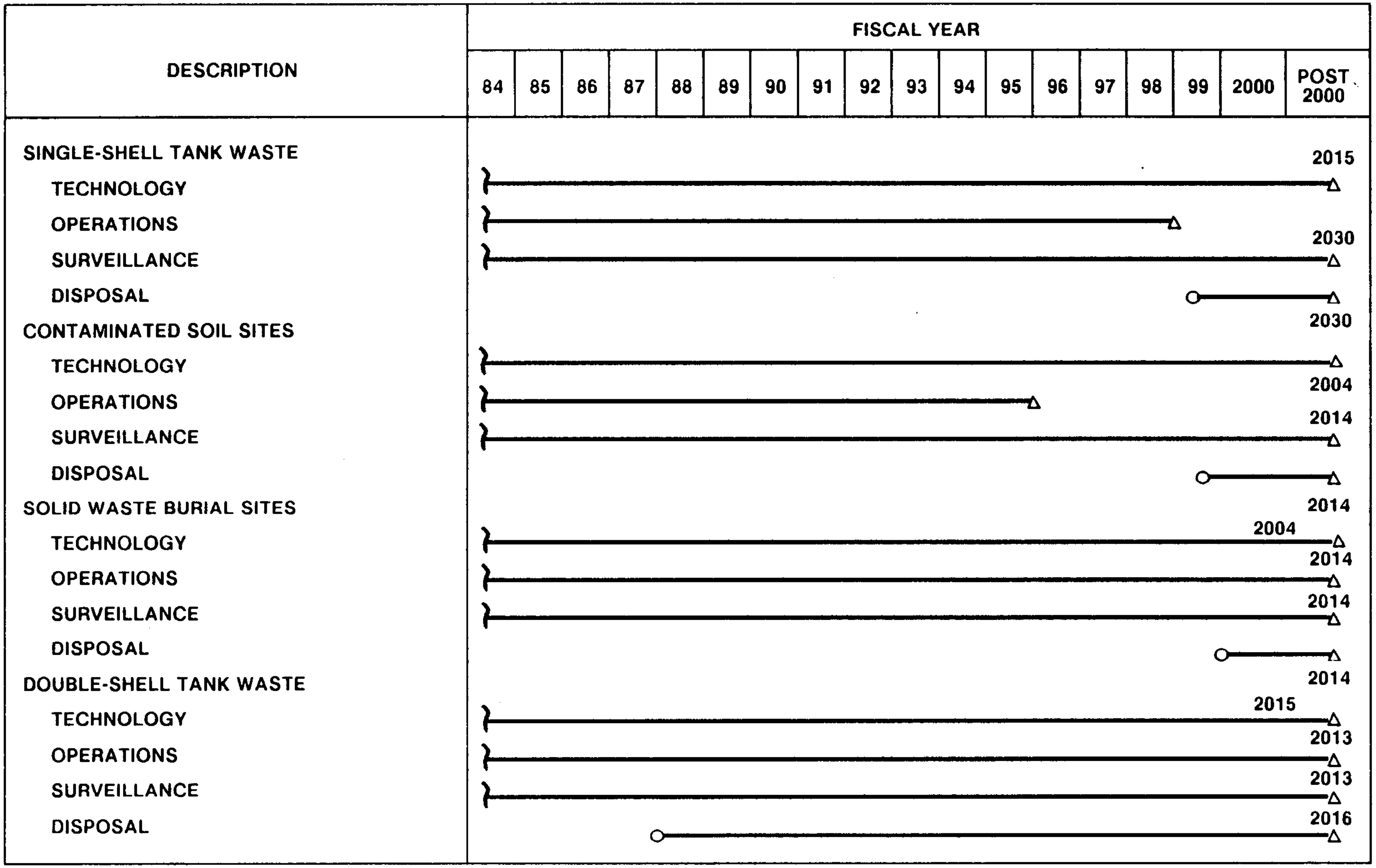

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Figure IV-1. Master Schedule for Waste Management Operations. (sheet 1 of 2)

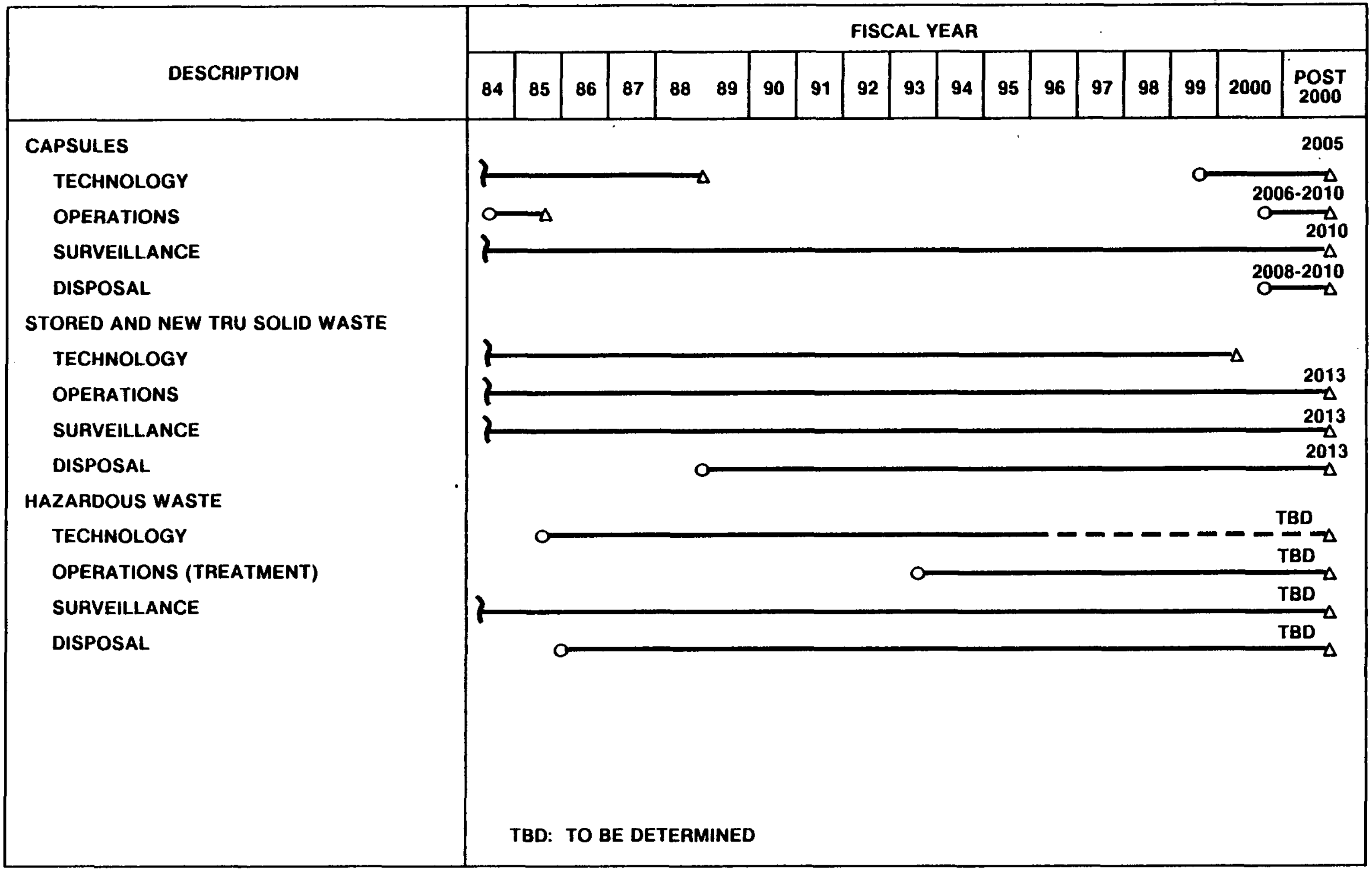

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Figure IV-1. Master Schedule for Waste Management Operations. (sheet 2 of 2)

Table IV-2. Other Costs Associated With Waste Management (Millions of Dollars).

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Criteria and standards and NEPA	3.7	2.6	2.7	3.0	2.3	1.3	4.3	3.2	2.9	2.9	2.9	3.3	2.5	2.2	1.8	1.8
Management and planning	1.9	0.8	1.1	1.6	1.4	1.3	2.0	2.1	2.2	2.3	2.5	2.5	2.5	2.5	2.1	2.1
Public information			1.4	0.5	0.1	0.0	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Enhanced technology	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	0.3	0.3	0.6	
Unspecified general plant projects				0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	6.5	6.5	6.5	6.5	6.5
Total	5.6	3.5	5.2	5.1	3.8	2.6	7.2	6.2	6.1	6.2	14.1	14.5	12.8	12.5	12.0	11.4
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Criteria and standards and NEPA	1.4	1.4	1.1	1.1	1.1	1.1	0.7	0.7	0.7	0.7	0.3	0.3	0.3	0.3		
Management and planning	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	1.0	1.0
Public Information	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Enhanced technology																
Unspecified general plant projects	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	5.5	4.5	3.5	2.5	1.5	0.5	
Total	11.0	11.0	10.7	10.7	10.7	10.7	10.3	10.3	10.3	9.3	7.9	6.9	5.9	4.9	2.5	2.0
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**Total**
Criteria and standards and NEPA																54.6
Management and planning	1.0															63.4
Public Information	1.0															28.8
Enhanced technology																3.7
Unspecified general plant projects																115.5
Total	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	265.9

NOTE: All expense and CENRTC costs (millions of dollars) escalated through 1989.

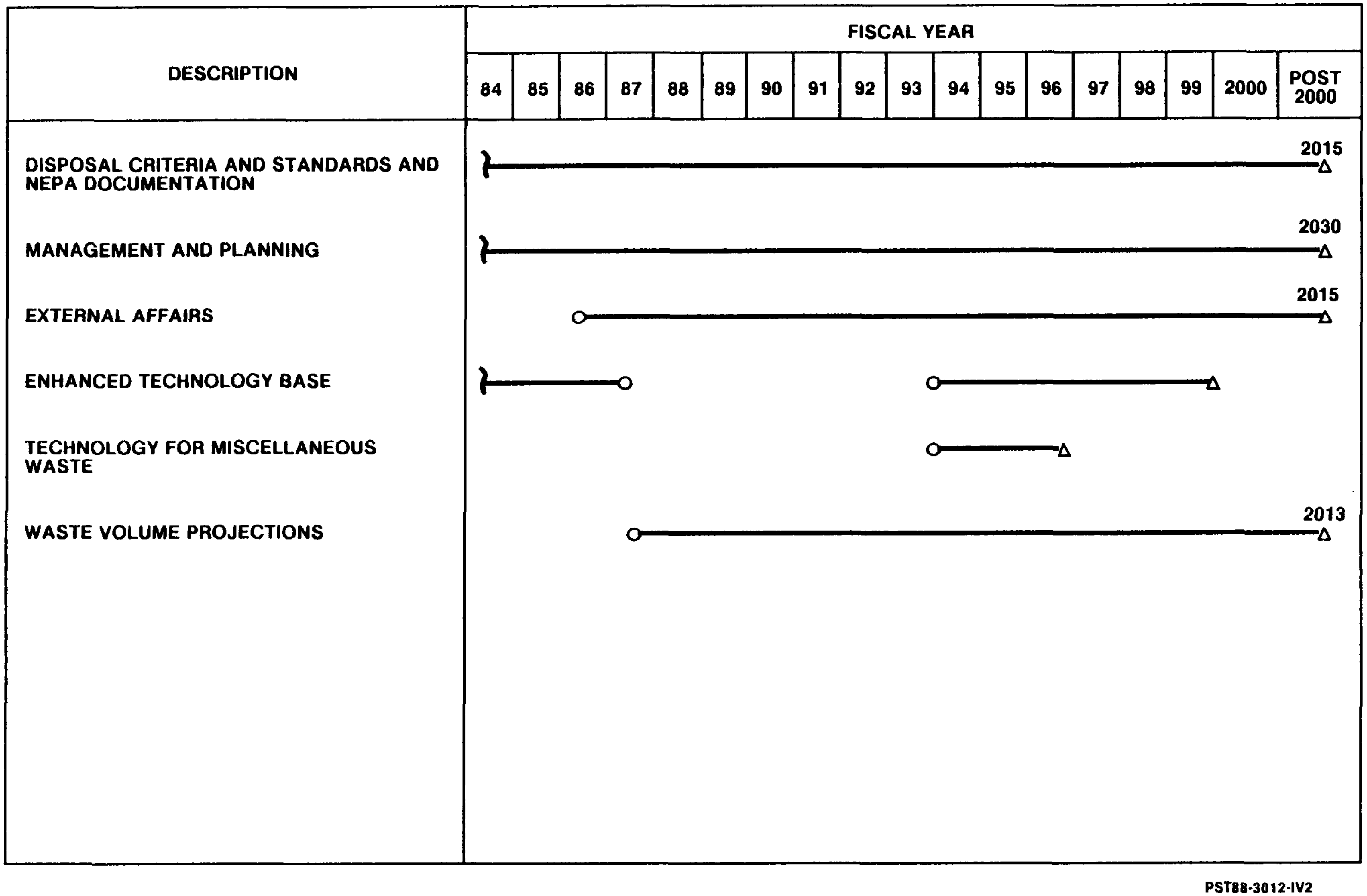

Figure IV-2. Other Costs Associated With Waste Management.

Table IV-3. Costs for Total Hanford Waste Management Plan (Millions of Dollars).

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Waste storage and surveillance	68.6	69.1	53.5	60.5	59.8	62.1	73.9	74.6	74.0	72.4	71.7	71.4	71.1	58.4	57.6	56.8
Technology development	18.7	23.0	30.5	30.4	23.4	20.2	40.6	37.6	36.7	37.1	58.4	54.4	54.9	56.9	64.2	55.4
Disposal operations and operations technology support	0.0	0.0	17.9	27.7	27.0	30.9	44.3	51.3	57.7	60.4	63.7	64.9	64.9	94.4	142.7	170.5
Capital expenditures	49.9	18.7	17.2	22.9	50.3	65.2	112.1	146.7	216.8	250.1	371.0	184.3	99.2	59.3	27.2	26.5
Total	136.2	110.8	119.1	141.5	160.5	178.4	270.9	310.2	385.2	420.0	564.8	375.0	290.1	269.0	291.7	309.2

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Waste storage and surveillance	55.8	54.5	53.0	51.5	49.7	47.9	45.9	43.9	39.9	35.9	32.0	20.0	15.7	11.3	5.5	0.3
Technology development	22.2	20.1	8.7	7.8	7.1	6.3	5.1	4.5	4.0	3.5	3.1	3.1	3.1	3.0	1.5	1.0
Disposal operations and operations technology support	170.2	170.0	169.5	169.6	170.3	171.7	193.6	193.4	345.2	345.3	330.8	270.6	270.6	269.3	320.9	62.1
Capital expenditures	26.5	29.3	29.3	35.6	35.6	35.6	26.2	25.2	25.2	24.2	22.2	20.0	19.0	18.0	16.9	0.2
Total	274.7	273.9	260.5	264.5	262.7	261.5	270.8	267.0	414.3	408.9	388.1	313.7	308.4	301.6	344.8	63.6

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Waste storage and surveillance	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1,621.5
Technology development	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	747.4
Disposal operations and operations technology support	62.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	4,645.5
Capital expenditures	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	2,108.5
Total	63.6	3.5	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	9,122.9

NOTE: All expense and CENRTC costs (millions of dollars) escalated through 1989. Construction costs escalated to midpoint of construction.

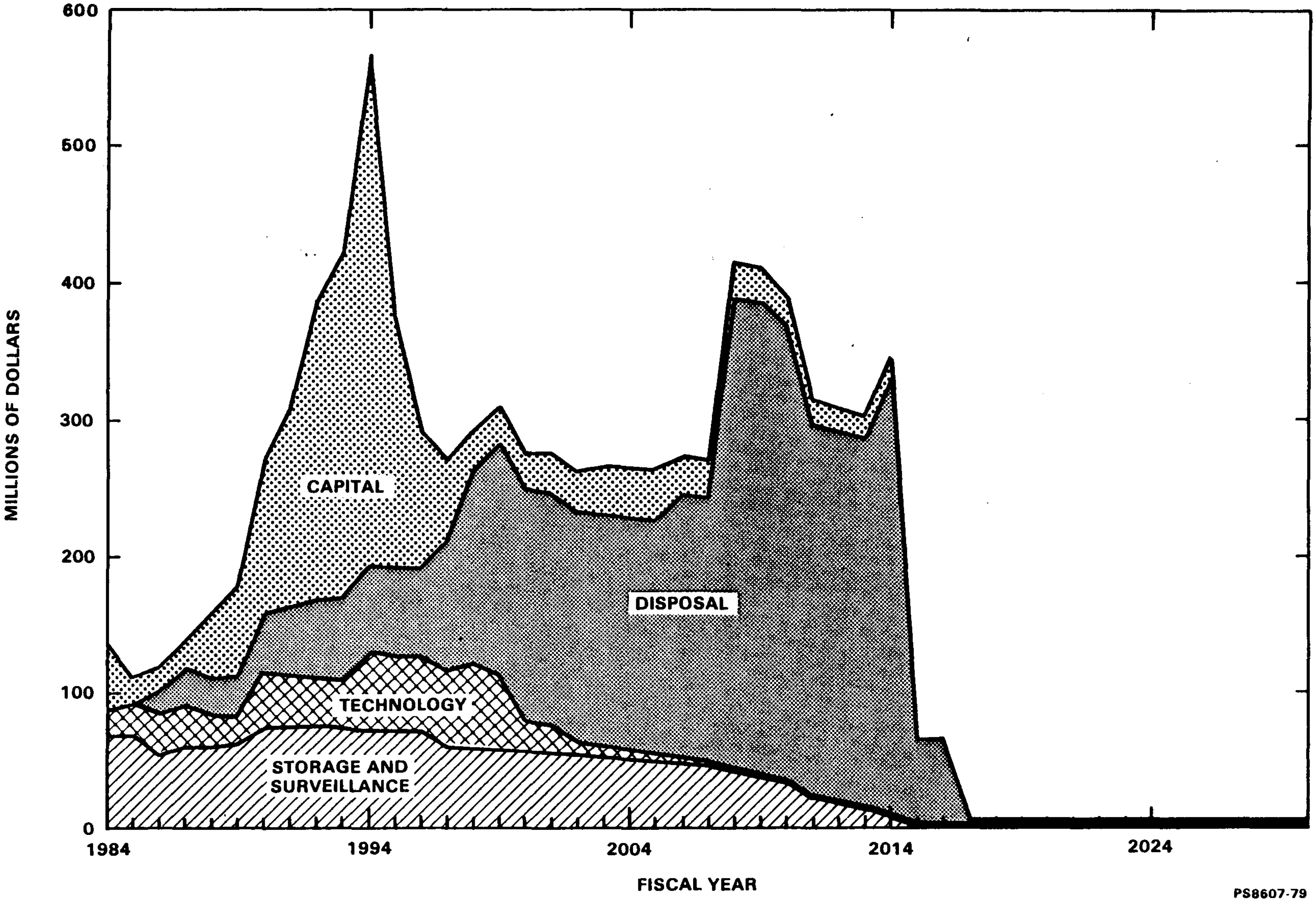

Figure IV-3. Costs for Total Hanford Waste Management Plan.

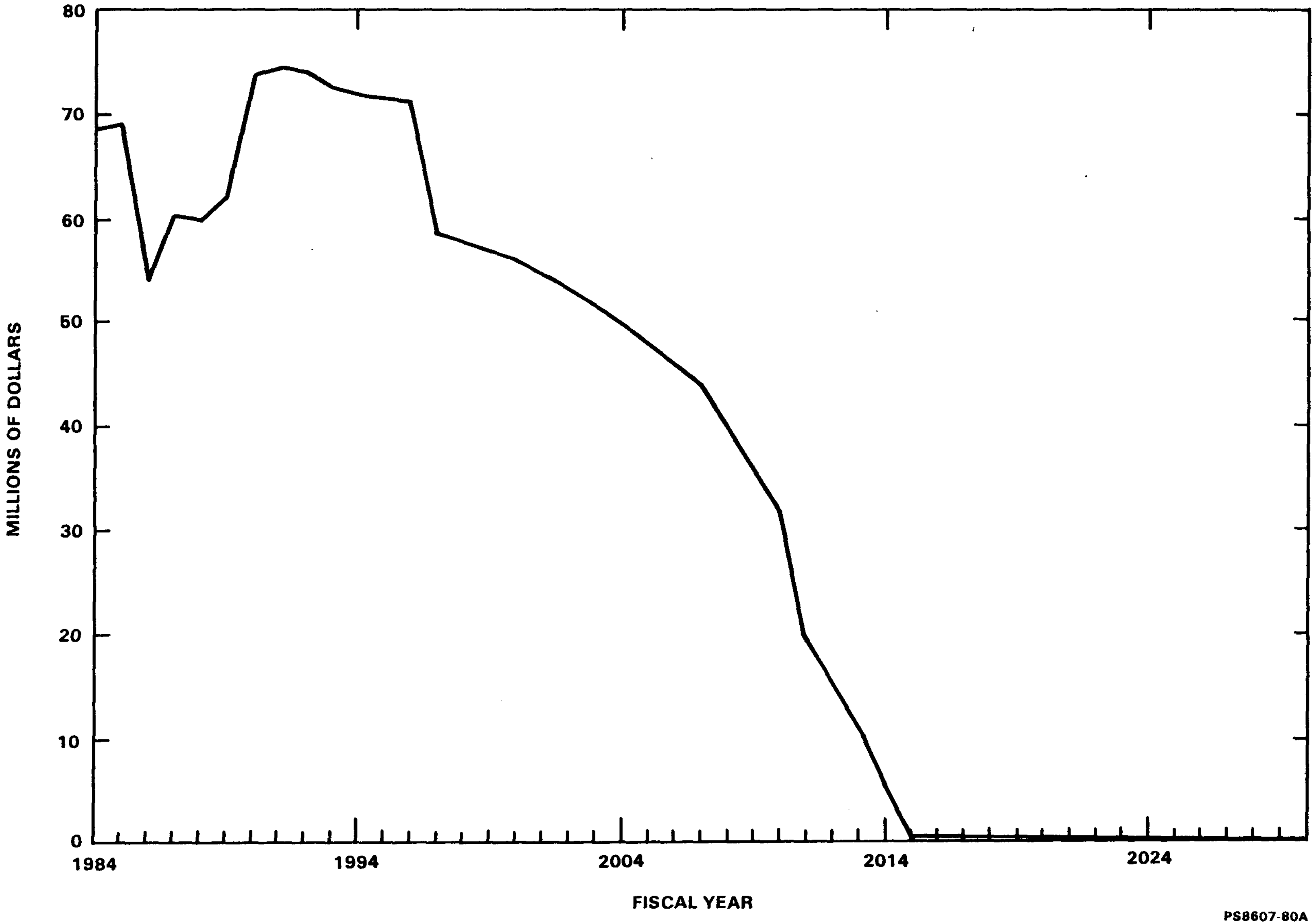

Figure IV-4. Costs for Waste Storage and Surveillance.

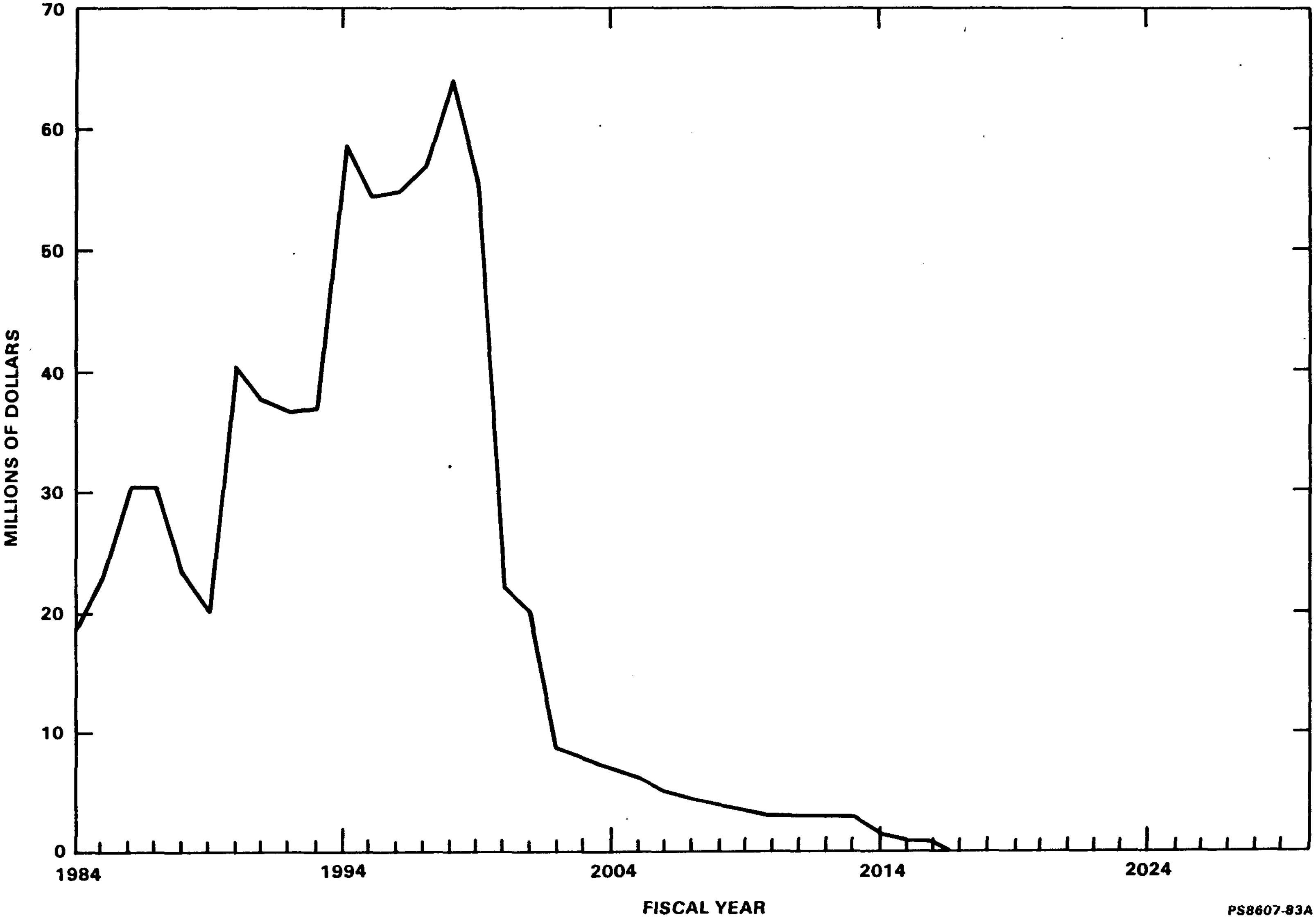

Figure IV-5. Costs for Technology.

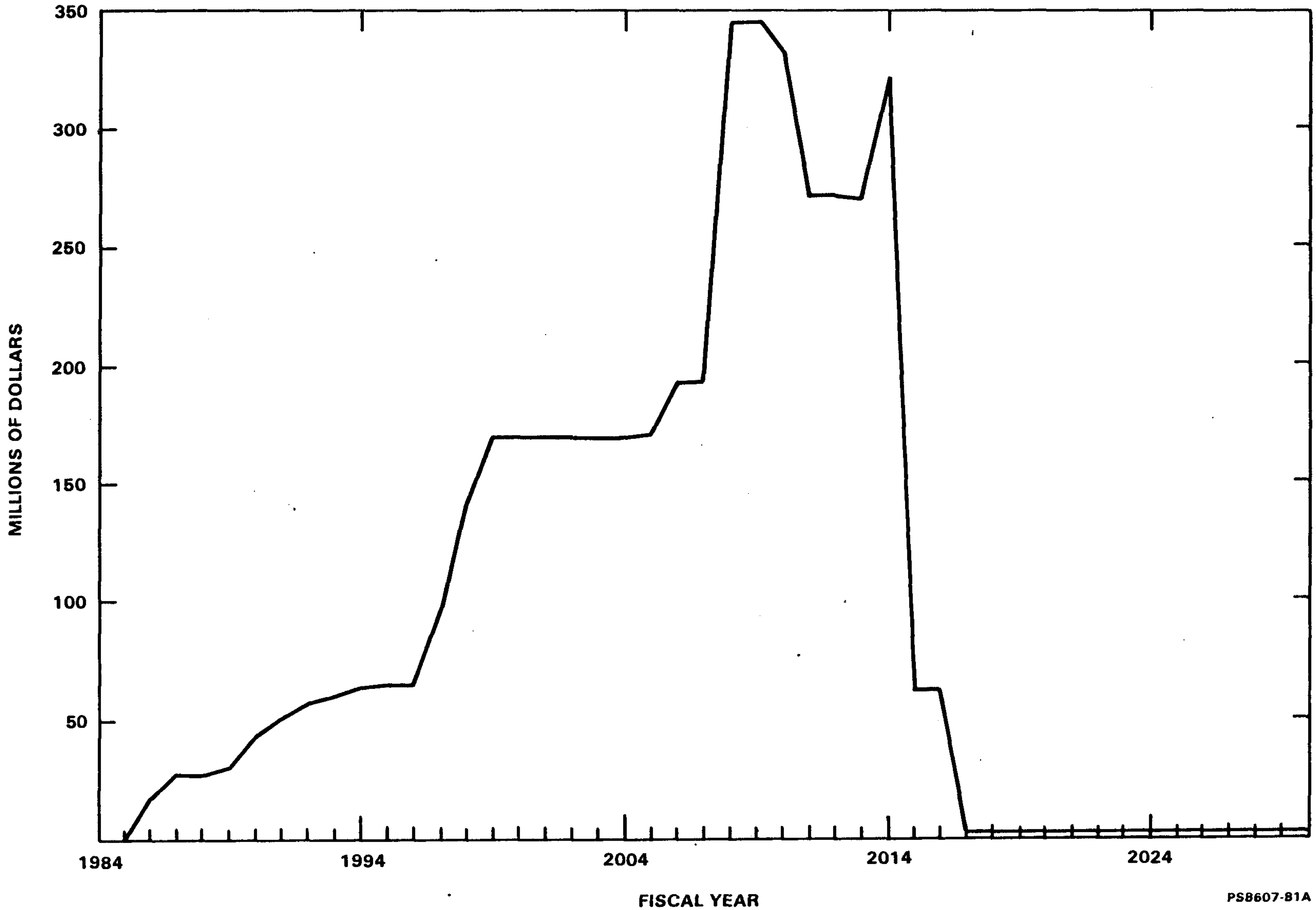

Figure IV-6. Costs for Disposal.

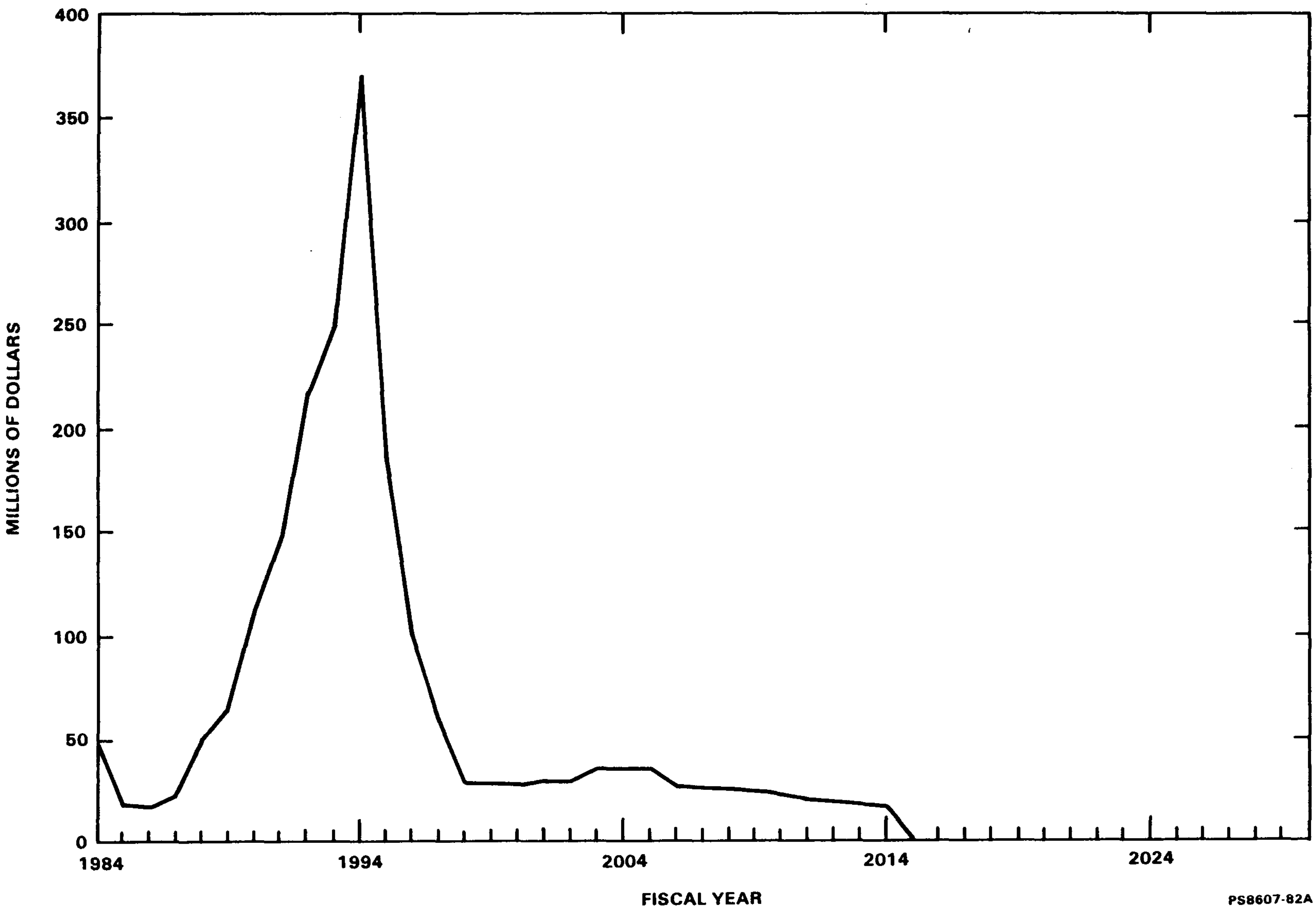

Figure IV-7. Costs for Capital Projects.

Table IV-4. Capital Projects Summary. (sheet 1 of 4)

CENRTC summary by fiscal years--costs in thousands (escalated through 1989)															
Waste type category	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996-2005	2006-2015	2016-2030	Total
Single-shell tanks	566	345	451	605	465	1,065	1,030	2,217	2,420	803	803	803	8,030	7,377	2,250	29,229
Contaminated soil sites	852	1,114	69	210	105	182	535	294	424	3,145	3,145	3,145	1,664	1,350	0	7,741
Solid waste burial sites	890	195	62	251	106	804	1,534	569	931	565	565	565	3,265	2,700	0	13,001
Double-shell tanks	1,297	1,222	1,193	4,438	3,965	3,549	8,082	7,844	10,508	10,265	10,265	10,265	102,650	76,000	0	251,541
Capsules	1,982	1,903	116	324	126	205	470	334	378	318	318	318	3,180	0	0	9,972
Transuranic solid waste	0	60	0	0	45	160	600	1,100	100	100	100	100	100	800	0	4,165
Hazardous			0	8	8	8	8	8	8	8	8	8	80	72	0	
Total CENRTC	5,587	4,839	1,891	5,835	4,819	5,972	12,259	12,366	14,768	12,373	12,373	12,373	119,869	88,299	2,250	315,649

GPPs by fiscal year ($1,000 in year of construction dollars)																	
General plant projects	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999-2015	Totals
B-453 General Site Improvement (WK)	150																150
B-558 B Plant Third Expansion Filter (WA)	990																990
B-533 Cross Site Transfer Facility Upgrade (WB)	500																500
B-555 Second B Plant Culvert (WA)	205																205
B-480 241-C Tank Farm Ventilation Upgrade (WC)	640																640
B-464 Evaporator Upgrade 200-W (WB)	930																930
B-489 AN Tank Farm Drain Reroute (WB)	500																500
B-487 216-B-59 Retention Basin (WD)	793																793
B-472 Fire Detection and Safety Equipment (WD)	525																525
B-465 B Plant Electrical Status Indicators (WD)	250																250
B-495 B Plant Motor Control Center (WD)	805																805
B-496 B Plant Chemical Sewer Upgrade (WD)		640															640
B-494 Low Volt Distribution System (WL)		900															900
B-493 WESF Ventilation Control Upgrade (WE)		980															980
B-551 AR Vault Ventilation Upgrade (WB)		730	450														1,180
B-560 AX-155 to AZ-152 Waste Transfer Line (WB)		800															800
B-548 216-A-10 Crib Replacement (WA)			682														682
B-545 216-U-12 Crib Replacement (WA)			76														76
B-550 AR Vault Diversion Basin Upgrade (WB)			468														468
B-568 Grout Disposal Area Enclosure (WB)			147														147

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Table IV-4. Capital Projects Summary. (sheet 2 of 4)

General plant projects	GPPs by fiscal year ($1,000 in year of construction dollars)																
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999-2015	Totals
B-479 B Plant Canyon Crane Electrical Upgrade (WD)			122														122
B-478 B Plant Canyon Lighting Upgrade (WD)			57														57
B-547 B Plant Retention Basin Upgrade (WD)			439														439
B-557 B Plant Ventilation Control System (WD)			32														32
B-561 200-E Contingency Pond (WA)			161														161
B-499 B Plant Effluent Monitoring Upgrade (WD)			129														129
B-625 B Plant Sand Filter Duct Upgrade (WD)				880													880
B-672 Tank 102 AY Annulus Vent Upgrade (WB)				1,140													1,140
B-675 B-2-3 Ditch Upgrade (WA)				830													830
B-677 200-W Low-Level Burial Ground Wells (WX)				1,090													1,090
B-678 200-E Low-Level Burial Ground Wells (WX)				890													890
B-622 Grout Liquid Feed Sampler (WP)					900												900
B-673 Tank 101-AY Annulus Vent Upgrade (WB)					1,140												1,140
B-683 Ground Water Monitoring West (WX)					1,000												1,000
B-684 Ground Water Monitoring East (WX)					1,000												1,000
B-646 Regulated Maintenance Facility (WB)						1,100											1,100
B-653 Grout Sampling Facility (WP)						900											900
B-659 211-B Chemical Tank Farm Environmental Upgrades (WD)						800											800
B-660 B Plant AMU Environmental Upgrades (WD)						1,050											1,050
B-XXX 216-U-14 Ditch (WA)						800											800
B-XXX Mixer Facilities - Liquid Waste (WP)						1,000											1,000
B-XXX Grout Facilities - Heat Removal System (WP)						1,200											1,200
Capital Work Orders (WA)			502	200	200	200											1,102
Capital Work Orders (WB)	95	100	502	200	200	200											1,297
Capital Work Orders (WD)	250		502	200	200	146											1,298
Capital Work Orders (WG)	120																120
Capital Work Orders (WL)						100											100
Capital Work Orders (WP)				270	200	150											620

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Table IV-4. Capital Projects Summary. (sheet 3 of 4)

GPPs by fiscal year ($1,000 in year of construction dollars)																
General plant projects	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999-2015	Totals
Capital Work Orders (WX)					182												182
Capital Work Orders (HL)							250										250
GPPs and Capital Work Orders (WA)							1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	16,000	25,000
GPPs and Capital Work Orders (WB)							2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	32,000	50,000
GPPs and Capital Work Orders (WD)							2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	14,200	32,200
GPPs and Capital Work Orders (WP)							2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	32,000	50,000
GPPs and Capital Work Orders (WX)							1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	16,000	25,000
Totals	6,753	4,150	4,269	5,700	5,022	7,646	8,250	8,000	8,000	8,000							65,790
Line items ($1,000 in mid-point of construction dollars)																	
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999-2015	Totals
B-222 Isolation of Salt Wells and SSTs (WC)	1,000	7,000															1,700
B-231 Isolation of Auxiliary Tank Farm Facilities (WC)	1,370																1,370
B-234 Upgrade 200 Area Cathodic Protection System (WB)		823	1,546														2,369
B-462a AR Vault Second Filter System (WB)	228	800	971														1,999
B-492 Shallow Land Disposal Facility (WB,WG)	400	1,440															1,840
B-340 241-AP Tank Farm (WB)	31,000	1,500	6,176														38,676
B-475 Transportable Grout Facility (WP)	4,000	3,400	1,840	1,968	0												11,208
B-463 B Plant "F" Filter (WD)			403	2,953	0												3,356
B-534 242-A Evaporator Upgrade (WB)				2,756	7,200	1,944	700										12,600
B-535 241-AQ Tank Farm (WB)				3,267	22,300	25,433	7,000										58,000
B-455 K3 Filter System Upgrade (WD)				492	2,800												3,292
B-562 222-S Ventilation System Upgrade (WL)							1,000	4,400	1,200								6,600
B-595 Hanford Waste Vitrification Plant (V1)					7,500	10,000	34,100	71,000	143,100	186,0000	300,700	98,300	46,300	23,000			920,000
B-571 Waste Transfer Lines (WB)							1,400	8,300	1,400	1,700							12,800
B-600 Tank Farm Ventilation System Upgrade (WB)						1,800	15,400	3,400	4,000								24,600
B-565 Waste Receiving and Processing, CH (Y1)												24,700	26,000	8,450	650		59,800

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Table IV-4. Capital Projects Summary. (sheet 4 of 4)

Line items ($1,000 in mid-point of construction dollars)																	
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999-2015	Totals
B-602 B Plant New Canyon Crane (WD)							2,900	3,300	3,300								9,500
Organic Complexant Destruction (WD)										500	1,400	1,400					3,300
Transfer Line Facility Upgrade (WB)									0	2,000	9,000	9,000					20,000
Hanford Environmental Compliance (WX)						12,000	29,000	35,000	35,000	28,000	25,000	16,000					180,000
Tank Farm Control Room (WB)								500	3,500	1,000							5,000
219-S to 240-S-151 Transfer Line (WB)								500	1,000								1,500
Tank 105- 106-C Cooling System Upgrade (WB)									500	3,500							4,000
B Plant Cell and Ventilation System Upgrade (WD)									1,000	5,000							6,000
Tank Farm Ventilation Retrieval Upgrade (WB)										2,000	8,000	8,000					18,000
Capsule Packaging Facility (WD)																15,000	15,000
Caisson Retrieval (Y1)																18,900	18,900
Totals	37,998	8,663	10,936	11,436	39,800	51,177	91,500	126,400	194,000	229,700	344,100	157,400	72,300	31,450	650	33,900	1,441,410

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APPENDIX A

1.0 DESCRIPTION OF HANFORD DEFENSE WASTES

1.1 BACKGROUND

The diversity of waste managed at the Hanford site includes low-level waste (LLW), high-level waste (HLW), transuranic (TRU) waste, and hazardous waste. Radioactive mixed waste (RMW) is a subset of hazardous waste and contains both hazardous components and radioisotopes. By this definition, RMW can also be LLW, HLW, and TRU. These wastes are currently disposed of or stored in a variety of forms and facilities including capsules, tanks, burial sites, caissons, tunnels, and various underground and surface contaminated soil sites. Future wastes will result from reprocessing and support operations, onsite and offsite decommissioning, and miscellaneous operations. Figure A-1 illustrates in general the Hanford waste sources and storage sites.

Hanford wastes have originated from plutonium, uranium, and fission-product recovery processes and from ongoing waste volume reduction and waste solidification operations. The three plutonium recovery processes are Bismuth Phosphate, Reduction-Oxidation (REDOX), and Plutonium Uranium Extraction (PUREX). Radionuclides were produced during fuel irradiation in eight lightwater, single-pass reactors, and one lightwater, closed-loop reactor. The operating periods of these processes and reactors can be seen in figure A-2.

To place Hanford Site waste volumes in national perspective, the Hanford Site has about 60% of the volume and about 35% of the radioactivity of the nation's high-level defense wastes. The Hanford Site accounts for 30% of the nonretrievable TRU waste volume, 17% of the retrievably stored TRU waste, and about 15% of the volume of LLW generated by defense programs.

1.2 SINGLE-SHELL TANK WASTE

Single-shell tanks were originally constructed for the storage of radioactive liquid wastes generated as a result of the plutonium production and separation operations at the Hanford Site. One hundred forty-nine single-shell tanks were constructed and placed into operation between 1944 and 1964, and removed from service in 1981. The single-shell tanks are underground, reinforced concrete tanks with carbon steel liners. Nominal tank capacities vary from 55,000 to 1 million gal. The total constructed storage capacity exceeds 90 million gal.

Approximately 37 million gal of wet solids are stored in these tanks consisting of a bottom layer of sludge covered with salt cake. Aqueous solution is contained in the interstices of the sludge and salt cake (interstitial liquid) and, in some cases, over the salt cake (supernate). During the operating years, much of the volume was recovered from these

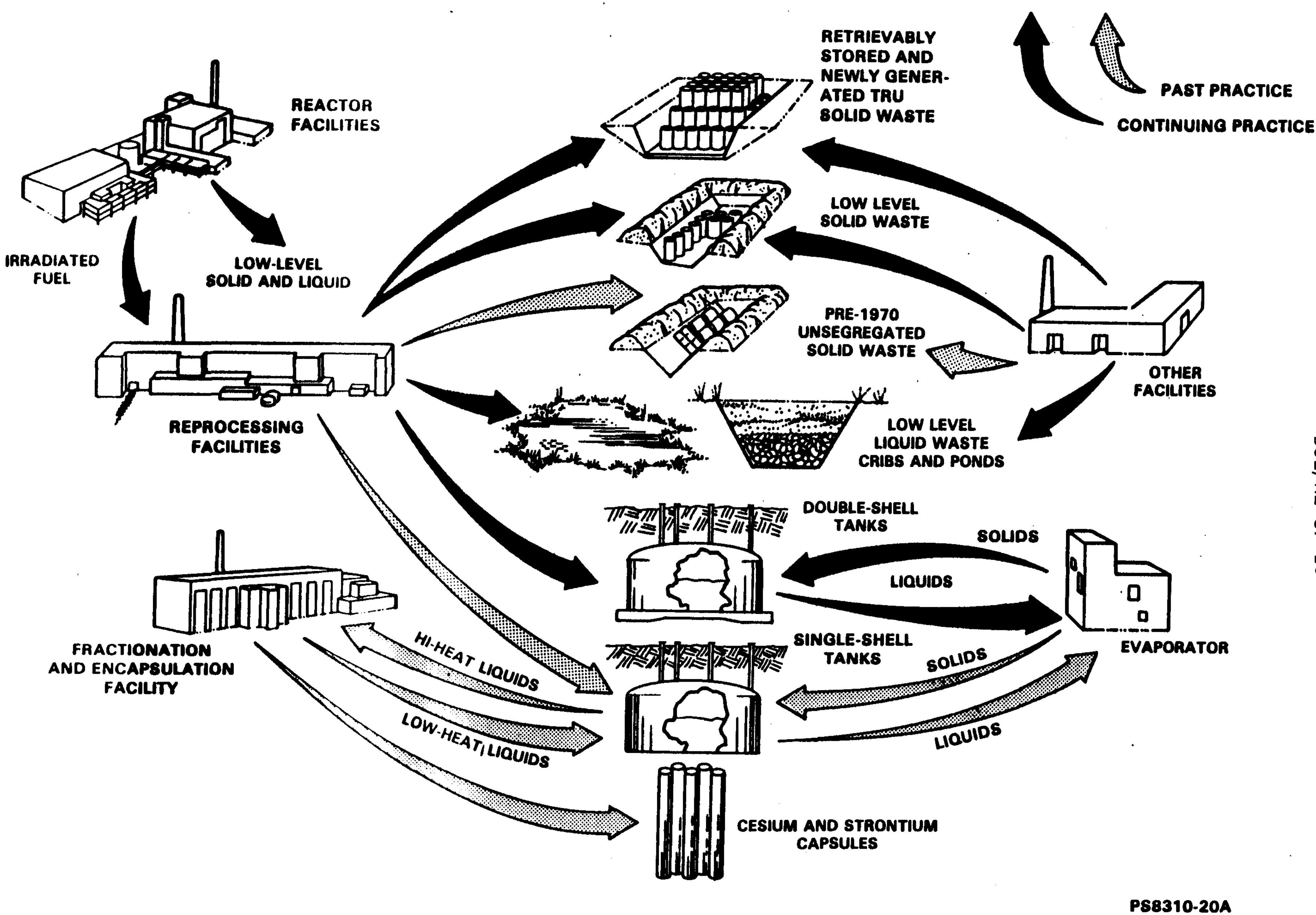

Figure A-1. Hanford Waste Sources and Storage Sites.

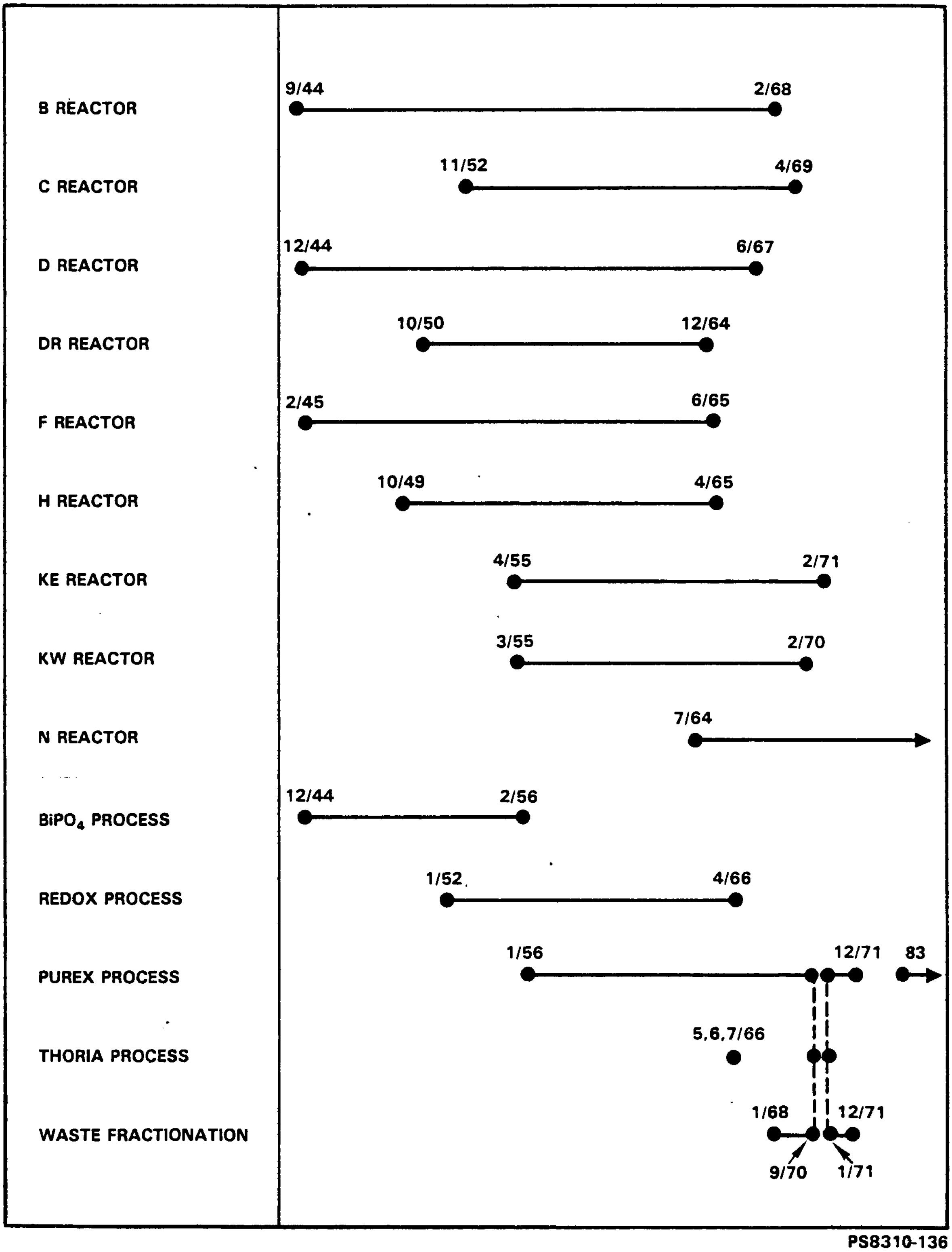

Figure A-2. Process and Reactor Operating Periods.

tanks by evaporating the water. In recent years, porous well casings were sunk into the salt cake and sludge of many of the tanks, and the supernate and pumpable portion of the interstitial liquid were removed by jet pumping. These jet-pumping operations are not complete and are expected to continue through FY 1996.

The salt cake is composed primarily of crystallized nitrate salts, particularly sodium nitrate. The majority of this is produced during waste concentration operations. Sludge is composed of insoluble metal hydroxides and hydrated oxides that have precipitated from neutralized high-level waste and cladding removal solutions. Most of the TRU and strontium inventory in the single-shell tanks is contained in the sludge.

Interstitial liquid, which occupies the void spaces of the salt cake and sludge, and supernate are aqueous solutions of sodium hydroxide and nitrate, nitrite, and aluminum salts of sodium. A majority of the interstitial liquid is pumpable, the remainder is held in the interstices by capillary forces. The liquid portions contain nearly all of the radioactive cesium and technetium inventory.

Single-shell tank waste inventories by tank farm is shown in table A-1. Listed are nominal tank capacities and the volumes of salt cake, sludge, and supernate which, when combined, constitute the total current volume. The estimated volumes of interstitial liquid are shown based on porosities of the salt cake and sludge determined from early jet pumping. The volumes of pumpable liquid consist of the supernate, where jet pumping is deemed practical, and the interstitial liquid that drains to the jet-pumping wells. The volumes of interim stabilization consist of the salt cake and sludge. Under current planning, the pumpable liquid will be removed from the single-shell tanks prior to any disposal action.

1.3 CONTAMINATED SOIL SITES

Disposal of low-level liquid wastes has been accomplished by discharge to the soil through engineered disposal structures. This method of disposal takes advantage of both the sorptive qualities of the soil and the depth to groundwater which helps isolate the waste in the vadose zone and allows for radionuclide decay.

The engineered disposal structures for liquid waste consist of (1) underground structures such as cribs, (in the past, french drains and reverse wells were used), and (2) open excavations such as trenches, ditches, and ponds (which may be backfilled after use).

There are approximately 340 contaminated soil sites, of which 24 are considered to be suspect TRU waste sites. The remainder are low-level waste sites. Table A-2 provides a summary description of these sites.

Table A-1. Single-Shell Tank Waste.

Tank farm	Nominal tank capacity (gallons)	Number of tanks	Waste volumes, (gallons)[a]						
			Salt cake	Sludge	Supernate	Interstitial liquid	Pumpable liquid	Total current volume	Volume at interim stabiliza-tion
A	1,000,000	6	1,457,000	186,000	89,000	628,000	666,000	1,732,000	1,643,000
AX	1,000,000	4	878,000	26,000	23,000	355,000	334,000	927,000	904,000
SX	1,000,000	15	2,950,000	1,562,000	67,000	1,304,000	1,194,000	4,579,000	4,512,000
BY	758,000	12	4,178,000	724,000	56,000	1,017,000	889,000	4,958,000	4,902,000
S	758,000	12	4,797,000	1,171,000	46,000	1,300,000	1,075,000	6,014,000	5,968,000
TX	758,000	18	6,659,000	241,000	5,000	250,000	0	6,905,000	6,900,000
TY	758,000	6	64,000	571,000	3,000	19,000	0	638,000	635,000
B	533,000	12	345,000	1,542,000	12,000	147,000	0	1,899,000	1,887,000
	55,000	4	0	152,000	4,000	18,000	0	156,000	152,000
BX	533,000	12	153,000	1,361,000	104,000	136,000	161,000	1,618,000	1,514,000
C	533,000	12	0	2,155,000	77,000	173,000	196,000	2,232,000	2,155,000
	55,000	4	0	11,000	1,000	0	0	12,000	11,000
T	533,000	12	0	1,865,000	72,000	157,000	191,000	1,937,000	1,865,000
	55,000	4	0	122,000	1,000	13,000	0	123,000	122,000
U	533,000	12	2,744,000	626,000	164,000	1,138,000	1,097,000	3,534,000	3,370,000
	55,000	4	0	12,000	4,000	0	0	16,000	12,000
Totals	94,244,000	149	24,225,000	12,327,000	728,000	6,655,000	5,803,000	37,280,000	36,552,000

[a]Data as of December 1986 from RHO-RE-SR-14.

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Table A-2. Contaminated Soil Site Description.

Site category	Number of sites	Contaminated volume (m^3)	Area (ha)	TRU inventory (Ci)	Non-TRU inventory (Ci)	Plutonium (kg)
Surface sites (ditches, ponds)	36	4.5 E + 05	110	8.5 E + 02	2.0 E + 03	9
Subsurface sites (cribs, trenches, french drains, unplanned releases)	294	2.0 E + 05	27	1.7 E + 04	1.4 E + 05	181
Deep sites (reverse wells)	10	1.9 E + 02	0.8	7.3 E + 02	2.7 E + 02	8
Totals	340	6.5 E + 05	137.8	1.9 E + 04	1.4 E + 05	198

NOTE: Inventory current to December 31, 1985.

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1.4 SOLID WASTE BURIAL SITES

Radioactive solid wastes generated as a result of plutonium production and separation operations are buried at the Hanford Site. These wastes consist of unsegregated (and possibly TRU) solid waste buried prior to 1970 and non-TRU solid wastes buried after 1970. The TRU solid waste generated after 1970 is stored for 20-yr retrievability.

Solid wastes are typically very diverse in physical nature, consisting of failed process equipment, laboratory and process wastes, room waste, and decommissioning and decontamination (D&D) wastes. Smaller items are packaged in drums and fiberboard boxes; larger items in burial boxes constructed of wood, metal or concrete.

The majority of solid wastes have been disposed of by shallow land burial in unlined trenches. These trenches are backfilled with Hanford soil following waste placement. Higher activity (high exposure) solid wastes have been disposed of in subsurface engineered structures (caissons and vaults).

There are 71 solid-waste burial sites, 9 of which are considered to be suspect TRU waste sites. The remainder are low-level waste sites. A summary inventory of the solid wastes disposed of at the Hanford Site is provided in table A-3.

1.5 DOUBLE-SHELL TANK WASTES

Double-shell tanks are used for interim storage of current and future liquid wastes.

Existing double-shell tank wastes (table A-4) are considered to consist of those wastes currently in double-shell tanks and those wastes which will be added as a result of salt well pumping. After concentration in the evaporator/crystallizer, the existing wastes will consist predominantly of 3.6 million gal of complexed concentrate (CC), 2.2 million gal of double-shell slurry (DSS) and 6.7 million gal of double-shell slurry feed (DSSF).

The CC is a liquid waste which, due to the presence of organic complexants, cannot be further concentrated in the evaporator/crystallizer. Because of the organic complexants this waste may contain significant quantities of complexed TRU.

The DSS is a semi-solid material, rich in sodium hydroxide which results from the final concentration of interstitial liquid and other dilute wastes. The DSS can contain small quantities of organic complexants and insoluble solids. The DSSF, a dilute form of DSS, was to be concentrated to conserve on tank space but recent studies have shown that the DSSF poses fewer problems during retrieval and pipelines transfer. Therefore, it is not planned to further concentrate the DSSF.

Table A-3. Solid Waste Burial Site Descriptions.

Site category	Number of sites	Contaminated volume (m^3)	Area (ha)	TRU inventory (Ci)	Plutonium (kg)
Pre-1970	9	1.1 E + 05	7.4 E + 00	3.3 E + 04	3.5 E + 02

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Low-Level Solid Waste Burial Grounds.

Site category	Number of sites	Area (ha)	TRU inventory (Ci)	Non-TRU inventory (Ci)	Plutonium (kg)
Low-level waste	62	4.6 E + 01	2.6 E + 05	4.5 E + 06	1.6 E + 01

NOTE: Inventory current to December 31, 1986.

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Table A-4. Double-Shell Tank Wastes.

Tank farm	Number of tanks	Waste volume, gallons[a]							
		Total	Salt cake	Sludge	Double-shell slurry	Interstitial liquid	Supernate	Pumpable liquid	Available space
AN	7	6,422,000	0	346,000	912,000	32,000	5,164,000	5,174,000	1,586,000
AP	8	170,000	0	0	0	0	170,000	170,000	8,982,000
AW	6	4,031,000	196,000	62,000	0	58,000	3,773,000	3,787,000	2,833,000
AY	2	1,094,000	0	94,000	0	1,000	1,000,000	1,000,000	906,000
AZ	2	1,837,000	0	45,000	0	0	1,792,000	1,792,000	163,000
SY	3	2,166,000	616,000	0	1,134,000	246,000	416,000	631,000	1,266,000
Totals	28	15,720,000	812,000	547,000	2,046,000	337,000	12,315,000	12,554,000	15,736,000

[a]Data as of December 1986 from RHO-RE-SR-14.

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Future double-shell tank wastes are categorized into four waste types. These categories are HLW, cladding removal waste (CRW), miscellaneous low-level and TRU liquid waste, and Hanford facility wastes.

The future HLW is defined as the PUREX first cycle extraction waste, or neutralized current acid waste (NCAW), resulting from reprocessing of post-1972 irradiated fuel from N Reactor, Fast Flux Test Facility (FFTF) Cores I-IV and the Shippingport reactor fuel. This waste contains the bulk of the radionuclides. It is estimated that 3.9 million gal of these wastes will be generated by PUREX prior to completion of planned operations in 1998.

About 28 million gal of CRW will be generated by PUREX. This waste after concentration will be reduced to approximately 5.7 million gal. After December 1987, cladding removal waste is treated in PUREX to remove significant quantities of TRU.

Miscellaneous LLW and TRU wastes are a composite of several waste streams. Sources of these wastes include B Plant cesium and strontium purification, vessel cleanout and cell drainage, Plutonium Finishing Plant, T Plant and laboratory wastes, and all PUREX wastes except NCAW and CRW. About 86 million gal of LLW is to be generated after 1983 through FY 2015.

Hanford Facility Wastes are liquid low-level wastes received from the 100-N, 300 and 400 Areas. Most of these wastes come from 100-N. The N Reactor wastes are dilute sodium phosphate and sodium sulfate wastes. These wastes are low-level. About 13 million gal of Hanford Facility Waste is to be generated from FY 1984 through FY 2015.

1.6 CAPSULES

High-level liquid wastes stored in the single-shell tanks at Hanford were processed through B Plant for separation of cesium and strontium fission products. The resulting solutions were converted to solid cesium chloride and strontium fluoride salts in the Waste Encapsulation and Storage Facility (WESF), encapsulated in double-walled capsules, and stored in water basins. This storage mode requires active cooling systems, monitoring, and surveillance to maintain safe storage conditions.

The assumed calorimetric radionuclide inventories and number of capsules for encapsulated cesium and strontium wastes at Hanford are shown in table A-5. A number of capsules have been shipped offsite for licensed byproducts utilization under a lease contract. Additional shipments are proposed. However, it is planned that these capsules will be returned for storage and disposal after their useful byproduct life is over.

Table A-5. Encapsulated Waste Status.

	Originally produced		Currently onsite[a]	
	Cs	Sr	Cs	Sr
Number of capsules[b]	1,576	640	551	605
Radioactivity (MCi)[c]	74.5	31.4	26.0	29.7
Thermal loading (kw)	358	210	125	198
Average activity (kCi)	47	49	47	49
Average thermal loading (W)	227	328	227	327

[a]Accounts for 770 cesium capsules leased to commercial irradiation facilities and expected to be returned to Hanford or other DOE facilities for final disposal; 143 cesium and 4 strontium capsules that have been disencapsulated (cut up) and the material used for other purposes; 57 cesium and 31 strontium capsules that have been shipped to other DOE facilities and which may be returned to the Hanford Site for disposal; and 150 cesium capsules (143 cut up) that have been shipped to foreign countries and which may be returned to the Hanford Site for disposal.

[b]Includes 13 tracer and intermediate totaling 0.1 MCi.

[c]Does not include contribution of daughter products ^{137}Ba and ^{90}Y. Values are decayed to December 31, 1986.

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1.7 STORED AND NEW TRANSURANIC SOLID WASTE

In 1970 the U.S. Atomic Energy Commission (AEC) issued a directive requiring TRU waste to be stored retrievably in packages designed to last 20 yr or more. In response to this directive, solid TRU waste is now packaged, stacked, and stored in trenches with an asphalt pad foundation to allow for 20-yr retrievability. This waste may be packaged inside the trench encased in 55-gal drums, or encased in steel, concrete, or fiberglass reinforced plywood boxes and covered with 4 ft of overburden. These TRU trenches are located in the 200 Areas on the Hanford Site. In FY 1985 above ground storage was made available for newly generated contact handled waste when the Transuranic Storage and Assay Facility (TRUSAF) at building 224-T accepted drums for storage.

The volume of retrievably stored TRU waste stored in the 200 Areas through the end of calender year 1986 was 15,205 m^3 with a total of 433 kg of TRU isotopes. Table A-6 summarizes the volumes and inventories of retrievably stored TRU solid wastes.

For the period 1970 through 1986, approximately 33,000 metal drums and 800 burial boxes were placed in retrievable storage. About 70 to 80% of the drummed waste is categorized as combustible. Typical combustible items include wood, plastics, paper, absorbents, rubber, and rags. Noncombustible waste, about 20 to 30% of the total, includes failed machinery, tools, glass, concrete, plumbing and fixtures, and soil. Burial boxes contain 80 to 90% noncombustible materials, primarily metals. These materials consist of whole and sectioned glove boxes, hoods, ducting, conduit, lathes, pumps, piping, fans, light fixtures, instrumentation, tools, conveyor sections, wire, etc.

Boxes may also contain combustible materials. This material includes, cotton rags and clothing, plastic sheeting, plastic pipe, tape, ladders, plexiglass, step benches, polyethylene bottles, gloves, and rubber. Absorbed combustible liquids such as oils have also been placed in some boxes or drums. Boxes were used for the disposal of High Efficiency Particulate Air (HEPA) filters. Several boxes contain only HEPA filters, while others contain HEPA filters mixed with the other waste forms previously mentioned.

According to waste volume projections, approximately 1,500 m^3/yr of future TRU waste will be placed in retrievable storage at the Hanford Site. The majority of this waste will result from the processing of spent fuel at the PUREX plant, including hulls from the fuel cladding, and from planned decontamination and decommissioning activities. Additional TRU solid waste will continue to be received from onsite and offsite federal facilities for storage and eventual processing.

Approximately 23 m^3 of remote-handled (RH) transuranic waste resulting from fuels examination hot-cell activities is currently stored in subsurface caissons. This waste is contained in 1- and 5-gal paint cans.

Table A-6. Retrievably Stored Transuranic Solid Wastes.

Site designation	Waste volume (m^3)	Surface area (m^2)	Total grams transuranic
218-W-3A	4,140	14,365	19,132
218-W-4B			
Trenches	3,262	4,695	58,865
Caissons	23	1,607	5,934
Total	3,285	6,302	64,799
218-W-4C	6,829	21,887	346,616
218-E-12B	722	1,789	165
224-T (TRUSAF)	8	--	2,080
212-N	217	--	44
212-P	4	--	14
Total	15,205	44,343	432,850

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1.8 HAZARDOUS AND RADIOACTIVE MIXED WASTE (RMW)

This waste category is intended to include hazardous waste that is not radioactively contaminated and HRMW that is not included in the other waste categories. The representation of this waste category will be presented in future updates of the HWMP. The upcoming issuance of the Hazardous Waste Management Plan (HAZWMP) will provide more detail on the inventory for this waste category.

APPENDIX B

1.0 ONGOING WASTE STORAGE AND SURVEILLANCE OPERATIONS

1.1 OPERATIONS AND PROCESSING

1.1.1 Waste Concentration

Waste streams from two geographically separated areas, 200 West and 200 East, are reduced in volume through the use of evaporators and subsequently stored in double-shell tanks. Waste streams include: interstitial liquids jet pumped from single-shell tanks; complexed, noncomplexed, neutralized waste from Z, T and B Plant operations, and noncomplexed, aging and cladding waste from PUREX. Phosphate and sulfate wastes from the 100 N Reactor and noncomplexed wastes from Fast Flux Test Facility (FFTF), Hanford Engineering Development Laboratory (HEDL) and Pacific Northwest Laboratory (PNL) are received through the Waste Unloading Facility. All waste is volume reduced in an evaporator (except the cladding waste) and stored in double-shell settling tanks.

1.1.2 Stabilization and Isolation

The objective is to reduce the amount of liquid waste that potentially could be released to the soil due to a single-shell tank leak. In order to meet this goal, two major activities are underway: (1) stabilization - the removal of interstitial liquid from underground single-shell radioactive waste storage tanks with jet pumps in salt wells; followed by (2) interim isolation - the physical separation of these single-shell tanks from all unnecessary piping and the provision of a barrier to credible sources of inadvertent liquid addition. Single-shell tank farm surfaces will be cleaned up and maintained in an as low as reasonably achievable (ALARA) condition.

1.1.3 Fractionization and Encapsulation

The objective of this program is to treat liquid radioactive Hanford Defense Waste (HDW) to provide feed suitable for immobilization in the Transportable Grout Facility or in the Hanford Waste Vitrification Plant (HWVP) and to store and monitor the ^{137}Cs and ^{90}Sr capsules in water filled basins in the Waste Encapsulation and Storage Facility (WESF). The technical approach is to use B Plant to separate HDW into two streams; a liquid low-level waste (LLW) stream for immobilization as a cementitious grout and a stream containing essentially all of the transuranic (TRU) and other solids for vitrification. B Plant's capability to recover and purify ^{137}Cs and ^{90}Sr is maintained in standby in the event that more of these nuclear byproducts are to be processed for beneficial use. The capsules now in storage in WESF are made available for byproducts utilization for gamma irradiation.

1.1.4 Storage and Disposal

The objective of this program is to store and/or treat TRU waste for ultimate disposal in WIPP and to dispose of low-level waste, both with and without hazardous constituents. The TRUSAF is currently certifying TRU waste for WIPP disposal.

1.1.5 Grout

The objective of this program is to dispose of low-level waste in cementitious grout. The source of the waste is either supernate or designated slurries contained in double-shell tanks. This program will continue constructing vaults and operating the grout facilities until all double-shell tank waste has been treated.

1.1.6 Applied Technology and Strategic Planning

The program provides centralized development of strategy and planning for disposal of HDW. Included are the preparation of environmental documentation in accordance with the National Environmental Policy Act, strategies and criteria for waste disposal, and assurance of adequate interfacing between ongoing operations goals and the planned operations for final disposal of the waste.

1.2 ENVIRONMENTAL CONTROL

1.2.1 Surveillance and Maintenance

This program encompasses the monitoring of all radioactive waste material stored or collected in tanks and sumps beneath the 200 Area ground surface and of all liquid and gaseous effluents discharged from operating facilities. It includes tracking of radionuclides in the soil under tanks which have leaked, and under liquid disposal sites. Groundwater is also checked for radionuclides. Data collected from dry wells near the tanks are analyzed to provide early detection of any breach of waste containment. Instrument readings and groundwater samples from wells are analyzed to define and more precisely locate and track radionuclides. Effluents streams are sampled, analyzed and evaluated to determine the degree of compliance with current standards and regulations. Routine reports of airborne and liquid effluent releases are issued to DOE.

1.2.2 Laboratories and Processes

Analytical and process support for all the Waste Management operations facilities and for environmental monitoring are performed within the 222-S Facility. In addition, all laboratory investigations for the development of Waste Management technologies are performed in this facility. This program is to assure the availability of analytical instrumentation, methodology, and automated measurement systems required to support programs in a reliable, safe, timely, and cost-effective manner. Effort is focused on developing methodology for measuring the isotopic, elemental, and molecular species of waste, process and effluent streams at Hanford.

1.2.3 Radiation Area Reduction

This program provides for interim surface stabilization of waste sites (burial grounds, cribs, ponds and ditches) to eliminate and or prevent surface contamination in order to prevent the spread of radioactivity.

1.2.4 Hazardous Waste

This program provides overall project management for hazardous and radioactive mixed waste to ensure that planning is consistent with long-term goals. The program coordinates hazardous waste regulatory compliance activities including evaluations to determine compliance status. Implementation of corrective actions is undertaken by the responsible waste generator. The program develops hazardous waste analytical techniques for the characterization of HDW. The program will coordinate hazardous waste minimization efforts and provide technology development for the treatment, storage and disposal of hazardous and radioactive mixed waste.

2.0 INTERIM MANAGEMENT ISSUES

2.1 INTERIM MANAGEMENT FOR SINGLE-SHELL TANK WASTES

What if any additional technology is required to continue safe interim storage of wastes in single-shell tanks? What work must be performed to provide the required new technology? Operations have shifted form safe active management of liquid wastes to safe management of deactivated tanks containing some liquid and solid material. As a result, items need to be addressed regarding continued safe management such as a review of ventilation methods for isolated tanks, a review of the accuracy of ongoing tank monitoring activities, and a review of data management related to interim stabilized and isolated tanks.

2.2 INTERIM MANAGEMENT FOR CONTAMINATED SOIL SITES

Is there a need to provide upgraded technology for interim management of contaminated soil sites resulting from disposal of low-level liquid wastes? Contaminated soil sites are currently being safely managed on an interim basis. However, a number of issues exist concerning how best to prepare these sites for any remedial action to take place for long-term safety. For example, is it advisable to grout voids in the gravel portion of existing cribs or is isolation and grouting of distribution lines sufficient?

2.3 INTERIM MANAGEMENT FOR DOUBLE-SHELL TANK WASTE

On the basis that upgrades in procedures used for interim management of double-shell tank waste are warranted, what are such upgrades and what technology must be acquired to make the needed upgrades to the management system? Personnel and the environment are being protected during interim storage of existing and future wastes in double-shell tanks. Technology development to continue safe storage prior to waste retrieval and disposal is ongoing. Additional double-shell tanks will be built to provide the projected capacity necessary to implement the preferred plan.

APPENDIX C

GLOSSARY OF HANFORD TERMS

A

Acceptable Corrosion Rate - that rate of surface removal permissible, based on back calculations from a vessel design life, original thickness, and minimum thickness for strength and integrity.

Actinides - elements with atomic numbers above 88. Common actinides for Hanford waste management include Th, U, Np, Pu, Am and Cm.

Active Institutional Control - for purposes of this document this will consist of continued federal control of Hanford along with maintenance and surveillance of facilities and waste sites.

Active Subsidence Control - (see also subsidence and subsidence accommodating barrier.) This consists of engineering techniques such as pile driving, dropping weights, and grout injection intended to minimize future subsidence.

Aging Waste - term usually reserved for high activity and/or high-heat waste which must be stored until it sufficiently decays to allow processing and/or disposal, generally associated with PUREX NCAW.

ALARA - as low as reasonably achievable - a concept adopted at Hanford from the International Commission on Radiation Protection (ICRP) whereby an attempt is made to reduce an emission or exposure level to a level below established regulations, based on cost versus risk trade-off evaluations. Guidance is provided in DOE Order 5480.1A.

Asphalt Pad - (see also retrievably stored) - an abbreviated description of a standard design for a 20-year retrievable storage trench, pertaining to the blacktop paving upon which waste is stacked.

Atomic Energy Act (AEA) of 1954 - the Act, as amended, authorizes DOE to conduct nuclear materials production, research and development, and associated activities. The Act authorizes the agency to regulate its research, development, and production activity and to adopt such orders and standards as it may deem necessary to protect health and safety.

Atmosphere, Control of - in this document it refers to engineered regulation of the environment within a facility and usually consisting of a maintained negative pressure and/or an inert gas blanket.

B

B Plant - (see also Bismuth Phosphate Process) - a Hanford facility orginally used for fuel-extraction and later converted for waste fractionization and waste pretreatment for disposal.

Barrier - (see protective barrier.)

Biosphere - that combination of the portions of the atmosphere, lithosphere and hydrosphere which supports plant and animal life on earth, the life zone.

Bismuth Phosphate Process - (see also extraction.) One of the earliest separation techniques used at Hanford to separate Pu from irradiated U fuels. Later replaced by REDOX and PUREX, which were more efficient processes.

Burial Ground - (see also trench, overburden, vault, caisson.) Land area specifically designated to receive contaminated waste packages and equipment, usually in trenches covered with overburden.

BWIP - Basalt Waste Isolation Project, (see also repository), Hanford investigation into the suitability of deep basalt flows for disposal of wastes.

Byproduct - certain radioisotopes produced along with the primary Pu product which may have other beneficial uses. Examples include ^{137}Cs and ^{90}Sr.

Byproduct Material - any radioactive material, except special nuclear material, yielded in or made radioactive by exposure to the radiation incident to the process of producing special nuclear material. The radioactive material is subject to regulation under the Atomic Energy Act and the nonradioactive hazardous component of the waste substance is subject to regulation under RCRA as defined in 10 CFR 962.

C

Caisson - an underground structure used to store high activity wastes. Typical designs include corrugated metal or concrete cylinders 8 ft to 9 ft in diameter, 55 gal drums welded end-to-end, and vertical steel pipes below grade.

Canister - container for high activity waste such as Cs or Sr capsules or vitrified wastes (borosilicate glass).

Canyon facility - at sites where radioactive material handling is conducted, this is a heavily shielded, partially below grade concrete structure used for remote chemical processing of fuels or wastes.

Capsules - (see also WESF, Hastelloy, fractionization) - double-walled containers of stainless steel or Hastelloy in which CsCl or SrF_2 are encapsulated.

Cask - a heavily shielded container used to transport highly radioactive material.

CAW - current acid waste, the high-level waste stream from PUREX containing most of the fission products from the dissolved fuel.

Centrifugation - a solids-liquids phase separation technique using inertia which impels material outward from the center of rotating bodies .

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act of 1980.

CFR - Code of Federal Regulations.

Characterization - the measurement of physical properties and components of a material.

Complexants - chemicals, usually organics, which assist in chelating (a type of chemical bonding) metallic atoms, examples include citrates, EDTA, HEDTA.

Complexed Concentrate (CC) - (or concentrated complexant), material containing high concentrations of complexants.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 - the Act establishes reporting requirements for non-federally permitted releases of hazardous substances (e.g., spills) and establishes a program for funding and undertaking remedial action at inactive hazardous waste sites. Federal agencies are subject to the reporting requirements and inactive waste site review and remediation requirements of the Act, but are not entitled to use the trust fund established by the Act for cleanup. Inactive waste sites at DOE facilities are evaluated under DOE Order 5480.1A.

Contact-Handled Waste (CH) - waste, usually packaged in some form, which emits low enough radiation levels (less than 200 mR/hr) to permit close and unshielded manipulation by workers.

Crib - an underground structure (e.g., open wooden box) designed to receive liquid waste which can percolate into the soil directly and/or after traveling to a connected tile field.

Criteria - general guidelines or principles from which more quantitative or definitive standards are derived.

CRW - cladding removal waste - chemical wastes resulting from the dissolution of the metal sheath or coating surrounding fuel elements. Usually contaminated with activation products, fission products and some TRU.

Curie - (Ci) - unit of radioactive decay rate equal to 3.7 x 10^{10} disintegrations per second.

D

D and D - decontamination and decommissioning - the fixation, clean-up, dismantling, and/or entombment of surplus equipment or facilities.

Dangerous Waste - solid waste designated in accordance with procedures specified in WAC 173-303-070 through 173-303-103.

Dangerous Waste Regulations - those regulations promulgated by WDOE for the handling (generating, transporting, recycling, treating and storage) and disposal under Washington Administrative Code (WAC) 173-303.

Daughter Product - a product of radioactive decay of a parent radioisotope which itself may produce daughters or be a stable end of a decay chain.

Decay - (radioactive decay) - the gradual diminishing of the quantity of a radioactive substance due to the spontaneous disintegration of nuclei by the emission of alpha or beta particles or gamma rays.

Defense Waste - radioactive waste from any activity performed in whole or in part in support of DOE atomic energy defense activities. The term excludes radioactive waste under purview of the Nuclear Regulatory Commission or generated by the commercial nuclear power industry.

Department of Energy Radioactive Waste - radioactive waste generated directly by activities of the Department (or its predecessors) and its contractors or subcontractors or other radioactive waste for which the Department is responsible. Such waste may be referred to as DOE waste.

Disposal - emplacement of waste in a manner that assures isolation from the biosphere without maintenance and with no intent of retrieval and that requires deliberate action to gain access to the waste after emplacement.

Distribution Box - an underground or in plant enclosure containing jumpers or valved manifolds which enable solution transfers via pipelines between various processes and storage facilities.

Ditch - (see also ponds) - an open trench used for conducting liquid waste streams from facilities, usually to ponds.

DOE - Department of Energy - the federal agency responsible for the management of the Hanford Site.

Dome Fill Material - material for backfilling the open space above the wastes in single- and double-shell tanks.

DSS - Double-Shell Slurry - a thick, but pumpable, double-shell tank waste resulting from the concentration of non-complexed waste.

Double-Shell Slurry Feed - Dilute feed, from various sources, to the evaporator/crystallizer. Product is double-shell slurry, (DSS).

Double-Shell Tank (DST) - a reinforced concrete underground vessel with a double steel liner to provide backup containment of liquid wastes. Annulus is instrumented to permit detection of leaks through the inner liner.

Drainable Liquid - liquid in waste storage tanks which can migrate by gravity through the saltcake or sludge such that it could leak out of an impaired tank liner.

Drywell - a drainage receptacle constructed by digging a hole and refilling it with coarse gravel. Also a water tight well casing used for inserting monitoring equipment.

DWMP - Defense Waste Management Plan - a plan prepared in response to Public Law 97-90 that sets forth plans for the disposal of high-level and transuranic wastes resulting from atomic energy defense activities.

E

Encapsulated Waste - (see capsules).

Enhanced Technology - Refers to the need to maintain a viable position with respect to evolving technology which will provide for an upgraded ability to respond (in a cost-effective manner) to Hanford waste management program needs.

Environmental Assessment (EA) - a concise document prepared to assist in determining if a proposal is a major Federal action significantly affecting the quality of the human environment (see NEPA). The EA serves as the basis for a determination to whether an EIS is required.

Environmental Impact Statement (EIS) - a document prepared in accordance with the requirement of section 102(2)(c) of NEPA.

EPA - Environmental Protection Agency - the federal agency responsible for promulgation and enforcement of implementing regulations for environmental laws.

Evaporator/Crystallizer - Hanford facilities to reduce the volume of tank waste to reduce the need for new tank construction.

Extraction - (see also bismuth phosphate, TBP, PUREX and REDOX) - the mass transfers of an element or compound between two immiscible phases.

Extremely Hazardous Waste - a subcategory of dangerous waste designated in accordance with procedures specified in WAC 173-303-070 through 173-303-103.

F

FFTF - Fast Flux Test Facility - A facility at the Hanford Site for the testing of fuels, materials, and designs related to breeder reactor technology.

FONSI - Finding of No Significant Impact (see NEPA) - a determination that an EIS is not needed, made after preparing an Environmental Assessment.

Fractionization - specifically, internal reflux within a media resulting in separation between high and low boiling fractions. Also applied to isotope separations to reduce heat content of HLW.

French Drain - subsurface soil drain for disposal of relatively low volume, low activity solutions similar in basic design principles to a tile field or crib arrangement.

FRP Box - fiberglass reinforced plywood, a commonly used package for storing TRU waste or burying LLW.

G

Geologic Disposal - a waste management alternative which achieves permanent disposal of high-level and TRU waste by storage in a deep geologic repository.

Greater Confinement - a technique for disposal of waste that uses natural and/or engineered barriers which provide a degree of isolation greater than that of shallow land burial but possibly less than that of a geologic repository.

Grout - a fluid mixture of cement, water, flyash, and clay used for waste fixation or immobilization.

Grout Plant - facility to be built at Hanford to combine low-level, CRW, DSS, and/or customer wastes etc. with a grout binder for subsequent placement in trenches or tanks or injection into solid waste sites.

GPP - General Plant Project - a construction project with a total estimated cost less than $1.2 million.

H

Hanford Facility Waste (HFW) - Hanford term used to identify wastes generated by facilities other than those in the 200 Areas. These wastes are concentrated to DSS and end up in double-shell tanks.

Hanford Waste Vitrification Plant (HWVP) - (see vitrification) A facility designed to process Hanford HLW or TRU to borosilicate glass and package the glass in steel canisters. Plant is scheduled for operation in FY 1999.

Hastelloy - a special nickel-based alloy with corrosion resistant properties and used at Hanford for encapsulating strontium fluoride.

Hazardous and Solid Waste Amendment (HSWA) of 1984 - the act authorizes EPA to require corrective action to be undertaken to address releases of hazardous constituents at sites located at either interim status facilities or facilities that will require a RCRA permit (section 3004(u)).

Hazardous Waste - solid waste designated in accordance with procedures specified at 40 CFR 261.

HDW-EIS - Hanford Defense Waste-Environmental Impact Statement - a draft environmental impact statement titled Disposal of Hanford Defense High-Level, Transuranic, and Tank Wastes, DOE/EIS-0113.

Heat Content - usually refers to the amount of heat generated through radioactive decay.

Helium Leak Check - a method used during encapsulation at WESF to ensure the integrity of weld seals on capsules.

HEMP - Hanford Environmental Management Program.

HEPA Filters - High Efficiency Particulate Air - Material which captures entrained particles from an air stream, usually with efficiencies in the 99.95% and above range. Filter material is usually a paper or fiber sheet pleated to increase surface area.

High-Level Waste (HLW) - the highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid, that contains a combination of TRU waste and fission products in concentrations as to require permanent isolation.

HSDW - Hanford Site Defense Wastes - Comprises all existing and certain future radioactive wastes generated at the Hanford Site including single-shell and double-shell tank wastes; solid and liquid waste burial sites; encapsulated $^{137}CsCl$ and $^{90}SrF_2$; stored and new TRU solid wastes.

HSWA - Hazardous and Solid Waste Amendment of 1984.

HWMP - Hanford Waste Management Plan.

HWMTP - Hanford Waste Management Technology plan - a companion document to HWMP which provides greater detail on the technical tasks needed to resolve the technical issues identified in HWMP.

Hydraulic Sluicing - a method for suspending settled solids in a liquid storage tank using a high-impact sluicing nozzle with a high-pressure, recirculating slurry pump. A portion of the slurry is removed for subsequent treatment.

I

ICRP - International Commission on Radiation Protection.

Immobilization - a process such as grouting or vitrification designed to inhibit waste mobility.

Inadvertent Intrusion - human activity such as home excavation, resource mining, and well digging which accidentally breaches a waste site.

Institutional Control - Federal ownership and presence.

In Situ Immobilization - an in place technique such as electrode glassification which is performed to inhibit mobility.

Interim Storage - a management policy of controlling waste until such time that an ultimate disposal plan is approved and implemented.

Interstitial Liquor - the liquid which fills the void in a solid. In the waste tanks, this liquid is in physico-chemical equilibrium with the solids. The voids within the solids consist of 30 to 50% of the total volume attributed to the solids. About 40 percent of the liquid in salt cake is held in place by capillary forces and will not drain (nondrainable). In the sludge portion of the tank farm waste, none of the liquor is normally considered pumpable or drainable.

Isolation - seclusion of waste from the biosphere (see also immobilization, engineered barrier, waste form).

Issue - a technical question or uncertainty of such significance that it must be answered or solved before specific waste disposal plans can be satisfactorily implemented.

J

<u>**Jet Pumping**</u> - a technique for removing interstitial liquor from single-shell tanks.

L

<u>**Low-Level Waste (LLW)**</u> - radioactive waste not classified as high-level waste, TRU waste, spent nuclear fuel, or byproduct material.

<u>**Liquid Waste Disposal Site**</u> - an engineered structure used for discharge of contaminated liquids to the ground. In the HWMP these sites are referred to as "contaminated soil sites."

M

<u>**Marker**</u> - a surface or subsurface monument or plaque of durable material containing a warning and/or information message designed to prevent inadvertant intrusion.

<u>**Mechanical Recovery**</u> - a means of removing wastes from an underground storage tank by mechanical means and without using water or other liquid(s).

<u>**MIBK**</u> - methyl isobutyl ketone (hexone) a solvent used at the REDOX separations plant.

N

<u>**NCAW**</u> - neutralized current acid waste.

<u>**NEPA**</u> - National Environmental Policy Act of 1969 (PL91-190) - implementing regulations are found in 40 CFR Parts 1500-1508.

<u>**Neutralization**</u> - the buffering of acidic wastes with an alkali (such as NaOH, $Ca(OH)_2$, KOH) to increase the life of waste containers.

<u>**Non-Combustible**</u> - waste items such as concrete rubble and steel tools which will not support combustion under ordinary circumstances.

<u>**Nondestructive Assay (NDA)**</u> - analytical technique which can determine the presence and quantity of an element(s) without altering the matrix material.

NPH - normal paraffin hydrocarbons - a solvent used at PUREX consisting of straight chain hydrocarbons primarily in the C-10 to C-14 (light paraffin oil) range.

NRC - Nuclear Regulatory Commission.

N Reactor Fuel - usually referring to irradiated fuel from the Hanford production reactor.

O

Off-Gas Treatment - generic name for equipment designed to clean up vent gasses from processes. The equipment may consist of adsorbers, sand beds, gas flares, HEPA filters, etc.

ORNL - Oak Ridge National Laboratory located in the state of Tennessee.

Overburden - soil used to backfill an excavation containing solid waste or a liquid waste disposal structure.

Ozonization - (see also complexants) - a process for oxidizing (or destroying) complexants in recovered complexed concentrate from double-shell tanks by reaction with ozone.

P

PFMP - Process Facility Modification Project - a fuel processing headend facility, often called "shear-leach."

PFP - Plutonium Finishing Plant (Z Plant) - Hanford facility (234-5 building) which processes solid Pu compounds and metals.

Performance Assessment - an analysis which identifies events and processes which might affect the disposal system, examines their effects upon its natural and engineered barriers, and estimates the probabilities and consequences of the events and processes.

Permit - in the context of environmental laws and regulations, a document issued by EPA or an authorized State regulating body consisting of an affirmative response to a prescribed application by a person or persons treating, storing, or disposing of hazardous waste.

Ponds - surface depressions used to contain potential low-level contaminated solutions.

PREPP - Process Experimental Pilot Plant - an incinerator facility at the Idaho National Engineering Laboratory (INEL) for radioactive waste treatment.

Protective Barrier - a manmade structure designed to interdict as many waste migration pathways (e.g., animal burrows, plant roots, erosion, water infiltration) as possible and necessary depending on waste mobility, hazard and lifetime.

PUREX - Plutonium Uranium Extraction - latest in a line of separation technologies preceded by bismuth phosphate and REDOX.

R

Radioactive Mixed Waste (RMW) - waste composed of both radionuclides, as defined by the Atomic Energy Act, and hazardous constituents, as defined by the Resource Conservation and Recovery Act (RCRA) and regulations promulgated thereunder (40 CFR 260 et seq.).

RCRA - Resource Conservation and Recovery Act of 1976.

REDOX - (an acronym for reduction-oxidation); a large radiochemical solvent extraction processing plant for the recovery and purification of uranium, plutonium, and neptunium from irradiated fuel elements. The solvent methyl isobutyl ketone (Hexone) and the salting agent, aluminum nitrate nonahydrate, were contacted in extraction columns packed with Raschig rings. The plant, the 202-S facility located in 200 West Area, was completed in 1952 and deactivated in 1967.

Remote Handled (RH) - (see contact handled) - waste emitting greater than 200 mR/hr but less than 100 R/hr and requiring shielding and distance from human operations.

Remote Sensing - monitoring at a distance as opposed to bringing sample and detector in direct contact.

Repository - (see also geologic disposal) - a land-based, deep disposal site for long-term isolation of radioactive waste.

Resource Conservation and Recovery Act (RCRA) of 1976 - the Act provides for protection of health and the environment from activities associated with the management and disposal of solid wastes. It sets forth requirements for generators and transporters of hazardous waste and also establishes a specific permit program for treatment, storage, and disposal of hazardous waste.

Retrievably Stored - interim stored waste retrievable with minimal risk and cost for further processing and/or disposal.

Reverse Well - an early Hanford liquid waste disposal structure consisting of a well (sometimes drilled into water table) into which waste solutions were pumped.

ROD - Record-of-Decision - concise statement for the public record of the decision on a proposed action for which an EIS was prepared which includes the alternatives considered, the environmentally preferrable alternative, factors balanced in the decision, and mitigation measures and monitoring to minimize harm.

S

Salt Cake - crystallized nitrate and other salts deposited in waste tanks usually after active measures were taken to remove the water content.

Salt Well - a hole drilled or sluiced into a salt cake and lined with a cylindrical screen to permit drainage and jet pumping of interstitial liquor.

SARA - Superfund Amendments and Reauthorization Act of 1986.

Single-Shell Tank (SST) - older style Hanford underground tank composed of a single carbon steel liner surrounded by concrete.

SIS - Special Isotope Separation - laser process for partitioning isotopes of Pu from one another.

Site Preparation - activities such as road building, bringing in power, surveys, etc. necessary before initiating waste disposal actions.

Sludge - primarily insoluble metal hydroxides and hydrated oxides precipitated from neutralized acidic wastes.

Sludge Washing - sludge cleanup with water in order to remove soluble "impurities" which would unnecessarily increase the resulting glass volume if the sludge were vitrified.

Soil Plume - the trail in contaminated soil left behind due to adsorption of chemical or radionuclide ions from a liquid waste discharge.

Solid Waste Burial Site - a land area specifically designated to receive contaminated solid waste materials for burial.

Special Nuclear Material (SNM) - this term refers to ^{239}Pu, ^{233}U containing more than the natural abundance of ^{235}U, or any material enriched in any of these substances.

Spent Fuel - fuel discharged from a reactor after using a desired or maximum practical percentage of fissile material.

Stabilization - treatment of waste or a waste site to protect the biosphere from contamination spread.

Standard - a quantitative measure of criteria satisfaction.

Subsidence - gradual or catastrophic sinking of the ground surface below normal grade level due to collapse of a large void space or slow decay and compression of material.

Subsidence Accommodating Barrier - sometimes call a slump-and-fill barrier, designed thick and rugged enough to remain functional as waste below compacts or decays.

Sump - usually associated with other liquid waste disposal facilities, a sump is an underground tank often used to clarify wastes, permit addition of chemicals to waste, and/or provide an integrated sample reservoir.

Superfund Amendments and Reauthorization Act (SARA) of 1986 - the act that extends the applicability and expands the coverage of CERCLA.

Supernatant Liquors - usually refers to a distinct liquid phase resting on top of a solid layer.

Surplus facilities - (see also D&D) - structures or plants that have outlived their design life or usefulness. At Hanford this inevitably requires some sort of decontamination and decommissioning before the facilities can be released from caretaker status.

Surveillance System - a network of sensors associated with recording devices and alarms to provide continuous monitoring of a site, facility, or area.

SWEPP - Stored Waste Encapsulation Pilot Plant - a pilot facility at the Idaho National Engineering Laboratory (INEL), includes capabilities for non-destructive examination and assay of solid wastes.

T

TBP - tri-n-butyl phosphate - an organic extractant used at PUREX.

Technology Demonstration - specifically refers to a series of proposed, and currently underway, test applications of proposed waste management techniques.

TGF - Transportable Grout Facility.

Tiering - (see NEPA) - a method (see 40 CFR 1508.28) for preparing a network of environmental documents splitting off from a generic, broad EIS, with the intent of minimizing support documentation.

TRUSAF - TRU Storage and Assay Facility - a facility for assay and storage of transuranic solid waste materials.

TRU Waste - without regard to source or form, radioactive waste that at the end of institutional control periods is contaminated with alpha-emitting transuranium radionuclides with half-lives greater than 20 years and concentrations greater than 100 nCi/g.

Tunnel - a large underground storage structure for large pieces of equipment often on railroad cars; PUREX storage tunnels.

Two Hundred (200) Area Plateau - highest portion (aside from Rattlesnake and Gable Mountains) on Hanford Site, containing most of the waste processing and storage facilities. Name derived from numbering system devised in early 1940's.

U

Unsegregated Solid Waste - waste buried prior to 1970 which was not separated according to TRU content, combustibility or any other criteria.

V

Vault - a below grade engineered structure used for storage or disposal of waste.

Vitrification - a method of immobilizing waste by dispersing it within a glass compound.

Void Space - space either above waste in caisson or tank and/or within pores or interstices of a bulk material such as gravel or random barrels.

W

WAC - Washington (State) Administrative Code.

Washington Department of Ecology (WDOE) - the operative Washington State agency for regulating the handling and disposal of the hazardous component of RMW with oversight authority provided by EPA.

Waste Concentration - removal of excess water from liquid wastes or slurries.

Waste Form - usually the matrix or physical state of a waste.

Water Basin - stainless steel lined concrete pool with water circulation and treatment for storing and cooling capsules.

WESF - Waste Encapsulation and Storage Facility - a facility built for the purpose of receiving strontium and cesium solutions from B Plant and creating a solid, encapsulated product. Also includes water basins for capsule interim storage.

WIPP - Waste Isolation Pilot Plant.

WRAP - Waste Receiving and Processing (facility) - a process plant to sort, shred, grout and package solid TRU waste.