DOE/DP-0015

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WM: 109

The Defense Waste Management Plan

June 1983

U.S. Department of Energy
Assistant Secretary for Defense Programs

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The Defense Waste Management Plan

June 1983

U.S. Department of Energy
Assistant Secretary for Defense Programs
Washington, DC 20585

THE SECRETARY OF ENERGY
WASHINGTON, D.C. 20585

May 25, 1983

MEMORANDUM FOR The President
The White House

Enclosed for your transmittal to Congress is the Defense Waste Management Plan developed by the Department to comply with Public Law 97-90, the Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1982. The report describes reference plans for the permanent disposal of high-level and transuranic wastes resulting from atomic energy defense activities in each of the six States where such waste is located.

It should be noted that with the strong support of this Administration, we have initiated an extensive effort to reverse the open-ended "interim" storage approach which has been in effect for decades. In FY 1983, construction funding was approved for the Waste Isolation Pilot Plant in New Mexico. This facility will demonstrate the safe disposal of defense waste. In the FY 1984 budget, construction of the Defense Waste Processing Facility at Savannah River was approved. This facility will immobilize into a glass form suitable for disposal, the sludge waste currently stored in large tanks. In addition, facilities were approved for processing the large volume of stored transuranic waste in Idaho so that such waste will be suitable for permanent disposal.

The report being forwarded to you contains plans for additional new facilities for the treatment of nuclear wastes at other defense sites. Because such wastes have been and can continue to be stored in a safe and environmentally sound manner, the Department is addressing the final disposition of these wastes in a set of sequential steps on a site-by-site basis. Not only does this avoid large funding fluctuations, but also it allows the Department to acquire operating experience before proceeding to the next site. The reference plan provides the necessary context for implementing site-specific activities. As new information is developed or new technical options become available, the Plan will need to be adjusted accordingly.

In that regard, cost estimates and schedules in the report will be reviewed annually by the Department during the course of the normal budget cycle. We will shortly begin preparing our FY 1985 budget submission. New activities described for FY 1985 in the report will be evaluated in terms of their scope, timing, need, and relative ranking compared to other Departmental priorities.

The Plan has already been informally coordinated with the Environmental Protection Agency, Department of the Interior, and Nuclear Regulatory Commission. The Governors of the States of Georgia, Idaho, Nevada, New Mexico, South Carolina, Tennessee, and Washington were briefed and provided with a draft plan for review and comment. The congressional delegations of the seven States and the congressional committees which have cognizance over atomic energy defense activities were also briefed. Comments received as a result of these reviews have been addressed in the Plan or reconciled with the originating organization by separate correspondence.

Additionally, the Plan is mindful of Section 8 of the Nuclear Waste Policy Act of 1982 regarding the placement of defense high-level waste in a commercial or defense repository. An evaluation of this issue is underway.

The Administration can be proud of the strong commitment it has made to the safe disposition of nuclear waste from both defense and commercial nuclear activities. I intend to assure that this commitment is carried out in a manner both that is cost-effective and that recognizes the very real concerns of the Congress and affected States.

Respectfully,

Donald Paul Hodel

DONALD PAUL HODEL

Enclosure

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EXECUTIVE SUMMARY

Public Law 97-90, the Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1982, states that:

> "The President shall submit to the Committees on Armed Services of the Senate and of the House of Representatives not later than June 30, 1983, a report which sets forth his plans for the permanent disposal of high-level and transuranic wastes resulting from atomic energy defense activities".

According to the Atomic Energy Act of 1954, as amended, and the Department of Energy Organization Act, responsibility for radioactive waste and byproducts generated by DOE's nuclear activities belongs to the Secretary of the Department of Energy. The flow of materials and the resulting waste from the atomic energy defense activities addressed in P.L. 97-90 are illustrated in Figure E-1.

Defense high-level waste (HLW) and defense transuranic (TRU) waste are in interim storage at three sites, namely: at the Savannah River Plant, in South Carolina; at the Hanford Reservation, in Washington; and at the Idaho National Engineering Laboratory, in Idaho. Defense TRU waste is also in interim storage at the Oak Ridge National Laboratory, in Tennessee; at the Los Alamos National Laboratory, in New Mexico; and at the Nevada Test Site, in Nevada. (Figure E-2).

This document describes a workable approach for the permanent disposal of high-level and transuranic waste from atomic energy defense activities. The plan does not address the disposal of "suspect" waste which has been conservatively considered to be high-level or transuranic waste but which can be shown to be low-level waste. This material will be processed and disposed of in accordance with low-level waste practices.

The primary goal of this program is to utilize or dispose of high-level and transuranic waste routinely, safely, and effectively. This goal will include the disposal

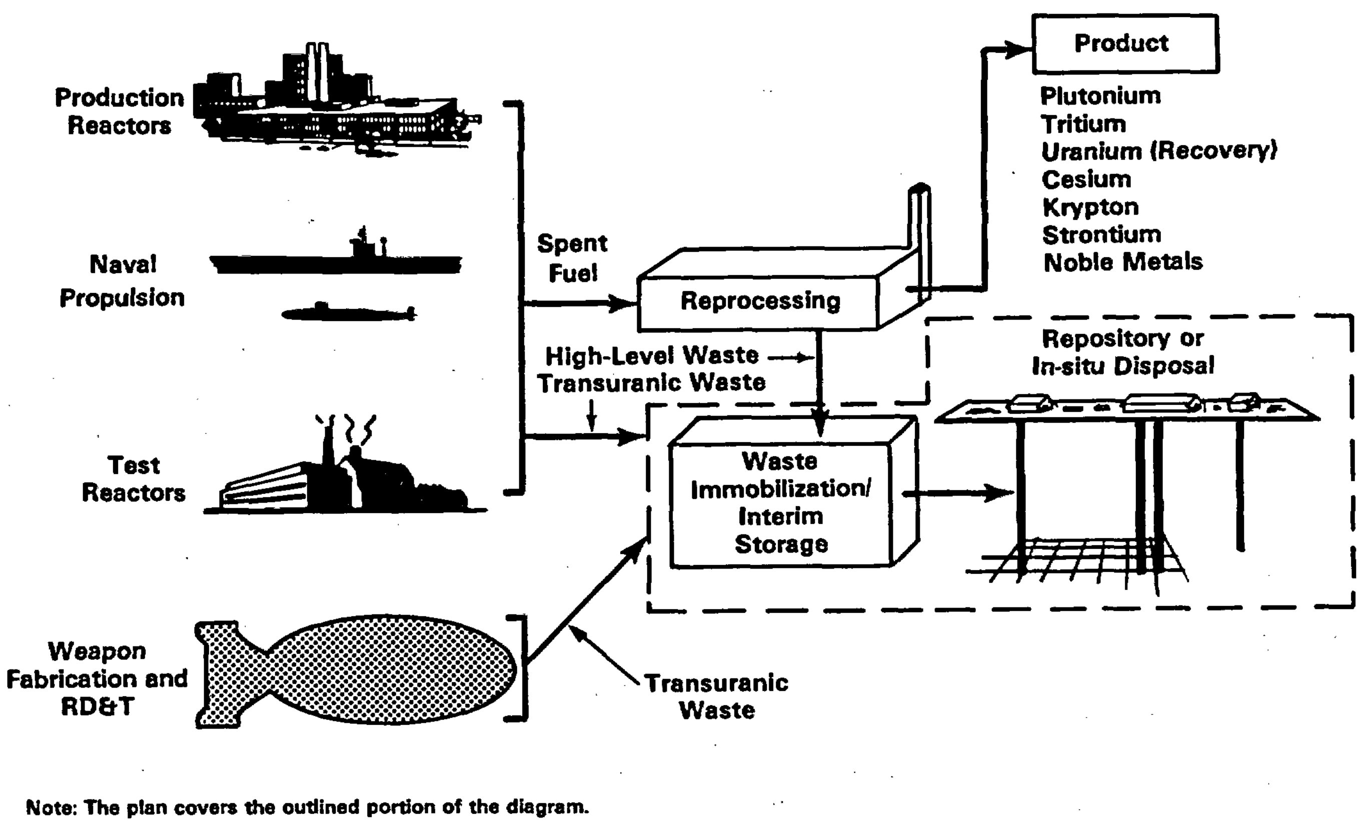


FIGURE E-1

ATOMIC ENERGY DEFENSE ACTIVITIES. IRRADIATED FUELS FROM PRODUCTION, TEST AND NAVAL REACTORS ARE REPROCESSED TO SEPARATE PRODUCTS. THE WASTE FROM THESE ACTIVITIES AS WELL AS FROM WEAPON FABRICATION AND RESEARCH/DEVELOPMENT AND TESTING IS PROCESSED AND DISPOSED OF OR STORED PENDING DISPOSAL.

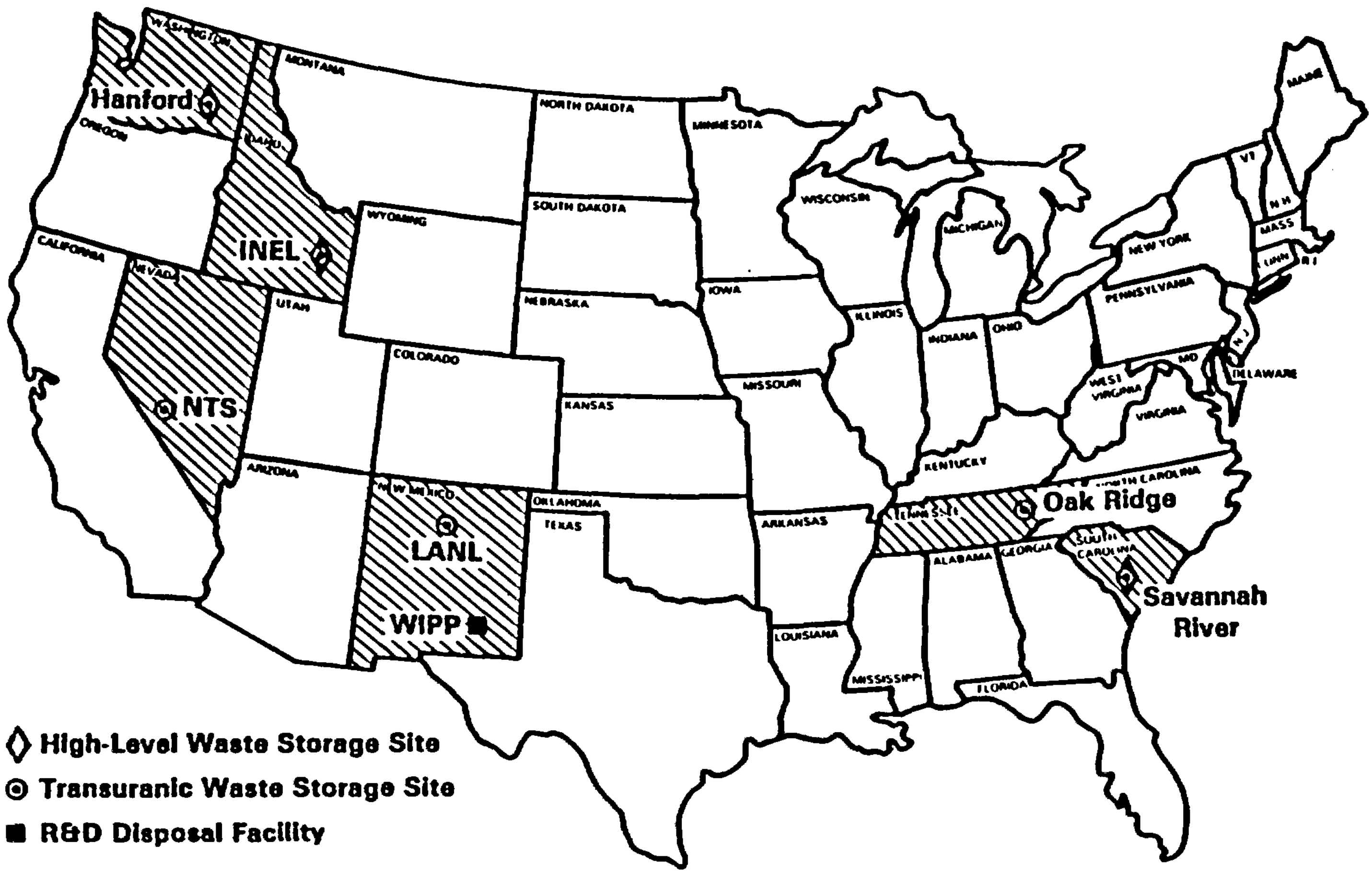


FIGURE E-2
HIGH-LEVEL WASTE AND TRANSURANIC WASTE STORAGE SITES

of the backlog of stored defense waste. A "Reference Plan" for each of the sites describes the sequence of steps leading to permanent disposal.

No technological breakthroughs are required to implement the reference plan. Not all final decisions concerning the activities described in this document have been made. These decisions will depend on: completion of the National Environmental Policy Act process, authorization and appropriation of funds, agreements with states as appropriate, and in some cases, the results of pilot plant experiments and operational experience.

The major elements of the reference plan for permanent disposal of defense high-level and transuranic waste are summarized below:

High-Level Waste (HLW)

The objective is to end interim storage and to achieve permanent disposal by immobilizing and preparing high-level waste for shipment to a geologic repository. The orderly transition to permanent disposal at the three DOE sites will proceed sequentially (Figure E-3). This approach permits the experience gained at the first site to be applied to the other sites thereby achieving the more efficient use of resources including funding.

Valuable byproduct materials will be separated from the waste for beneficial use in military and civilian applications where separation is economical and safe.

New and readily retrievable old high-level waste will be processed for disposal in a geologic repository. Other waste will be stabilized in place if, after the requisite environmental documentation, it is determined that the short-term risks and costs of retrieval and transportation outweigh the environmental benefits of disposal in a geologic mined repository.

Geologic disposal is the reference method for permanent disposal of immobilized defense high-level waste. The geologic repository is being developed under the commercial radioactive waste management program. It is assumed that the repository can receive high-level waste beginning in 1998. Defense high-level waste will be placed in a commercial repository unless there would be unacceptable adverse impacts to defense programs. The Nuclear Waste Policy Act of 1982 (P.L. 99-425) requires an evaluation of this issue by January 1985.

The plans for the individual DOE sites are described below:

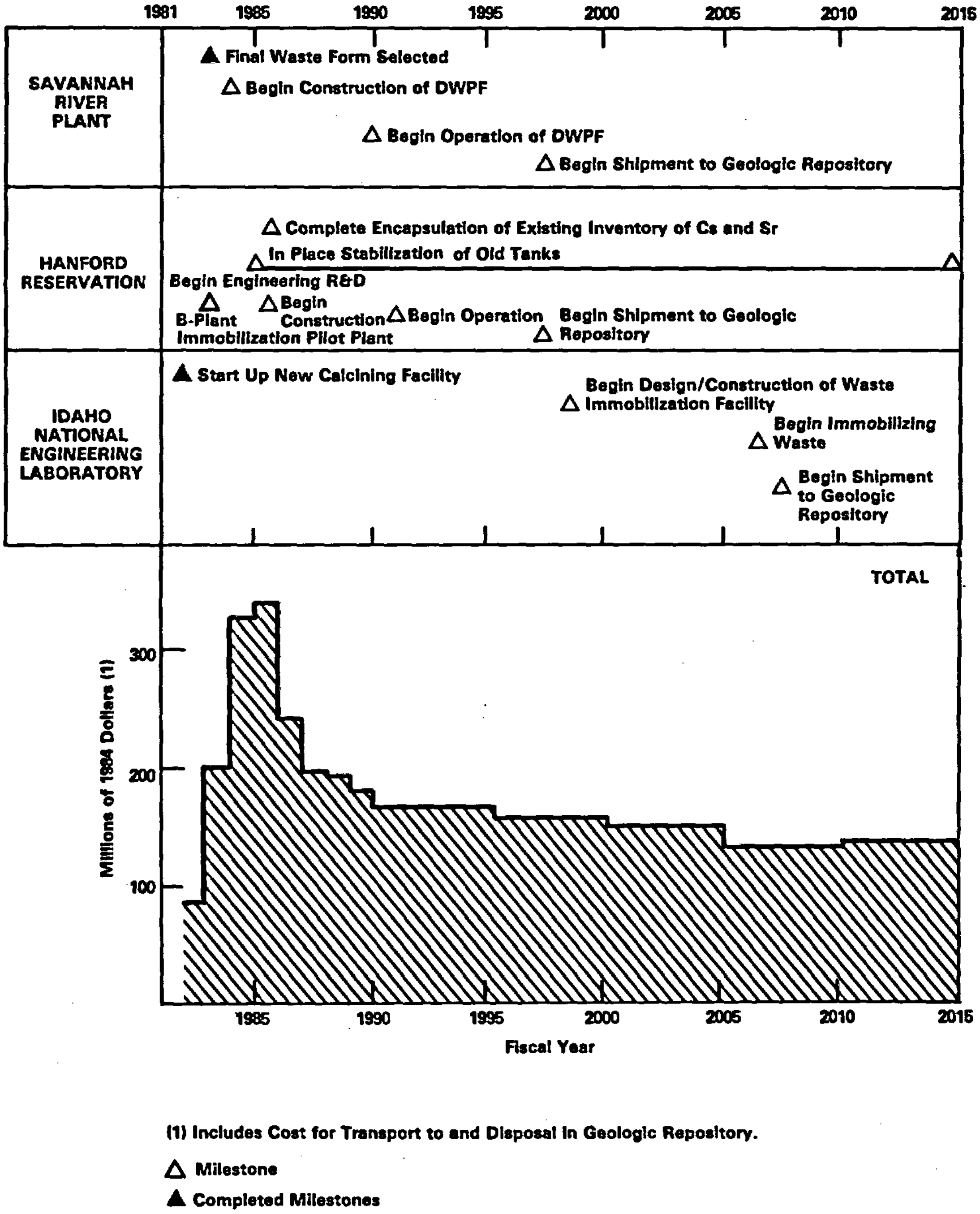


FIGURE E-3

MAJOR MILESTONES AND COSTS FOR PERMANENT DISPOSAL OF DEFENSE HIGH-LEVEL WASTE

Savannah River Plant (SRP). High-level waste* from this site is readily retrievable and will be sent off-site for disposal in a geologic repository. Processing for disposal will begin at this site before the other two because it contains 75 percent of DOE's tanked waste radioactivity and because environmental factors are less favorable than at the other two sites. Savannah River Plant waste will be immobilized in the Defense Waste Processing Facility (DWPF) (Figure E-4) beginning in 1989.**

Hanford Reservation. Hanford's high-level waste tanks are isolated from the water table and contain much less radioactivity than tanks at the Savannah River Plant. Immobilization of new and readily retrievable high-level waste will begin about 1990 after sufficient experience is available from Savannah River's vitrification process.

*Volumes of stored waste and quantities of radioactive constituents are shown in Appendix B.

**All years shown in this plan are fiscal years.

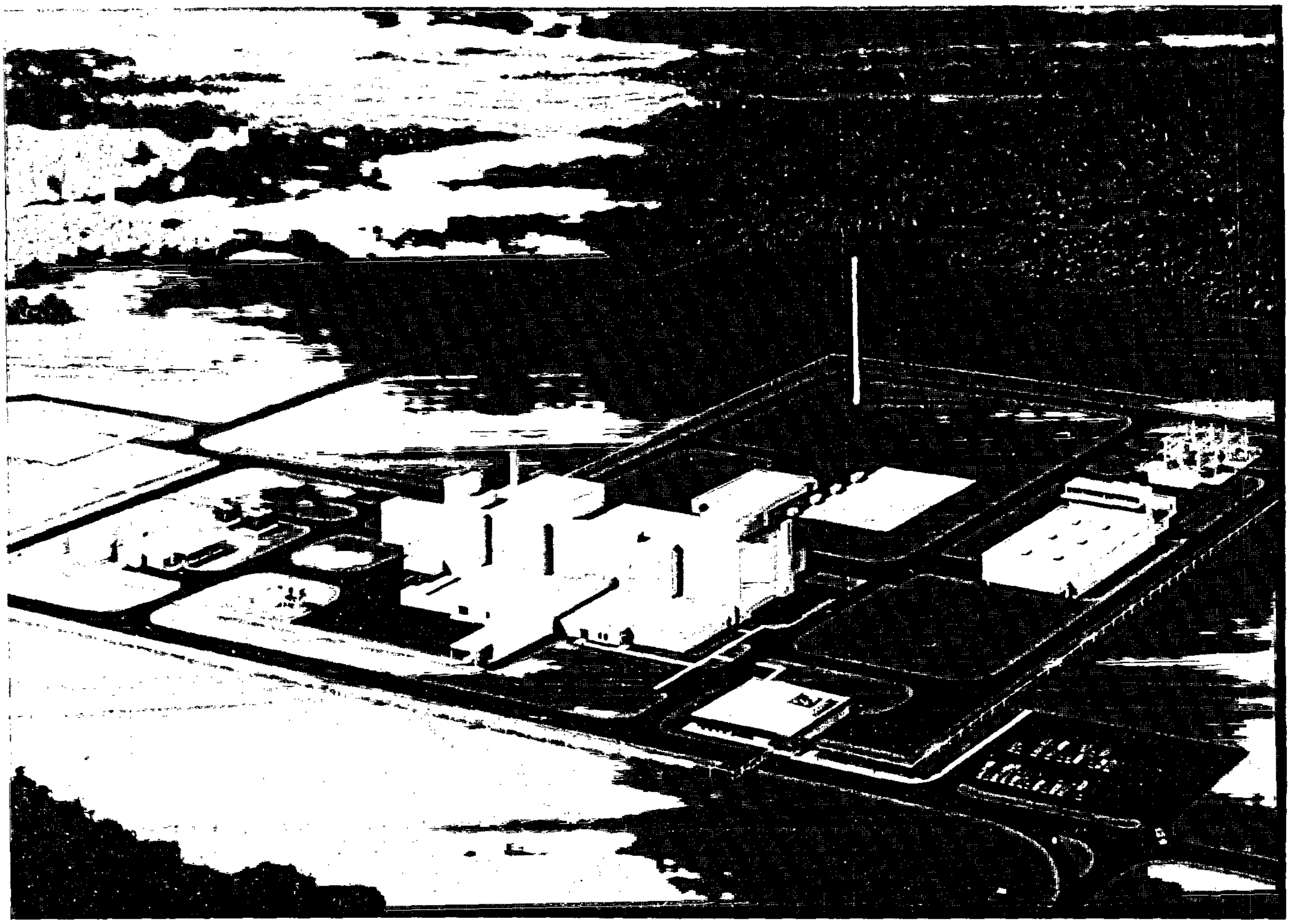


FIGURE E-4
DEFENSE WASTE PROCESSING FACILITY AT SAVANNAH RIVER PLANT

Other waste will be stabilized in place in the 1985-2015 time frame if, after the requisite environmental documentation, it is determined that the short-term risks and costs of retrieval and transportation outweigh the environmental benefits of disposal in a geologic mined repository.

Idaho National Engineering Laboratory (INEL). High-level waste at INEL is readily retrievable and will be processed third because it is being calcined and is exceptionally stable in this solid form. A facility to immobilize new high-level waste from the Idaho reprocessing plant is planned for operation by 2008. It will also be able to process the solid stored calcine.

Milestones and costs for the permanent disposal of defense high-level waste are shown in Figure E-3.

Transuranic (TRU) Waste

The objective is to end interim storage and to achieve permanent disposal. Newly generated and stored defense transuranic waste will be certified for compliance with waste acceptance criteria, after processing if necessary, and then sent to the Waste Isolation Pilot Plant (WIPP). Certification of newly generated waste was initiated in 1983. Stored waste will be retrieved, examined, processed if necessary, and certified. As with the high-level waste, the transition to permanent disposal at the different sites will proceed sequentially. After the WIPP is operational, waste generating sites will send certified waste directly to WIPP. After 5 years of operational experience, a decision will be made to "leave or retrieve" the transuranic waste.

Before 1970, transuranic contaminated solid material was disposed of by burial as low-level waste. The National Academy of Science and others have found that retrieval of this waste can be more hazardous than leaving it in place. The reference plan for such buried waste is to monitor it, to take such remedial actions as may be necessary, and to re-evaluate its safety periodically. Major evaluations will be scheduled as necessary or in about 10-year periods.

The plans for the individual DOE sites are described below:

Idaho National Engineering Laboratory (INEL). The Stored Waste Examination Pilot Plant (SWEPP) will begin certification of retrievably stored transuranic waste in 1985. Experiments will begin in the Process Experimental Pilot Plant (PREPP) in 1986 to demonstrate production scale treatment and certification and to provide design and operational data for other transuranic waste processing facilities. Processing will begin at INEL before the other sites because it has the largest inventory of stored transuranic waste. Certified transuranic waste will be sent to the WIPP beginning in 1989.

Hanford Reservation. Beginning in 1992, stored waste could be retrieved, examined, and certified in the Waste Receiving and Processing Facility (WRAP). Certified transuranic waste will be sent to the WIPP beginning in 1992.

Savannah River Plant (SRP). Waste processing will begin in 1989 by incineration or by disassembly and decontamination. Stored waste will be retrieved, processed (if necessary), and certified. Certified transuranic waste will be sent to the WIPP beginning in 1992.

Oak Ridge National Laboratory (ORNL). Examination and certification of stored transuranic waste was initiated in 1983. Certified transuranic waste will be sent to the WIPP beginning in 1990.

Los Alamos National Laboratory (LANL). Transuranic waste will be processed in a controlled air incinerator beginning in 1985. Certified transuranic waste will be sent to the WIPP beginning in 1990.

Nevada Test Site (NTS). A decision on where and how to process non-certified waste will be made in 1990. Certified transuranic waste will be sent to the WIPP beginning in 1990.

Waste Isolation Pilot Plant (WIPP). This research and development facility near Carlsbad, New Mexico (Figure E-5) is intended to demonstrate the safe disposal of radioactive waste from national defense programs. The WIPP will be used to retrievably emplace and dispose of defense transuranic waste and to conduct experiments with high-level waste. The limited quantity of high-level waste emplaced for experimental purposes will be removed from the WIPP before decommissioning. The WIPP can be completed in December 1987 and the first radioactive waste received for emplacement 10 months later. The "leave or retrieve" decision will be made after five years of emplacement operations.

The milestones and costs for the permanent disposal of defense transuranic waste are shown in Figure E-6.

The annual cost for the disposal of defense high-level and transuranic waste is shown in Figure E-7. Estimated cost savings from the transition from interim waste management to permanent disposal are also shown.

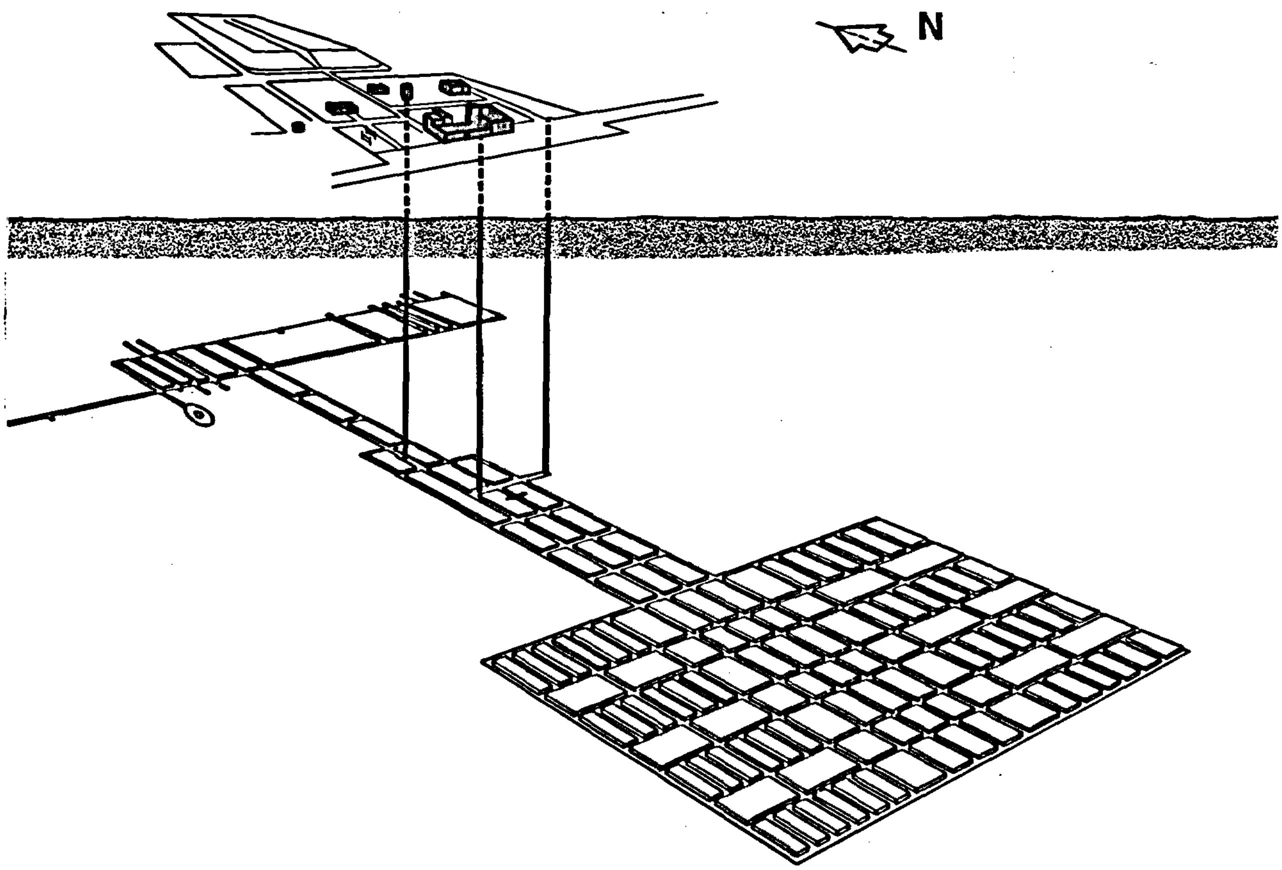
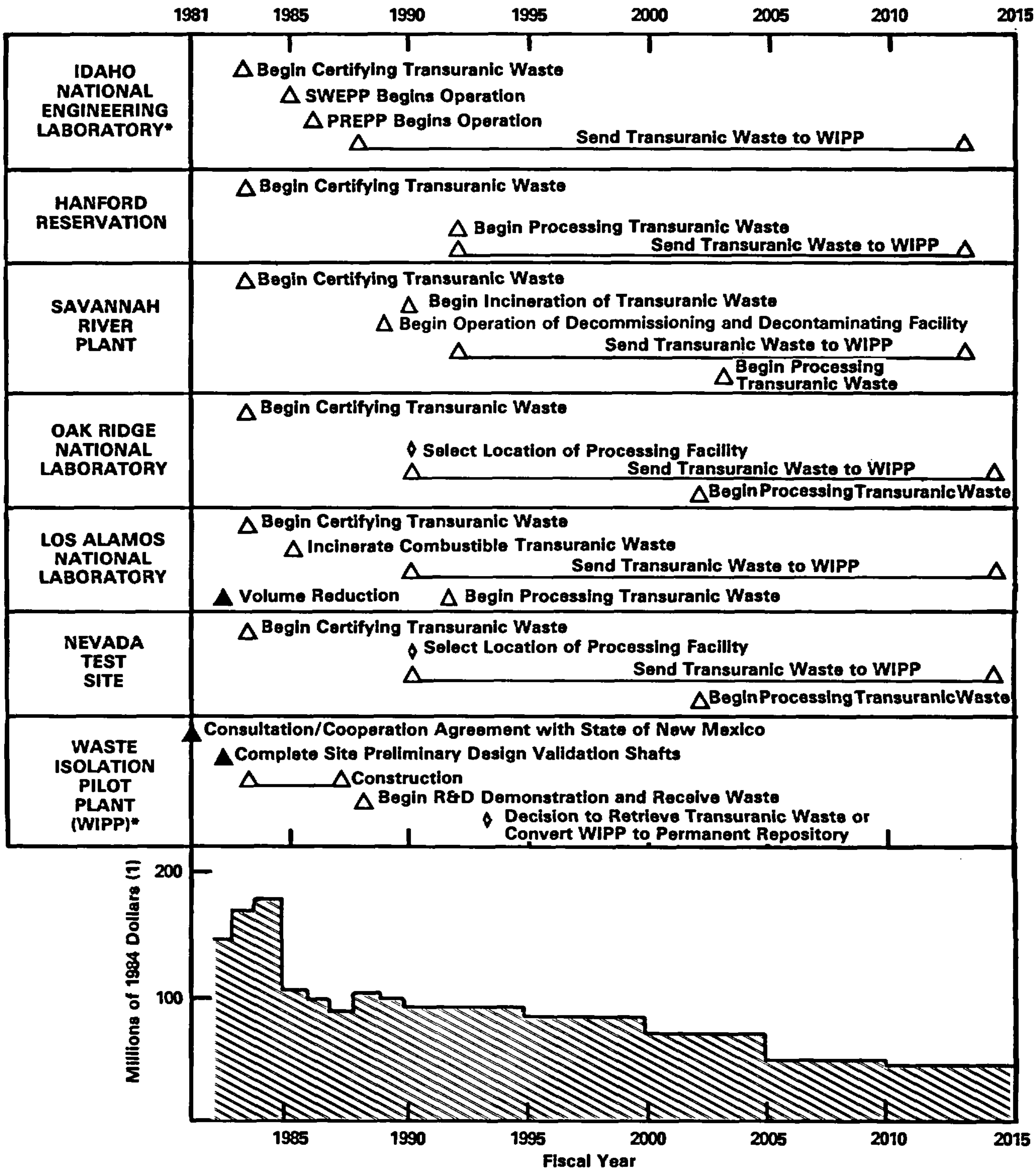


FIGURE E-5
ARTIST PERSPECTIVE OF THE WASTE ISOLATION PILOT PLANT



(1) Includes Cost for Transport and Disposal in WIPP.

△ Milestone

▲ Completed Milestones

◊ Decision

* The NEPA Process for Shipment of Stored INEL Transuranic Waste to the WIPP has been Completed.

FIGURE E-6
MAJOR MILESTONES AND COSTS FOR PERMANENT DISPOSAL OF DEFENSE TRANSURANIC WASTE

(1) Includes Costs for Transport to and Disposal in Geologic Repository and WIPP.

▬ Estimated Annual Savings in Interim Operation Program Costs Due to Activities Shown in this Plan.

FIGURE E-7
TOTAL COST OF DEFENSE LONG-TERM HIGH-LEVEL AND TRANSURANIC WASTE MANAGEMENT

1.0 INTRODUCTION

The Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1982 (P.L. 97-90) states that:

The President shall submit to the Committees on Armed Services of the Senate and of the House of Representatives not later than June 30, 1983, a report which sets forth his plans for the permanent disposal of high-level and transuranic wastes resulting from atomic energy defense activities.

Such report shall include, but not be limited to, for each State in which such wastes are stored in interim storage facilities on the date of enactment of this Act:

- *specific estimates of amounts planned for expenditure in each of the next five fiscal years to achieve the permanent disposal of such wastes and general estimates of amounts planned for expenditures in fiscal years thereafter to achieve such purpose; and*

- *a thorough and detailed program management plan for the disposal of such wastes, including but not limited to:*

  — *an explicit schedule for decisions regarding the further processing and permanent disposal of such wastes;*

  — *a general description of new facilities likely to be required to achieve such permanent disposal; and*

  — *identification of all major program objectives, milestones, key events, and critical path items.*

This document describes a workable approach for the permanent disposal of high-level and transuranic waste from atomic energy defense activities. This plan does not address the disposal of "suspect" waste which has been conservatively considered to be high-level or transuranic waste but which can be shown to be low-level waste. This material will be processed and disposed of in accordance with low-level waste practices.

The primary goal of this program is to utilize or dispose of high-level and transuranic waste routinely, safely, and effectively. This goal will include the disposal of the backlog of stored defense waste. A "Reference Plan" for each of the sites describes the sequence of steps leading to permanent disposal. Final decisions will be made after the careful evaluation of alternatives once sufficient experience from operations at "lead" sites has been acquired.

No technological breakthroughs are required to implement the reference plan. Not all final decisions concerning the activities described in this document have been made. These decisions will depend on: completion of the process required by the National Environmental Policy Act of 1969 (NEPA), authorization and appropriation of funds, agreements with states as appropriate, and in some cases, the results of pilot plant experiments and operational experience. NEPA-related milestones, where major documentation has been completed or is in preparation, are specifically mentioned in Chapters 4 and 5.

2.0 MANAGEMENT OF DEFENSE NUCLEAR WASTE

2.1 Federal Government - Executive Branch

The Executive Office of the President and several Departments, agencies, and offices have roles in the disposal of defense wastes. The relationship among them is shown on Figure 2-1. The Department of Energy (DOE) has the lead role and is responsible for developing radioactive waste disposal technologies and for designing, constructing, and operating storage and disposal facilities for its wastes. DOE is cooperating with other agencies including the Department of the Interior (DOI) and the Department of Transportation (DOT), which manage the public lands and develop and enforce transportation regulations, respectively. Within the Executive Office of the President, the Office of Management and Budget (OMB), the National Security Council (NSC), the Office of Science and Technology Policy (OSTP), and the Council on Environmental Quality (CEQ) provide, respectively, oversight of funding and management, national security policy, federal science policy, and guidance on the National Environmental Policy Act.

The Environmental Protection Agency (EPA) sets generally applicable environmental radiation standards for radioactive waste. Although DOE atomic energy defense activities are not under the jurisdiction of the Nuclear Regulatory Commission (NRC), repositories for high-level waste are regulated by NRC under Section 202 of the Energy Reorganization Act of 1974 and the Nuclear Waste Policy Act of 1982.

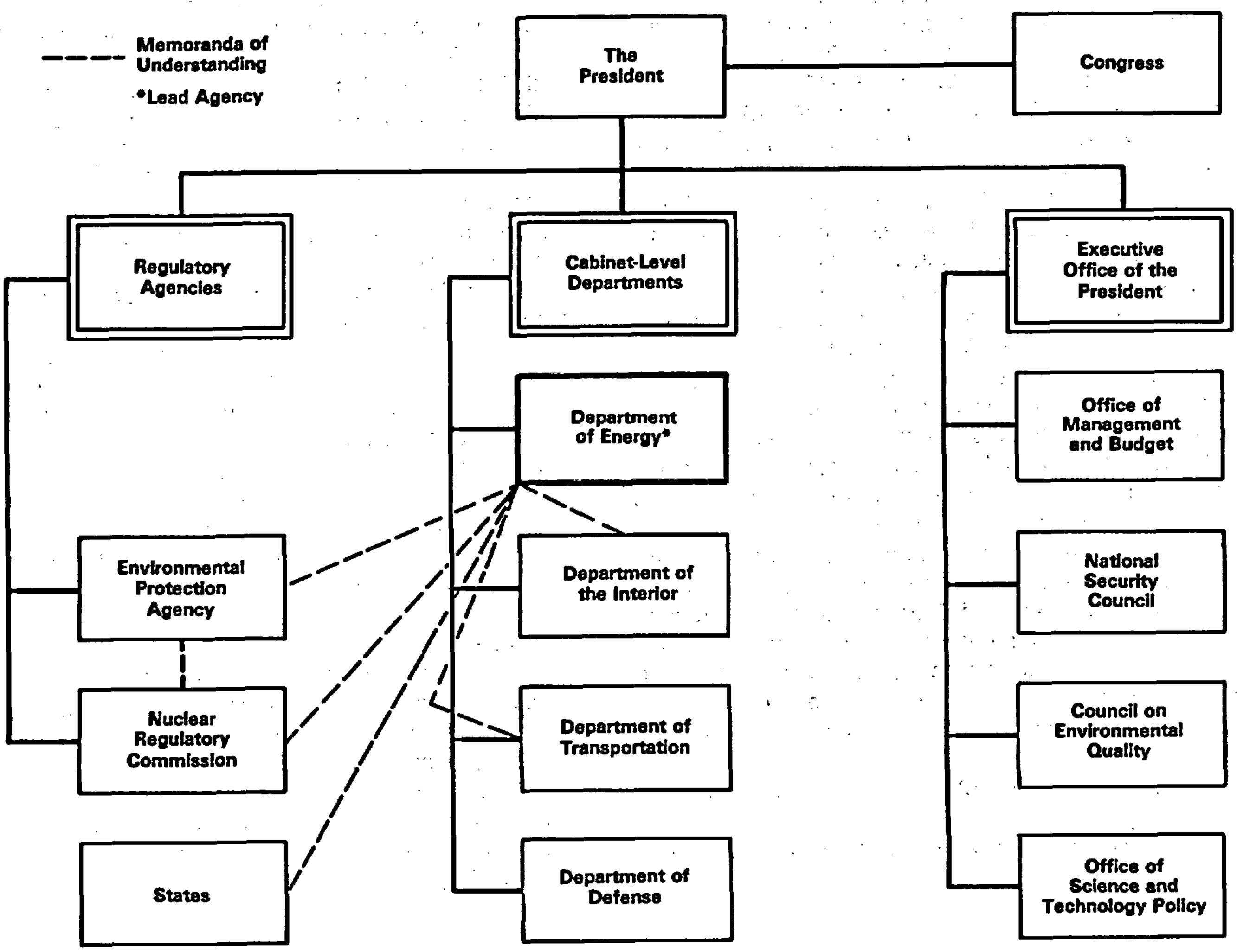


FIGURE 2-1

THE MANAGEMENT OF DEFENSE WASTE: WASTES FROM ATOMIC ENERGY DEFENSE ACTIVITIES ARE MANAGED BY DOE, WORKING WITH OTHER AGENCIES AND THE STATES, UNDER THE OVERSIGHT OF THE EXECUTIVE OFFICE OF THE PRESIDENT.

2.2 Legislation

The following statutes impact the management of defense wastes:

- Atomic Energy Acts of 1946 and 1954 (as amended)
- Energy Reorganization Act of 1974
- Department of Energy Organization Act of 1977
- National Energy Act of 1978
- Department of Energy National Security and Military Applications of Nuclear Energy Authorization Acts
- Federal Land Policy and Management Act of 1976
- Nuclear Waste Policy Act of 1982

The first two of these laws define the roles and responsibilities of various agencies as previously discussed.

Environmental protection is also addressed by the Clean Air Act, Clean Water Act, and the National Environmental Policy Act among others. Under Executive Order 12088, federal agencies will take actions to prevent, abate, and control environmental pollution from federal facilities under their purview. The EPA* has *proposed* environmental radiation protection standards for Management and Disposal of Spent Nuclear Fuel, High-level and Transuranic Radioactive Waste (40 CFR Part 191, 47 Federal Register 58196 (December 29, 1982)). It is DOE's intent to comply with applicable standards when they are finalized.

The Federal Land Policy and Management Act of 1976 defines the policy toward U.S. government lands and allows multiple use of those lands. For example, a land withdrawal of over 5,000 acres for a repository site with a single use would require Congressional approval.

The Nuclear Waste Policy Act of 1982 (P.L. 97-425) directs the President to evaluate, within two years after the enactment of the legislation (7 January 1983), the use of commercial waste disposal capacity for defense high-level waste. The evaluation will consider cost efficiency, health and safety, regulatory, transportation, public acceptability, and national security factors. Unless the evaluation concludes that national security or other considerations necessitate a dedicated defense waste repository, the Secretary of Energy is directed to proceed with arrangements for repository use for both defense and commercial waste. A defense waste repository would comply with all applicable provisions of this Act. The legislation also provides for State and Indian tribe participation in the development of such repositories.

Congress oversees defense waste activities through annual authorization and appropriations and through oversight hearings. The Armed Services and Appropriations Committees in the Senate and in the House of Representatives review defense waste programs at least annually.

*Under authorities established by the Atomic Energy Act and Reorganization Plan No. 3 of 1970.

2.3 Management by DOE

The Assistant Secretary for Defense Programs at DOE Headquarters is responsible for the management of defense wastes. The implementation of technical and operational programs and projects is decentralized to field offices. For example, technology development and planning for high-level waste (HLW) is assigned to the Savannah River Operations Office (SR), and for transuranic waste to the Albuquerque Operations Office (AL). DOE's operations offices also oversee the national laboratories, industry, and universities which conduct research and development. Headquarters is responsible for the development of plans, budgets, and priorities for program implementation and for the overview of program execution in the field, including safety and quality assurance.

The major program elements are:

Interim Waste Operations. This program covers the management of all defense high-level and transuranic waste including the construction, operation, and maintenance of storage facilities. It also involves decommissioning and decontamination of surplus facilities, the operation and maintenance of low-level waste (LLW) burial grounds at DOE sites and certain basic site support responsibilities (called the "landlord function") at the Hanford and Idaho National Engineering Laboratory (INEL) sites. Finally, the Department's traffic management function is assigned to this program.

Long-Term Waste Management Technology. This program covers the development of technologies for the disposal of Defense wastes including such projects as the Defense Waste Processing Facility. It includes the evaluation of risks, costs, and environmental impacts of alternative management strategies. Technology for packaging is developed and packages are tested to ensure the safety, efficiency, and cost-effectiveness of transportation and disposal. Beneficial applications of radioactive byproducts from defense waste are developed and demonstrated. Technical approaches to recover and use valuable materials in waste for recycle are developed where appropriate and cost-effective.

System integration studies, ranging from analysis of specific issues to long-range master planning, are conducted to assure compatibility among schedules, facilities and equipment, and to anticipate requirements.

Terminal Disposal. This program covers the Waste Isolation Pilot Plant (WIPP), a research and development facility to demonstrate the safe disposal of defense wastes (Section 5.9).

3.0 DEFENSE NUCLEAR MATERIAL PRODUCTION AND WASTE GENERATION

The flow of materials and waste from atomic energy defense activities addressed in P.L. 97-90 is illustrated in Figure 3-1. Spent nuclear fuel and other irradiated material from defense production reactors, test reactors, and naval nuclear propulsion units is reprocessed to recover uranium, plutonium and tritium. Reprocessing, weapons production, research and development, and testing, and other activities generate high-level and transuranic wastes. The interim storage of increasing volumes of these wastes requires increasing expenditures for surveillance and control. With the technology in hand, it is now timely to begin disposal of these wastes permanently, safely, and cost-effectively.

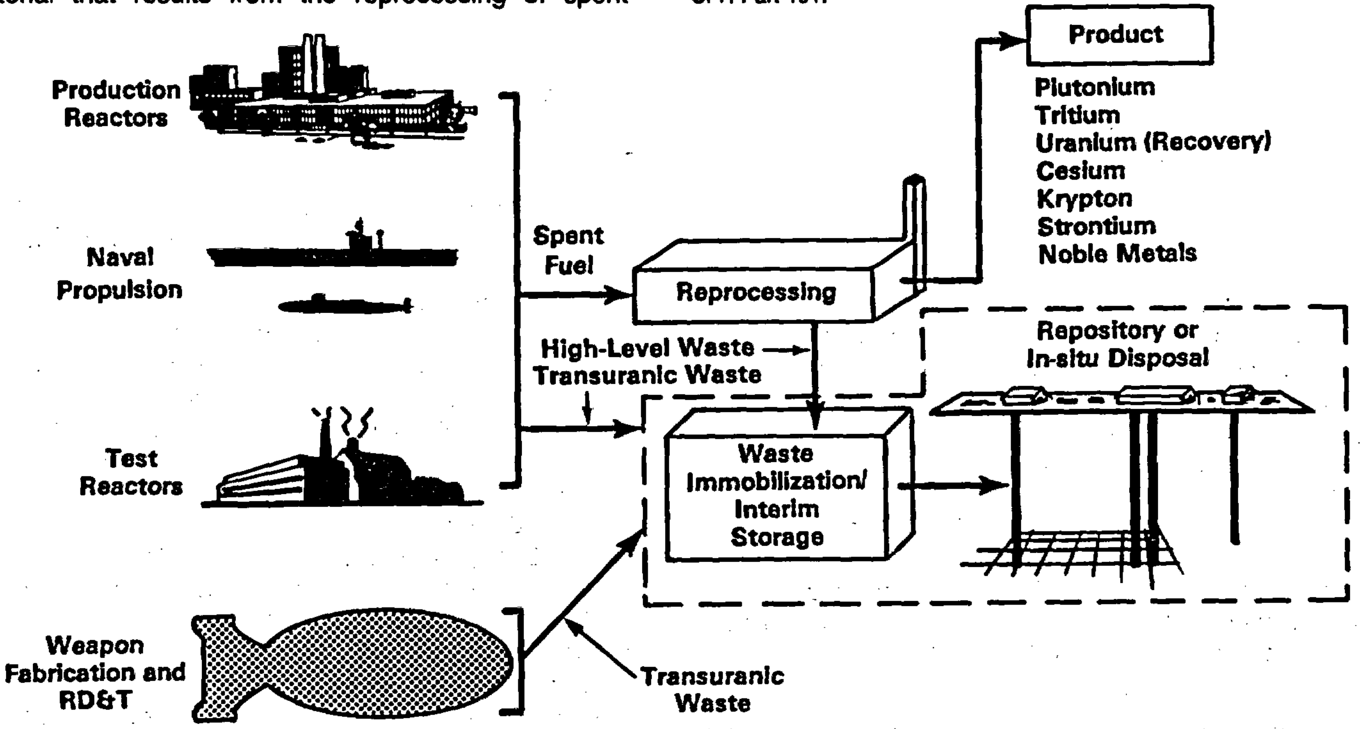
This section briefly describes defense high-level and transuranic wastes. The plans for their disposal are described in sections 4 and 5.

3.1 High-Level Waste (HLW)

High-level waste* is 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 transuranic (TRU) waste and fission products in concentrations as to require permanent isolation. Such waste is stored at the Savannah River Plant and the Idaho National Engineering Laboratory (INEL) where fuel processing continues, and at the Hanford Reservation where fuel processing was suspended in 1972 but will resume by 1984.

High-level waste emerges from fuel processing as an acidic, highly radioactive, and heat-producing liquid. At INEL this material is transformed directly to a dry granular solid (calcine). At the Savannah River Plant and Hanford Reservation, the acidic waste is neutralized, dehydrated, then stored as damp crystalline salt, sludge, and "supernate" liquid. Radioactive cesium and strontium have been separated from high-heat producing waste at the Hanford Reservation and are being encapsulated (Table 3-1).

*As defined in DOE Order 5820 and consistent with the proposed 40 CFR Part 191.



Note: The plan covers the outlined portion of the diagram.

FIGURE 3-1

ATOMIC ENERGY DEFENSE ACTIVITIES. IRRADIATED FUELS FROM PRODUCTION, TEST AND NAVAL REACTORS ARE REPROCESSED TO SEPARATE PRODUCTS. THE WASTE FROM THESE ACTIVITIES AS WELL AS FROM WEAPON FABRICATION AND RESEARCH/DEVELOPMENT AND TESTING IS PROCESSED AND DISPOSED OR STORED PENDING DISPOSAL.

TABLE 3-1

COMPOSITION OF STORED HIGH-LEVEL WASTE AND SEPARATED BYPRODUCTS

HANFORD RESERVATION AND SAVANNAH RIVER PLANT

- *Alkaline Liquid*

  A solution of primarily sodium and aluminum salts that remains when liquid effluents from the reprocessing plant are neutralized and sludge precipitates. Most of the radioactive Cesium (Cs-137) is in the alkaline liquid.

- *Sludge*

  This solid forms when liquids are neutralized. It consists primarily of oxides and hydroxides of manganese, iron, and aluminum. Virtually all radionuclides, except Cesium (Cs-137), are predomi nantly or exclusively in the sludge.

- *Salt Cake*

  A damp (1/4 liquid) crystalline salt that results from the evaporation of water from the alkaline liquid.

- *Separated Byproducts*

  Radioactive cesium and strontium are separated and stored as byproducts (Hanford only). They are doubly encapsulated as strontium fluoride and cesium chloride, and stored in a water basin pending beneficial use.

IDAHO NATIONAL ENGINEERING LABORATORY

- *Acidic Liquid*

  The chemical composition depends upon the type of fuel processed. The most prevalent liquid contains aluminum and zirconium fluorides and nitrates in nitric and hydrofluoric acid. Principal radionuclides are the fission products such as Strontium (Sr-90) and Cesium (Cs-137), and transuranium elements.

- *Solid Calcine*

  A dry powder derived from acidic liquids which consists predominantly of aluminum oxide, zirconium oxide, and calcium fluoride. It contains the same radionuclides as the acidic liquid.

Approximately 13 percent of the radioactivity in high-level waste in this country originated from atomic energy defense activities and is addressed in this plan. Most of the remainder is contained in commercial spent nuclear fuel. By 2000, the radioactivity in defense high-level waste will be 4 percent of the total. By volume, defense high-level waste is 98 percent of the total inventory because it is more dilute and older than average commercial spent nuclear fuel. By 2000, defense waste will be 92 percent of the total volume. The volume and radioactivity of high-level waste at the three DOE sites accumulated through 1982 are shown in Figure 3-2.

New and readily retrievable high-level waste will be placed in engineered waste packages in a mined geologic repository. Other high-level waste will be stabilized in place if, after the requisite environmental documentation, it is determined that the short-term risks and costs of retrieval and transportation outweigh the environmental benefits of disposal in a geologic mined repository.

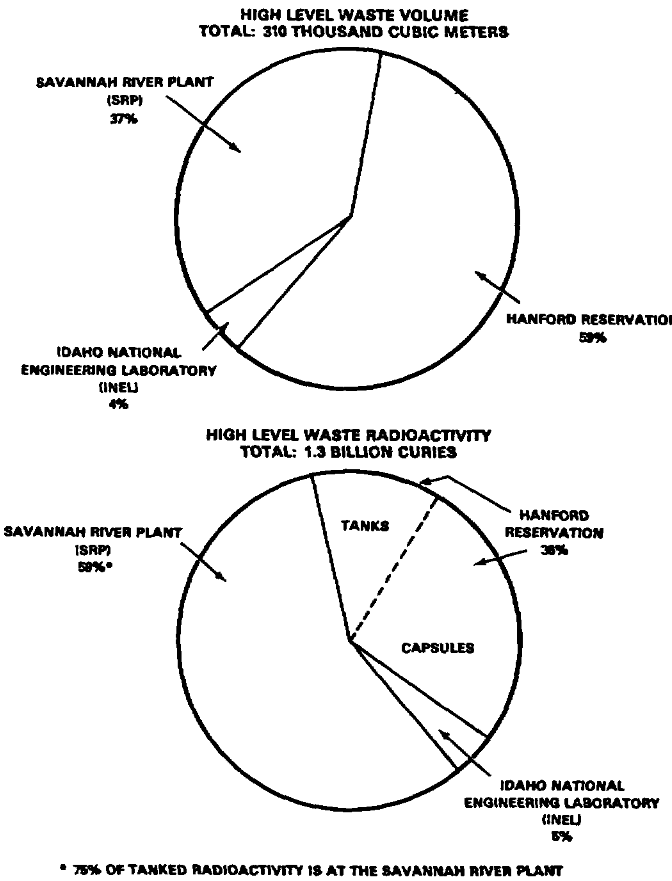


FIGURE 3-2

VOLUME AND RADIOACTIVITY OF HIGH-LEVEL WASTE ACCUMULATED THROUGH 1981

3.2 Transuranic (TRU) Waste

"TRU" waste is defined* as radioactive waste that, without regard to source or form, 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 nanocuries per gram. Typical forms include metal, glassware, process equipment, soil, and laboratory waste such as ion exchange resins, filters, clothing, and paper products.

Before 1970, transuranic contaminated solid waste was not distinguished from other low-level solid waste and was disposed of by shallow land burial. The U.S. Atomic Energy Commission then declared that TRU waste must be stored retrievably in packages designed to last 20 years or more, pending decisions on its permanent disposal.

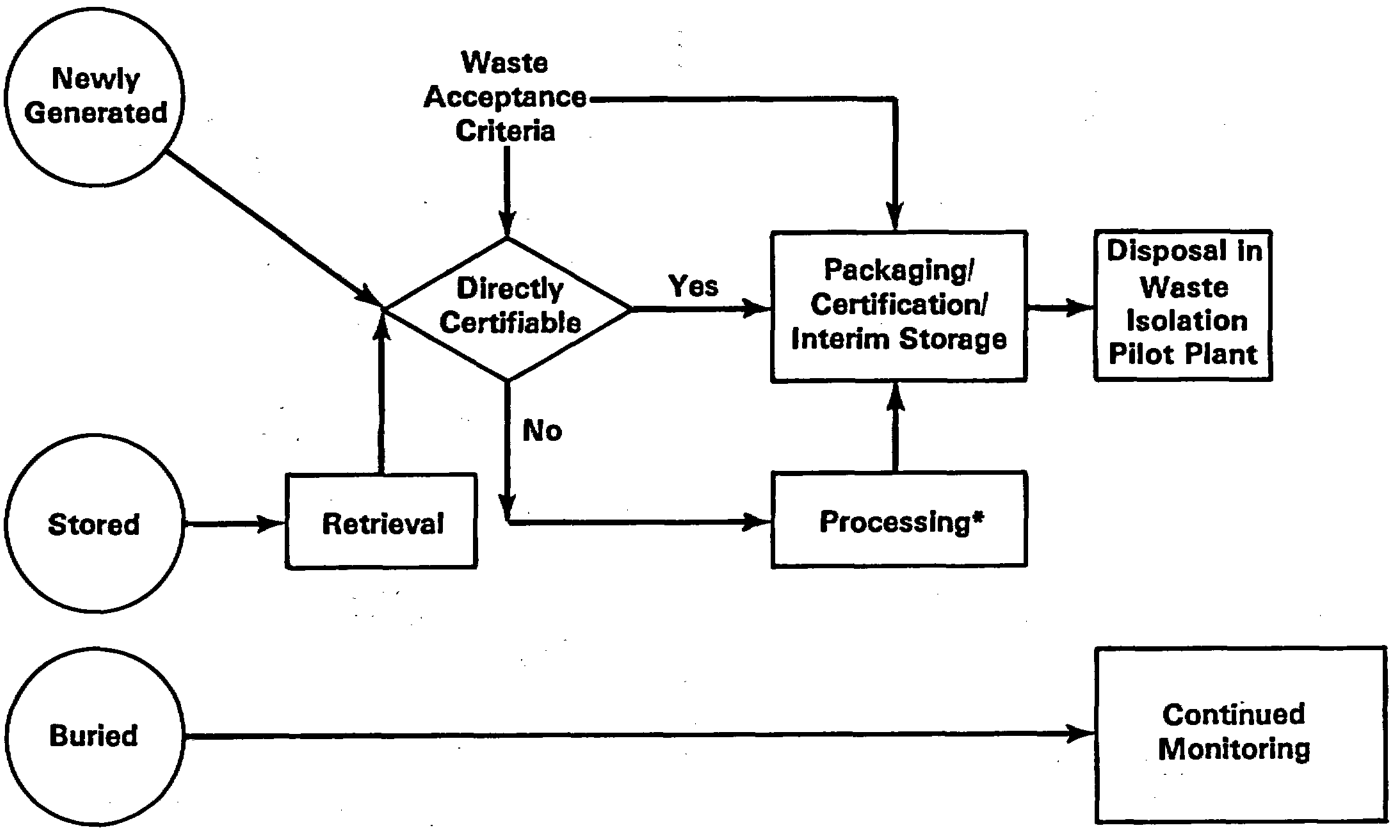
Buried, stored, and newly generated TRU wastes require and permit different management approaches. Newly generated and readily retrievable TRU waste are destined for geologic disposal. Other TRU waste may be stabilized and monitored in-place if, after the requisite

*As defined in DOE Order 5820 and consistent with the proposed 40 CFR Part 191. Until 1982, the TRU waste definition was 10 nanocuries or more per gram of material.

environmental documentation, it is determined that the short-term risks and costs of retrieval and transportation outweigh the environmental benefits of disposal in a geologic mined repository.

The steps in the disposal of TRU waste are summarized in Figure 3-3. All newly generated and stored TRU waste will be certified in compliance with Waste Isolation Pilot Plant (WIPP) criteria, after processing if necessary, and emplaced in the WIPP if that facility becomes a repository after a successful retrievable phase. The NEPA process for so emplacing stored INEL TRU waste has been completed. The WIPP waste acceptance criteria determine whether a waste package can be certified, and if not, what processing may be necessary. For example, processing might improve safety through measures to prevent dispersal of particulates in handling, to remove free liquids, to control gas generation, or to stabilize chemically hazardous materials.

Volume and radioactivity of retrievably stored transuranic waste accumulated through 1982 are shown in Figure 3-4.



*Remote handled processed at a single site.

FIGURE 3-3

TRANSURANIC WASTE STRATEGY: TRU WASTE WILL BE CERTIFIED FOR TRANSPORT AND DISPOSAL IF IT MEETS THE CRITERIA. THE REMAINING VOLUME WILL BE PROCESSED AS REQUIRED. BURIED WASTE WILL CONTINUE TO BE MONITORED.

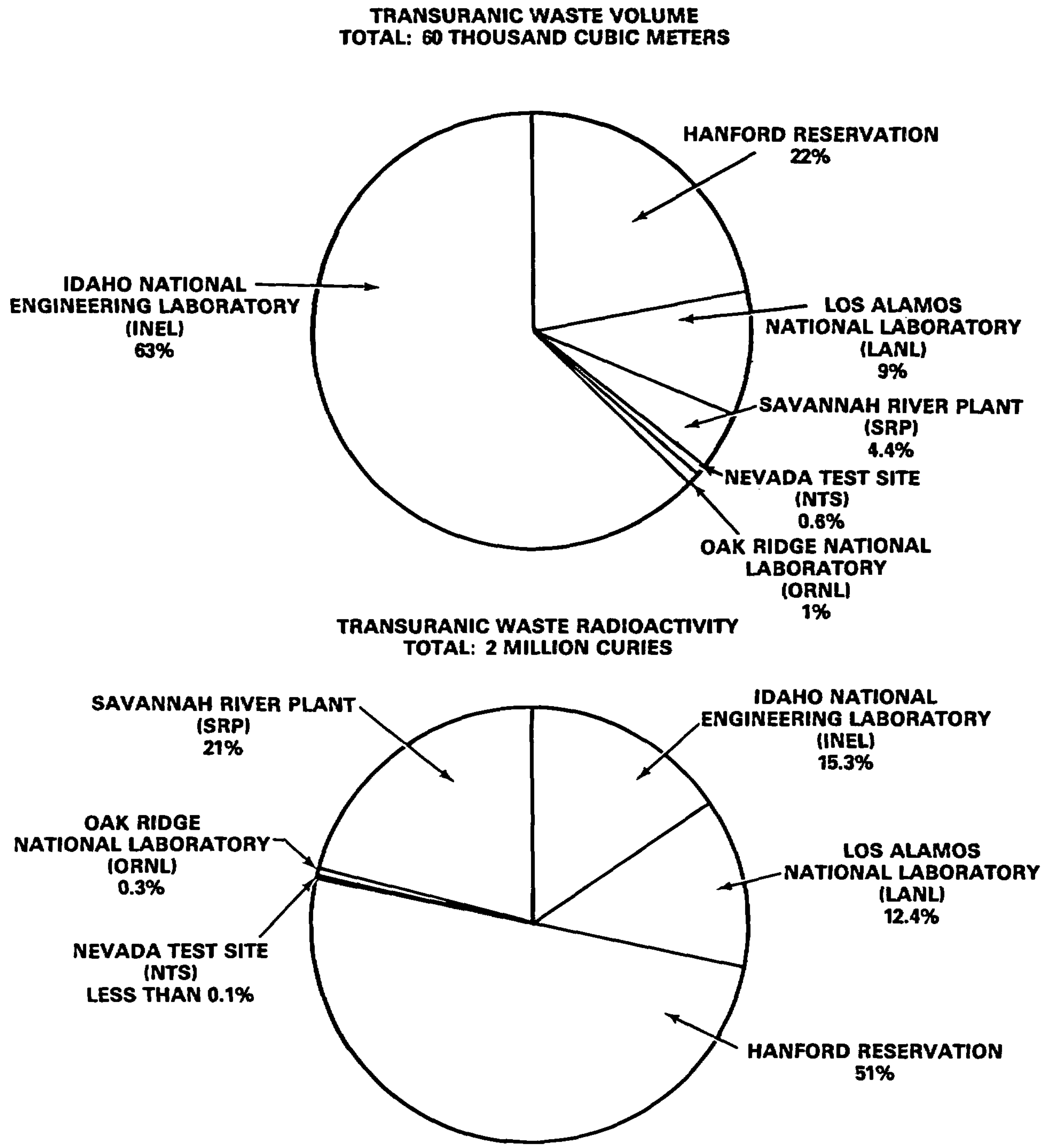


FIGURE 3-4

ESTIMATED VOLUME AND RADIOACTIVITY OF RETRIEVABLY STORED DEFENSE TRANSURANIC WASTE ACCUMULATED THROUGH 1982

4.0 PLANS FOR PERMANENT DISPOSAL OF HIGH-LEVEL WASTE

4.1 Introduction

The objective is to end interim storage and to achieve permanent disposal by immobilizing and preparing high-level waste for shipment to a geologic repository. The orderly transition to permanent disposal at the three DOE sites (Figure 4-1) will proceed sequentially. This approach permits the applicable operating experience gained at the first site to be applied to the other sites thereby achieving the more efficient use of resources including funding.

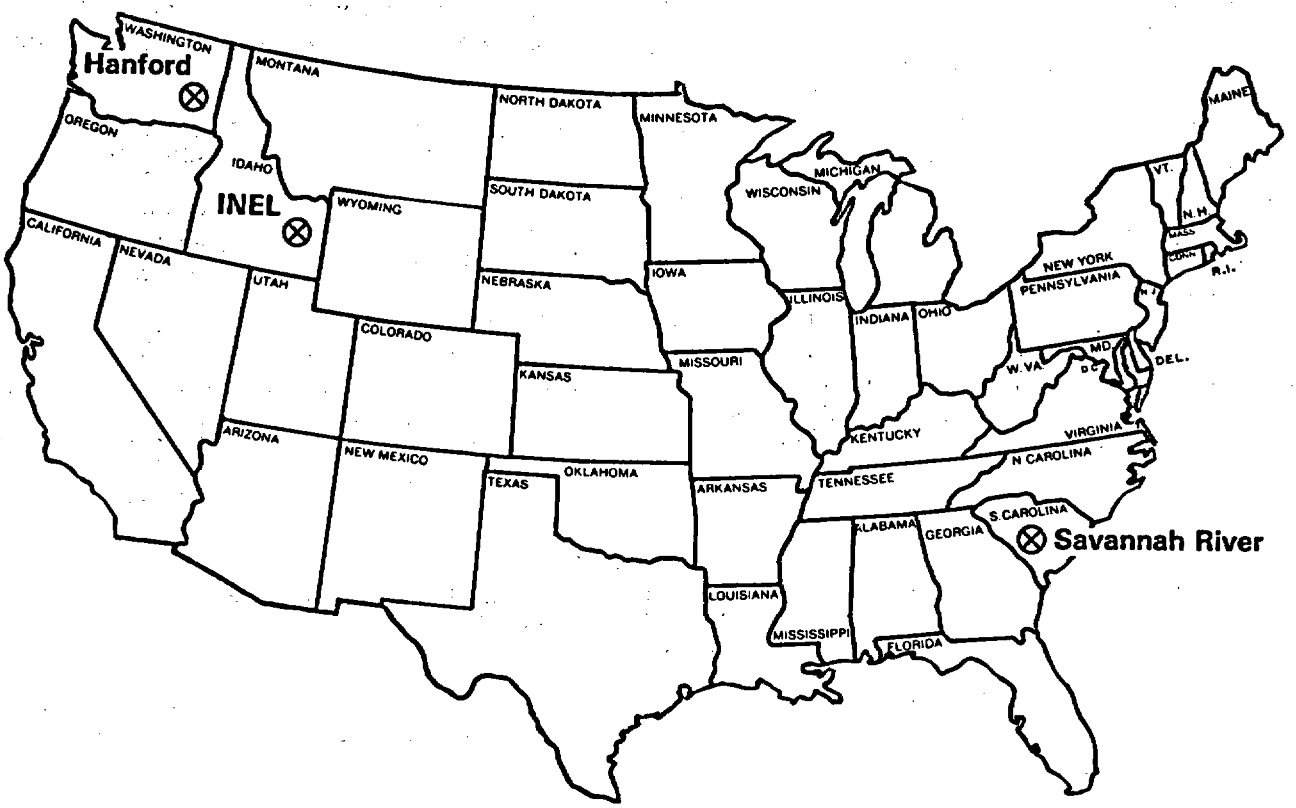


FIGURE 4-1
HIGH-LEVEL WASTE STORAGE SITES

Valuable byproduct materials will be separated from the waste for beneficial use in military and civilian applications where separation is economical and safe. New and readily retrievable old high-level waste will be processed for disposal in a geologic repository. Other waste will be stabilized in place if, after the requisite environmental documentation, it is determined that the short-term risks and costs of retrieval and transportation outweigh the environmental benefits of disposal in a geologic mined repository.

Processing for disposal will begin at the Savannah River Plant before the other sites because its tanks contain 59 percent of the radioactivity in DOE's high-level waste inventory (75 percent of the activity in tanks); it is in a wet climate; and it has a high ground water table. Hanford's high-level waste tanks are isolated from the water table and most contain much less radioactivity than tanks at the Savannah River Plant. Idaho will be third in the sequence because its solid calcine waste can be adequately and safely stored in its stainless steel underground bins for up to several hundred years.

Specific plans for permanent disposal of high-level waste at the three sites are described below. Present and projected inventories of high-level waste are shown in Appendix B.

4.2 Savannah River Plant

Since 1954, the plant has generated more than 265,000 cubic meters of high-level liquid waste and it continues to generate between 5,700 and 7,600 cubic meters per year. The volume is being reduced by more than 60 percent through evaporation. The waste is stored in tanks underground with capacities from 2,800 to 4,900 cubic meters. From 1966 to 1982, DOE has constructed 27 high-integrity, double-shell storage tanks to replace the 23 older tanks, and to store new waste. The new tanks have a combined capacity of 132,000 cubic meters. High-Level waste will be transferred from the older tanks to the new tanks or to the Defense Waste Processing Facility (DWPF), the first production scale vitrification plant.

High-level waste from this site is readily retrievable and will be sent off-site for disposal in a geologic repository. It is therefore planned to fully remove the waste from tanks, immobilize it, and dispose of it in an off-site geologic repository. Borosilicate glass was selected as the waste form in 1983.

The high-level waste sludge, which contains most of the radionuclides and virtually all the long-lived activity, will be separated and treated for removal of aluminum salts, mercury, and noble metals and immobilized in the Defense Waste Processing Facility. The immobilized HLW will be stored on site until a repository becomes available. Some of it will be used for tests in R&D facilities such as the Waste Isolation Pilot Plant.

Mercury and noble metals will be recovered for recycle or beneficial use. The salts and the alkaline liquids will be decontaminated by removal of cesium and treated as a chemical waste due to the high concentration of nitrate. The cesium could be available for beneficial use.

Figure 4-2 shows the reference plan for the disposal of high-level waste at the Savannah River Plant. The schedules for decisions and key events are shown in Table 4-1 and the costs in Table 4-2. A description of the Defense Waste Processing Facility is given below.

Defense Waste Processing Facility (DWPF). This facility will process about 1,250 cubic meters of sludge/water slurry to produce approximately 500 canisters of borosilicate glass per year. This waste form, as part of the waste package, is capable of meeting proposed repository acceptance criteria. It can accommodate many waste compositions and is suitable for large scale production operations. A passive, air-cooled vault will house the immobilized waste pending transportation to a geologic repository. The sludge inventory will be reduced to a normal operational level within approximately 15 years.

TABLE 4-1

DECISIONS AND KEY EVENTS FOR SAVANNAH RIVER PLANT HIGH-LEVEL WASTE MANAGEMENT

EVENTS	*FISCAL YEAR*
Select final waste form for high-level waste	1983
Begin construction of Defense Waste Processing Facility	1984*
Begin salt decontamination	1989
Begin operation of Defense Waste Processing Facility	1989*
Begin experiments in off-site R&D disposal facility	1990
Begin shipments of immobilized high-level waste to geologic repository	1998*

*Critical path items.

TABLE 4-2

ESTIMATED ANNUAL COST FOR LONG-TERM HIGH-LEVEL WASTE MANAGEMENT AT SAVANNAH RIVER PLANT*

(millions of dollars)

	Prior Year Constr.[1]	*Current Year*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991-1995***	*1996-2000*	*2001-2005*	*2006-2010*	*2011-2015*	*TOTAL*
DEFENSE WASTE PROCESSING FACILITY															
Total Estimated Cost (TEC)[2]	20.0	40.0	142.0	236.3 (258.0)	218.5 (260.0)	103.9 (135.0)	39.0 (55.0)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	799.6 (910.0)
Total Project Cost	156.3	59.8	173.3	274.3 (299.5)	252.3 (300.3)	141.9 (184.5)	83.6 (117.8)	38.3 (58.9)	0.0	0.0	0.0	0.0	0.0	0.0	1,179.7 (1,350.4)
THREE STORAGE MODULES															
Total Project Cost		0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.0	17.4	0.0	0.0	0.0	0.0	105.0
SALT DISPOSAL															
Total Project Cost		0.0	0.0	9.0 (10.0)	12.4 (15.0)	3.8 (5.0)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.2 (30.0)
TREATMENT OPERATIONS FOR DISPOSAL[3]															
Operating Costs		0.0	0.0	0.0	2.5	4.5	8.9	36.0	62.1	52.8	52.8	52.8	52.8	52.8	1,434.0
TOTAL		59.8	173.3	283.3 (309.5)	267.2 (317.8)	150.2 (194.0)	92.5 (126.7)	74.3 (94.9)	80.1	70.2	52.8	52.8	52.8	52.8	2,744.3 (2,919.4)

[1]Prior year construction only includes costs for construction and general plant projects initiated prior to 1983.
[2]Construction line item.
[3]Treatment operations for disposal costs include labor and overhead, equipment replacement (a new glass melter is planned every two years), supplies, and storage.
*Parenthesized costs are shown in year of expenditure dollars for construction projects started prior to 1988. Costs outside of parenthesis are in 1984 dollars. Costs before 1984 are in actual dollars spent.
**Average Yearly Costs from 1991 to 2015 are shown in five-year intervals.

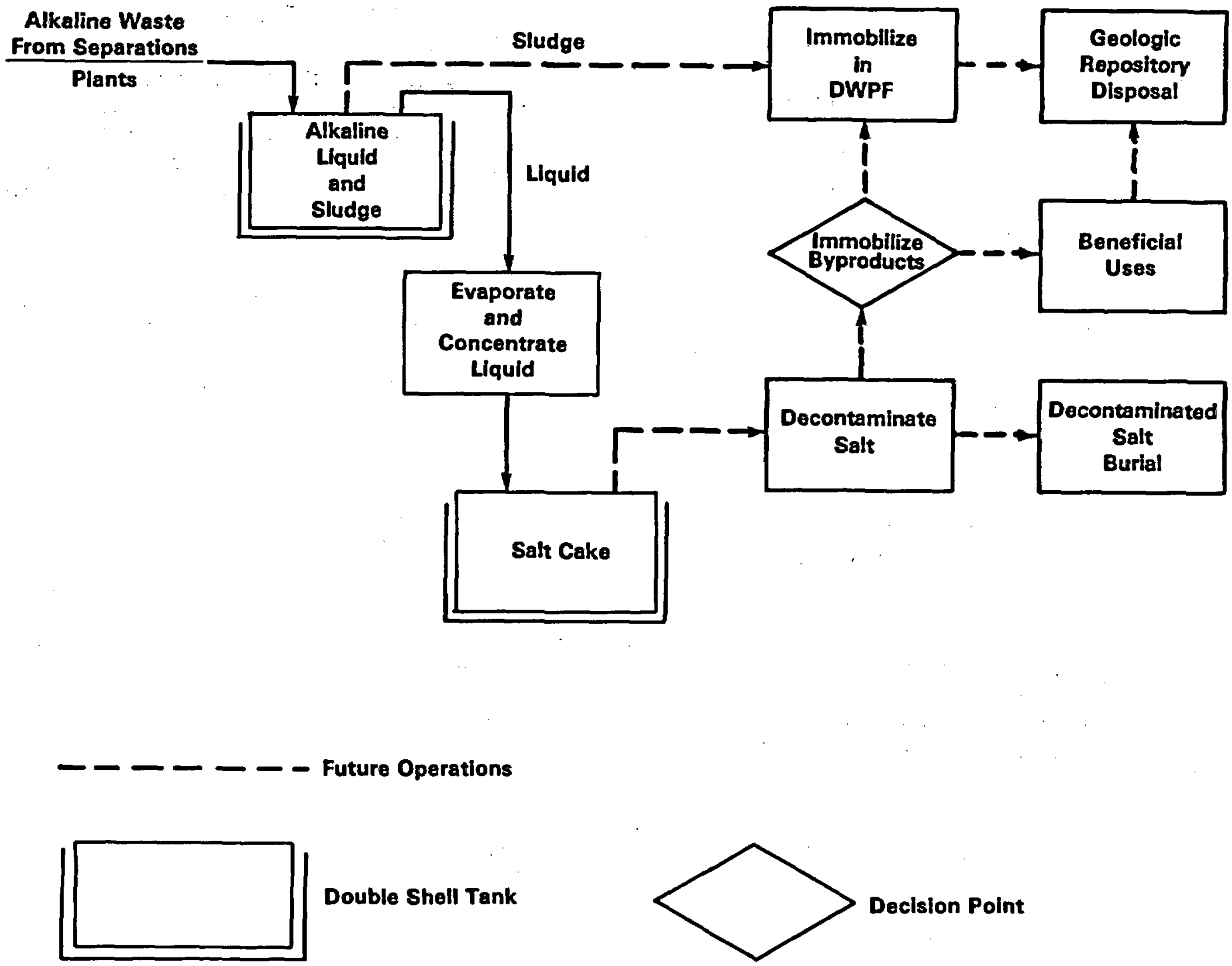


FIGURE 4-2
REFERENCE PLAN FOR SAVANNAH RIVER PLANT HIGH-LEVEL WASTE DISPOSAL

The sludge will be mixed with a borosilicate glass frit and the slurry fed to a melter. The vitrified waste will be poured into canisters with capacities of about 0.62 cubic meters. Filled canisters will be cooled, decontaminated, plugged, welded, and transferred to vaults in a shielded, air-cooled building which will hold 1,000 canisters (two years' production).

The capacity for temporary storage of canisters can be expanded by constructing additional building modules. Each module would contain 2 years' production of canisters. For example, if the first shipments to a geologic repository were made in 1998, four modules of storage capacity would be required.

Construction of the facility is expected to begin in 1984 and operation in 1989. Annual funding requirements for the construction and operation of the DWPF, additional storage modules and salt disposal are presented in Table 4-2.

4.3 Hanford Reservation

Between 1944 and 1972, Hanford atomic energy defense activities generated 397,000 cubic meters of high-level liquid waste. This volume was reduced to about 183,000 cubic meters of saltcake, sludge, liquids, and slurries and stored in 149 single-shell tanks and 20 new double-shell tanks. New waste, which will be generated by the PUREX process beginning in 1984, will be stored in double-shell tanks.

Most of the cesium and strontium was separated from the stored waste and is being converted to dry cesium chloride and strontium fluoride salts, sealed in double-wall metal capsules and stored in water basins pending use. Removal of these high activity byproducts has significantly reduced the potential hazard of the stored waste.

Most liquids have been pumped from the old tanks to prevent the possibility of leakage to surrounding soil.

When such leaks did occur in the past, the long-lived radioactive material of concern was fixed in place by the sorptive properties of the soil. This material did not migrate further than 16 meters from the tank in the worst case and is stable well above the water table. It will continue to be monitored to detect any migration.

New and readily retrievable high-level waste will be immobilized for disposal in a geologic repository. Other high-level waste will be stabilized in place if, after the requisite environmental documentation, it is determined that the short-term risks and costs of retrieval and transportation outweigh the environmental benefits of disposal in a geologic mined repository. Retrievable waste that requires repository disposal will be immobilized in glass. Figure 4-3 shows the reference plan for Hanford high-level waste disposal. The schedules for decisions and key events are shown in Table 4-3 and the costs in Table 4-4. A description of major activities and facilities follows.

Immobilization for Geologic Disposal. Waste that requires repository disposal will be stored pending immobilization. If practical, immobilization capabilities will be incorporated into existing facilities. The reference case is vitrification in an annex to an existing building (B Plant Immobilization Pilot Plant). This facility will process 114 cubic meters of PUREX sludge and produce 120 canisters of glass annually for disposal in a geologic repository. The costs for vitrification of Hanford Reservation waste are shown in Table 4-4.

New Storage Tank Facilities. Hanford's 20 double-shell tanks have capacities of 3,800 cubic meters each. Eighteen are in use and contain 33,000 cubic meters of waste. About 25,000 cubic meters of additional capacity will be used when all the liquids have

TABLE 4-3

DECISIONS AND KEY EVENTS FOR HANFORD RESERVATION HIGH-LEVEL WASTE MANAGEMENT

EVENT	*FISCAL YEAR*
Begin engineering for B Plant Immobilization Pilot Plant	1983
Complete environmental analysis on Hanford Defense Waste Strategy Alternatives	1984
Initiate in place stabilization of old tanks	1985
Complete encapsulation of existing inventory of cesium and strontium	1986
Begin construction of the B-Plant Immobilization Pilot Plant	1986*
Begin operation of the B Plant Immobilization Pilot Plant	1990*
Begin shipment of immobilized waste to a geologic repository	1998*
Complete in place stabilization of old tanks	2015*

*Critical path items.

TABLE 4-4

ESTIMATED ANNUAL COST FOR LONG-TERM HIGH-LEVEL WASTE MANAGEMENT AT HANFORD RESERVATION*
(millions of dollars)

	Prior Year Constr.[1]	*Current Year*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991-1995***	*1996-2000*	*2001-2005*	*2006-2010*	*2011-2015*	*TOTAL*
TANK FARM STABILIZATION															
Total Project Cost		0.0	0.0	0.6 (0.7)	2.3 (2.7)	11.3 (14.5)	24.3 (33.8)	30.2 (44.7)	44.2 (56.7)	17.9 (19.1)	1.6	0.0	0.0	0.0	210.6 (256.6)
GROUT FIXATION FACILITY															
Total Project Cost		0.0	0.0	0.0	0.0	2.3 (2.9)	4.6 (6.4)	23.0 (34.5)	23.0 (37.3)	0.0	0.0	0.0	0.0	0.0	52.9 (81.1)
BYPRODUCT FACILITIES															
Total Project Cost		0.0	0.0	0.0	1.7 (2.0)	8.1 (10.4)	10.4 (14.5)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.2 (26.8)
B PLANT IMMOBILIZATION PILOT PLANT															
Total Project Cost		5.1	11.5	19.0 (20.7)	38.0 (44.8)	40.0 (51.2)	39.6 (55.0)	25.0 (37.5)	0.0	0.0	0.0	0.0	0.0	0.0	178.2 (225.9)
PROGRAM GENERIC WASTE MANAGEMENT ACTIVITIES															
General Plant Projects		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	4.0	0.0	0.0	0.0	32.0
Equipment Cost		0.0	0.0	0.0	5.2	0.0	0.0	2.5	2.0	2.5	2.2	0.0	0.0	0.0	33.2
TREATMENT OPERATIONS FOR DISPOSAL[2]															
Operating Costs		8.2	10.0	10.3	12.7	15.2	11.8	14.6	20.2	45.3	63.8	27.1	14.7	14.7	930.9
TOTAL		13.3	21.5	29.9 (31.7)	59.9 (67.5)	76.9 (94.2)	90.7 (121.5)	95.3 (133.8)	89.4 (116.2)	68.1 (69.3)	71.6	27.1	14.7	14.7	1,458.0 (1,586.5)

[1]Prior year construction only includes costs for construction and general plant projects initiated prior to 1983.
[2]Treatment operations for disposal costs include labor and overhead, equipment replacement, supplies, and storage, but does not include separation of cesium and strontium.
*Parenthesized costs are shown in year of expenditure dollars for construction projects started prior to 1988. Costs shown outside of parenthesis are in 1984 dollars. Costs before 1984 are in actual dollars spent.
**Average Yearly Costs from 1991 to 2015 are shown in five-year intervals.

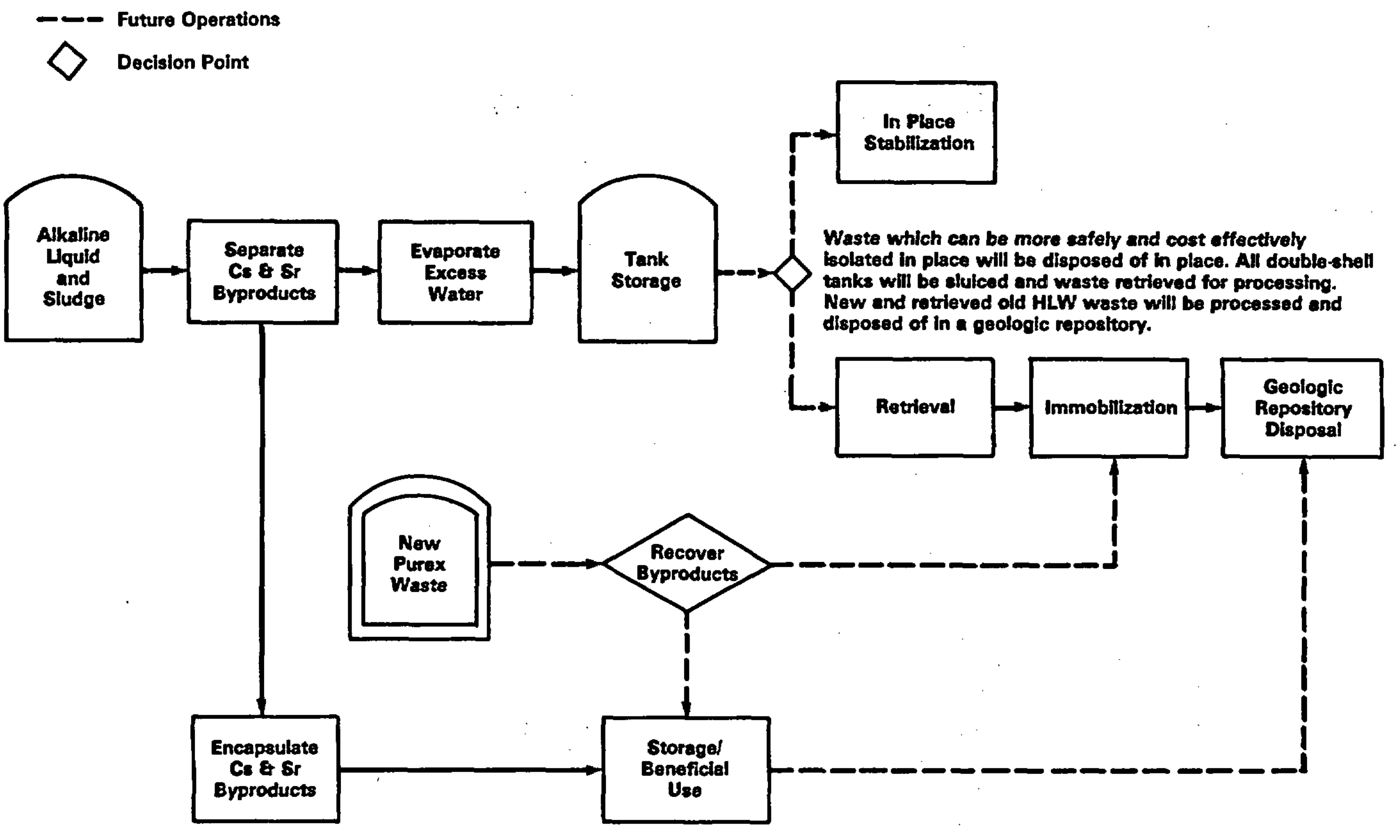


FIGURE 4-3
REFERENCE PLAN FOR HANFORD RESERVATION HIGH-LEVEL WASTE DISPOSAL

been recovered, concentrated, and transferred from single-shell tanks to the double-shell tanks. Eight new tanks, with capacities of 3,800 cubic meters each, will be required by 1988 to store 3,200 cubic meters of waste that will be generated annually after start-up of the PUREX facility and before operation of a waste immobilization facility begins. The cost for these facilities (except PUREX) is included in interim operations (Table 6-2).

Byproduct Recovery. Pending a decision on separation of new PUREX waste, *facilities for fractionation* and encapsulation of cesium and strontium will be upgraded as necessary. The cost for upgrading is included in the costs for interim operations (Table 6-2). When the encapsulation work is complete, the Waste Encapsulation and Storage Facility (WESF) will be modified to allow overpacking of excess capsules to permit dry storage pending future disposition. The costs for the facility modifications and for dry storage are shown in Table 4-4.

In-Place Stabilization. This process will encompass the in-place stabilization and isolation of waste in the single-shell tanks from which retrieval would not be warranted. Liquids will be removed, concentrated, and transferred to double-shell tanks. The single-shell tanks are isolated by disconnecting all pipelines and by sealing openings to prevent the inadvertent entry of liquids. The tank voids will be filled with cement-based grout to provide structural support for the tank dome, and an engineered barrier will be placed over the surface above the tank to prevent disturbance of the waste and enhance safety. These operations would occur between 1985 and 2015. Costs for a Grout Fixation Facility to stabilize the old tanks are shown in Table 4-4. Other costs for in-place stabilization of Hanford Reservation waste are included in Table 4-4 as part of Program Generic Waste Management Activities. Costs for retrieval of solid waste from the old tanks are not included. They will be determined on a case by case basis as necessary.

4.4 Idaho National Engineering Laboratory

This laboratory was established in 1949 near Idaho Falls, Idaho, as an experimental nuclear reactor test site. It includes the Idaho Chemical Processing Plant (ICPP) which recovers uranium from spent nuclear fuels generated by national defense programs. Since 1953, it has generated over 24,600 cubic meters of acidic high-level liquid waste.

In 1963, the plant began solidifying the waste by a "calcination" process, which essentially drives off gases and liquids. By December 1981, 13,200 cubic meters of liquid had been converted to about 2,200 cubic meters of dry calcine and stored in stainless steel bins which are encased in underground concrete vaults. The bins are expected to retain their integrity for at least 500 years. Three of five sets of bins are full. A sixth set is under construction and additional sets will be constructed as needed. Construction of an immobilization facility is planned for 1999. When it becomes operational, liquid and calcined waste will be immobilized for disposal in an off-site geologic repository. Approximately 500 canisters of immobilized waste will be produced annually from new waste operations, and the backlog of calcine will be immobilized as the plant capacity permits. No additional calcine will be produced.

Figure 4-4 shows the reference plan for INEL high-level waste disposal. The schedules for decisions and key events are shown in Table 4-5. The costs for construction and operation of facilities for the long-term management of INEL's high-level waste are presented in Table 4-6. The costs for construction of calcine storage facilities are included in the costs of interim operations (Table 6-2).

TABLE 4-5

DECISIONS AND KEY EVENTS FOR IDAHO NATIONAL ENGINEERING LABORATORY HIGH-LEVEL WASTE MANAGEMENT

EVENTS	*FISCAL YEAR*
New calcining facility started operation	1982
Begin design and construction of a waste immobilization facility	1999
Begin immobilization of waste	2008*
Begin shipping immobilized waste to a geologic repository	2008*

*Critical path items.

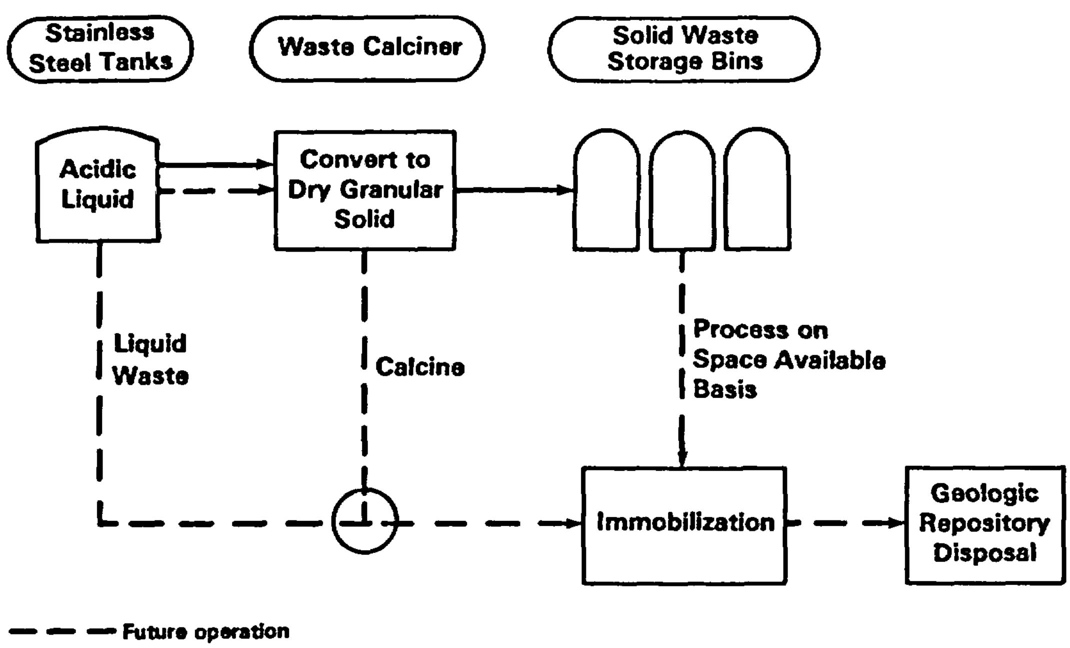


FIGURE 4-4

REFERENCE PLAN FOR IDAHO NATIONAL ENGINEERING LABORATORY HIGH-LEVEL WASTE DISPOSAL

TABLE 4-6

ESTIMATED ANNUAL COST FOR LONG-TERM HIGH-LEVEL WASTE MANAGEMENT AT IDAHO NATIONAL ENGINEERING LABORATORY
(millions of 1984 dollars)

	Prior Year Constr.[1]	*Current Year*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991-1995**	*1996-2000*	*2001-2005*	*2006-2010*	*2011-2015*	*TOTAL*
PILOT IMMOBILIZATION FACILITY															
Total Project Cost		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	1.8	0.0	0.0	0.0	39.0
WASTE IMMOBILIZATION FACILITY															
Total Project Cost		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	48.4	3.2	0.0	298.0
TREATMENT OPERATIONS[2] FOR DISPOSAL															
Operating Cost		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	4.2	0.0	34.0	34.0	386.0
TOTAL		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0	14.0	48.4	37.2	34.0	723.0

[1]Prior year construction only includes costs for construction and general plant projects initiated prior to 1983.
[2]Treatment operations for disposal costs include labor and overhead, equipment replacement, supplies, and storage.
*Average Yearly Costs from 1991 to 2015 are shown in five-year intervals.

4.5 Supporting Technology

HLW (Lead Office: Savannah River Operations)

The technical basis for implementing this plan is provided by the high-level waste technology program with assistance from the transportation and byproducts technology programs.

The major tasks are:

- plan for dealing with all defense wastes
- coordinate among the three DOE sites, and with the transportation, byproducts, and commercial geologic repository programs
- develop processing technology including pretreatment, in-place stabilization, immobilization, canister sealing and storage, verification, and quality control
- adapt technology for application at INEL

A characterization program under the overview of the Chicago Operations Office will assure the uniform and authoritative evaluation of waste form properties and the testing for compliance with repository acceptance criteria and regulatory requirements. Procedures for testing are developed and screened at the Materials Characterization Center at Pacific Northwest Laboratories and proposed to a Materials Review Board (MRB) with members from national industrial and academic laboratories. Test data produced in conformance with approved procedures and approved by the MRB are published in a materials handbook.

Transportation (Lead Office: Albuquerque Operations)

The Transportation Technology Center at Sandia National Laboratories is developing or demonstrating transportation methods and supports the high-level waste program by assuring that immobilized high-level waste will be safely, reliably, and economically transported.

A prototype licensable truck shipping cask and associated transporter are being defined. Tests assure compliance with Federal regulations on transportation, containment, shielding, and environmental protection. In particular, tests must demonstrate that the transport system will safely contain the waste under severe accident conditions in which containers may be subjected to impact, puncture, fire, and/or water immersion.

The cost estimates for the supporting technology programs are shown in Table 4-7.

Byproducts Recovery and Utilization

This program seeks to identify and demonstrate beneficial applications of high-level waste byproducts including sewage sludge irradiation and food disinfestation with cesium (Cs-137); lighting with krypton (Kr-85) and tritium; utilization of strontium (Sr-90) for thermoelectric power generators; and the recovery of noble metals in the platinum family. Byproduct recovery and utilization can reduce the hazard of the residual waste and the cost for managing it. Costs are included in the costs for "other" Defense Waste and Byproducts Management in Table 6-2.

4.6 Geologic Repository

Geologic disposal is the reference method for immobilized high-level waste. DOE's National Waste Terminal Storage (NWTS) program is expected to begin operating a geologic repository for commercial nuclear waste by 1998. There is no technical reason why such a repository could not also accommodate defense high-level waste. This course will be pursued unless it should cause unacceptable adverse impacts on national security programs, facilities or information.

The Nuclear Waste Policy Act of 1982 (Section 2.2) requires an evaluation of this issue by January 1985. This evaluation will consider cost efficiency, health and safety, regulation, transportation, public acceptability, and national security impacts. In the meantime, close liaison between the defense waste and National Waste Terminal Storage (NWTS) programs will continue to assure technical and scheduling compatibility.

Costs for geologic disposal fees and transportation to a geologic repository are presented in Table 4-8.

TABLE 4-7

ESTIMATED ANNUAL COST FOR THE HIGH-LEVEL WASTE SUPPORTING TECHNOLOGY PROGRAM (millions of 1984 dollars)

	Prior Year Constr.[1]	*Current Year*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991-1995**	*1996-2000*	*2001-2005*	*2006-2010*	*2011-2015*	*TOTAL*
TOTAL[2]		8.2	7.1	11.1	12.0	11.7	13.1	14.2	13.3	10.6	8.4	3.2	1.7	1.6	218.1

[1]Prior year construction only includes costs for construction and general plant projects initiated prior to 1983.
[2]Costs are for generic high-level waste technology development for all sites and includes product and process technology development, waste form testing and verification, and transportation research and development. It does not include funds used to support technology development for the Defense Waste Processing Facility at Savannah River, which are covered in Table 4-2, DWPF total project cost.
*Average Yearly Costs from 1991 to 2015 are shown in five-year intervals.

TABLE 4-8

ESTIMATED ANNUAL COST FOR DISPOSAL OF DEFENSE HIGH-LEVEL WASTE IN A GEOLOGIC REPOSITORY
(millions of 1984 dollars)

	Prior Year Constr.[1]	*Current Year*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991-1995**	*1996-2000*	*2001-2005*	*2006-2010*	*2011-2015*	*TOTAL*
Transport to and disposal in geologic repository[2]		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.0	21.7	29.7	35.0	497.0

[1]Prior year construction only includes costs for construction and general plant projects initiated prior to 1983.
[2]Includes cost for transport and disposal of: 500 HLW canisters per year from Savannah River Plant beginning in 1998, 120 canisters per year from Hanford Reservation from 1998 to 2007, and 500 canisters per year from Idaho National Engineering Laboratory beginning in 2007.
*Average Yearly Costs from 1991 to 2015 are shown in five-year intervals.

4.7 Schedule

The schedules and milestones for the management of high-level waste at the three sites are shown in Figure 4-5.

4.8 Planned Expenditures

Table 4-9 summarizes annual expenditures for the long-term management of high-level waste resulting from atomic energy defense activities.

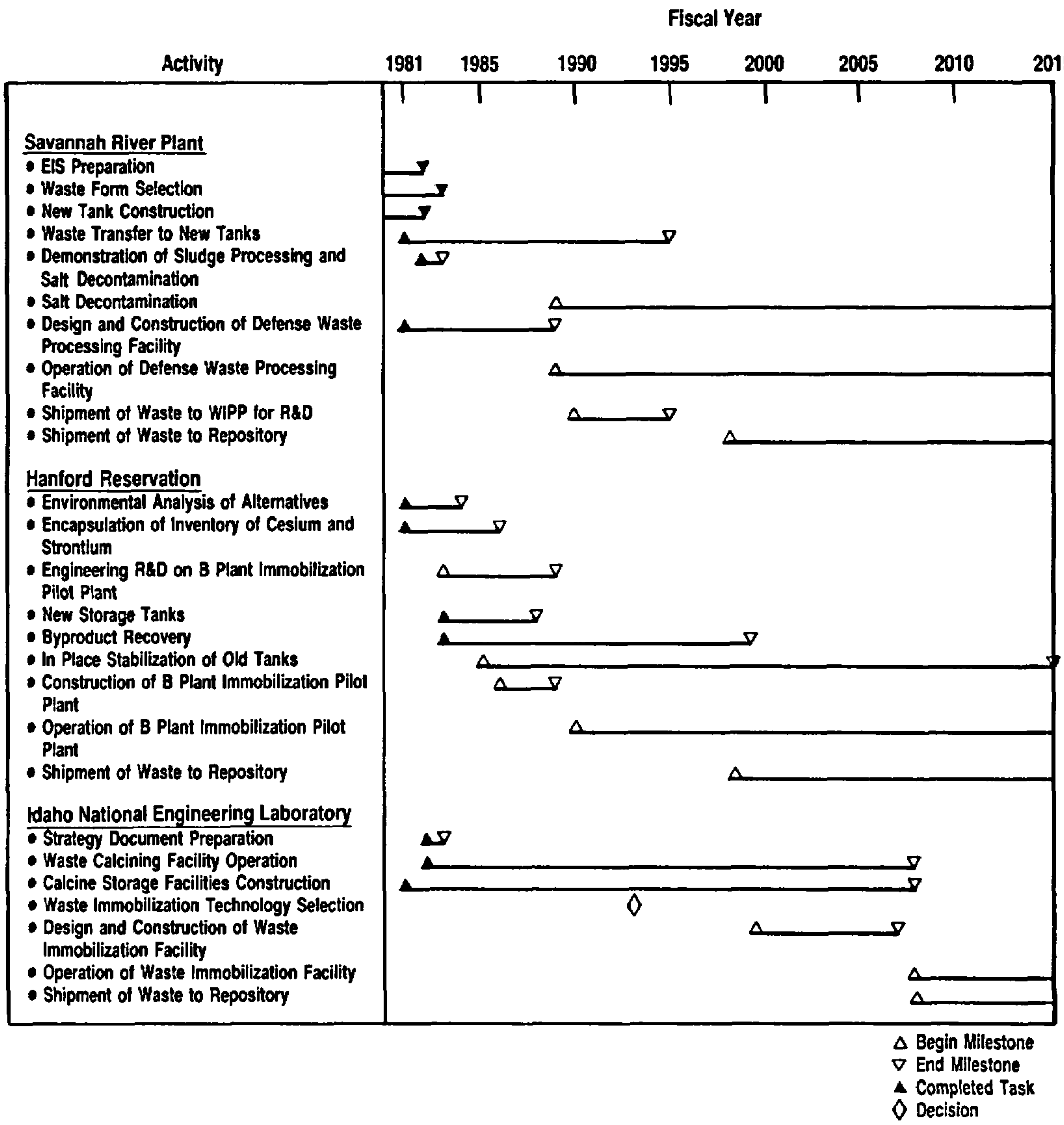


FIGURE 4-5
SCHEDULE AND MILESTONES FOR HIGH-LEVEL WASTE REFERENCE PLANS

TABLE 4-9

ESTIMATED ANNUAL COST FOR THE LONG-TERM DEFENSE HIGH-LEVEL WASTE MANAGEMENT PROGRAM*
(millions of dollars)

	Prior Year Constr.[1]	*Current Year*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991-1995***	*1996-2000*	*2001-2005*	*2006-2010*	*2011-2015*	*TOTAL*
Savannah River Plant	156.3	59.8	173.3	283.3 (309.5)	267.2 (317.8)	150.2 (194.0)	92.5 (126.7)	74.3 (94.9)	80.1	70.2	52.8	52.8	52.8	52.8	2,744.3 (2,919.4)
Hanford Reservation		13.3	21.5	29.9 (31.7)	59.9 (67.5)	76.9 (94.2)	90.7 (121.5)	95.3 (133.8)	89.4 (116.2)	68.1 (69.3)	71.6	27.1	14.7	14.7	1,458.0 (1,586.5)
Idaho National Engineering Laboratory		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0	14.0	48.4	37.2	34.0	723.0
Supporting Technology Program		8.2	7.1	11.1	12.0	11.7	13.1	14.2	13.3	10.6	8.4	3.2	1.7	1.6	218.1
Transportation to and Disposal in a Geologic Repository		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.0	21.7	29.7	35.0	497.0
TOTAL		81.3	201.9	324.3 (352.3)	338.9 (397.3)	238.8 (299.9)	196.3 (261.3)	183.8 (242.9)	182.8 (209.6)	160.3 (168.6)	159.8	153.2	136.1	138.1	5,640.3 (5,944.0)

[1]Prior year construction only includes costs for construction and general plant projects initiated prior to 1983.

*Parenthesized costs are shown in year of expenditure dollars for construction projects started prior to 1988. Costs outside of parenthesis are in 1984 dollars. Costs before 1984 are actual dollars spent.

**Average Yearly Costs from 1991 to 2015 are shown in five-year intervals.

5.0 PLAN FOR PERMANENT DISPOSAL OF TRANSURANIC WASTE

5.1 Introduction

The goal is to end interim storage and to achieve permanent disposal. Transuranic (TRU) waste is stored at the Savannah River Plant in South Carolina; at the Hanford Reservation, in Washington; at the Idaho National Engineering Laboratory, in Idaho; at the Oak Ridge National Laboratory, in Tennessee; at the Los Alamos National Laboratory, in New Mexico; and at the Nevada Test Site, in Nevada. These six sites also store TRU waste from other DOE Waste generators which maintain only a temporary working level of waste (See Figure 5-1).

Newly generated and stored TRU waste will be certified for compliance with the WIPP (Section 5.9) acceptance criteria, after processing if necessary, then emplaced in the WIPP (Figure 3-3). The WIPP waste acceptance criteria were developed in 1980 to ensure that the operations at the WIPP facility will be safe. The criteria specify the properties of the waste and the container including limits on weight, surface radioactivity contamination level and dispersibility. All TRU waste must meet these criteria, and be so certified, before it can be emplaced in the WIPP.

Newly generated waste will be certified to meet the WIPP acceptance criteria at the site where the waste is generated, or processed, as necessary, either on-site or off-site to meet the acceptance criteria. Stored waste will be retrieved, examined, sorted, processed if necessary, and certified for emplacement in the WIPP. Processing at the various sites will begin between 1983 and 2002 (see Section 5.10) as experience is gained.

Before 1970, transuranic contaminated solid material was not distinguished from other low-level solid waste and was disposed of by shallow land burial. This waste does not present a hazard to the public nor is it expected to in the future. The National Academy of Science and others have found that retrieval of this waste can be more hazardous than leaving it in place. The reference plan for such buried waste is to monitor it, to take such remedial actions as may be necessary, and to re-evaluate its safety periodically.

The plans for the individual DOE sites are described below. Present and projected inventories of TRU waste are shown in Appendix C.

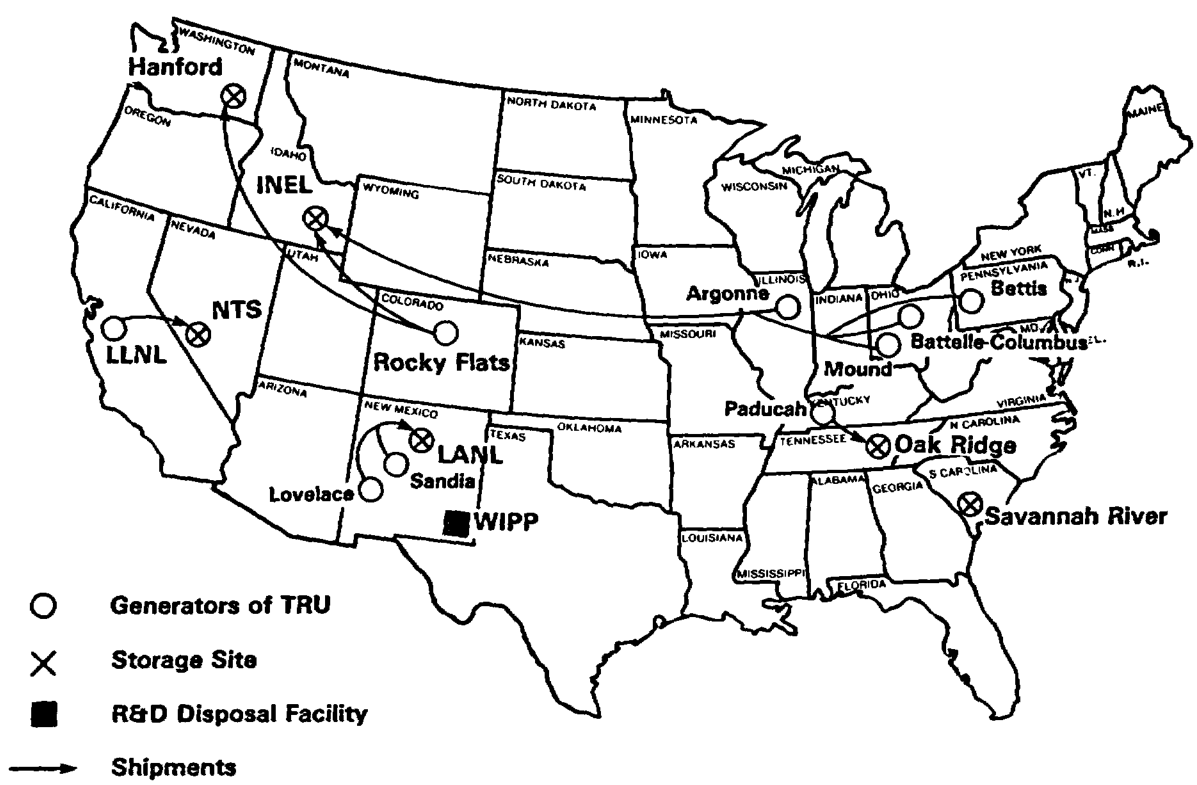


FIGURE 5-1
FACILITIES GENERATING OR RECEIVING TRANSURANIC WASTE

5.2 Idaho National Engineering Laboratory (INEL)

About two-thirds by volume of the stored TRU waste is at INEL. Much of it originated at other facilities, such as the Rocky Flats Plant near Golden, Colorado.

Waste certified for disposal in the Waste Isolation Pilot Plant (WIPP) is stored separately. The inventory of uncertified TRU waste will be examined, sorted, and processed, if necessary, to meet the WIPP waste acceptance criteria, and then certified for the WIPP. The containers will be examined and assayed by non-destructive methods to confirm contents and opened, if necessary, to verify the contents.

About 30 percent of the stored waste may be certifiable without processing. About 20 percent is expected to prove to be low-level waste and will be disposed of accordingly. The remainder will require processing to meet the WIPP waste acceptance criteria. Processing will begin at INEL before the other sites because it has the largest inventory of stored transuranic waste. The NEPA process for shipment of this waste to the WIPP has been completed.

When the WIPP begins to operate, certified waste will be sent from the generating sites directly to the WIPP. INEL will then cease to accept TRU waste for storage.

About 57,000 cubic meters of transuranic contaminated material was disposed of by burial as low-level waste before 1970. The reference plan for such buried waste is to monitor it, to take such remedial actions as may be necessary, and to re-evaluate its safety periodically. Major evaluations will be scheduled as necessary or in about 10-year periods. Monitoring of the buried TRU waste over 20 years shows that the waste is staying in place and poses no immediate or foreseeable health hazard. A 1976 National Academy of Science study strongly cautions against digging up this waste unless it poses a significant health hazard. It is risky and costly to retrieve and process the buried waste. We are developing technology to reduce this cost and risk. In about 10 years this capability should be more fully developed and more geologic and monitoring information will be available. In addition, experience will have been gained from handling, processing, and shipping off-site the stored TRU waste.

The schedules for decisions and key events are shown in Table 5-1 and associated costs in Table 5-2. A description of major facilities follows.

TABLE 5-1

DECISIONS AND KEY EVENTS FOR IDAHO NATIONAL ENGINEERING LABORATORY TRANSURANIC WASTE MANAGEMENT

EVENT	*FISCAL YEAR*
Begin certification of newly generated waste	1983*
Begin certification in the Stored Waste Experimental Pilot Plant (SWEPP)	1985*
Begin experimental processing in the Process Experimental Pilot Plant (PREPP)	1986*
Phase out acceptance of TRU waste from off-site generators	1989*
Send certified waste to WIPP**	1989-2013*

*Critical path items.

**The NEPA process has been completed for stored transuranic waste.

TABLE 5-2

ESTIMATED ANNUAL COST FOR LONG-TERM TRANSURANIC WASTE MANAGEMENT AT IDAHO NATIONAL ENGINEERING LABORATORY*

(millions of dollars)

	Prior Year Constr.[1]	*Current Year*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991-1995***	*1996-2000*	*2001-2005*	*2006-2010*	*2011-2015*	*TOTAL*
STORED WASTE EXAMINATION PILOT PLANT (SWEPP)															
Project Cost		1.8	1.7	1.2 (1.3)	0.2 (0.2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9 (5.0)
SWEPP Support		1.9	1.7	1.1 (1.2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7 (4.8)
PROCESS EXPERIMENTAL PILOT PLANT (PREPP)															
Total Project Cost	1.6	5.8	6.7	12.3 (13.3)	1.8 (2.1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.2 (29.5)
TRANSURANIC WASTE TREATMENT FACILITY[2]															
Total Project Cost		0.0	0.0	0.3 (0.3)	1.2 (1.3)	2.8 (3.5)	3.7 (5.1)	4.8 (7.2)	4.8 (7.8)	1.0 (1.7)	0.0	0.0	0.0	0.0	22.4 (33.7)
TREATMENT OPERATIONS[3] FOR DISPOSAL															
Operating cost		0.6	0.6	1.9	7.4	9.9	11.6	12.6	11.6	12.0	12.0	3.0	3.0	3.0	221.2
TOTAL		10.1	10.7	16.8 (18.0)	10.6 (11.0)	12.7 (13.4)	15.3 (16.7)	17.4 (19.8)	16.4 (19.4)	13.0 (13.7)	12.0	3.0	3.0	3.0	281.4 (294.2)

[1]Prior year construction only includes costs for construction and general plant projects initiated prior to 1983.

[2]The costs for this facility are considered to be for enhancements to the SWEPP facilities.

[3]Treatment operations for disposal costs include SWEPP and PREPP labor and overhead, equipment replacement, supplies and storage, and waste certification development.

*Parenthesized costs are shown in year of expenditure dollars for construction projects started prior to 1988. Costs outside of parenthesis are in 1984 dollars. Costs before 1984 are actual dollars spent.

**Average Yearly Costs from 1991 to 2015 are shown in five-year intervals.

The Stored Waste Examination Pilot Plant (SWEPP) and Support Facilities. Stored containers will be examined non-destructively to determine if they contain TRU waste and whether they meet the acceptance criteria for the WIPP. Packages not meeting the acceptance criteria will be processed (See PREPP below). SWEPP will also prepare and load all containers for disposal in the WIPP or for processing. It will handle up to 13,000 packages annually.

Process Experimental Pilot Plant (PREPP). This plant will process TRU waste for disposal in the WIPP and provide design and operational data for processing facilities at other sites. PREPP will process solid waste and sludge, drums, boxes, and bins through a low-speed shredder and rotary kiln incinerator at a rate of 3,000 cubic meters per year. The ash will be immobilized for disposal in the WIPP.

Transuranic Waste Treatment Facility (TWTF). The TWTF will process TRU wastes which cannot be handled by the PREPP including unshreddable items, hazardous materials, massive lead, highly radioactive materials, and lead-lined drums. It may be possible to modify the pilot plant facilities for this purpose. Shipments will be made to support the WIPP's proposed remote-handled waste disposal demonstration. The need, scope, and location of a TWTF facility will be determined after the pilot plant facilities begin operation.

5.3 Hanford Reservation

About one fifth of the TRU waste generated annually by DOE is stored at the Hanford Reservation, about 65 percent from operations on-site.

Newly generated TRU waste will be certified by the generator, after processing if necessary, to meet WIPP

TABLE 5-3

DECISIONS AND KEY EVENTS FOR HANFORD RESERVATION TRANSURANIC WASTE MANAGEMENT

EVENT	*FISCAL YEAR*
Begin certification of newly generated waste	1983
Complete environmental analysis on Hanford Defense Waste Strategy Alternatives	1984
Receive, examine, and store TRU waste	1985-1992*
Retrieve stored TRU waste, process as required, and certify	1992-2013*
Send certified waste to WIPP	1992-2013*

*Critical path items.

TABLE 5-4

ESTIMATED ANNUAL COST FOR LONG-TERM TRANSURANIC WASTE MANAGEMENT AT HANFORD RESERVATION*
(millions of dollars)

	Prior Year Constr.[1]	*Current Year*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991-1995***	*1996-2000*	*2001-2005*	*2006-2010*	*2011-2015*	*TOTAL*
WASTE RECEIVING AND PROCESSING (WRAP) FACILITY															
Total Project Cost		0.0	0.0	0.0	0.0	0.0	2.3 (3.2)	16.1 (24.2)	13.8 (22.4)	0.0	0.0	0.0	0.0	0.0	32.2 (49.7)
TRU WASTE RETRIEVAL FACILITIES															
Contact															
Total Project Cost		0.0	0.0	0.0	0.0	1.2 (1.5)	4.6 (6.4)	4.6 (6.9)	1.1 (1.8)	0.0	0.0	0.0	0.0	0.0	11.5 (16.6)
Remote															
Total Project Cost		0.0	0.0	0.0	0.0	0.0	0.0	1.2	3.4	4.6	0.0	0.0	0.0	0.0	27.6
SPECIAL HANDLING, RETRIEVAL AND PACKAGING FACILITY															
Total Project Cost		0.0	0.0	0.0	0.0	0.0	0.0	1.2	3.4	8.8	0.0	0.0	0.0	0.0	48.6
PROGRAM GENERIC WASTE MANAGEMENT ACTIVITIES															
Equipment Cost		1.3	1.8	1.7	1.6	1.5	1.5	1.3	1.0	1.3	1.1	0.0	0.0	0.0	23.7
TREATMENT OPERATIONS[2] FOR DISPOSAL															
Operating Cost		1.3	2.6	4.5	1.6	1.7	1.1	1.3	1.7	11.8	15.0	13.1	1.3	1.0	226.8
TOTAL		2.6	4.4	6.2	3.2	4.4 (4.7)	9.5 (12.2)	25.7 (36.1)	24.4 (33.6)	26.5	16.1	13.1	1.3	1.0	370.4 (393.0)

[1]Prior year construction only includes costs for construction and general plant projects initiated prior to 1983.
[2]Treatment operations for disposal costs include labor and overhead, equipment replacement, supplies and storage.
*Parenthesized costs are shown in year of expenditure dollars for construction projects started prior to 1988. Costs outside of parenthesis are in 1984 dollars. Costs before 1984 are actual dollars spent.
**Average Yearly Costs from 1991 to 2015 are shown in five-year intervals.

waste acceptance criteria, and stored until it can be received at the WIPP. Waste which cannot be certified will be stored separately for processing. Starting in 1992, stored waste will be retrieved, examined, and certified if appropriate. Uncertifiable waste will be processed starting in 2000 and then certified to the WIPP criteria. Certified waste will be sent to the WIPP.

Between 2 and 7 million cubic meters of transuranic contaminated material was disposed of by burial as low-level waste in the past. The reference plan for such buried waste is to monitor it, to take such remedial actions as may be necessary, and to re-evaluate its safety periodically. Major evaluations will be scheduled as necessary or in about 10-year periods.

The schedules for decisions and key events are shown in Table 5-3 and associated costs in Table 5-4. A description of major facilities follows.

Waste Receiving and Processing Facility (WRAP) - Containers will be examined by non-destructive methods to determine if they contain TRU waste and if they can be certified for the WIPP. If they contain low-level waste, they will be disposed of on site. Containers of TRU waste will be processed and the contents immobilized, if necessary, to meet the WIPP waste acceptance criteria. The WRAP facility is planned to operate from 1992 through 2013 and will certify approximately 9,000 cubic meters of waste.

Transuranic Waste Retrieval Facilities. These facilities will be used to retrieve TRU contact-handled and remote-handled waste packages from storage for transfer to the WRAP facility beginning in 1992.

Special Handling, Retrieval and Packaging Facility. This facility will be used to process TRU waste which is recovered or received from other sites and requires special processing beginning in 1995.

5.4 Savannah River Plant (SRP)

The Savannah River Plant generates about 10 percent by volume of the defense TRU waste. This share will rise to about 15 percent by 1989.

Newly generated TRU waste will be certified, after processing if necessary, to meet the WIPP waste acceptance criteria beginning in 1983. Certified waste will be

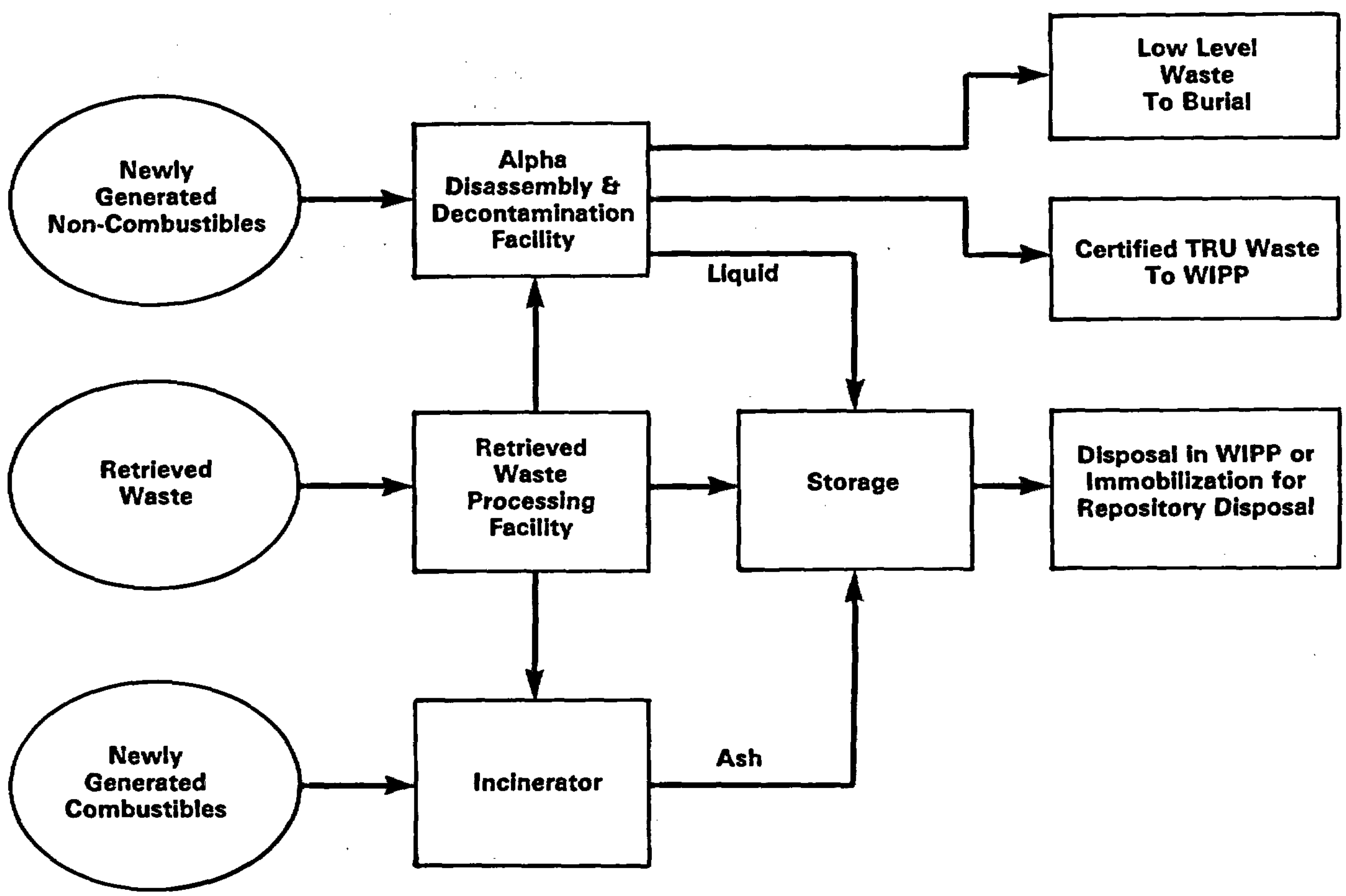


FIGURE 5-2
SAVANNAH RIVER PLANT FACILITIES: COMBUSTIBLES WILL BE INCINERATED AND THE ASH WILL BE IMMOBILIZED. NON-COMBUSTIBLES WILL BE DECONTAMINATED, IF POSSIBLE. THE RESULTING LIQUID WILL BE IMMOBILIZED. CERTIFIED TRU WASTE WILL BE SHIPPED TO THE WIPP.

shipped to WIPP beginning in 1992. Stored TRU waste will begin to be retrieved, examined, processed if necessary, and certified to the WIPP criteria in 1989 and then sent to the WIPP.

About 31,000 cubic meters (approximately 4,000 curies) of transuranic contaminated material was disposed of by burial as low-level waste in the past. The reference plan for such buried waste is to monitor it, to take such remedial actions as may be necessary, and to re-evaluate its safety periodically. Major evaluations will be scheduled as necessary or in about 10-year periods. The schedules for decisions and key events are shown in Table 5-5.

TABLE 5-5

DECISIONS AND KEY EVENTS FOR SAVANNAH RIVER PLANT TRANSURANIC WASTE MANAGEMENT

EVENT	*FISCAL YEAR*
Begin certification of newly generated waste	1983
Begin incineration and dissassembly/decontamination for immobilization by DWPF or disposal in WIPP	1989*
Begin retrieving stored waste	1989
Begin processing retrieved TRU waste	1989*
Send certified TRU waste to WIPP	1992-2013*

*Critical path items.

Several facilities may be needed to process TRU waste at the Savannah River Plant. TRU waste (incinerator ash) will either be sent to the WIPP, or immobilized in the Defense Waste Processing Facility and shipped to a geologic repository. The relationship among these facilities and their connections to other activities are shown in Figure 5-2 and the associated costs in Table 5-6. A description of these facilities follows.

Incinerator. Up to 60 percent by volume and up to 90 percent by radioactivity of TRU waste at the Savannah River Plant is combustible. An incinerator will process about 200 cubic meters of waste per year and will reduce the volume of combustibles about 30 fold, beginning in 1990. The ash will be immobilized for disposal.

Alpha Disassembly and Decontamination Facility. Bulky items will be disassembled and decontaminated for disposal as low-level waste while the transuranic waste fraction will be immobilized for disposal beginning in 1989. This facility can reduce the annual volume of non-combustible TRU waste from 140 cubic meters to approximately 0.4 cubic meters.

Retrieved Waste Processing Facility. This facility will serve to receive, unpack, sort, and repackage retrieved TRU waste for transfer to the incinerator or the Alpha Dissassembly and Decontamination Facility beginning in 1989.

TABLE 5-6

ESTIMATED ANNUAL COST FOR LONG-TERM TRANSURANIC WASTE MANAGEMENT AT SAVANNAH RIVER PLANT*
(millions of dollars)

	Prior Year Constr.[1]	*Current Year*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991-1995***	*1996-2000*	*2001-2005*	*2006-2010*	*2011-2015*	*TOTAL*
ALPHA DISASSEMBLY AND DECONTAMINATION FACILITY															
Total Project Cost		0.0	0.0	0.0	19.9 (23.5)	14.4 (18.8)	3.4 (4.7)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.7 (47.0)
INCINERATOR															
Total Project Cost	2.5	0.7	0.7	4.7 (5.1)	7.0 (8.3)	4.1 (5.3)	0.6 (0.8)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.3 (23.5)
RETRIEVED WASTE PROCESSING FACILITY															
Total Project Cost		0.0	0.0	0.0	5.3 (6.3)	3.9 (5.1)	0.8 (1.1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0 (12.5)
TREATMENT OPERATIONS[2] FOR DISPOSAL															
Operating cost		0.0	0.0	0.0	0.0	0.0	6.6	10.4	10.4	10.4	10.4	10.4	10.4	10.4	287.4
TOTAL		0.7	0.7	4.7 (5.1)	32.2 (38.1)	22.4 (29.2)	11.4 (13.2)	10.4	10.4	10.4	10.4	10.4	10.4	10.4	355.4 (370.0)

[1]Prior year construction only includes costs for construction and general plant projects initiated prior to 1983.

[2]Treatment operations for disposal costs include labor and overhead, equipment replacement, supplies and storage.

*Parenthesized costs are shown in year of expenditure dollars for construction projects started prior to 1988. Costs outside of parenthesis are in 1984 dollars.

**Average Yearly Costs from 1991 to 2015 are shown in five-year intervals.

5.5 Oak Ridge National Laboratory (ORNL)

About one percent of DOE's TRU waste is produced and stored annually at ORNL. Starting in 1983, ORNL will certify newly generated waste for shipment to the WIPP if it meets the acceptance criteria. About 50 percent of the stored waste will require processing for certification. The decision on whether to process on-site or off-site will be made by 1990.

About 6,200 cubic meters of transuranic-contaminated material was disposed of by burial as low-level waste in the past. The reference plan for such buried waste is to monitor it, to take such remedial actions as may be necessary, and to reevaluate its safety periodically. Major evaluations will be scheduled as necessary or in about 10-year periods. The schedules for decisions and key events are shown in Table 5-7 and facility costs in Table 5-8. A description of the TRU Waste Packaging Facility follows:

TABLE 5-7

DECISIONS AND KEY EVENTS FOR OAK RIDGE NATIONAL LABORATORY TRANSURANIC WASTE MANAGEMENT

EVENT	*FISCAL YEAR*
Begin certification of newly generated waste	1983
Begin sending certified TRU waste to WIPP	1990-2013*
Select location of TRU waste processing facility	1990*
Begin retrieving "remote handled" TRU waste for certification and send to processing site or to WIPP	2002*

*Critical path items.

Waste Packaging Facility. TRU waste which requires shielding and remote handling will be retrieved, certified and packaged for shipment to the WIPP if it meets the WIPP waste acceptance criteria. If it cannot be certified, it will be shipped to a processing facility beginning in 2002. It is estimated that the majority of remote-handled waste at ORNL can be certified without extensive processing.

TABLE 5-8

ESTIMATED ANNUAL COST FOR LONG-TERM TRANSURANIC WASTE MANAGEMENT AT OAK RIDGE NATIONAL LABORATORY (millions of 1984 dollars)

	Prior Year Constr.[1]	*Current Year*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991-1995**	*1996-2000*	*2001-2005*	*2006-2010*	*2011-2015*	*TOTAL*
WASTE PACKAGING FACILITY															
Total Project Cost		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	8.3	0.2	0.0	0.0	48.0
TREATMENT OPERATIONS[2] FOR DISPOSAL															
Operating Cost		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	1.4	1.0	27.0
TOTAL		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	8.3	3.2	1.4	1.0	75.0

[1]Prior year construction only includes costs for construction and general plant projects initiated prior to 1983.
[2]Treatment operations for disposal costs include labor and overhead, equipment replacement, supplies and storage.
*Average Yearly Costs from 1991 to 2015 are shown in five-year intervals.

5.6. Los Alamos National Laboratory (LANL)

Between 1982 and 1990, LANL will account for about 7 percent of DOE's annual TRU waste generation. Newly generated waste will be certified if it meets the WIPP acceptance criteria. About 55 percent of the LANL TRU waste (2,000 cubic meters) will require processing. Beginning in 1983, large glove boxes will be reduced in size, certified, and stored. By 1985, newly generated combustible waste will be incinerated. Certified waste will be sent to the WIPP beginning in 1990. Beginning in 1991, the remainder of the stored TRU waste will be retrieved, examined, processed if necessary, certified, and sent to the WIPP.

About 11,500 cubic meters of transuranic contaminated material was buried as low-level waste in the past. The reference plan for such buried waste is to monitor it, to take such remedial actions as may be necessary, and to reevaluate its safety periodically. Major evaluations will be scheduled as necessary or in about 10-year periods.

The schedules for decisions and key events are shown in Table 5-9 and facility costs in Table 5-10.

TABLE 5-9

DECISIONS AND KEY EVENTS FOR LOS ALAMOS NATIONAL LABORATORY TRANSURANIC WASTE MANAGEMENT

EVENT	*FISCAL YEAR*
Begin certification of newly generated waste	1983
Begin operation of size reduction facility	1983
Begin using the controlled air incinerator to process newly generated combustible TRU waste	1985
Send certified waste to WIPP	1990-2014*
Begin processing retrieved TRU waste	1991

*Critical path items.

TABLE 5-10

ESTIMATED ANNUAL COST FOR LONG-TERM TRANSURANIC WASTE MANAGEMENT AT LOS ALAMOS NATIONAL LABORATORY*
(millions of dollars)

	Prior Year Constr.[1]	*Current Year*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991-1995***	*1996-2000*	*2001-2005*	*2006-2010*	*2011-2015*	*TOTAL*
STORED WASTE EXAMINATION AND PROCESSING FACILITY															
Total Project Cost		0.0	0.0	0.0	2.0 (2.4)	1.0 (1.3)	6.0 (8.3)	10.0 (15.0)	2.0 (3.2)	0.0	0.0	0.0	0.0	0.0	21.0 (30.2)
TREATMENT OPERATIONS[2] FOR DISPOSAL															
Operating Cost		0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	12.0
TOTAL		0.0	0.0	0.0	2.0 (2.4)	1.0 (1.3)	6.0 (8.3)	11.0 (16.0)	3.0 (4.2)	1.0	1.0	0.0	0.0	0.0	33.0 (42.2)

[1]Prior year construction only includes costs for construction and general plant projects initiated prior to 1983.
[2]Treatment operations for disposal costs include labor and overhead, equipment replacement, supplies and storage.
*Parenthesized costs are shown in year of expenditure dollars for construction projects started prior to 1988. Costs outside of parenthesis are in 1984 dollars.
**Average Yearly Costs from 1991 to 2015 are shown in five-year intervals.

5.7 Nevada Test Site (NTS)

At the end of 1981, approximately 200 cubic meters of TRU waste were in retrievable storage at the site. In 1982, NTS began phasing down acceptance of non-certified TRU waste for storage. After the WIPP is operational, NTS will cease to accept TRU waste from off-site generators.

Stored TRU waste will begin to be processed, if necessary, and certified for the WIPP beginning in 1990. The decision whether to process on-site or off-site will be made by 1990. Certified waste will be sent to the WIPP. The schedules for decisions and key events are shown in Table 5-11 and costs in Table 5-15.

TABLE 5-11

DECISIONS AND KEY EVENTS FOR NEVADA TEST SITE TRANSURANIC WASTE MANAGEMENT

EVENT	*FISCAL YEAR*
Accept certified TRU waste from off-site generators	1983-1989
Begin retrieval of stored waste, examine, sort and certify	1984-1989
Begin sending certified TRU waste to WIPP	1990*
Select location of TRU waste processing facility	1990*

*Critical path items.

Underground testing of nuclear weapons and other nuclear experiments for defense programs have resulted in deeply buried TRU materials. This material does not present a risk and its retrieval is not practical.

5.8 Supporting Technology TRU (Lead Office: Albuquerque Operations)

The goal of this effort is to provide technology and system integration as necessary to handle, process, and transport TRU waste from generator to disposal. The objectives include: (1) minimize the generation of new TRU waste, (2) assure that TRU wastes are safely isolated from the biosphere, and (3) assure continued safety of burial sites. The supporting technology activities are described below:

Reduce Generation. The quantity of newly generated TRU waste can be reduced through: administrative controls, equipment and materials substitution and recycle to replace disposable materials by reuseable items, new and more efficient chemical processes and recycling of oils and solvents, and advanced instrumentation to segregate "suspect" wastes from actual TRU waste.

Waste Treatment. The objective is to demonstrate technology to process TRU waste as necessary for compliance with disposal criteria, to reduce costs and to enhance safety. This technology is well developed.

Instrumentation. The objective is to develop instrumentation for nondestructive examination of waste types and containers by 1986. The first prototype system for determining TRU content was installed at Oak Ridge National Laboratory in 1982. The first examination system will be installed in the SWEPP at the Idaho National Engineering Laboratory (Section 5.2) by 1985 and later at other storage sites.

Packaging. By limiting shippers to use a few standard types of metal containers, DOE will improve transportation and WIPP handling and emplacement safety, quality control, and efficiency. Continued use of the standard 55-gallon drum is planned, both individually and in banded "six packs". Other containers will be modular metal boxes meeting transportation and WIPP waste acceptance criteria. Four standard metal boxes are planned. A canister similar to the HLW canister will be developed for remote-handled TRU waste.

TABLE 5-12

ESTIMATED ANNUAL COST FOR THE TRANSURANIC WASTE SUPPORTING TECHNOLOGY PROGRAM*
(millions of 1984 dollars)

	Prior Year Constr.[1]	*Current Year*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*19901*	*1991-1995***	*1996-2000*	*2001-2005*	*2006-2010*	*2011-2015*	*TOTAL*
TOTAL[2]		8.1	7.7	10.5	10.8	9.9	7.9	6.7	6.7	5.9	2.0	2.0	1.2	1.0	129.0

[1]Prior year construction only includes costs for construction and general plant projects initiated prior to 1983.
[2]Costs are for generic transuranic waste technology development for all sites and includes reduced waste generation, waste processing, instrumentation, packaging, and transportation research and development.
*Costs before 1984 are actual dollars spent.
**Average Yearly Costs from 1991 to 2015 are shown in five-year intervals.

Transportation. DOE is considering two transportation systems for TRU waste, one for rail only, and one for both truck and rail transport. An advanced transportation system, the vented TRU package transporter (TRUPACT), which will use foam-filled doublewall construction with puncture-resistant walls and tight seals, will be available in 1984.

The cost estimates for the transuranic waste technology development are shown in Table 5-12.

5.9 Waste Isolation Pilot Plant (WIPP)

This research and development facility near Carlsbad, New Mexico is intended to demonstrate the safe disposal of radioactive waste from national defense programs. The WIPP, as authorized by Public Law 96-164, is specifically exempted from licensing by the Nuclear Regulatory Commission.

In 1957, the National Academy of Sciences recommended disposal of radioactive waste in salt formations. The search for a suitable site first led to the Permian Basin in the southwestern United States. Project Salt-Vault near Lyons, Kansas (1963-1967) proved the site to be unsuitable. The search then narrowed to the Delaware Basin in southeast New Mexico in 1972. The WIPP site is located in a 2,000-foot thick bedded salt formation. This formation is first encountered at a depth of 850 feet below the surface and is over 200 million years old.

The WIPP will demonstrate the technical and operational aspects of permanent isolation of defense-generated radioactive waste on a full pilot scale. It will be used to retrievably emplace defense TRU waste and to conduct experiments with defense high-level waste. The full design capability of the WIPP for TRU waste will be utilized after sufficient operating and technical data have been accumulated to ensure safe long-term isolation. The NEPA process for the transfer of stored INEL TRU waste to the WIPP has been completed. The decision on whether or not to convert the WIPP to a permanent repository for TRU waste will be made after five years of operation.

On January 22, 1981, the Department of Energy announced its decision to proceed with the project as authorized in Public Law 96-164. Ground was broken on April 20, 1981. A 12-foot diameter exploratory shaft and a 6-foot diameter ventilation shaft have been drilled into the salt formation and are interconnected at a depth of approximately 2,150 feet. Underground excavation is underway to prepare for various experiments in the geologic formation (Figure 5-3).

Several important steps have recently been taken regarding the WIPP facility. An agreement for consultation and cooperation between the state of New Mexico and the U.S. Department of Energy was signed in July 1981. This Agreement designates key events and establishes procedures and schedules for review of the WIPP project and for resolution of conflicts.

A cooperative agreement between the Bureau of Land Management, Department of the Interior, and DOE

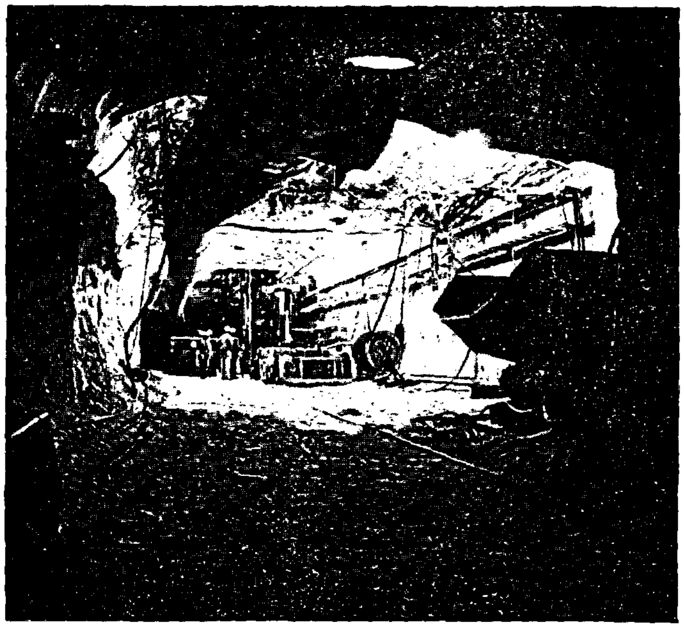


FIGURE 5-3

WIPP UNDERGROUND EXCAVATION: VIEW FROM THE SOUTH OF THE EXPLORATORY SHAFT STATION. STATION EXCAVATION IS APPROXIMATELY 17 FT. HIGH AND 32 FT. WIDE. A MINING TRUCK AND THE PERSONNEL AND SALT CONVEYANCE TO THE SURFACE IS IN THE BACKGROUND.

was signed in April 1981 to provide DOE access to the site for conducting the Site and Preliminary Design Validation (SPDV) phase of the project and to protect the site as a possible future disposal area for radioactive waste. State-owned land will be exchanged for Federal lands.

Following the site validation and verification of the site's suitability for a waste disposal facility (Summer 1983), the construction of surface and underground facilities could begin. The WIPP can be completed in December 1987 and the first radioactive waste received for emplacement 10 months later.

The surface area of the site is 10,240 acres most of which is a buffer zone. The surface operations will require about 30 acres. The principal surface structure will be a waste handling building which has separate areas for the receipt, inventory, inspection, and transfer of TRU wastes to the underground disposal area.

The underground facilities are approximately 2,150 feet below the surface. They include three separate areas: (1) approximately 100 acres for disposal of TRU wastes; (2) approximately 7.5 acres for retrievable experiments with high-level waste, and (3) approximately 12 acres for research and development in rock mechanics and mine design. The connecting tunnels cover about 30 acres.

WIPP is expected to receive 180,000 cubic meters of TRU waste during the first 25 years of its operation, about 700 cubic meters of which require remote handling. WIPP can accept about 15,000 cubic meters of TRU waste annually. The limited quantity of high-level waste emplaced for expermental purposes will be removed from WIPP before decommissioning.

The schedules for decisions and key events are shown in Table 5-13 and costs in Table 5-14.

TABLE 5-13

DECISIONS AND KEY EVENTS FOR THE WASTE ISOLATION PILOT PLANT

EVENT	*FISCAL YEAR*
Consulation/Cooperation Agreement with State of New Mexico	1981
Complete drilling SPDV shafts	1982
Complete Site and Preliminary Design Validation and begin Construction of WIPP facility	1983*
Complete construction and begin pre-operational testing	1988*
Begin R&D with radioactive waste	1989*
Decision on whether to retrieve waste or convert WIPP to a permanent repository for TRU waste	1993*

*Critical path items.

TABLE 5-14

ESTIMATED ANNUAL COST FOR THE WASTE ISOLATION PILOT PLANT*
(millions of dollars)

	Prior Year Constr.[1]	*Current Year*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*19901*	*1991-1995***	*1996-2000*	*2001-2005*	*2006-2010*	*2011-2015*	*TOTAL*
WASTE ISOLATION PILOT PLANT (WIPP)															
Total Project Cost	175.6	125.4	141.1[2]	136.8 (149.1)	49.0 (57.8)	42.7 (54.6)	32.0 (44.5)	0.0	0.0	0.0	0 .0	0.0	0.0	0.0	702.6 (748.1)
Annual Operating Cost		0.0	0.0	0.0	0.0	0.0	0.0	23.9	23.9	23.9	23.9	23.9	23.9	23.9	645.3
TRANSPORT TO WIPP															
Operating		0.0	0.0	0.0	0.0	0.0	0.0	2.2	3.5	9.1	10.8	10.8	3.1	0.5	177.3
Equipment		0.0	0.0	0.0	0.0	4.1	7.0	7.3	11.4	3.2	0.0	0.0	0.0	0.0	45.8
TOTAL		125.4	141.1[2]	136.8 (149.1)	49.0 (57.8)	46.8 (58.7)	39.0 (51.5)	33.4	38.8	36.2	34.7	34.7	27.0	24.4	1,571.0 (1,616.5)

[1]Prior year construction only includes costs for construction and general plant projects initiated prior to 1983.
[2]Assumes full 1984 funding for the WIPP Project. If not received, this figure is reduced by 60.4 million dollars.
*Parenthesized costs are shown in year of expenditure dollars for construction projects started prior to 1988. Costs outside of parenthesis are in 1984 dollars. Costs before 1984 are actual dollars spent.
**Average Yearly Costs from 1991 to 2015 are shown in five-year intervals.

5.10 Schedule

The schedule and milestones for the management of TRU waste at the DOE sites and the WIPP are shown in Figure 5-4.

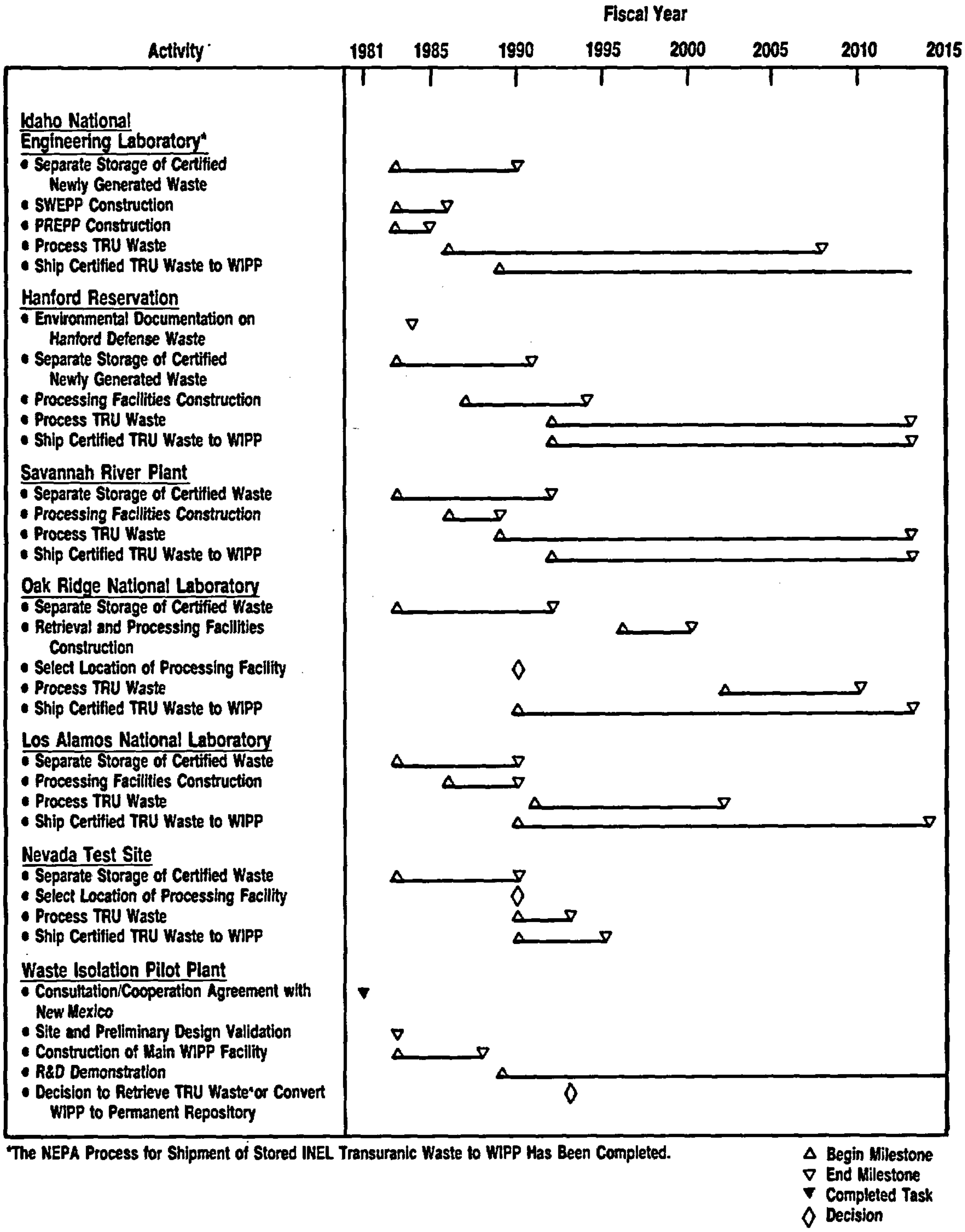


FIGURE 5-4
SCHEDULE AND MILESTONES FOR TRANSURANIC WASTE REFERENCE PLANS

5.11 Planned Expenditures

Estimated expenditures for the TRU waste management program are shown in Table 5-15. This includes costs for the WIPP facility.

TABLE 5-15

TOTAL ESTIMATED ANNUAL COST FOR THE LONG-TERM DEFENSE TRANSURANIC WASTE MANAGEMENT PROGRAM*
(millions of dollars)

	Prior Year Constr.[1]	*Current Year*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991-1995***	*1996-2000*	*2001-2005*	*2006-2010*	*2011-2015*	*TOTAL*
Idaho National Engineering Laboratory	1.6	10.1	10.7	16.8 (18.0)	10.6 (11.0)	12.7 (13.4)	15.3 (16.7)	17.4 (19.8)	16.4 (19.4)	13.0 (13.7)	12.0	3.0	3.0	3.0	281.4 (294.2)
Hanford Reservation		2.6	4.4	6.2	3.2	4.4 (4.7)	9.5 (12.2)	25.7 (36.1)	24.4 (33.6)	26.5	16.1	13.1	1.3	1.0	370.4 (393.0)
Savannah River Plant	2.5	0.7	0.7	4.7 (5.1)	32.2 (38.1)	22.4 (29.2)	11.4 (13.2)	10.4	10.4	10.4	10.4	10.4	10.4	10.4	355.3 (370.0)
Oak Ridge National Laboratory		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	8.3	3.2	1.4	1.0	75.0
Los Alamos National Laboratory		0.0	0.0	0.0	2.0 (2.4)	1.0 (1.3)	6.0 (8.3)	11.0 (16.0)	3.0 (4.2)	1.0	1.0	0.0	0.0	0.0	33.0 (42.2)
Nevada Test Site		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02	0.03	0.02	0.03	0.02	0.02	0.6
Supporting Technology Program		8.1	7.7	10.5	10.8	9.9	7.9	6.7	6.7	5.9	2.0	2.0	1.2	1.0	129.0
Construction, Operation and Transportation for WIPP	175.6	125.4	141.1[2]	136.8 (149.1)	49.0 (57.8)	46.8 (58.7)	39.0 (51.5)	33.4	38.8	36.2	34.7	34.7	27.0	24.4	1,571.0 (1,616.5)
TOTAL	179.7	146.9	164.6[2]	175.0 (188.9)	107.8 (123.3)	97.2 (117.2)	89.1 (109.8)	104.6 (122.4)	99.7 (113.1)	94.1 (94.8)	84.5	66.4	44.3	40.8	2,815.7 (2,920.5)

[1]Prior year construction only includes costs for construction and general plant projects initiated prior to 1983.
[2]Assumes full 1984 funding for the WIPP Project. If not received, this figure is reduced by 60.4 million dollars.
*Parenthesized costs are shown in year of expenditure dollars for construction projects started prior to 1988. Costs outside of parenthesis are in 1984 dollars. Costs before 1984 are actual dollars spent.
**Average Yearly Costs from 1991 to 2015 are shown in five-year intervals.

6.0 PROGRAM COST SUMMARY

The summary costs for the long-term management of high-level and TRU waste are shown in Table 6-1.

The total costs for the defense waste management and byproducts program has been aggregated in Table 6-2, including costs for interim operations. "Other" costs include: byproduct utilization, airborne waste management, low-level waste management, decontamination and decommissioning, and program management.

TABLE 6-1

TOTAL ESTIMATED ANNUAL COST FOR THE LONG-TERM DEFENSE HIGH-LEVEL WASTE AND TRANSURANIC WASTE MANAGEMENT PROGRAM*
(millions of dollars)

	Prior Year Constr.[1]	*Current Year*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991-1995***	*1996-2000*	*2001-2005*	*2006-2010*	*2011-2015*	*TOTAL*
High-Level Waste	156.3	81.3	201.9	324.3	338.9	238.8	196.3	191.3	182.8	160.3	159.8	153.2	136.1	138.1	5,640.3
				(352.3)	(397.3)	(299.9)	(261.3)	(242.9)	(209.6)	(168.6)					(5,944.0)
Transuranic Waste[2]	179.7	146.9	164.6[2]	175.0	107.7	97.2	89.1	104.6	99.7	94.1	84.5	66.4	44.3	40.8	2,815.7
				(188.9)	(123.3)	(117.2)	(109.8)	(122.4)	(113.1)	(94.8)					(2,920.5)
TOTAL	336.0	228.2	366.5[2]	499.3	446.6	335.9	285.4	295.9	282.5	254.4	244.3	219.6	180.4	178.9	8,456.0
				(541.2)	(520.6)	(417.1)	(371.1)	(365.3)	(322.7)	(263.4)					(8,864.5)

[1]Prior year construction only includes costs for construction and general plant projects initiated prior to 1983.
[2]Assumes full 1984 funding for the WIPP Project. If not received, this figure is reduced by 60.4 million dollars.
*Parenthesized costs are shown in year of expenditure dollars for construction projects started prior to 1988. Costs outside of parenthesis are in 1984 dollars. Costs before 1984 are actual dollars spent.
**Average Yearly Costs from 1991 to 2015 are shown in five-year intervals.

TABLE 6-2

TOTAL DEFENSE WASTE AND BYPRODUCTS MANAGEMENT BUDGET*
(millions of dollars)

	Prior Year Constr.[1]	*Current Year*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991-1995***	*1996-2000*	*2001-2005*	*2006-2010*	*2011-2015*	*TOTAL*
Long Term Management of High-Level and Transuranic Waste	336.0	228.2	366.5[2]	499.3	446.6	335.9	285.4	295.9	282.5	254.4	244.3	219.6	180.4	178.9	8,456.0
				(541.2)	(520.6)	(417.1)	(371.1)	(365.3)	(322.7)	(263.4)					(8,864.5)
Interim Operations for High-Level and Transuranic Waste	1.4	215.6	231.6	280.4	291.1	280.0	254.6	226.2	184.5	177.7	177.2	154.1	154.6	99.8	5,782.5
				(285.5)	(301.3)	(302.3)	(276.7)	(238.5)	(185.5)						(5,855.3)
Other Defense Waste and Byproducts Management[3]	12.7	74.9	73.7	72.9	93.6	96.5	106.3	102.7	101.0	93.4	82.4	69.1	64.9	64.9	2,607.2
				(73.7)	(97.7)	(100.4)	(113.0)	(108.0)	(104.3)						(2,631.1)
TOTAL		518.7	671.9[2]	852.6	831.3	712.4	646.3	624.8	568.0	525.5	504.9	442.8	399.9	343.6	16,845.7
				(900.4)	(920.6)	(819.8)	(760.8)	(711.8)	(612.5)	(534.5)					(17,350.9)

[1]Prior year construction only includes costs for construction and general plant projects initiated prior to 1983.
[2]Assumes full 1984 funding for the WIPP Project. If not received, this figure is reduced by 60.4 million dollars.
[3]Includes costs for decommissioning and decontamination, low-level waste management, airborne waste management, byproducts utilization, transportation R&D, traffic management, and program direction.
*Parenthesized costs are shown in year of expenditure dollars for construction projects started prior to 1988. Costs outside of parenthesis are in 1984 dollars. Costs before 1984 are actual dollars spent.
**Average Yearly Costs from 1991 to 2015 are shown in five-year intervals.

APPENDIX A

GLOSSARY

atomic energy defense activity	any activity of the Secretary performed in whole or in part in carrying out any of the following functions: naval reactors development; weapons activities including defense inertial confinement fusion; verification and control technology; defense nuclear materials production; defense nuclear waste and materials by-products management; defense nuclear materials security and safeguards and security investigations; and defense research and development as defined by the Atomic Energy Act of 1954.
byproducts	any radioactive materials (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material as defined by the Atomic Energy Act of 1954
calcination	the process of making unconsolidated powder or granules by thermal evaporation and partial decomposition (release of gases) of high-level liquid wastes
certified waste	waste that meets WIPP waste acceptance criteria
contact handled	waste containers that can be handled without shielding
DWPF	Defense Waste Processing Facility (Savannah River Plant)
fission products	nuclides produced by the fission of heavier elements or daughter products from decay of those nuclides
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
INEL	Idaho National Engineering Laboratory (Idaho)
in-place disposal	stabilization and isolation in place, with engineered improvements if necessary.
interim storage	waste storage operations (for which monitoring and human control are provided) pending final disposal
low-level waste	the contaminated waste products which are not high-level or transuranic waste
LANL	Los Alamos National Laboratory, (New Mexico)
nanocurie	one-billionth of a curie (10^{-9}Ci) equivalent to 37 disintegrations per second
NEPA	National Environmental Policy Act of 1969
NTS	Nevada Test Site (Nevada)
NWTS	National Waste Terminal Storage Program
ORNL	Oak Ridge National Laboratory (Tennessee)
PREPP	Process Experimental Pilot Plant (Idaho)
PUREX	Plutonium-uranium extraction
remedial actions	corrective measures taken to improve or clean up an area
remote handled waste	material contaminated in such a way that it cannot be handled without shielding
salt cake	wet crystalline solids which result when water is evaporated from solution such as supernate

solvent extraction	process for recovery of uranium, plutonium, and other heavy elements from dissolved irradiated fuels
SPDV	Site and Preliminary Design Validation, an early phase of the Waste Isolation Pilot Plant project
special nuclear material	includes plutonium, uranium-233, uranium enriched (to any degree) in uranium-235, or any other material as defined by the Atomic Energy Act of 1954
SRP	Savannah River Plant (South Carolina)
supernate	the liquid solution above the sludge in a storage tank for neutralized high-level waste
SWEPP	Stored Waste Examination Pilot Plant (Idaho)
transuranium radionuclide	any radionuclide having an atomic number greater than 92
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 nanocuries per gram
TRUPACT	transporter for TRU waste packages
TWTF	Transuranic Waste Treatment Facility (Idaho)
vitrify	convert to glass or glassy substance
waste acceptance criteria	DOE developed requirements for receipt of wastes at a facility that specify chemical, physical, and radiological conditions
waste byproducts	material, other than special nuclear material, which can be separated and recovered from nuclear fuel cycle waste streams and made available for safe, environmentally acceptable, and cost-effective applications. Not to be confused with the term "byproducts" defined by the Atomic Energy Act.
WIPP	Waste Isolation Pilot Plant, (New Mexico)

APPENDIX B

HIGH-LEVEL WASTE INVENTORIES AND PROJECTIONS

B.1 High-Level Waste Inventories and Projections

Table B-1 presents inventories and projections for each site.

TABLE B-1

INVENTORIES* OF DEFENSE HIGH-LEVEL WASTE

	1982		1990	
Form of Waste	*Quantity (cubic meters)*	*Curies (millions)*	*Quantity (cubic meters)*	*Curies (millions)*
Savannah River Plant				
Glass	0	0	325	15
Sludge	12,300	527	14,800	951
Salt Cake	29,800	106	59,700	106
Supernate	72,900	159	21,200	41
	115,000	792	96,025	1,113
Hanford Reservation				
Sludge	47,000	141	55,000	338
Salt Cake	98,000	4	98,000	12
Liquid	34,000	45	34,000	33
Slurry	4,000	1	8,000	366
Capsules	5	290	10	5
	183,005	481	195,010	749
Idaho National Engineering Laboratory				
Liquid	9,100	30	2,700	4
Calcine	2,400	40	5,400	92
	11,500	70	8,100	96

* The volumes in this table are consistent with data to be reported in the next annual revision of the DOE Integrated Data Base, "Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics." DOE Report No. DOE/NE-0017-2.

APPENDIX C

TRANSURANIC WASTE INVENTORIES AND PROJECTIONS

C.1 TRU Waste Inventories and Projections

Table C-1 presents the inventories and projections at each site through 1988, after which WIPP will begin receiving certified waste.

TABLE C-1
INVENTORIES* OF RETRIEVABLY STORED DEFENSE TRANSURANIC WASTE
(cubic meters)

CATEGORY	*INEL*	*HANFORD*	*SRP*	*ORNL*	*LANL*	*NTS*	*TOTAL*
Stored Waste (end of 1982)	38,280	12,310 (1,130)**	2,670	119 (331)**	5,300 (17)**	330	59,009 (1,478)**
Stored Waste (end of 1988)	46,404	13,270	5,110	155	7,856	690	73,485
Average Annual Receipt (1983-1988)	1,354	160	240	6	426	60	2,226

* *The volumes in this table are consistent with data to be reported in the next annual revision of the* DOE Integrated Data Base, "Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics." DOE Report No. DOE/NE-0017-2.

** Numbers shown in parenthesis are remote handled TRU waste and should be added to the other figures shown for a total inventory.

APPENDIX D

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