Subcontractor Report

MRS ACTION PLAN TASK B REPORT

Analyses of Alternative Designs
and Operating Approaches for a
Monitored Retrievable Storage Facility

December 1988

Prepared by the Ralph M. Parsons Company of Delaware
Pasadena, California
under Contract DE-AC06-84RL10436
with the U.S. Department of Energy

Pacific Northwest Laboratory
Operated for the U.S. Department of Energy
by Battelle Memorial Institute

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W. H. Woods
A. K. Dowdy
D. H. Keating
R. M. Gale(a)
R. I. Smith(a)

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Pacific Northwest Laboratory
Richland, Washington 99352

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ACRONYMS

ACD	Advanced conceptual design
ACDR	Advanced conceptual design report
A/E	Architect - engineering
ALARA	As low as reasonably achievable
AMS	Alarm monitoring system
BWR	Boiling water reactor
CCTV	Closed circuit television
CDR	Conceptual design report
CFR	Code of Federal Regulation
CHTRU	Contact-handled transuranic
DOE	Department of Energy
DP	Dual-purpose
EA	Environmental assessment
ER	Environmental report
FHM	Fuel handling machine
FPC	Final procurement and construction
FTE	Full time equivalent
HEPA	High efficiency particulate
HLW	High level waste
HVAC	Heating, air conditioning, and ventilation
KW	Kilowatt
LA	License application
LLW	Low level waste
MRS	Monitored retrievable storage
MTU	Metric tons of uranium
MWD	Megawatt days
NDE	Non-destructive examination
NFBC	Non-fuel-bearing components
NRC	Nuclear Regulatory Commission
NWPA	Nuclear Waste Policy Act
NWPAA	Nuclear Waste Policy Amendments Act
PNL	Pacific Northwest Laboratory
PWR	Pressure water reactor
RB	Receiving Building
RH-LLW	Remote-handled low level waste
R & H	Receiving and handling

ACRONYMS (Contd)

SF	Spent fuel
SFHB	Spent Fuel Handling Building
TC	Transfer cask
TSLCC	Total system life cycle cost
UPS	Uninterruptible power supply
VS	Vault Storage Building

SECTION 1

INTRODUCTION

The Nuclear Waste Policy Amendments Act (NWPAA) instituted a number of changes in the DOE commercial nuclear waste management system. After passage of the Act, the DOE initiated a number of systems studies to reevaluate the role of Monitored Retrievable Storage (MRS) within the federal waste management system. This report summarizes the results of a study to determine the schedules and costs of developing those MRS facilities needed under a number of scenarios, with differing functions allocated to the MRS and/or different spent fuel acceptance schedules.

1.1 SCENARIO OVERVIEW

Nine cases were defined for the system study, seven of which included an MRS Facility. The study cases or scenarios evaluated varied relative to the specific functions to be performed at the MRS. The scenarios ranged in magnitude from storage and shipment of bare, intact spent fuel to consolidating the spent fuel into repository emplacement containers prior to storage and shipment. Each scenario required specific modifications to be made to the design developed for the MRS proposal to Congress (the Conceptual Design Report).

In addition to the functional differences, each scenario was evaluated to determine the impact resulting from:

- (1) Phased construction to achieve early receipt of spent fuel.
- (2) Different onsite storage modes (concrete storage cask, drywell, and air-cooled open-cycle vault).
- (3) Constructing the MRS in a western or eastern region of the United States.
- (4) Receiving up to 400 MTU of vitrified high level waste (HLW) per year.
- (5) Variations in dates for the start of operation of the MRS or the Repository.

Table 1-1 presents the packaging functions to be performed by the MRS and the repository for each scenario.

1.2 EXISTING MRS FACILITY DESIGN

The basis for the data presented in the MRS system study is the current Conceptual Design Report (CDR) published by Parsons in September 1985. The CDR contains building design and cost data which can be utilized in determining

Table 1-1 - Scenario Functions

<u>Scenario</u>	<u>MRS Packaging Functions</u>	<u>Repository Packaging Functions</u>
1	None (No MRS)	Consolidates spent fuel; provides emplacement container (Figure 1-2)
2	None (No MRS)	Spent fuel remains intact; provides emplacement container (Figure 1-3)
3	None (stores only intact spent fuel)	Consolidates spent fuel; provides emplacement container (Figure 1-2)
4	None (stores only intact spent fuel)	Spent fuel remains intact; provides emplacement container (Figure 1-3)
5	Consolidates spent fuel; pro- vides canister (Figure 1-5) for fuel and drums for fuel hardware (NFBC)	Provides emplacement container (Figure 1-4) for canisters and, required, for spent fuel
6	Provides emplacement container (Figure 1-3) for intact spent fuel and, if required, for HLW; repairs/replaces defective containers, as required	Inspects emplacement container (Figure 1-3); returns defective containers to MRS for repair/replacement
7	Provides emplacement container (Figure 1-3) for intact spent fuel and, if required, for HLW	Inspects emplacement container (Figure 1-3); repairs/replaces container, as required
8	Consolidates spent fuel; pro- vides emplacement container (Figure 1-2) for fuel, NFBC and, if required, for HLW; repairs/ replaces defective containers, as required	Inspects emplacement container (Figure 1-2); returns defective containers to MRS for repair/replacement
9	Consolidates spent fuel; pro- vides emplacement container (Figure 1-2) for fuel, NFBC and, if required for HLW	Inspects emplacement container (Figure 1-2); repairs/replaces container, as required

the impact of facility function changes required by the study scope of work. Since the NWPAA rejects the siting of the MRS in Tennessee as proposed to Congress, the CDR site arrangements and site-related costs cannot be used for the system study. To provide site preparation costs for this study, site arrangements and related costs were derived from data presented in the Advanced Conceptual Design Report (ACDR) published in April 1985. The ACDR was developed for generic sites and provides an appropriate data base for the sensitivity analyses required for the generic-site MRS of this study. Data relating to this earlier design effort was modified for this study, assuming common design impacts relating to the site for any location in the United States. However the buildings on the site and the inter-relationship of the buildings reflect the CDR design requirements.

Operating costs were developed by Pacific Northwest Laboratory (PNL) in June 1986 for the CDR design. These projected costs have been utilized in subsequent analyses and provide the basis for data developed for this study.

1.2.1 CDR DESIGN PARAMETERS

The following were key design parameters of the CDR:

- (1) Facility can simultaneously receive and ship 3,600 MTU of spent fuel per year.
- (2) Routine operation is three shifts per day, seven days per week, year-round.
- (3) Spent fuel shipments to MRS are 50 weight percent by rail and 50 weight percent by truck.
- (4) Spent fuel mix is 60 weight percent PWR and 40 weight percent BWR, based on an average of 0.462 MTU per PWR assembly and 0.186 MTU per BWR assembly.
- (5) Receiving and Handling (R&H) Building in-building vault can store 1,000 MTU of canistered, consolidated spent fuel.
- (6) Total onsite storage capability is limited to 15,000 MTU of spent fuel (14,000 MTU if 1,000 MTU is stored in-building) and 300 canisters of vitrified high level waste (HLW).
- (7) Spent fuel cladding surface temperature will be maintained below 375°C in an inert atmosphere.
- (8) Spent fuel will be placed in canisters prior to storage and/or shipment to the repository and the repository will provide the final emplacement container.
- (9) Spent fuel canisters will contain one intact PWR, two intact BWR, consolidated fuel rods from three PWR, or consolidated fuel rods from seven BWR assemblies.

- (10) NFBC remaining after fuel rod consolidation will be size-reduced by shredding and packaged in 55-gallon drums.
- (11) Up to 10% of the spent fuel received will be canistered intact (not consolidated) due to fuel age (5 year), burnup (55,000 MWD/MTU) or damage.
- (12) A small amount of HLW, less than 60 canisters per year, can be received at the MRS.
- (13) Spent fuel shipping cask envelopes will be identical to current casks, both truck and rail, but will have a greater capacity (truck cask capacity of 2 PWR or 5 BWR assemblies; rail cask capacity of 12 PWR or 32 BWR assemblies).
- (14) MRS-to-repository shipping casks will not exceed the envelope or intact spent fuel capacity (24 PWR or 52 BWR) of the "dual-purpose" (shipping/storage) cask.
- (15) Space and equipment will be provided to permit the packaging of MRS canisters in a repository emplacement container (repository "overpack") prior to shipment offsite. This process will accommodate any of the three repository-specific container configurations.

1.2.2 FACILITY OPERATION

The description of facility operations is based on the facility as presented in the CDR. Being a completely independent installation, the MRS Facility requires facilities to support the spent fuel handling and storage operations. These include administrative, maintenance, warehousing, security, fire-protection, and standby power generation facilities.

The R&H Building is the primary operating building of the MRS Facility. It is designed to physically confine and control all radioactive or toxic materials being handled or generated by handling operations. The systems, equipment, and operations are designed to minimize the quantity of radioactive waste generated during operations. It includes spaces and equipment for receiving, identifying, disassembling, consolidating, and packaging spent fuel; and for densifying, packaging, and handling of spent fuel hardware and site-generated waste. Spaces and equipment are also provided to prepare these materials for temporary onsite storage or to ship them offsite. It includes mechanized and automated remote-handling equipment, where feasible, to permit rapid and economic handling of wastes. The operations are predicted on spent fuel arriving in a dry environment and shipping casks being unloaded in air.

Shipping casks arriving at the MRS Facility are first received through the Inspection Gatehouse before proceeding to the R&H Building receiving, inspection, and shipping area, where the casks are removed from their transport vehicles and loaded onto cask carts. Figure 1-1 presents a schematic of the R&H Building. All process cells are configured to accept either PWR or

Figure 1-1

BWR assemblies with minimal subsystem changeout. Typically, casks of spent PWR assemblies are routed to the cask handling and decontamination room located beneath process cells Nos. 1 and 3. Casks of spent BWR assemblies go to the cask handling and decontamination room located beneath process cells Nos. 2 and 4. Here the casks are prepared for unloading. The cask is then moved into the cask unloading room, mated to a port located in the floor of the process cell, and unloaded.

In process cells Nos. 1, 2, 3, and 4, the spent fuel is inspected, identified, disassembled, consolidated, and packaged in canisters. Spent fuel may also be temporarily stored in a lag storage pit or canistered as intact assemblies within these same process cells. In canyon cells No. 5 and 6, the fuel canisters are filled with inert gas, sealed by a welded end closure, leak tested, decontaminated, and the weld ultrasonically tested. The canisters are either stored in the in-building lag storage vault or loaded directly into a storage cask or drywell transporter for onsite storage or into a shipping cask for transport to offsite disposal.

The storage cask system is an array of concrete storage casks that are placed above grade, upright on support pads. The heat from radioactive decay is conducted through the storage cask and removed by atmospheric convection and thermal radiation. The walls of the cask and the shielding plug provide the radiological protection. Crawler-type transporters deliver the storage casks to and from the R&H Building.

The field drywell storage system, the alternate storage concept in the CDR, is a series of in-ground, sealed steel caissons. The thermal conductivity of the soil establishes the drywell spacing required to dissipate the heat from radioactive decay. The drywell shielding plug provides the required radiological protection after the waste is placed in the caisson. A shielded transporter is used to move the radioactive material to and from the storage yard.

Space and support systems are also provided for the temporary storage of dual-purpose casks. If required by the waste management system, dual-purpose casks containing intact, bare spent fuel are received at the R&H Building for transfer to an onsite transporter. The casks are delivered to the storage facility and placed on cask supports.

1.2.3 FACILITY DESIGN

The existing MRS Facility design as presented in the CDR and in the proposal to Congress includes all infrastructure, facilities, and equipment required to routinely receive, unload, prepare for storage, and store spent fuel, and to externally decontaminate and return shipping casks received by both rail and truck. The facility is complete with all supporting facilities to make the MRS Facility a self-sufficient installation. The facility will be licensed by the NRC under Part 72 of the Code of Federal Regulations (10 CFR 72).

The overall site plan comprises three distinct areas: the limited access area, the facility protected area, and storage area. An additional limited access area is required for the Cask Manufacturing Facility for the sealed storage

cask option and is an industrial area adjacent to the primary limited area and the protected area.

The limited access area(s) contains the facilities and services (administration, security, cold maintenance, utilities, emergency response, and industrial) required to support the waste handling and storage operations. It is enclosed within a single fence which provides controlled access, via a manned gatehouse, for personnel, offsite vehicles, and nonradioactive materials. The following is a summary of the limited area buildings and their functions:

- Administration Building: Contains offices and support areas for operation, quality assurance, health physics, accountability, State and Federal officials, and general site administration.
- Site Services Building: Contains offices, shop areas for site (cold) maintenance, shielded process cell mockup, and redundant process computer.
- Warehouse: Contains nonradioactive bulk materials and equipment.
- Vehicle Maintenance Building: Contains repair facilities for onsite vehicles (trucks, cars, cask/canister transportation, and rail equipment).
- Security Building: Contains security force administration and redundant hardened alarm monitoring station.
- Main Gate/Badgehouse: Contains security station, including security-related monitoring equipment, for personnel and offsite vehicle access control into the limited area.
- Protected Area Gatehouse: Contains security station for personnel and vehicle access from the limited area to the protected area, the primary alarm monitoring station, and the personnel monitoring station.
- Fire Station: Contains administration, central fire alarm and dispatch station, vehicle storage, and central first-aid station.
- Water Treatment Facility: Contains water supply system and firewater pumps.
- Sewage Treatment Plant: Contains sewage treatment system.
- Cask Manufacturing Facility: Contains bulk cask material storage, concrete batch plant, and cask casting and curing facilities.

The protected area contains the R&H Building and other related support services. This area is enclosed within a double fence and is provided with surveillance and detection devices in accordance with the requirements of 10 CFR 73 and DOE Order 5632, Chapter III. Support buildings in the protected area include:

- Inspection Gatehouse: Contains security/inspection station for shipments of radioactive materials into or from the protected access area.
- Storage Facility Gate Station: Contains access control from the protected area to the Storage Facility.
- Standby Generator Building: Contains standby generator and normal and standby switchgear.
- Steam Generator Building: Contains equipment to provide steam for the R&H Building operations.

The storage area is separated from the R&H Building and the other support buildings in the protected area by a single fence.

The facility is designed to limit direct radiation exposure of onsite and offsite personnel within the limits established in 10 CFR 72, 10 CFR 20, 40 CFR 191, DOE Order 5480.1B, and other applicable regulations in force at the time of publication (1985). The design also includes the application of As Low As Reasonably Achievable (ALARA) principles to the facility design and the operating philosophy. DOE Order 5480.1B requires, as a design objective, that operating personnel exposure levels shall be less than one-fifth of the permissible dose equivalent limits promulgated by the order.

Radioactive waste treatment systems are also included for the treatment, solidification, storage, and shipment of radioactive wastes generated at the MRS Facility. All potentially contaminated effluent streams are treated and monitored to meet the environmental requirements of 10 CFR 20, 40 CFR 191 (1983), and DOE Order 5480.1B before release.

Spent fuel storage facilities are capable of attenuating the radiation and dissipating the heat generated primarily by 33,000 MWD/MTU spent fuel ten years out of reactor. As much as 10% of the spent fuel received was considered to be five years out of reactor and/or ten-year-old spent fuel with burnups as high as 55,000 MWD/MTU. The storage configuration is capable of maintaining spent fuel cladding surface temperatures below 375°C in an inert-gas environment.

The design life of the R&H Building is 50 years, maintainable or replaceable to extend life to at least 100 years, irrespective of licensing intervals. The design life of the storage facilities is 100 years. The design life of supporting facilities is 30 years, except for exterior finishes that may require periodic maintenance to satisfy the 30-year requirement.

As presented in the CDR, the MRS Facility design is scheduled for a total design duration of 36 months. The license application is submitted in the 22nd month of design and the total licensing process has a duration of 30 months. Construction, including cold testing of components and systems, requires a total of 53 months. Hot testing is initiated with the receipt of spent fuel and is ramped up to full scale operation by the 3rd year.

1.3 REPORT FORMAT

Criteria and assumptions which are generic or which apply to multiple scenarios are presented in Section 2. Criteria and assumptions which are specific to a scenario or to a set of scenarios are presented in the first subsection of subsequent scenario sections.

Data developed for the study is typically derived from a common basis. The approach to developing the data for the study is presented in Section 3. This section also addresses the data format, cost data development, and design and construction schedules.

The seven scenarios incorporating an MRS Facility were organized into four groups, depending on the primary functions to be performed. Since Scenarios 3 and 4 are identical relative to the MRS, they are addressed in Section 4. Scenario 5 is the only case that requires the use of canisters and is therefore the only scenario presented in Section 5. Consolidation is not performed prior to the loading of emplacement containers for Scenarios 6 and 7. Since the only difference between these two cases is the container repair requirement, the two scenarios are described in Section 6. As with Section 6, Section 7 addresses Scenarios 8 and 9 when consolidation and containerizing of spent fuel, and container repair for Scenario 8, are required.

A comparison of the data developed for the scenarios and the issues or uncertainties relating to the study are presented in Section 8.

In addition to the seven scenarios and their functional variations, six sensitivity analyses were performed to provide modifications to or specific variations of one or more of the original scenarios. These sensitivity studies, in the appendices of this document, are as follows:

- Appendix 1: Receipt and unloading of reactor-consolidated spent fuel in Scenario 5
- Appendix 2: Receipt and unloading of reactor-loaded NUHOMS canisters in Scenarios 3 and 4 or in Scenario 5
- Appendix 3: Receipt of 0, 200, or 400 MTU per year of HLW in Scenarios 6, 7, 8, and 9
- Appendix 4: Use of the MRS as a waste management system element for the second repository, utilizing Scenarios 3 and 4 or Scenario 8
- Appendix 5: No spent fuel is received in Scenarios 3 and 4 after the requisitory reaches full operation, thereby placing the MRS in hot standby until the interim storage inventory can be shipped from the MRS
- Appendix 6: Use of high capacity casks to ship spent fuel from the MRS in Scenarios 3 and 4

1.4 REFERENCE DOCUMENTS

The following reference documents were utilized, as noted, in the development of this study:

- (1) DOE (U.S. Department of Energy, OSIR), MRS Systems Studies, Task A Report. Scenario Development and System Logistics. Memorandums of August 2, 1988 and August 19, 1988

Utilized for study criteria baseline

- (2) DOE (U.S. Department of Energy), Monitored Retrievable Storage Submission to Congress. DOE/RW-0035/1, Rev. 1, Volume III, March 1987

Utilized for the licensing duration

- (3) DOE (U.S. Department of Energy), "Assumptions for the 1988 Analysis of the Total-System Life-Cycle Costs," final draft, HQW.880505.0015, May 1988

Utilized for transportation and waste characteristics

- (4) LLNL (Lawrence Livermore National Laboratory) and SAIC (Science Applications International Corporation), Yucca Mountain Project Waste Package Design for MRS Systems Studies, draft, NN1.881213.0058, December 1988

Utilized for spent fuel and high level waste package configurations and costs

- (5) The Ralph M. Parsons Company of Delaware, Integral Monitored Retrievable (MRS) Facility Conceptual Design Report. MRS-11, September 1985

Utilized as the baseline for cost and facility configuration data

- (6) Boeing Engineering Company, Monitored Retrievable Storage Conceptual System Study: Open Cycle Vault. BEC-MRS-3304, November 1983

Utilized for vault storage building equipment cost basis

- (7) FW (Foster Wheeler) Energy Applications, Inc., Topical Report for the Foster Wheeler Modular Vault Dry Store (M.V.D.S.) for Irradiated Nuclear Fuel. 08-27164: EA 86/20, Rev. 0, August 1986

Utilized for equipment and operating parameters

- (8) NUTECH Inc., Topical Report for the Nutech Horizontal Modular Storage System for Irradiated Nuclear Fuel. HUH-001: ADV001.0100, Rev. 0, November 1984

Utilized for Nutech/NUHOMS canister construction data

- (9) SNL (Sandia National Laboratories), Site Characterization Plan-Conceptual Design Report, SAND84-2461, 1987

REPOSITORY REFERENCE DESIGN CONTAINERS

INTACT FUEL CONFIGURATIONS

0221-00405 8 1 86

Figure 1-3

FIGURE 3A

4 INTACT PWRs
(LOADED WEIGHT-10,350 lb.)
OR
6 CONS. PWRs (POWER LIMITED)
(LOADED WEIGHT-12,900 lb.)
OR
20 CONS. SWRS
(LOADED WEIGHT-16,800 lb.)

FIGURE 3B

8 INTACT SWRS
(LOADED WEIGHT-11,650 lb.)

CANISTERED FUEL CONFIGURATIONS

8221-8044DS 8/1/82

Figure 1-4

Configuration 4 A - PWR-Intact + consolidated, and BWR - Consolidated

Configuration 4 B - BWR Intact

MRS CANISTERS

Figure 1-2

ВНЕШНИЙ ВИД

Самолет в полете - вид сверху

Самолет в полете - вид сбоку - Сечение

SECTION 2

SECTION 2

GENERAL CRITERIA AND ASSUMPTIONS

The CDR design and related costs, based on the Functional Design Criteria prepared by PNL, require modification to accommodate the specific requirements defined for this MRS System Study. To provide a common basis to the MRS and repository study participants, revised and new criteria were established for the study.

2.1 CRITERIA

The criteria used for the MRS System Study scenarios were primarily based on the assumptions for the 1988 Analysis of the Total-System Life-Cycle Costs (TSLCC). Additional criteria or revisions to the assumptions were received during or as a result of study meetings in the first months of the study effort.

The following sections present the criteria utilized by the MRS Project Team. Also included are basic definitions for the various alternatives evaluated. Following each criterion statement, the source of the criterion is indicated, where (a) represents the TSLCC assumptions, (b) the scope of work definitions, (c) data resulting from meetings, and (d) the Task A Report.

2.1.1 WASTE CHARACTERISTICS

Waste to be received by the MRS Facility meets the following:

- (1) Spent fuel mix by reactor type is (0.67) by weight (MTU) from PWR and (0.33) from BWR. (a)
- (2) Peak fuel burn-up is 60,000 MWD/MTU for PWR and 50,000 MWD/MTU for BWR. (a)
- (3) Average content per assembly is 0.43 MTU for PWR and 0.18 MTU for BWR. (a)
- (4) All spent fuel is bare, intact; at-reactor consolidation quantity is negligible. (a and d)
- (5) Spent fuel age is at least 5 years out of reactor. (a)
- (6) Defense vitrified high level waste (HLW) is 0.5 MTU per canister; commercial (West Valley) HLW is 2.13 MTU per canister. (a and d)
- (7) Commercial HLW will be received following the receipt of defense HLW. (a)

- (8) Allocation of waste receipt is oldest fuel or HLW canister first.
(a and d)

2.1.2 TRANSPORTATION

Transportation interfaces and analyses are based on the following:

- (1) The primary location of the MRS Facility is central with respect to the majority of the nation's civilian reactors. (a)
- (2) A secondary MRS location, for the study, will be in the western region of the United States. (b)
- (3) Approximately 300 MTU per year of spent fuel will be shipped directly from the reactors to the repository if the MRS is operative at its "primary" location. (a and b)
- (4) All spent fuel will be received by an MRS at its "secondary" location. (b)
- (5) All HLW is shipped by rail. (a)
- (6) All shipments from an MRS are by rail. (a and d)
- (7) Rail shipments from the MRS are by dedicated trains consisting of 5 cars for spent fuel or HLW, plus car(s) for spent fuel hardware as required. (a and d)
- (8) Spent fuel from reactors to the MRS is shipped in truck or rail casks, depending cask handling capability of the specified reactor. (a)
- (9) Truck casks can contain either 3 PWR or 7 BWR intact fuel assemblies. (a)
- (10) Rail casks from waste generators can contain either 21 PWR or 48 BWR intact fuel assemblies, or 5 canisters of HLW. (a)
- (11) Maximum loaded cask weight, without the lifting yoke, is 300,000 pounds. (a and c)
- (12) "Dual-purpose" casks (shipping/storage) have a capacity of 24 PWR or 60 BWR intact fuel assemblies with a maximum loaded cask weight of approximately 250,000 pounds. (c)
- (13) As required by the scenario, rail casks from the MRS to the repository have a capacity of: 28 PWR or 61 BWR intact fuel assemblies; 28 PWR or 61 BWR intact fuel canisters; 28 canisters of consolidated fuel rods from either 2 PWR or 5 BWR assemblies; 4 repository emplacement containers; or 4 units or "canisters" of 5 drums each containing volume-reduced fuel assembly hardware. (a and c)

- (14) Based on projected system receipt schedules, the maximum percentage of truck casks utilized is 92% at an annual receipt rate of 3000 MTU. (The average transportation modal mix is assumed to be approximately 55% rail and 45% truck, by MTU weight.) (c)
- (15) MRS receipt and shipment rates to be used for the system study scenarios are based on acceptance schedules 2, 3, 4, 26, 27, 28, 48, 49, 50, 70, 71, and 72, received on August 3, 1988. (c)
- (16) Low level waste (LLW) not exceeding Class C is shipped to a "nearby" disposal site. (a and c)
- (17) Remotely-handled and contact-handled LLW is packaged in 55 gallon drums. (a)

2.1.3 WASTE PACKAGES

Waste packages produced by the MRS are based on the following:

- (1) Spent fuel to be consolidated will equate to 95% of the spent fuel inventory received; the remaining 5% will remain intact. (c and d)
- (2) Thermal energy constraint for the emplacement container is 3.5 kilowatts. (a and d)

2.1.4 MRS OPERATION

The following presents criteria relating to MRS storage capacity, storage modes, start of operation, and costing:

- (1) Per the NWPAA, the maximum onsite storage capacity is 15,000 MTU. (a)
- (2) Per the NWPAA, up to 10,000 MTU can be stored prior to repository operation. (a)
- (3) The primary storage mode is concrete storage casks. (a and c)
- (4) Optional storage modes to be studied are drywell and open-cycle vault. (c)
- (5) If repository operation is delayed beyond year 2003, MRS can store more than storage limits stated in the NWPAA, if approved by congress. (b)
- (6) For the base case (single phase construction), MRS construction will begin in 1998. (b)
- (7) MRS operation for the base case (single phase construction) will start in the year 2003. (a)
- (8) To achieve early receipt of spent fuel, phased construction can be utilized. (b)

- (9) Concrete storage cask design parameters are as presented in the MRS CDR. (a)
- (10) Cost estimates will be in 1988 dollars, requiring the escalation of conceptual design cost estimates by the following adjustment factors (c):

<u>Cost Estimate Date</u>	<u>Labor</u>	<u>Material</u>
1985 to 1986	2.5%	1.2%
1986 to 1987	2.7%	1.6%
1987 to 1988	2.4%	3.3%

- (11) For scenarios 5 through 9, the in-building lag storage vault and related canyon cell configuration (footprint) will be as shown in the CDR and the scenario-specific capacity (MTU) identified. (c)
- (12) HLW is received only if the MRS is providing the final emplacement container, e.g. Scenarios 6 through 9. (a and d)

2.2 ASSUMPTIONS

In addition to the criteria stated in Section 2.1, general and case-specific assumptions were made to permit timely completion of the study scenarios. Specific assumptions relating only to one scenario are presented in the introductory portion of the scenario section. The following sections present assumptions which apply to multiple cases studied.

2.2.1 MRS OPERATIONS

The following are assumptions related to MRS material handling operations and storage modes:

- (1) Drywell and associated transporter has a capacity of one HLW canister, one emplacement container, four bare or canistered intact PWR, eight bare or canistered intact BWR, and one 9" canister.
- (2) Concrete storage cask spent fuel capacity is based on a thermal constraint of 18 kW and an interior cavity diameter constraint of 68 inches.
- (3) Concrete storage cask NFBC drum capacity is 3 stacks of 5 drums (15 drums/cask).
- (4) Concrete storage cask HLW capacity, based on an interior cavity diameter constraint of 78 inches, is five canisters.
- (5) HLW canisters will be placed into emplacement containers immediately prior to shipment to the repository, not prior to storage at the MRS.
- (6) In-process lag storage in the R & H Building is as presented in the CDR (180 PWR or 320 BWR assemblies per process cell).

- (7) Contact-handled LLW drums will be shipped to a LLW disposal site when a cask capacity of 15 has been accumulated. (Reference cask: NEC Model B-2.)
- (8) Remote-handled waste greater than Class C, except for NFBC, will not be produced at the MRS.
- (9) Remote-handled LLW will be routinely shipped in 7-drum capacity truck casks. (Reference cask: CNS Model 7-100.)
- (10) Onsite storage capacity of NFBC is equal to the quantity generated while packaging the maximum onsite inventory of consolidated spent fuel.
- (11) Volumes of onsite generated waste per MTU resulting from MRS operations (i.e., cell and equipment decontamination, HEPA filters, etc.) is proportional to quantities stated in the CDR for scenarios requiring fuel consolidation and are conservative based on recent data from the consolidation projects at Idaho National Engineering Laboratory.
- (12) LLW drum storage will not be required external of the R & H Building.
- (13) Spent fuel shipping cask envelopes will be identical to current casks, but will have a greater capacity (see Section 2.1.2.)
- (14) Minimum spacing of intact fuel or consolidated fuel canisters in the R&H Building canyon storage vault is 15" on center.
- (15) Minimum spacing of spent fuel containers in the R&H Building canyon storage vault is 5'-0" on center.
- (16) Maximum allowable opening in the R&H Building canyon cell floor which will maintain the required air zone pressure differential is 100 square feet.
- (17) Soil thermoconductivity for the drywell spent fuel storage concept is 1.2 w/mk.
- (18) Constraint of the soil thermoconductivity requires high-burnup or 5-year fuel to be canistered intact.
- (19) Spent fuel which cannot be consolidated (5% of throughput) includes high-burnup fuel, 5-year fuel, nonstandard fuel (i.e., extra long) and "damaged" fuel.
- (20) The target value for remotely operated equipment utilization will be 50% but will not exceed 60% to allow time for tool changeout, off-normal event recovery, and periodic maintenance and testing.

- (21) Onsite transfer casks for bare, intact spent fuel transfers between waste handling buildings have a capacity equal to a standard rail cask, e.g. 21 PWR or 48 BWR fuel assemblies.
- (22) Shipping casks receive external decontamination only.
- (23) No routine maintenance or reconfiguration of transportation casks is performed at the MRS.
- (24) Dual-purpose casks will be stored horizontally at the MRS.
- (25) Loading of spent fuel into canisters or containers will not be based on "heat tailoring" of the emplacement container.
- (26) Canisters or containers will be delivered to the MRS with the top (pintle) end attached, permitting bottom loading and closure of the unit.
- (27) Defective canister or container welds will be repaired by cutting off the base of the unit and welding a new end cap in place.
- (28) Thermal loads generated by spent fuel assemblies are 550 watts per PWR and 180 watts per BWR.
- (29) Time to perform incremental operations will be based on Design Study 2 of the CDR.
- (30) No miscellaneous fuel cycle hardware (i.e., flow channels, control spiders, etc.) will be received at the MRS

2.2.2 MRS COSTS

The following assumptions relate to cost data developed for the system study:

- (1) Site preparation costs will be based on the Advanced Conceptual Design Report (ACDR) developed for a generic site.
- (2) Consolidation equipment design, cost, and operating times shall be as presented in the CDR, although it is anticipated that the equipment to be tested in the Prototypical Consolidation Demonstration Project will be utilized in the MRS final design.
- (3) Operating envelopes, capital equipment costs, and operating costs for the CDR canister handling and welding systems are adequate to permit the future substitution of new equipment relating to the emplacement container or the new MRS canister configurations.
- (4) Labor rates, escalated to 1988 dollars, and productivity factors will be as presented in the CDR.
- (5) Subelement costs relating to engineering, construction management, program management, etc., will be calculated as a percentage of constructed value.

- (6) A contingency factor of 30% will be applied to all construction costs for the Spent Fuel Handling Building (SFHB), Vault Storage Building (VSB), and major modifications to the R & H Building design. All other facility construction costs, in accordance with the CDR, are burdened with a 20% contingency.
- (7) The frequency of HEPA filter changeout to be used for life cycle cost data is as follows:

<u>Filter Location</u>	<u>Frame</u>	<u>Consolidated Fuel Handling</u>	<u>Intact Fuel Handling</u>
Contaminated Area (nontestable)	Stainless Steel	1 month	6 months
Remote Changeout	Stainless Steel	4 months	-
Zone I and II	Wood	12 months	12 months
General Exhaust	Wood	12 months	24 months

- (8) Decommissioning costs are a percentage of constructed value. The percentages are 12% for contaminated facilities/items and 5% for potentially contaminated facilities, and 1% for noncontaminated facilities.
- (9) Adequate potable water is available for MRS operations and requires minimal water treatment and associated equipment as presented in the CDR.
- (10) All support buildings presented in the CDR are required to support MRS operations.
- (11) Costs associated with the transportation system and its components and those associated with the disposal of waste packages are not included in the cost data presented in this report.

2.2.3 MRS SCHEDULES

The design, construction, and operating schedules developed for the study are based on the following:

- (1) The operating schedules, Tables 2-1 through 2-12, are the basis for design and cost data developed for the study.
- (2) Acceptance schedules in accordance with the constraints of the NWPAA are identical for the repository-delay cases except for the calendar year of the start of operation.
- (3) The design configuration for Scenarios 5, 8, and 9 is the same as that developed for the CDR.

- (4) New building configurations developed for phased construction or resulting from function additions/deletions (i.e., no consolidation for Scenarios 3,4,6 and 7) require the preparation of an advanced conceptual design prior to license application (LA) design.
- (5) Sufficient specific site data is available within the first six months of LA design.
- (6) Construction activities for critical elements of the R&H Building, such as concrete placement, can be performed on a double-shift basis (2-shift/5-day week).
- (7) Adequate construction personnel are available at the jobsite.
- (8) Labor contracts are in place for the duration of construction activities.
- (9) No major delays (greater than one week) are encountered because of weather.
- (10) Remotely-operated, programmable cranes can be procured and delivered to the jobsite in twelve months.
- (11) Duration for NRC license application review and approval is assumed to be 30 months for those scenarios (5 through 9) requiring a R&H Building in accordance with that presented in Reference 2 (Section 1.4).
- (12) Due to reduced functions, complexity, and size at the SFHB, the license application review and approval is assumed to be 24 months.
- (13) For three-phase construction, long-lead equipment will be procured by the government prior to construction authorization.

2.3 CDR MODIFICATIONS

When compared to the design parameters for the CDR, the study criteria and assumptions stated require modifications to the design and/or operation of the MRS. The following highlights the primary impacts of the study criteria on multiple scenarios.

2.3.1 RECEIPT RATES

The reduction of the base case receipt rate from 3600 MTU/yr to 2700 MTU/yr or 3000 MTU/yr retains the R&H Building footprint but may reduce the operating time to three shifts per day, five days per week. This reduction does not apply to security and fire station personnel and only a partial reduction in maintenance personnel is feasible. The potential reduction of personnel in the R&H Building is dependent on the receipt of HLW, the process cell operating time, and/or the storage option.

2.3.2 CASK RECEIPT

The increase in the quantity of truck casks received for a brief period increases the utilization rates of the receiving and cask unloading equipment. This increase in the number of casks received is offset by the increased capacity of the casks and the overall reduction in receipt rates.

2.3.3 FUEL CHARACTERISTICS

The spent fuel mix and the MTU content per assembly for the CDR can be revised to match the study criteria without an operating impact. However the reduction of unconsolidated fuel from 10% to 5% of throughput reduces the quantity of canisters or containers and has a related impact on the storage requirements.

2.3.4 IN-BUILDING LAG STORAGE

Maintaining the R & H Building canyon cell footprint presented in the CDR requires variations in the quantity of material stored for each scenario. The canyon cell lag storage vault capacity, as shown in the CDR, is 1000 MTU of consolidated, canistered spent fuel and does not reflect the requirement for 10% of the fuel to remain intact. Changes in the fuel quantity and its associated heat generation impacts the size of the vault cooling system. Note that for Scenarios 3 and 4, no in-building lag storage vault is required.

2.3.5 ONSITE GENERATED WASTE

Shipment of remotely-handled and contact-handled LLW to a disposal site is to be performed on a routine, scheduled basis. The concrete storage casks allocated to remotely-handled LLW and the CHTRU Storage Facility presented in the CDR are therefore deleted.

2.3.6 PHASED CONSTRUCTION

The NWPAA states that the MRS construction cannot be initiated until construction authorization for the repository has been received from the NRC. However, the Amendments Act does permit up to 10,000 MTU of material to be stored at the MRS prior to the start of repository operations. Since the construction period of the MRS is approximately equal to the repository, early receipt of waste at the MRS may only be feasible if the MRS Facility is constructed in phases. The criteria for this study identifies the possible use of three phases to accelerate the receipt of waste. The single-phase MRS has the capacity to receive, package, and store spent fuel and is comparable to the size and configuration of the CDR facility. Two-phase would require the construction of a second waste handling building (the SFHB) designed to receive and prepare for storage, bare intact spent fuel while the primary waste handling building (R&H Building) was being completed. The addition of the capability to receive and store dual purpose casks to the two-phase option is defined as a three-phase MRS. Flow diagrams for phased construction are presented in Figures 2-1, 2-2, and 2-3. Diagrams containing additional details relating to each scenario are presented in the scenario sections.

Table 2-1 - MRS Operating Schedule

Facility Operation: Single-phase facility construction, eastern location, no HLW received, maximum throughput of 2,700 MTU/yr of spent fuel (SF).

Waste Acceptance Schedules: 2, 9, and 18

<u>Operating Year</u>	<u>SF Thru R&H Bldg.</u>	<u>SF Stored</u>	<u>SF Shipped</u>
1 (Note 1)	1,350	950	400
2	2,025	2,075	900
3	2,700	3,275	1,500
4	2,700	3,725	2,250
5	2,700	4,175	2,250
6-22	2,700	4,175	2,700
23 (Note 2)	2,700	1,701	2,700
24 (Note 3)	1,701	0	1,701

Notes:

- (1) Requires hot test of R&H Building at full scheduled receipt rate.
- (2) R&H Building receives spent fuel from reactors and from storage.
- (3) R&H Building receives only from storage.

Table 2-2 - MRS Operating Schedule

Facility Operation: Two-phase facility construction, eastern location, no HLW received, maximum throughput of 2,700 MTU/yr of spent fuel (SF).

Waste Acceptance Schedules: 3, 10, and 19

<u>Operating Year</u>	<u>SF Thru SFHB</u>	<u>SF Thru R&H Bldg.</u>	<u>SF Stored</u>	<u>SF Shipped</u>
1 (Note 1)	1,350	-	1,350	-
2	2,025	-	3,375	-
3	2,700	-	6,075	-
4 (Note 2)	1,700	1,000	8,375	400
5 (Note 3)	-	2,700	10,175	900
6	-	2,700	11,375	1,500
7	-	2,700	11,825	2,250
8	-	2,700	12,275	2,250
9-22	-	2,700	12,275	2,700
23 (Note 4)	2,474	2,700	9,801	2,700
24 (Note 4)	2,700	2,700	7,101	2,700
25 (Note 4)	2,600	2,700	4,401	2,700
26	-	2,700	1,701	2,700
27	-	1,701	-	1,701

Notes:

- (1) Requires hot test of SFHB at full scheduled receipt rate.
- (2) R&H Building hot test reduces receipt rate of SFHB.
- (3) SFHB placed in hot standby.
- (4) Intact, bare SF retrieved from storage via SFHB.

Table 2-3 - MRS Operating Schedule

Facility Operation: Three-phase facility construction, eastern location, no HLW received, maximum throughput of 2,700 MTU/yr of spent fuel (SF).

Waste Acceptance Schedules: 4, 11, and 20

<u>Operating Year</u>	<u>SF in D/P Casks</u>	<u>SF thru SFHB</u>	<u>SF thru R&H Bldg.</u>	<u>SF in Storage</u>	<u>SF Shipped</u>
1	750	-	-	750	-
2 (Note 1)	1,100	1,000	-	2,100	-
3	1,100	2,025	-	4,125	-
4 (Note 2)	1,100	1,700	1,000	6,825	-
5 (Note 3)	1,100	-	2,700	9,125	400
6	1,100	-	2,700	10,925	900
7	1,100	-	2,700	12,125	1,500
8	1,100	-	2,700	12,575	2,250
9	1,100	-	2,700	13,025	2,250
10-22	1,100	-	2,700	13,025	2,700
23 (Note 4)	1,100	524	2,700	12,501	2,700
24 (Note 4)	1,100	2,700	2,700	9,801	2,700
25 (Note 4 & 5)	-	1,501	2,700	7,101	2,700
26	-	-	2,700	4,401	2,700
27	-	-	2,700	1,701	2,700
28	-	-	1,701	-	1,701

Notes:

- (1) SFHB hot test reduces quantity of D/P (dual-purpose) casks received.
- (2) R&H Building hot test reduces receipt rate of SFHB.
- (3) SFHB placed in hot standby.
- (4) Intact, bare SF retrieved from storage via SFHB.
- (5) R&H Building unloads spent fuel from D/P casks (for Scenarios 3 and 4, D/P casks not unloaded but are shipped directly to repository in last operating year).

Table 2-4 - MRS Operating Schedule

Facility Operation: Single-phase facility construction, western location, no HLW received, ~~maximum~~ throughput of 3,000 MTU/yr of spent fuel (SF).

Waste Acceptance Schedules: 26, 32, and 40

<u>Operating Year</u>	<u>SF Thru R&H Bldg.</u>	<u>SF Stored</u>	<u>SF Shipped</u>
1 (Note 1)	1,350	950	400
2	2,025	2,075	900
3	3,000	3,575	1,500
4	3,000	4,325	2,250
5	3,000	5,075	2,250
6-21	3,000	5,075	3,000
22 (Note 2)	3,000	4,701	3,000
23 (Note 3)	3,000	1,701	3,000
24 (Note 3)	1,701	-	1,701

Notes:

- (1) Requires hot test of four cells in R&H Building at full scheduled receipt rate.
- (2) R&H Building receives spent fuel from reactors and from storage.
- (3) R&H Building receives only from storage.

Table 2-5 - MRS Operating Schedule

Facility Operation: Two-phase facility construction, western location, no HLW received, maximum throughput of 3,000 MTU/yr of spent fuel (SF).

Waste Acceptance Schedules: 27, 33, and 41

<u>Operating Year</u>	<u>SF Thru SFHB</u>	<u>SF Thru R&H Bldg.</u>	<u>SF Stored</u>	<u>SF Shipped</u>
1 (Note 1)	1,350	-	1,350	-
2	2,025	-	3,375	-
3	3,000	-	6,375	-
4 (Note 2)	2,000	1,000	8,975	400
5 (Note 3)	-	3,000	11,075	900
6	-	3,000	12,575	1,500
7	-	3,000	13,375	2,250
8	-	3,000	14,075	2,250
9-21	-	3,000	14,075	3,000
22 (Note 4)	374	3,000	13,701	3,000
23 (Note 4)	3,000	3,000	10,701	3,000
24 (Note 4)	3,000	3,000	7,701	3,000
25 (Note 4)	2,001	3,000	4,701	3,000
26	-	3,000	1,701	3,000
27	-	1,701	-	1,701

Notes:

- (1) Requires hot test of SFHB at full scheduled receipt rate.
- (2) R&H Building hot test reduces receipt rate of SFHB.
- (3) SFHB placed in hot standby.
- (4) Intact, bare SF retrieved from storage via SFHB.

Table 2-6 - MRS Operating Schedule

Facility Operation: Three-phase facility construction, western location, no HLW received, maximum throughput of 3,000 MTU/yr of spent fuel (SF).

Waste Acceptance Schedules: 28, 34, and 42

<u>Operating Year</u>	<u>SF in D/P Casks</u>	<u>SF thru SFHB</u>	<u>SF thru R&H Bldg.</u>	<u>SF in Storage</u>	<u>SF Shipped</u>
1	750	-	-	750	-
2 (Note 1)	1,100	1,000	-	2,100	-
3	1,100	2,025	-	4,125	-
4 (Note 2)	1,100	2,000	1,000	7,125	-
5 (Note 3)	1,100	-	3,000	9,725	400
6	1,100	-	3,000	11,825	900
7	1,100	-	3,000	13,325	1,500
8	1,100	-	3,000	14,075	2,250
9	1,100	-	3,000	14,825	2,250
10-22	1,100	-	3,000	14,825	3,000
23 (Note 4)	1,100	1,124	3,000	13,701	3,000
24 (Note 4)	1,100	3,000	3,000	10,701	3,000
25 (Notes 4 & 5)	-	901	3,000	7,701	3,000
26	-	-	3,000	4,701	3,000
27	-	-	3,000	1,701	3,000
28	-	-	1,701	-	1,701

Notes:

- (1) SFHB hot test reduces quantity of D/P (dual-purpose) casks received.
- (2) R&H Building hot test reduces receipt rate of SFHB.
- (3) SFHB placed in hot standby.
- (4) Intact, bare SF retrieved from storage via SFHB.
- (5) R&H Building unloads D/P casks (for Scenarios 3 and 4, D/P casks not unloaded but are shipped directly to repository in last operating year).

Table 2-7 - MRS Operating Schedule

Facility Operation: Single-phase facility construction, eastern location, maximum throughput of 2,700 MTU/yr of spent fuel (SF) and 400 MTU/yr of HLW.

Waste Acceptance Schedules: 48, 54, and 62

Operating Year	Spent Fuel			HLW		
	Thru R&H Bldg.	Stored	Shipped	Thru R&H Bldg.	Stored	Shipped
1 (Note 1)	1,350	950	400	-	-	-
2	2,025	2,075	900	-	-	-
3	2,700	3,275	1,500	400	400	-
4	2,700	3,725	2,250	400	800	-
5	2,700	4,175	2,250	400	1,200	-
6-19	2,700	4,175	2,700	400	1,200	400
20 (Note 2)	2,700	4,175	2,700	400	999	400
21 (Note 2)	2,700	4,175	2,700	400	599	400
22 (Note 2)	2,700	4,175	2,700	400	199	400
23 (Notes 2&3)	2,700	1,701	2,700	199	-	199
24 (Note 4)	1,701	-	1,701	-	-	-

Notes:

- (1) Requires hot test of R&H Building at full scheduled receipt rate.
- (2) R&H Building receives HLW from storage.
- (3) R&H Building receives SF from reactors and from storage.
- (4) R&H Building receives SF only from storage.

Table 2-8 - MRS Operating Schedule

Facility Operation: Two-phase facility construction, eastern location, maximum throughput of 2,700 MTU/yr of spent fuel (SF) and 400 MTU/yr of HLW.

Waste Acceptance Schedules: 49, 55, and 63

Operating Year	Spent Fuel				HLW			
	Thru SFHB	Thru R&H Bldg.	Stored	Shipped	Thru SFHB	Thru R&H Bldg.	Stored	Shipped
1 (Note 1)	1,350	-	1,350	-	-	-	-	-
2	2,025	-	3,375	-	-	-	-	-
3 (Note 2)	2,700	-	6,075	-	400	-	400	-
4 (Note 3)	1,700	1,000	8,375	400	-	400	800	-
5 (Note 4)	-	2,700	10,175	900	-	400	1,200	-
6	-	2,700	11,375	1,500	-	400	1,600	-
7	-	2,700	11,825	2,250	-	400	2,000	-
8	-	2,700	12,275	2,250	-	400	2,400	-
9-19	-	2,700	12,275	2,700	-	400	2,400	400
20 (Note 5)	-	2,700	12,275	2,700	-	400	2,199	400
21 (Note 5)	-	2,700	12,275	2,700	-	400	1,799	400
22 (Note 5)	-	2,700	12,275	2,700	-	400	1,399	400
23 (Notes 5&6)	2,474	2,700	9,801	2,700	-	400	999	400
24 (Notes 5&6)	2,700	2,700	7,101	2,700	-	400	599	400
25 (Notes 5&6)	2,601	2,700	4,401	2,700	-	400	199	400
26	-	2,700	1,701	2,700	-	199	-	199
27	-	1,701	-	1,701	-	-	-	-

Notes:

- (1) Requires hot test of SFHB at full scheduled receipt rate.
- (2) Receipt of HLW at the SFHB can result in surface contamination of the canister; HLW shipments in year 3 should be re-evaluated.
- (3) R&H Building hot test reduces receipt rate of SFHB.
- (4) SFHB placed in hot standby.
- (5) HLW retrieved from storage directly to R&H Building.
- (6) Intact, bare SF retrieved from storage via SFHB.

Table 2-9 - MRS Operating Schedule

Facility Operation: Three-phase facility construction, eastern location, maximum throughput of 2,700 MTU/yr of spent fuel (SF) and 400 MTU/yr of HLW.

Waste Acceptance Schedules: 50, 56, and 64

Operating Year	Spent Fuel					HLW			
	In D/P Casks	Thru SFHB	Thru R&H Bldg.	Stored	Shipped	Thru SFHB	Thru R&H Bldg.	Stored	Shipped
1	750	-	-	750	-	-	-	-	-
2 (Note 1)	1,100	1,000	-	2,100	-	-	-	-	-
3	1,100	2,025	-	4,125	-	-	-	-	-
4 (Notes 2)	1,100	-	1,000	6,825	-	-	-	-	-
5 (Note 3)	1,100	-	2,700	9,125	400	-	-	-	-
6	1,100	-	2,700	10,925	900	-	400	400	-
7	1,100	-	2,700	12,125	1,500	-	400	800	-
8	1,100	-	2,700	12,575	2,250	-	400	1,200	-
9	1,100	-	2,700	13,025	2,250	-	400	1,600	-
10-22	1,100	-	2,700	13,025	2,700	-	400	1,600	400
23 (Note 4)	1,100	524	2,700	12,501	2,700	-	400	1,399	400
24 (Note 4)	1,100	2,700	2,700	9,801	2,700	-	400	999	400
25 (Notes 4,5&6)	-	1,501	2,700	7,101	2,700	-	400	599	400
26 (Note 6)	-	-	2,700	4,401	2,700	-	400	199	400
27 (Note 6)	-	-	2,700	1,701	2,700	-	199	-	199
28	-	-	1,701	-	1,701	-	-	-	-

Notes:

- (1) SFHB hot test reduces quantity of D/P (dual-purpose) casks received.
- (2) R&H Building hot test reduces receipt rate of SFHB.
- (3) SFHB placed in hot standby.
- (4) Intact, bare SF retrieved from storage via SFHB.
- (5) R&H Building unloads SF from D/P casks.
- (6) HLW retrieved from storage directly to R&H Building.

Table 2-10 - MRS Operations Schedule

Facility Operation: Single-phase facility construction, western location, maximum throughput of 3,000 MTU/yr of spent fuel (SF) and 400 MTU/yr of HLW.

Waste Acceptance Schedules: 70, 76, and 84

Operating Year	Spent Fuel			HLW		
	Thru R&H Bldg.	Stored	Shipped	Thru R&H Bldg.	Stored	Shipped
1 (Note 1)	1,350	950	400	-	-	-
2	2,025	2,075	900	-	-	-
3	3,000	3,575	1,500	400	400	-
4	3,000	4,325	2,250	400	800	-
5	3,000	5,075	2,250	400	1,200	-
6-19	3,000	5,075	3,000	400	1,200	400
20 (Note 2)	3,000	5,075	3,000	400	999	400
21 (Note 2)	3,000	5,075	3,000	400	599	400
22 (Notes 2&3)	3,000	4,701	3,000	400	199	400
23 (Notes 2&3)	3,000	1,701	3,000	199	-	199
24 (Note 4)	1,701	-	1,701	-	-	-

Notes:

- (1) Requires hot test of R&H Building at full scheduled receipt rate.
- (2) R&H Building receives HLW from storage.
- (3) R&H Building receives SF from reactors and from storage.
- (4) R&H Building receives SF only from storage.

Table 2-11 - MRS Operating Schedule

Facility Operation: Two-phase facility construction, western location, maximum throughput of 3,000 MTU/yr of spent fuel (SF) and 400 MTU/yr of HLW.

Waste Acceptance Schedules: 71, 77, and 85

Operating Year	Spent Fuel				HLW			
	Thru SFHB	Thru R&H Bldg.	Stored	Shipped	Thru SFHB	Thru R&H Bldg.	Stored	Shipped
1 (Note 1)	1,350	-	1,350	-	-	-	-	-
2	2,025	-	3,375	-	-	-	-	-
3	3,000	-	6,375	-	-	-	-	-
4 (Note 2)	2,000	1,000	8,975	400	-	-	-	-
5 (Note 3)	-	3,000	11,075	900	-	-	-	-
6	-	3,000	12,575	1,500	-	-	-	-
7	-	3,000	13,325	2,250	-	400	400	-
8	-	3,000	14,075	2,250	-	400	800	-
9-21	-	3,000	14,075	3,000	-	400	800	400
22 (Note 4)	374	3,000	13,701	3,000	-	400	800	400
23 (Note 4)	3,000	3,000	10,701	3,000	-	400	800	400
24 (Notes 4&5)	3,000	3,000	7,701	3,000	-	400	599	400
25 (Notes 4&5)	2,001	3,000	4,701	3,000	-	400	199	400
26 (Note 5)	-	3,000	1,701	3,000	-	199	-	199
27 (Note 5)	-	1,701	-	1,701	-	-	-	-

Notes:

- (1) Requires hot test of SFHB at full scheduled receipt rate.
- (2) R&H Building hot test reduces receipt rate of SFHB.
- (3) SFHB placed in hot standby.
- (4) Intact, bare SF retrieved from storage via SFHB.
- (5) HLW retrieved from storage direct to R&H Building.

Table 2-12 - MRS Operating Schedule

Facility Operation: Three-phase facility construction, western location, maximum throughput of 3,000 MTU/yr of spent fuel (SF) and 400 MTU/yr of HLW.

Waste Acceptance Schedules: 72, 78, and 86

Operating Year	Spent Fuel					HLW			
	In D/P Casks	Thru SFHB	Thru R&H Bldg.	Stored	Shipped	Thru SFHB	Thru R&H Bldg.	Stored	Shipped
1	750	-	-	750	-	-	-	-	-
2 (Note 1)	1,100	1,000	-	2,100	-	-	-	-	-
3	1,100	2,025	-	4,125	-	-	-	-	-
4 (Note 2)	1,100	2,000	1,000	7,125	-	-	-	-	-
5 (Note 3)	1,100	-	3,000	9,725	400	-	-	-	-
6	1,100	-	3,000	11,825	900	-	-	-	-
7	1,100	-	3,000	13,325	1,500	-	-	-	-
8	1,100	-	3,000	14,075	2,250	-	-	-	-
9	1,100	-	3,000	14,825	2,250	-	-	-	-
10-22	1,100	-	3,000	14,825	3,000	-	400	-	400
23 (Note 4)	1,100	1,124	3,000	13,701	3,000	-	400	-	400
24 (Note 4)	1,100	3,000	3,000	10,701	3,000	-	400	-	400
25 (Notes 4&5)	-	901	3,000	7,701	3,000	-	400	-	400
26	-	-	3,000	4,701	3,000	-	400	-	400
27	-	-	3,000	1,701	3,000	-	199	-	199
28	-	-	1,701	-	1,701	-	-	-	-

Notes:

- (1) SFHB hot test reduces quantity of D/P (dual-purpose) casks received.
- (2) R&H Building hot test reduces receipt of SFHB.
- (3) SFHB placed in hot standby.
- (4) Intact, bare SF retrieved from storage via SFHB.
- (5) R&H Building unloads spent fuel from D/P casks.

Figure 2-1
Single Phase Construction

Figure 2-2
Two Phase Construction

Figure 2-3
Three Phase Construction

SECTION 3

STUDY APPROACH

The objective of this study is the evaluation of specific variations on the total system life cycle cost (TSLCC). These variations include deletion or addition of functions to system elements (MRS versus repository), changes in waste acceptance schedules, and acceptance of high level waste (HLW) by the MRS.

To provide a uniform approach for developing TSLCC data, cost centers were defined relative to major functions. Each cost center is divided into subtier cost centers and/or cost elements to permit a more detailed evaluation of the functional variations. The cost centers utilized in the study are defined in Section 3.1. The correlation of these cost centers and the required scenarios, including the use of phased construction, is presented in Section 3.2.

Variations in the waste acceptance schedules primarily affect the quantity of material stored at and the operating life of the MRS Facility. The receipt and containerizing of HLW impacts Scenarios 6,7,8 and 9 relative to operations and storage volume, but these impacts do not result in modifications to facility arrangements. Schedule variations and HLW receipt requirements are addressed in Section 3.3.

Design, capital construction, and operating costs were developed for each scenario and related storage option, and were allocated to the appropriate cost centers and, as required, cost elements. The basis of the costs are described in Section 3.4. Note that this discussion is generic to all scenarios. Where specific variations of the bases are required for a scenario, the cost development is presented in the appropriate scenario section.

Schedules reflecting design, licensing, and construction durations were also developed for each scenario. A discussion of the schedule basis is presented in Section 3.5.

3.1 COST CENTER DEFINITIONS

Five major cost centers are used for the allocation of costs: 1) management and integration, 2) cask operations, 3) waste handling operations, 4) interim storage operations, and 5) balance of plant and support operations. The following sections describe the basic functions and/or buildings associated with these cost centers.

3.1.1 MANAGEMENT AND INTEGRATION

The management and integration cost center encompasses all activities, except construction, prior to the initiation of full operation. The cost elements of the management and integration cost center are:

- (1) site selection and investigation
- (2) design, including proof-of-principle tests, advanced conceptual design (if required), license application design, licensing support, final procurement and construction design, and engineering support during construction (Title III support);
- (3) operating contractor support during design and construction;
- (4) construction management; and
- (5) pre-operational testing and personnel training.

3.1.2 CASK OPERATIONS

The cask operations cost center includes the buildings or facility areas required to receive, inspect, and inventory incoming waste casks and transporters; provide onsite storage prior to cask unloading; provide onsite storage prior to release of empty or filled casks from the site; and to release a shipment from the site. The two cost elements of this cost center are:

- (1) receiving, including the Inspection Gatehouse; and
- (2) cask lag storage, including incoming, outgoing, and off-normal cask shipments.

3.1.3 WASTE HANDLING OPERATIONS

The waste handling operations cost center includes two subtier cost centers, each accommodating specific scenario functional requirements or phased construction options. Primary functions deleted from or added to the overall MRS operating options affect one or more of the subtier cost centers, therefore these subtier cost centers contain more detailed cost elements.

3.1.3.1 Receiving, Handling, and Packaging Building

The Receiving and Handling (R&H) Building is the primary waste handling building for Scenarios 5 through 9. Casks are received, unloaded, and shipped from the R&H Building. Spent fuel is packaged, temporarily stored in the building or transferred to interim storage, and loaded into casks for shipment to the repository. If consolidation is required by the scenario, radioactive waste resulting from this operation is also packaged and shipped offsite. For Scenarios 6 through 9, HLW received is unloaded from the shipping cask, stored if required, packaged, and shipped to the repository.

The cost elements of the R&H Building subtier cost center are:

- (1) cask unloading;
- (2) assembly lag storage;
- (3) processing, including consolidation if required;
- (4) volume reduction, if consolidation is performed;
- (5) canister (or container) closure;

- (6) canister (or container) lag storage;
- (7) interim storage loading and unloading;
- (8) MRS/repository cask handling; and
- (9) building support facilities.

3.1.3.2 Spent Fuel Handling Building

The Spent Fuel Handling Building (SFHB) receives casks containing spent fuel or HLW, if required by the scenario or acceptance schedule, for unloading. The unloaded material is transferred directly to storage; no waste packaging operations are performed. The SFHB is used as the primary waste handling building for Scenarios 3 and 4, or as the secondary waste handling building for the two-phase construction option of the remaining five scenarios. The following cost elements of the SFHB subtier cost center are:

- (1) cask unloading
- (2) assembly lag storage
- (3) processing (fuel handling)
- (4) interim storage loading and unloading
- (5) building support facilities

3.1.4 INTERIM STORAGE OPERATIONS

The interim storage operations cost center includes the storage structures and/or site improvements associated with radioactive waste material storage external of the R&H Building and the dual purpose cask Receiving Building. The Receiving Building (RB) is used for waste handling operations when dual-purpose (shipping and storage) casks are received onsite prior to the completion of the SFHB and R&H Building. Casks are received at the RB, transferred to an onsite transporter, and delivered to the storage yard.

The cost elements included in this subtier cost center are:

- (1) Storage Facilities
- (2) Storage Units
- (3) Receiving Building

3.1.5 BALANCE OF PLANT AND SUPPORT OPERATIONS

Since the MRS is a self-sufficient installation, support operations and the balance of plant features are typically not affected by the changes in waste handling and interim storage operations. The primary impact relates to the Cask Manufacturing Facility which is deleted for the drywell and vault storage options. The cost elements of this cost center are:

- (1) onsite preparation, including all site improvements for the limited access area and for the protected area which contains the waste handling operations;
- (2) offsite preparation required to interface with the existing infrastructure;

- (3) administration, consisting of the Administration Building only;
- (4) other support facilities, including all structures, associated equipment, and utilities on the MRS site not allocated to other cost centers or elements.

3.2 SCENARIO FACILITIES

Based on the definitions of the various cost centers and of the scenarios to be evaluated, a correlation can be made between the scenario requirements and the facilities or buildings required. Table 3-1 presents the scenarios, including phased construction options, as they relate to the cost centers or subtier cost centers.

Table 3-1 - Scenario Cost Centers

	Mgmt & Integration	Cask Opera- tions	Cost Centers			Interim Storage Operations (1)	Bal. of Plant & Support Operations
			Waste Handling Operations				
			R&H Bldg	SFHB	RB		
<hr/>							
Scenarios 3 & 4							
Single-phase	x	x		x		x	x
Two-phase	x	(2)		x	x	(3)	x
Scenario 5							
Single-phase	x	x	x			x	x
Two-phase	x	x	x	x		x	x
Three-phase	x	(2)	x	x	x	(3)	x
Scenarios 6 & 7							
Single-phase	x	x	(4)			x	x
Two-phase	x	x	(4)	x	x	(3)	x
Three-phase	x	(2)	(4)	x	x	(3)	x
Scenarios 8 & 9							
Single-phase	x	x	x			x	x
Two-phase	x	x	x	x		x	x
Three-phase	x	(2)	x	x	x	(3)	x

- (1) Storage options: concrete cask, drywell, & vault
- (2) Requires modification of inspection gatehouse
- (3) Adds dual-purpose cask storage
- (4) Deletes consolidation from processing cost elements and deletes volume reduction cost element

3.3 WASTE ACCEPTANCE VARIATIONS

Waste acceptance and associated operations can vary because of the MRS Facility location, the receipt of HLW at the MRS, and/or changes in the initiation of MRS or repository operations.

3.3.1 FACILITY LOCATION

The current draft 1988 Mission Plan Amendment reflects an eastern-region MRS location and identifies a reduced receipt rate of 2700 MTU/year to permit the transport of spent fuel from "western" reactors to the closer site of the repository. Since the site of the MRS has not been established, the potential for a western region MRS site and an accompanying receipt rate of 3000 MTU/year was also evaluated in the study.

The CDR is based on the construction of the MRS in the eastern sector with a design throughput of 3,600 MTU/year. The draft Mission Plan Amendment waste acceptance schedule reduces the CDR design rate by one-fourth. The proposed reduction does not require modification of the building designs; but does affect facility operations. For the lower rate, the MRS Facility, as presented in the CDR, can be operated on a three-shifts-per-day, five-days-per-week basis, although security, fire station, and maintenance personnel are required on the weekends. The reduced throughput would also affect the operating costs relating to consumables and utilities. Since the study varies the functions to be performed at the MRS, the projected operating shifts and associated costs are scenario-specific. The data provided for each scenario in subsequent report sections reflect the potential changes.

The receipt rate for the western location is likewise less than the CDR design rate, but is within the operational capability of the existing facility design for a three shift, five-day operation. Therefore the impacts discussed above also apply to a potential western site.

3.3.2 HIGH LEVEL WASTE RECEIPT

The study scope of work requested an evaluation of impacts resulting from the receipt of HLW canisters at the MRS. The potential receipt applies only to Scenarios 6 through 9 when the MRS prepares the final emplacement container prior to shipment of spent fuel to the repository. The rate of HLW receipt is 400 MTU/year which, at 0.5 MTU/canister, results in the potential handling of 800 24-inch canisters annually.

3.3.2.1 Operation

Receipt, handling, and shipment of HLW canisters will typically be performed in the weld discharge area of the R&H Building Canyon Cells. When required by the two-phase construction waste acceptance schedule (see Table 2-8 in Section 2), the canisters of HLW are unloaded from the shipping cask at the SFHB and transferred to storage by way of the spent fuel transfer cells.

Shipping casks containing HLW are received at the R&H Building and prepared for unloading utilizing equipment and procedures identical to the spent fuel rail casks, with one important difference: the cask cart used for the HLW cask is the loadout or repository shipping cask cart. The HLW canisters are unloaded from the cask by one of the two cranes in a canyon cell and are transferred to one of three locations: discharge lag storage, onsite storage transport (storage-option specific), or emplacement container preparation.

Casks can be unloaded into either canyon cell, however only a single weld station is provided in the weld/discharge area to serve both cells. To the extent possible, HLW will be unloaded in canyon cell #6 containing the weld station in order to simplify HLW handling operations. The "preferred cell" approach also minimizes the potential handling operation conflict resulting from outloading remotely-handled LLW drums into casks in canyon cell #5. When required, HLW received in canyon cell #5 is transferred to canyon cell #6 by the pass-through cart connecting the two cells.

When the SFHB is utilized for HLW receipt, the HLW canisters are transferred from concrete storage cask or drywell storage directly to the R&H Building for processing. For the open cycle vault storage concept, the canisters are returned to the SFHB spent fuel transfer cells, placed in a transfer cask, and delivered to the R & H Building weld/discharge area for further processing.

Prior to shipment from the MRS, the HLW canisters are placed in an upender, lowered to a horizontal position, aligned with the upender holding a container, and pushed into the container. The container upender rotates to the weld station and the container is welded. After leak testing, the container is checked for contamination and the weld undergoes the NDE process. The container is raised to a vertical position by the upender and is placed into the shipping casks by the canyon cell crane.

3.3.2.2 Design

The CDR is based on the receipt, handling, and possible storage of up to 60 canisters of HLW annually with a maximum storage of 300 HLW canisters. Although potential HLW receipt is 800 canisters/year, the CDR R&H Building arrangement is not impacted by the increase. Although the utilization rates of the cask cart, canyon cell crane, and storage-related equipment are increased, the rates are within the acceptable target values for these elements.

The welding station in the weld/discharge area of the CDR canyon cell was designed to accommodate canisters up to 26 inches in diameter. This welding station was to complete the overpacking process for defective canisters prior to shipment to the repository. Approximately 200 minutes per overpack is required for the load, weld, and test operations. If it is assumed that the same amount of time is required for the processing of the HLW emplacement container, the weld station will be operated on a routine basis during three operating shifts to accommodate the HLW canister quantity. Note that this station must also weld containers of NFBC drums for Scenarios 8 and 9.

3.3.3 ACCEPTANCE SCHEDULE VARIATION

The NWPAA defines two major constraints on the storage capacity at the MRS: 1) prior to repository operation, the storage inventory cannot exceed a total of 10,000 MTU; and 2) during the MRS operating life, the inventory cannot exceed 15,000 MTU. In addition, the NWPAA states that construction of the MRS can not be initiated prior to the issuance of the repository construction authorization by the NRC. The draft 1988 Mission Plan Amendment presents a preliminary schedule of waste acceptance for the repository and the MRS starting in 2003. MRS may be able to receive waste prior to the year 2003 if phased construction is utilized.

If authorized by Congress, the constraints of the NWPAA may be modified or removed. This potential was evaluated for the study to provide variations in costs as they relate to receipt schedules. In addition, the potential for a 5-year and a 10-year repository delay was also considered (both constrained and unconstrained by the NWPAA). A total of 88 possible schedules with an MRS in the waste management system were developed by staff at Roy F. Weston Co. in the MRS Action Plan Studies. In lieu of developing design descriptions and cost estimates for all schedules, typical or "base case" schedules were selected for the building designs and construction cost/schedule development with incremental or parametric operating cost data provided to Weston to permit a computer analysis of the other schedules.

As discussed in previous sections, the variations in waste quantities and forms have no substantial impact on the CDR design configuration. Therefore the primary impacts resulting from schedule variations relate to storage quantities and the operating life of the MRS, and associated capital and operating costs. The following sections describe the impact on the MRS of variations in the waste receipt schedules.

3.3.3.1 Constrained by NWPAA

The "base case" schedules in accordance with the NWPAA are presented in Tables 2-1 through 2-12 of Section 2. These MRS schedules reflect phased construction, eastern versus western location, and the receipt of HLW. The schedules also apply to the delay of the MRS and the repository for 5 or 10 years (a total of 36 potential schedules as noted on the tables).

Single-phase construction of the MRS Facility results in an operating life of 24 years and an onsite spent fuel inventory of 4,175 MTU (eastern) and 5,075 MTU (western) and a potential HLW inventory of 1,200 MTU. Since the R&H Building must be hot tested at the initial rate of 1,350 MTU in the first year, the operating and maintenance staff for three shifts may be required for testing and personnel training. Storage casks and drywells would be constructed as required, with the storage field prepared in progressive increments. The open-cycle vault storage concept requires the construction and operation of a vault building for spent fuel. Space for HLW in the vault building will also be required for Scenarios 6 through 9.

Two-phase construction extends the operating life to 27 years with a maximum site inventory of 12,275 MTU or 14,075 MTU of spent fuel plus up to 2,400 MTU of HLW. The SFHB only receives fuel for the first four years (the R&H Building

is tested at 1,000 MTU in the fourth year) and remains in hot standby until operating year 22 or 23 when the transfer of the storage inventory of intact bare spent fuel to the R&H Building, via the SFHB, is initiated. As with the single phase operation, the cask and drywell storage concepts are incrementally built. Each of the two waste handling buildings require the construction of storage vault buildings.

Three-phase construction extends the MRS operating life to 28 years and requires the interim storage of up to 1,100 MTU in dual purpose casks. The total site spent fuel inventory is 13,025 MTU (eastern) or 14,825 MTU (western) of which 6,125 MTU are bare, intact assemblies. In addition, as much as 1600 MTU of HLW may need to be stored.

3.3.3.2 Unconstrained by NWPAA

A total of 52 schedules were developed as examples of unconstrained conditions, assuming Congressional approval. These schedules reflect one or more of the following conditions:

- (1) Construction of the MRS initiated prior to receiving the repository construction authorization in 1998.
- (2) Delay of only the repository waste acceptance schedule for 5 years.
- (3) Delay of only the repository waste acceptance schedule for 10 years.
- (4) Phased MRS construction.
- (5) Waiver of the MRS inventory restriction.

Although the primary operations for any of the phased construction facilities are unchanged, the operating life varies from 27 years to 41 years. The inventory of spent fuel ranges from 12,275 MTU to 53,825 MTU, plus 2,400 MTU to 6,999 MTU of HLW. The maximum potential storage requirement is for a western location and the receipt of HLW for a total of 60,824 MTU at the MRS.

3.4 COST DATA DEVELOPMENT

This section presents the rationale and basis of the life cycle cost items reflected in the six cost data tables provided for each scenario. Each data sheet utilizes four of the five cost centers described in Section 3.1. The management and integration cost center is only presented on the first data sheet, whereas subsequent sheets portray data of the "operations" cost centers as they relate to construction costs, annual operating costs, staffing allocations, and decommissioning costs. In general, the data basis and methodology presented in this section are applicable to all scenarios. Where required, scenario-specific deviations are noted and discussed in the appropriate scenario section of this report.

Three of the six data tables present annual cost distribution (%) information. For the Management and Integration Table and the Construction Cost Distribution Table, the distribution is presented relative to the start of operations. Start of operations is defined as a single point in time between year -1 and

year +1 when the first spent fuel is received onsite. Therefore, the first year of operations (+1) also equates to the period of hot testing for the SFHB or R&H Building, depending on the scenario and construction phase.

The decommissioning cost distribution is defined relative to the last year of waste handling onsite, e.g. the last shipment is made to the repository during the "last year of operation". The quantity of material handled in the last year and the relative operating year (varies between year 24 and year 41) is specific to the waste acceptance schedule to be analyzed. Therefore the table identifies the years prior to that last year as a negative; the years after the last year are positive. Although decommissioning could be initiated on the waste handling building(s) in the last operating year, it was assumed that decommissioning of these buildings starts in the +1 year.

The following sections present the data development approach for each of the six data tables.

3.4.1 MANAGEMENT AND INTEGRATION

This cost center consists of the following five elements: site selection and investigation, design, operating contractor support, construction management, and pre-operational testing and personnel training. The following present the basis for element costing.

3.4.1.1 Site Selection and Investigation

The NWPA allows the DOE or the Negotiator to evaluate and recommend potential MRS sites. Subsequent to site recommendation, development of specific site data is required for design and licensing input. Therefore, site selection and investigation activities and their associated costs will be required and are the same for all scenarios. The following approach assumes multiple site selection and investigation by the DOE. The costs associated with the Site Selection process may not be incurred if a negotiation process is utilized.

Site Selection. This cost item provides the activities required to evaluate multiple sites and recommend an assumed total of three sites for consideration and final selection by the DOE. These activities include assistance in multiple site literature data gathering and evaluation; preliminary geotechnical and environmental field investigations and evaluations; and final report preparation.

The costs reflect an assumed six-month site screening phase resulting in the selection of three sites for which adequate geotechnical and environmental field data is available. This screening phase would be conducted by a dedicated task force which would assist in the evaluation of potential areas and specific locations and the recommendation of three or more specific potential MRS sites for further evaluation.

After the selection by DOE of three sites, preliminary field investigations, evaluations and report preparation would be conducted to provide information needed for an environmental assessment (EA). This phase is assumed to be six months in duration and will include field investigations to verify and update, if required, information previously gathered. Field work includes subsurface

borings and/or other methods of obtaining data to ascertain actual subsurface conditions; establishment of meteorological equipment and the initiation of data gathering; infrastructure interface requirement definition; and establishment of actual environmental, socioeconomic, and institutional profiles to provide a basis for impact evaluations. The evaluations and report preparation would be conducted by the same task force utilized for the site screening phase. It is estimated that the task force required for the total site selection activities will require a staff of 28 plus subcontracts for ground penetration radar, selective subsurface borings, and meteorological gathering.

The cost associated with these activities is \$4.7 million which includes \$3.7 million for engineering analysis and \$1.0 million for field investigation subcontracts.

Note that if sufficient existing site data is not available, the site selection phase could require a duration greater than 12 months with corresponding additional costs.

Site Investigation. This cost item provides the activities required to obtain the necessary site-related information required for subsequent MRS design and licensing efforts. These activities include detailed geotechnical, topographic, hydrological, environmental, and meteorological investigations and evaluations.

The cost for this effort was derived assuming a one-year investigation phase, resulting in sufficient data for a single site to support detailed design and an environmental report (ER) for the license application to the NRC. This phase would be a continuation of the data collection for the EA. The detailed investigations and evaluations include: continuation of subsurface borings, ecology data gathering, and meteorological data gathering; topographic surveys and mapping; vibratory ground motion and faulting survey and data collection; stability of surface and subsurface materials; surface and subsurface water quantity and quality; air quality; natural background radiation intensity; and more detailed data, if required, to evaluate potential socioeconomic impacts.

It is estimated that the task force required for the site investigation activities will require a staff of 18 plus subcontracts for geotechnical investigations, environmental monitoring, and socioeconomic studies.

The cost associated with this activity is \$3.9 million which includes \$2.4 million for engineering analysis and \$1.5 million for field investigation subcontracts.

3.4.1.2 Design

The activities associated with architect-engineer (A/E) design of the MRS Facility include: A/E support during proof-of-principle tests; advanced conceptual design if required; license application design; A/E licensing support; final procurement and construction design; and A/E Title III services. The cost for each design phase was based on: the number of activities and the A/E participation required for each activity (proof-of-principle tests); the effort required and the duration of the phase (A/E licensing support and A/E Title III services); and the engineering

deliverables or constructed value of facilities (advanced conceptual design, license application design, and final procurement and construction design).

Proof-of-Principle Tests. The proof-of-principle tests requiring A/E support include: 1) cask handling robotics; 2) canister/container structural tests; 3) decontamination systems; 4) canister/container welding; 5) fuel hardware volume reduction; and 6) sealed storage cask, drywell or vault tube thermal demonstrations. For each test, a manhour allocation was estimated and a cost developed using a manhour rate which includes direct, indirect, overhead, and profit. For this study, it is assumed that the cost for all tests are identical and the total cost for the six tests is \$1 million.

Advanced Conceptual Design. Those facilities not presently identified in the MRS CDR will require an advanced conceptual design (ACD). These facilities include SFHB, RB, Vault Storage Building (VSB) and the modified R&H Building (Modified R&H Building) for Scenarios 6 and 7. The ACDs for these facilities were estimated to be equal to 5% of their constructed value.

License Application and Final Procurement and Construction. To minimize the design schedule, the definitive design phase has been divided into two subphases: license application (LA) design and final procurement and construction (FPC) design. The LA design will develop the required analysis and documentation required by NRC for license consideration and approval. The FPC design will complete the analysis and documentation for the facilities and systems which are not important to safety.

The LA and FPC design costs for those facilities identical to that presented in the MRS CDR were based upon an estimate of the drawings required for the total effort. Using historical data, a manhour allocation per drawing and a unit cost per manhour was assigned to determine the total cost for these design phases. The manhour allocation includes: drawing and specification preparation, supporting calculations, engineering trade-offs, quality control, quality assurance, and administrative support.

For those facilities not presented in the MRS CDR (SFHB, RB, VSB and Modified R&H Building), the LA and FPC design costs were estimated to be 15% of the constructed value. It is estimated that the LA design will require 60% of the total design effort and the remaining will be required for the FPC phase. The design costs presented are scenario-specific and vary with the facilities/equipment required for the operational functions.

License Support. The effort required for A/E licensing support was developed by estimating the average number of personnel required (11) and the duration of the support activities. This estimate assumed a 12-month pre-submittal phase for the development of input to the license application in addition to the licensing phase which requires the development of data to support the hearings and of other supplemental information.

Except for special data development required for the license application, licensing support is a function of the number of hearings, amount of supplemental data required and the duration of this phase. For this study, the license application duration and its associated cost were based on that present in the CDR or an assumed duration (scenario specific).

Title III Support. Using historical data, the effort for A/E Title III support for the facilities presented in the MRS CDR were developed by estimating the number and classifications of field and home office personnel. The activities to be performed during the construction phase include review of vendor drawings, interpret design intent, and provide field engineering support. For those facilities not presented in the CDR (the SFHB, RB, VSB and Modified R&H Building), the A/E Title III support cost was estimated to be 5% of the constructed value of the facilities.

A/E Title III Support is a function of the project size. Consequently, the costs presented are scenario-specific and vary with the facilities/ equipment required for the operational functions.

3.4.1.3 Operating Contractor Support

This category includes the technical management and overview of the design and construction activities by the contractor designated to be the operator of the facility. The cost of reviews of the design and of the cost and schedule management are included. Similar activities are included in the construction phase of the facility.

The cost for the design support was estimated by personnel who had the experience of managing the conceptual design of the MRS facility. The same personnel estimated the cost for the technical overview of the construction phase.

3.4.1.4 Construction Management

The activities associated with construction management include establishment of field construction facilities; subcontract construction management; construction schedule and budget preparation, reporting and control; field inspection; quality control; and management of procurement for major materials and equipment.

The cost for facilities presented in the MRS CDR were derived by estimating the number, classifications and duration of the personnel required for this activity. For those facilities not presented in the MRS CDR, the costs were derived from a cost/constructed-value relationship of approximately 15% for a facility with a 15,000 MTU storage capacity.

The construction management costs are directly affected by the project size, and indirectly by the construction duration. Therefore, the costs presented are scenario-specific and vary with the facilities/equipment required.

3.4.1.5 Pre-operational Testing and Personnel Training

The activities associated with preoperational training and personnel testing encompass reviewing the design for operability and maintainability; developing and preparing operations and maintenance manuals and procedures; witnessing construction acceptance tests; preparing training manuals and procedures; training of the operators; conducting preoperational testing of the facility, systems and equipment; and training personnel for security and fire protection.

The cost for this activity was estimated by personnel experienced in the start-up and operation of nuclear facilities, coupled with the understanding of the type and complexity of the equipment proposed for the MRS facility. The cost is affected directly by the number of systems in the facility and indirectly by the duration of the personnel training and the preoperational testing. Therefore, the cost for this activity is the same for similar facilities. When the number and complexity of the systems significantly change, the costs change.

3.4.2 CONSTRUCTION

This cost item includes all activities required to construct the MRS Facility, such as construction of site improvements, buildings, structures, utilities, interties to offsite infrastructure and all equipment required for an independent facility.

The costs for facilities which were identical to those presented in the MRS CDR were derived from the CDR cost estimate of 1985. These construction costs were developed using material and equipment takeoffs based on the CDR drawings and specifications. The total construction cost was escalated to 1988 dollars by applying an average escalation factor. This factor was derived by applying a labor escalation factor of 1.078 to the total MRS construction labor account and a material and equipment escalation factor of 1.062 to the total MRS material and equipment accounts.

Construction costs for scenarios which required variations of the MRS CDR facilities were developed by scaling the CDR costs based on facility area. Equipment costs were developed by deletion or additions of specific equipment required by the scenario operations.

Construction costs for facilities not presented in the MRS CDR were derived from material take-offs of the preconceptual facility arrangements, allocations based on facility area, and historical cost data from like facilities.

3.4.2.1 Cask Operations

The Cask Operations cost center elements are categorized by functional activities. These elements will be required for all MRS operational scenarios, with variations in cost resulting from additional facilities/equipment to support ongoing waste receipt operations during construction phasing. This cost center includes the facilities (Inspection Gatehouse) and the site development (roads, parking, and rail spurs) required for normal and off-normal lag storage of incoming casks and their transporters.

The receiving element includes the Inspection Gatehouse as defined and costed in the CDR. Modifications to the Inspection Gatehouse are required for all three-phase and Scenario 3 and 4 two-phase construction scenarios. The modifications included the addition of a site alarm monitoring system (AMS) and additional space for security personnel for the first three years of operations.

The cask lag storage element costs were derived from a material take-off, using an assumed rail spur and parking area configuration capable of storing 24 incoming rail casks, 24 outgoing rail casks, and 64 truck casks. In addition, the onsite off-normal storage area provides storage for 10 incoming rail and 10 incoming truck casks.

3.4.2.2 Waste Handling Operations

This cost item includes the facilities (R&H Building and SFHB) required for preparation of incoming waste for storage.

The construction costs for all cost elements were developed for facility construction and for equipment procurement and installation. The CDR and subsequent preconceptual design cost estimate formats and cost collection were not in accordance with the functional cost elements established for the study. Therefore the facility costs ("Brick and Mortar") for these elements, except cask unloading, were proportioned based on the building area required for each element. The facility cost for the cask unloading element was derived from a material take-off of the receiving and inspection areas. Note that the costs associated with the Steam Generator Building and Cooling Tower, which support the R&H Building and SFHB, are included in the building support facilities cost element.

Allocations and variations of the cost center and cost elements required by specific scenarios and/or construction phases are discussed in subsequent sections of the report.

Equipment procurement and installation costs were derived by allocating the costs of specific equipment items which are associated with the cost element's function. In general, the equipment costs were assigned as follows:

<u>Element</u>	<u>Equipment Types</u>
Cask unloading	Special doors; cask and transport handling and washdown; and ventilation equipment.
Assembly lag storage	PWR and BWR intact spent fuel racks.
Processing	Cask transfer; cask shields; shielding doors and windows; plugs and hatches; spent fuel handling and, when required, consolidation; and cell ventilation equipment.
Volume reduction	Drum/canister transfer, handling and decontamination; shielding doors and windows; NFBC reduction; and area ventilation equipment.
Canister/container closure	Canister/container transfer and handling; canister inserting, welding, decontamination and testing; shielding doors and windows; plugs and hatches; and area ventilation equipment.

<u>Element</u>	<u>Equipment Types</u>
Canister/container lag storage	Shielding windows; storage compartments and racks; emergency power generation; and storage area ventilation equipment.
Interim storage loading/unloading	Canister/container transfer and handling; shielding doors and windows; plugs and hatches; cask welding and inspection (for storage cask option only); and area ventilation equipment.
MRS/repository cask handling	Canister/container and cask transfer and handling; shielding doors and windows, cask shields; plugs and hatches; decontamination and testing; and area ventilation equipment.
Building support facilities	All equipment required for an operational facility not included above.

3.4.2.3 Interim Storage Operations

The interim storage cost center consists of variable and fixed costs. The total storage facility cost is a function of the storage capacity required. Consequently, the total cost is a function of the amount of waste stored.

The cost for all storage options (storage facility and storage unit cost elements) was derived from an assumed site configuration reflecting a storage inventory of 15,000 MTU.

For phased construction facilities utilizing dual-purpose casks, facility, and equipment cost data (fixed) for the RB was developed from material take-offs of the preconceptual design drawings. Equipment required to place the casks in the storage area are presented as fixed costs in the storage facilities cost element. Area development and storage saddles are shown as a cost per cask.

The storage facility element includes: storage area site development (patrol roads, lighting, CCTV, and fences); storage area equipment; and the VSB area and equipment required for waste handling and support functions.

These aspects of the storage facility cost element are reflected as fixed and/or variable costs depending on the storage option. For the storage cask and drywell storage concepts, the increase or decrease of onsite storage directly affects the storage area site development costs. Therefore area development is presented as a cost per storage unit while the emplacement equipment is a fixed cost. Due to variations in drywell spacing based on waste type and related thermal loading, site development for the drywell concept is included in the cost of constructing each size/type. The vault storage option site development is dependent on the number of vault buildings to be constructed and was calculated as a fixed cost per storage building. Similarly the VSB equipment and support area requirements are a fixed cost per storage building regardless of VSB storage capacity.

For all storage options, the cost of constructing the storage unit (e.g., cask and storage pad, drywell, and vault storage position) are shown as consumables (see Section 3.4.3.2).

3.4.2.4 Balance of Plant and Support Operations

The balance of plant and support operations cost center includes: site preparation, except for the storage yard; transportation system and utility system interfaces; Administration Building; and all other supporting facilities and utility systems. The systems, building, structures, and equipment included in each cost element include:

<u>Element</u>	<u>Systems, Buildings, Structures and Equipment</u>
Onsite preparation	All site work, roads, railroads, and fences associated with the limited and waste handling protected areas.
Offsite preparation	Ten miles of off-site roads, railroads, utilities, and associated earth work and fencing to interface with existing infrastructure
Administration	Administration Building and associated equipment
Other support facilities	Security Building, Main Gate/Badgehouse, Protected Area Gatehouse, Storage Area Gate Station, Site Services Building, Warehouse, Vehicle Maintenance Building, Fire Station, Cask Manufacturing Facility, Standby Generator Building, Water Treatment Facility, Sewage Treatment Facility, and all equipment and onsite utility distribution.

The systems, buildings, structures, and equipment required for each element, except off-site preparation, were assumed to be identical to those contained in the CDR. The offsite preparation element was based on an assumed ten-mile extension of existing infrastructure and were costed using unit costs as presented in the CDR.

Since the MRS Facility is an independent installation, all functions provided by the balance of plant and support operations cost elements are required for all scenarios.

3.4.3 ANNUAL OPERATING COSTS

This item provides the yearly cost required to maintain and replace the mechanical, electrical and instrumentation equipment and components and consumable items that will be used during operations.

3.4.3.1 Equipment Maintenance and Replacement

For costing purposes, mechanical equipment was classified as "passive" and "active." The active classification includes all equipment containing moving parts or wearing surfaces such as pumps, fans, and mixers. The passive classification includes all equipment having no moving parts or wearing surfaces such as tanks and racks. It was assumed that the yearly maintenance of active and passive equipment is 2% and 1%, respectively, of the equipment procurement cost. This percentage represents the cost required for component replacement only. The maintenance labor cost is included in the staffing allocations.

Replacement of electrical and instrumentation equipment and components was assumed to be 2% of their procurement costs. Allocation of the total electrical gear maintenance costs was proportioned using each element's electrical demand load. Instrumentation maintenance was assigned to the building support facilities element as a lump sum. As noted for the mechanical equipment, the maintenance labor cost is included in the operating personnel allocation.

Based on Parsons' unpublished historical data, equipment replacement frequencies were assigned in accordance with equipment types. The following presents the average life of various equipment classifications:

<u>Equipment Classification</u>	<u>Average Life (yrs)</u>
Electrical switchgear	25
Motors	10
Fans and coils	15
Ductwork and chillers	20
Filter housings and boilers	30
Active mechanical equipment	15
Passive mechanical equipment	30
Consolidation equipment	10
Instrumentation equipment	10
Vehicles	10
Handling equipment	30
Shield windows	30

For this study, equipment was categorized into a 10 and 20 year frequency classification.

Equipment maintenance and replacement costs are a function of the quantity of equipment required to satisfy operational requirements. Therefore, they are scenario-specific.

3.4.3.2 Consumables and Utilities

This cost item provides the consumables and utilities required to operate the MRS Facility. All costs were based on the CDR MRS configuration and, where required, were scaled to suit other MRS operational scenarios.

Consumables. Typically the unit cost of each consumable was furnished by others or was derived from that shown in the CDR (escalated to 1988 dollars). In addition, other miscellaneous consumables; administrative, process, maintenance, and operating supplies; and service fees were allocated to the cost centers requiring their use.

The following items and associated unit costs were used, as appropriate, for the scenarios:

<u>Item</u>	<u>Unit Cost</u>
9" x 9" spent fuel canisters	\$1,800 (stainless steel)
6" x 6" spent fuel canisters	\$1,400 (stainless steel)
Repository reference containers	\$29,000 (stainless steel)
Intact fuel containers	\$31,000 (stainless steel)
HLW containers	\$17,000 (stainless steel)
NFBC and RH-LLW waste drums	\$520 (stainless steel)
NFBC Canisters	\$500 (stainless steel)
LLW waste drums	\$100 (carbon steel)
HEPA filters	\$350 (stainless steel frame)
	\$230 (wood frame)
Prefilters	\$60

Alternate materials are being considered for the MRS spent fuel canisters and the repository emplacement containers. If the material of construction is changed from the 304L stainless steel (as presented in the study data sheets) to alloy 825, the unit cost of the MRS canisters would increase to \$3,800 for the 9-inch unit and \$2,700 for the 6-inch unit. The corresponding unit cost for the repository reference container, the intact fuel container, and the HLW container would be \$59,000, \$63,000, and \$34,000, respectively.

The cost of onsite (interim) storage is related to the quantity of material stored, which varies with phased construction, operating functions, and/or waste acceptance schedule. In order to provide the capability to evaluate the storage variables, the constructed cost per storage unit was established. The cost of the concrete storage casks remains unchanged from the CDR. The cost per storage unit for the drywell was based on the CDR construction cost estimate, modified to reflect the size(s) required for the specific scenario. Since the thermal loading per dry well differs from the CDR, the drywell spacing was adjusted using the soil thermoconductivity value assumed for the study. The revised spacing is reflected in the site development cost and is included in the overall drywell unit cost. The storage position ("tube") cost for the VSB includes the proportional cost of the storage area structure of the building (vault and superstructure) plus the associated ventilation system for the emplacement equipment operating area.

The constructed value of each unit used for the scenarios, as appropriate, are as follows:

<u>Item</u>	<u>Unit Cost</u>
Spent fuel storage casks	\$197,000
NFBC and HLW storage casks	\$107,000
12-in drywell	\$4,000
16-in drywell	\$5,400
30-in drywell	\$11,800
16-in vault tube	\$8,000
30-in vault tube	\$12,000

Utilities. Utilities required for plant operation include the electrical power and fuel oil required for process steam and heating. Since these costs are operationally dependent, they are scenario-specific and also vary with construction phase.

The electrical consumption costs are based on the operational duration required for each scenario. In general, the CDR provided dedicated substations for each operating element of the MRS. The electrical power required was allocated based on the CDR substation demand loads which include adjustment factors for intermittent power usage of equipment, components, and lighting. For those facilities not included in the CDR, electrical power demand was based on estimates of specific operating equipment requirements and on area (square foot) allocations for lighting and general power.

Yearly power consumption was derived from the estimated demand loads and the anticipated usage during MRS operational and non-operational periods. The anticipated usage factors applied for typical connected services are as follows:

<u>Connected Service</u>	<u>Operating Period Usage (%)</u>	<u>Non-Operating Period Usage (%)</u>
Building ventilation	100	70
Steam generation	100	70
Cooling systems	100	70
Process and handling	100	-
Lag storage ventilation	100	100
Interior lighting	100	50
Exterior lighting	100	50

The MRS Facility assumes the use of fuel oil for steam generation and building heating. Based on consumption and building demands developed for the CDR, and scaled based on building volume, the total fuel oil consumption of the various operational configurations were determined.

3.4.4 STAFFING ALLOCATION

Although the four operations cost centers are retained, the allocation of staff within the cost centers is defined for specific operations, not functional areas as is the case with other cost distributions. Staff requirements vary relative to the quantity and type of waste received, handled, stored, and/or shipped. The requirements also change if functions are

added, deleted, or modified. To permit the required flexibility to establish the staff allocation over the operating life of the facility, incremental processing times were developed for each identified operation within the cost centers or subtier cost centers. The MRS CDR data was utilized in establishing unit operations and was modified, as required, to reflect the scenario-specific functions to be performed.

The annual FTE cost is the average value, of the composite crew escalated to 1988 dollars, developed for the operating cost analysis of the CDR design.

The FTE per crew is based on the composition of the crew (millwrights, hot cell operators, quality assurance, etc.) required for the specific function and the number of similar operating elements (process stations, volume reduction cells, discharge ports, etc.). The FTE/crew data was also derived from the CDR, modified as required for the scenario functions. The FTE/crew and the unit operating time establishes the number of shifts, and therefore the total staff, required for each operation. Since the staff requirements are based on the CDR, the CDR reference values for crews per shift, number of shifts, and annual number of units processed are shown on Table 3-2.

Facility maintenance, supervisory, laboratory, and other support staff is independent of the specific operations and was defined only as a total full-time-equivalent (FTE) value. Remote maintenance personnel, although associated with the operations, are also included in the support staff for the waste handling operations but are varied relative to the scenario-specific equipment maintenance anticipated.

The following paragraphs define the range of operations included for each functional activity presented on the staff allocation data sheets.

3.4.4.1 Cask Operations

This cost center includes all functions associated with the receipt of waste shipments at the Inspection Gatehouse and the transfer of the cask and carrier to either onsite lag storage or a waste handling building. Also identified is the time allocation relating to the release of casks, empty or loaded, from the site. The Inspection Gatehouse must be continuously staffed to permit the receipt of casks at any time.

3.4.4.2 Waste Handling Operations

This cost center contains two subtier cost centers, one for each of the major waste handling buildings. Data is provided for one or both buildings, depending on the scenario and the construction phase option.

Spent Fuel Handling Building Cask preparation time varies with the type (truck, rail or onsite transfer) of cask processed. The functional activities and associated processing time for a specific cask is identical for incoming casks for unloading or outgoing casks for loading. The processing times shown for cask preparation include all functional activities, except cask loading/unloading, for cask receipt; incoming/outgoing cask preparation;

Table 3-2 - CDR Reference Data
(3600 MTU/yr Throughput)

Functional Activities	No. of Crews/ Shift	No. of Shifts	No. of Units/Year
<u>Cask Operations</u>			
Receive and inspect casks	1	4	2259 SF casks and less than 12 HLW casks (up to 5 canisters/cask)
Inspect and ship casks	1	4	1259 SF, NFBC, and RH-LLW casks and 60 HLW casks (1 canister overpack/cask)
<u>Waste-Handling Operations</u>			
Spent Fuel Handling Building	N/A	N/A	N/A
Receiving and Handling Building			
Prepare transport casks for:			
unloading	6	4	1943 SF truck casks 316 SF rail casks less than 12 HLW rail casks
shipment	6	4	814 SF rail casks 316 NFBC rail casks 276 RH-LLW rail casks 60 HLW rail casks
Unload transport casks into process cells	4	4	4675 PWR assemblies 7742 BWR assemblies
Consolidate and canister fuel	4	4	2398 consolidated SF canisters 856 intact SF canisters
Volume-reduce and package NFBC	2	4	1582 drums
Weld, decon, and test canisters	2	4	3254 canisters
Canisters handling:			
to lag storage	2	4	varies

Table 3-2 (Contd)

Functional Activities	No. of Crews/Shift	No. of Shifts	No. of Units/Year
<u>Waste-Handling Operations (Contd)</u>			
storage loading/unloading	2	4	storage casks: 272 SF; 106 NFBC; 31 RH-LLW; 12 HLW drywells: 3254 SF; 316 NFBC; 276 RH-LLW; 60 HLW vault: N/A
transportation cask loading ⁽¹⁾ (w/repository "overpack")	2	4	814 SF; 316 NFBC; 276 RH-LLW; 60 HLW
Building support staff ⁽²⁾	varies	varies	N/A
<u>Interim Storage Operations</u>			
Receiving Building staff	N/A	N/A	N/A
Storage preparation, closure, and reopening:			
storage casks	1	1	421 casks
drywell	2	4	3906 drywells
vault	N/A	N/A	N/A
Storage placement:			
storage casks	1	1	421 casks
drywells	2	4	3906 drywells
vault	N/A	N/A	N/A
<u>Balance of Plant and Support Operations</u>			
Site support staff ⁽³⁾	varies	varies	N/A
⁽¹⁾ Each cask contains one "overpack" with a capacity of: 4 SF canisters, 5 drums (NFBC or RH-LLW), or one HLW canister ⁽²⁾ Building support, including laboratory, health physics, administration, control room, maintenance, etc., equals 181 ⁽³⁾ Other site support, excluding cask manufacturing, equals 287			

placement for unloading/loading; and release from the SFHB. Since onsite transfer casks do not require the same number of operations, a separate time is provided on the data sheets when the cask is required.

Cask unloading processing times include all functional activities required for cell port and cask inner lid opening; waste removal and placement in lag storage; and inner lid and cell port closing. The assumption of waste transfer and placement in lag storage provides in-cell waste handling operational flexibility and worst-case processing time.

Storage loading/unloading processing times include all functional activities required for cell port and storage cask or transport unit opening; waste transfer between lag storage and the storage cask or transporter; and cell port and storage or transporter closing. Similarly, times are provided for the loading/unloading of the onsite transfer cask when required by the scenario phased construction.

As previously stated, the building support staff is shown as a total FTE/crew value. Although the number is presented as a theoretical "single" shift, the quantity of personnel was calculated for multiple shifts based on throughput, processing times, and equipment utilization. The value presented is the anticipated total of all shifts required for a rate of 2700 to 3000 MTU/year.

Except for Scenarios 3 and 4, the SFHB is not used to load MRS-to-repository transport casks and the processing time for this operation is not presented on the staffing allocation tables. Since the unit capacity of the transport cask is identical to that used for Scenario 5, the MRS transport loading times presented for the R&H Building of Scenario 5 should be utilized for transport cask loading in Scenarios 3 and 4.

Some of the waste acceptance schedules show the receipt of HLW at the SFHB for approximately one year. Although the quantity of operation shifts should not be affected, the incremental operating times for transport cask unloading and storage loading/unloading will require modification. Since HLW is only evaluated in Scenarios 6 through 9, the process times presented for the R&H Building (phased construction) should be utilized.

Receiving and Handling Building. The functional activities for cask preparation and for transport cask unloading are identical to those required for the SFHB. Note that for phased construction, the values presented for the transfer casks must also be applied to the R&H Building. Onsite transfer casks containing spent fuel will be unloaded at the process cells; transfer casks with HLW will be unloaded at the MRS/repository cask loadout port in the weld/discharge area if the vault storage system is utilized. For the concrete cask and drywell concepts, the HLW is retrieved and transported directly to the R&H building onsite storage loadout ports in the weld/discharge area.

The functional activities for consolidation area canisterization or containerization of fuel or containerization of intact fuel have common initial and final operations. Intact spent fuel is retrieved from the in-cell lag storage and transferred into a horizontal canister or container positioned at the process/canyon cell dividing wall. The differences in operating or "processing" times reflect the type, capacity, and intermediate steps required

for loading of the canister or container. For intact spent fuel, each assembly must be processed as a single unit without the advantage of simultaneous cell operations. For consolidation, multiple assemblies are typically consolidated at one time. The exception is the need to consolidate only one PWR to each of the container segments for Scenarios 8 and 9, requiring each assembly and corresponding container segment to be treated individually.

For those scenarios which include consolidation, NFBC volume reduction and packaging is required. Since the canister or container is loaded horizontally, all volume reduced NFBC is packaged for further handling. The operating time is reflected as an average prior to drum transfer to the canyon cell either in drums (Scenario 5) or in containers (Scenarios 8 and 9.) The NFBC handling includes the transfer of the assembly top nozzle prior to fuel rod removal; transfer of the NFBC to the shredding/packaging operation; closure of the package; and transfer of the filled package and decontamination as required. The time required to supply the system with clean new drums or containers is also taken into account. Many of the operations are simultaneous, resulting in a "lapse" time on the data sheets.

The weld/decon/test of the canister or container includes all operations from the handling of the empty units to the completion of the weld test cycle. Credit is taken for simultaneous operations where possible. For instance, while a unit is being loaded (not part of the time allocation), a clean new unit can be obtained and placed into an empty canister/container downender. The containerizing of HLW in the discharge area of the canyon cell requires additional steps relating to the handling and inserting of each HLW canister into an emplacement container prior to welding. The additional steps increase the time for this operation to an average of 200 minutes/container, which takes into account the deletion of the inerting operation.

After the completion of the weld test, the canister/container is transferred to one of three destinations. Each of these options is presented separately in the table since the times are dependent on the destination and/or the capacity of the transport cask, storage cask, or storage transporter. Note that for those scenarios including consolidation, handling of NFBC cages and RH LLW, drums are also presented. Similarly, the loading/unloading times for HLW are shown for Scenarios 6 through 9.

As with the SFHB, building support staff is presented as FTE/crew and represents the total staff required for multiple shifts.

3.4.4.3 Interim Storage Operations

The RB is only required for construction phases utilizing dual purpose casks. The processing time allocation encompasses the operations from the receipt of a cask and carrier from the Inspection Gatehouse to the placement of the cask on the saddles in the storage area.

For the cask storage concept, the functional activities associated with cask preparation, loading, and reopening relate only to those functions within the SFHB or R&H Building prior to cask loading (e.g., alignment with the cask loadout port, operation of the contamination barrier, etc.); and to those functions required for cover plate welding after loading and cover plate

removal prior to unloading. The storage placement processing time allocation includes all functional activities required to deliver the cask to storage; the placement of the cask on the storage pad; connection of the monitoring system(s); and the transfer of a new cask from the Cask Manufacturing Facility to the waste handling building.

For the drywell and open cycle vault concept, a broader span of activities are included in the "transporter operations" function than in its cask counterpart. More functional activities are required to finalize storage placement, and these activities are performed concurrently with the travel time of the transporter. The drywell transporter operations include the delivery of the waste to a prepared drywell; the loading of an empty intact spent fuel basket and drywell shield plug, as required; return of the transporter to the waste handling building; and mating of the transporter with the cell for loading. The placement activities initiate with the removal of the drywell temporary cover and are completed by the seal welding of the final drywell coverplate and the connection of the monitoring system(s).

The transporter operations for the open-cycle vault system are similar to those of the drywell except that shield plug loading is not required and the transporter interfaces with a "fuel handling machine" within the VSB. The storage placement operations are: the delivery of the waste to a specific storage location in the vault; placement of the material; removal and replacement of the vault location shield plug; and the installation of the final coverplate.

3.4.4.4 Balance of Plant and Support Operations

Except for the Inspection Gatehouse and the Cask Manufacturing Facility, all remaining site personnel are allocated to this cost center. As with the support staff of the SFHB and the R&H Building, a total FTE value is presented. The majority of the personnel are employed on the day shift and provide administrative, maintenance, and training services. Security, emergency response, and some maintenance personnel are required at all times and are included in the total quantity shown.

3.4.5 DECOMMISSIONING

The activities associated with decommissioning are those required to economically restore the site for unrestricted use after MRS operations have been completed.

Decommissioning costs were assumed to be a percentage of the constructed value of the cost center. The percentages applied were 12% for Waste Handling Operations and the bare intact spent fuel storage units within Interim Storage Operations; 5% for all other Interim Storage Operations and for cask Operations; and 1% for Balance of Plant and Supporting Operations. Since the costs for decommissioning were based on the constructed value of each applicable element, these costs are scenario-specific and vary with each construction phase.

3.5 DESIGN AND CONSTRUCTION SCHEDULE DEVELOPMENT

For all scenarios, the overall schedule is dependent on the selection of a site(s), preparation of LA design documents, the NRC review and approval process (e.g., licensing), and construction of the critical-path facility. All scenarios require the construction of one or more major waste-handling buildings: the R&H Building and/or the SFHB.

The schedule durations are based on the CDR schedules, the assumptions stated in Section 2.2.3, and, for new buildings such as the SFHB, VSB, and RB, an evaluation of the construction labor and the building design. Note that siting-related activities correspond to the information presented in Section 3.4.1.1.

The first year of operation, e.g. the receipt of spent fuel at the MRS, varies with the use of phased construction. For VSB, SFHB and/or R&H Building construction, the first year of operation equates to the initiation or performance of facility hot testing. If dual-purpose casks are received, no period of hot testing for the RB is identified since the casks are received and stored without material unloading.

All schedules present a logical progression of activities required to provide input for the initiation of subsequent activities. To the extent feasible, the schedules utilize concurrent activities to optimize the overall duration. For example, site selection is performed simultaneously with advanced conceptual design to minimize the impact of this additional design activity. Similarly, the cold test of the equipment and components is performed during the last phase of construction, allowing two months of system operation tests after construction completion.

Design input data is required from proof-of-principle tests and site evaluation. Therefore, the initiation of these activities must be scheduled so that the resulting data can be incorporated into the LA design documentation prior to submittal to NRC. Based on the present CDR and subsequent studies and investigations, tests have been identified which provide the basis for initiation of testing. Therefore, this activity can be initiated prior to and/or concurrent with other site or design activities.

The principal design input resulting from site investigation is the geotechnical data required for foundation and seismic analysis/design. It is assumed that sufficient data to support the LA design can be available six months after initiation of site investigation which, depending upon scenario and construction option, provide a 12 to 19 month period for design incorporation.

Facilities requiring an ACD (SFHB, VSB, RB and Modified R&H Building) are variations of the CDR design or existing facilities and technology. Thus, where deemed appropriate for schedule minimization, it has been assumed that the ACD's will be developed as a generic design with assumed site conditions and, if required, modified to be site-specific during the LA design phase.

LA design is initiated based on the data developed from ACD and with that presented in the CDR. Therefore, to minimize schedule, it is assumed that LA

design and ACD can be performed concurrently for those options which utilize CDR input. However, the completion of the LA documentation requires the incorporation of input from ACD, proof-of-principle tests and site evaluation. Therefore, these activities are scheduled to be completed prior to completion of LA design.

Licensing and Final Procurement and Construction (FPC) Design are initiated at the completion of LA design and their durations are dependent upon previous license applications, operational experience and facility configurations. The licensing duration for those scenarios/construction phase options which include an R&H Building is shown as 30 months in accordance with the MRS Program Plan and the CDR. The license duration for the SFHB or VSB is assumed to be 24 months since the operational and storage methodology has been licensed or is on file as a topical report. Since the data developed by FPC is not required as input to licensing, this activity is scheduled concurrently with licensing. It should be noted that the license review and approval period will be determined by others.

In accordance with the federal regulations, MRS construction can not commence until authorized by NRC. Therefore, construction initiation is scheduled at the completion of the assumed licensing duration. The total construction schedule for any scenario/construction phase is determined by the facility which requires the greatest construction time. The estimated construction duration for the R&H Building configuration is 51 months; the SFHB configuration is 28 months; and, depending upon the specific scenario, VSB configuration is 33 to 50 months. Therefore, the waste receipt schedule is scenario, construction phase, and storage option dependent. In addition to the construction durations, additional schedule time is allocated for completion of cold testing prior to initiation of waste receipt (hot testing). It has been assumed that cold testing can be initiated 2 months prior to the completion of construction and that an adequate supply of construction personnel are available to perform concurrent construction activities for any of the phased construction options.

Brief discussions of the scenario-specific schedules, including construction phase and storage options, are presented in the scenario sections of this report.

SECTION 4

SCENARIOS 3 AND 4

Scenarios 3 and 4 are identical relative to the functions to be performed at the MRS Facility. Spent fuel will be received, stored, and shipped as bare, intact fuel assemblies. No consolidation or packaging operations are required. Figures 4-1 and 4-2 depict the basic functional flow of the MRS for these scenarios, including phased construction.

4.1 SPECIFIC CRITERIA AND ASSUMPTIONS

Criteria and assumptions specific to Scenarios 3 and 4 were required to provide design and cost bases for data prepared for the study. These criteria and assumptions are in addition to, or modifications of, those presented in Section 2.

4.1.1 SCENARIO CRITERIA

The following criteria are specific to Scenarios 3 and 4 and were obtained primarily during, or subsequent to, meetings of the study participants:

- (1) No in-building lag storage vault is required.
- (2) Phased construction consists of only two phases. Single-phase waste handling operations require the construction of the Spent Fuel Handling Building (SFHB). Two-phase construction adds the capability to receive and store dual purpose casks.
- (3) Rail casks received during steady-state operation of the MRS (receipt equals shipping) will not be unloaded but will be combined with MRS-loaded rail casks for a "unit" train to the repository.
- (4) Rail casks used to ship spent fuel from the MRS will have the capacity of 28 PWR or 61 BWR assemblies.
- (5) Since no packaging operations are performed at the MRS, HLW will not be received.

4.1.2 SCENARIO ASSUMPTIONS

In addition to the stated criteria the following were assumed for Scenarios 3 and 4:

- (1) The MRS operating schedules 2-2, 2-3, 2-5, and 2-6 presented in Section 2 are modified to reflect all spent fuel, except that received in dual purpose casks, is received at the SFHB, although the total quantities of waste received by the MRS remain unchanged.

Figure 4-1
Scenarios 3 & 4 Single Phase Construction

Figure 4-2
Scenarios 3 & 4 Two Phase Construction

- (2) Tables 2-1, 2-4, and 2-7 through 2-12 of Section 2 do not apply.
- (3) No remote-handled LLW (RH-LLW) is generated by fuel handling operations in the SFHB.
- (4) Contact-handled LLW treatment is identical to the CDR process and requires the same equipment arrangement and operation.
- (5) The SFHB fuel transfer cell design must accommodate the maximum receipt rate of truck casks plus the loading of rail casks for shipment to the repository in the same year.
- (6) All support buildings as presented in the CDR are required, except for modifications or deletions noted in Table 4-1.
- (7) Dual purpose casks and contained spent fuel are shipped directly to the repository.

Table 4-1

SUPPORT BUILDING MODIFICATIONS

<u>Building</u>	<u>Modification</u>
Inspection Gatehouse	Increase of administration and support areas for "two-phase" MRS
Storage Area Gate Station	Delete for vault storage option
Site Services	Revise mock-up equipment to reflect SFHB transfer cell
Standby Generator	Revise equipment and building to reflect new load requirements
Sewage Treatment	Proportion to site personnel quantity
Water Treatment	Modify storage tank and distribution to reflect revised requirements
Steam Generator	Reduce equipment and building to reflect deletion of RH-LLW treatment system

4.2 WASTE HANDLING OPERATIONS

The handling of spent fuel for Scenarios 3 and 4 is accomplished in a Spent Fuel Handling Building (SFHB) in the case of single-phase facility construction. For the two-phase facility where spent fuel is received initially in dual purpose (DP) casks in operating years 1 and 2, a Receiving Building (RB) is required to receive the dual purpose casks while construction of the SFHB is in progress. A description of the operations and facility designs is presented in the following sub-sections.

4.2.1 SPENT FUEL HANDLING BUILDING

The construction of an SFHB for the receipt, transfer to storage, and shipment of bare intact spent fuel is required. This building is used in lieu of the R & H Building presented in the CDR.

4.2.1.1 Operation

Shipments containing radioactive materials enter the site through an Inspection Gatehouse, where the casks and carriers are inspected. Offsite tractors or engines are disconnected from the carriers, an onsite tractor or railcar mover is attached, and the carriers are transported through a fenced corridor to the protected area. Access control for personnel and nonradioactive shipments that enter the protected area, from the limited area, is provided via the Protected Area Gatehouse.

After inspection, rail shipments containing radioactive material are routed onto a track that is provided for the receiving bay of the SFHB. A rail storage yard is also provided on the receiving bay side of the SFHB. The storage yard consists of ten tracks for: incoming spent-fuel cars, outgoing spent-fuel cars, empty incoming repository cars, and full outgoing repository cars, plus spares. This storage yard is connected to the receiving bay of the SFHB to provide flexibility for unloading the railcars during initial years of operations, loading the railcars, and creating the "unit train" shipment to the repository. Similar operations, including onsite storage, are provided for truck shipments.

An off-normal holding area is also provided for a limited number of truck and rail shipments. Shipments are routed to this interim storage area if shipping data is incomplete or the fuel is non-standard (i.e., high burn-up, extra long, etc.) and requires special handling. Shipments are retained in this area until the material can be handled in the SFHB.

Upon receipt at the SFHB receiving and inspection area, the cask impact limiters, personnel barriers, and cask restraints are removed. The cask is subsequently removed from its transport vehicle, placed on a cask cart, the cask and cart moved into the cask preparation and decontamination room where the cask is inspected for contamination, the interior gas pressure checked, gas samples taken and gas vented to the HVAC systems, the outer lid removed, and the inner lid bolts loosened. The cask cart is then moved into the cask unloading room and the cask mated to the transfer cell unloading port. The cask unloading room door is closed, thus completing the cask handling operation for unloading.

The spent fuel unloading operation begins with the removal of a transfer cell unloading port shield plug, using the cell power mast crane, followed by the replacement of the grapple and the removal of the shipping cask inner lid. The bolts and lid removal grapple is replaced with a spent fuel assembly grapple and the intact fuel assemblies removed from the shipping cask. In the event that a direct transfer of spent fuel assemblies to onsite storage cannot be made, the assemblies are placed in lag storage and subsequently loaded into storage.

For the storage cask option, a storage cask will have previously been mated to a loadout port and the loadout port plug and the storage cask shield plug removed, in simultaneous sequence with the initial shipping cask cell port mating operation. After completion of the fuel transfer, the storage cask shield plug and loadout port plug are replaced and the storage cask moved from the loadout/decontamination room into the transfer/discharge area where the cask lid is seal welded and the cask moved to the storage field. Due to the differences in spent fuel assembly capacities, multiple shipping casks from the reactors must be unloaded in order to fill each storage cask.

The drywell and vault storage building (VSB) options require an additional operating step to permit more efficient loading of these storage modes. Prior to the start of operations, the lag storage pits are loaded with special fuel baskets. These baskets are designed to receive either PWR or BWR assemblies. The PWR basket can hold four assemblies; the BWR basket, eight assemblies. The spent fuel unloaded from the shipping cask is placed in the appropriate basket configuration. Once filled, the basket is loaded into a drywell transporter or the open-cycle vault storage system transport cask and transferred to storage. At the storage location (drywell or vault building) the basket of fuel is placed in storage. To maintain a supply of baskets in the transfer cells, new baskets are inserted into the drywell transporter in the discharge area of the SFHB or into the transfer cask at the VSB prior to returning to the SFHB transfer cell. At the transfer cell, the new basket is loaded into the vacant lag storage position and a filled basket removed for transport to storage.

4.2.1.2 Design

The SFHB contains two transfer cells to unload shipping casks, transfer spent fuel to storage and to transfer stored spent fuel into rail shipping casks for transport to the repository. Each cell is provided with two shipping cask unloading/loading ports and one loadout port to storage. The four unloading ports support the 2700 and 3000 MTU/year receipt rates prior to the full operation of the repository. Upon reaching a steady state operation, the ports are used for truck cask unloading and/or rail shipping cask loading. Handling of the spent fuel assemblies and port shield plugs is by means of 20-ton power mast cranes.

The configuration of the facility loadout area is dependent on the storage mode. For the sealed storage cask and drywell options the configuration is the same. The vault storage option requires a shielded transfer through a corridor connecting the SFHB and the VSB.

The SFHB is a multi-level structure housing various building functions. The shipping cask receipt/inspection, cask preparation and unloading, and loadout, decon, and transfer/discharge areas are located on the ground level. Other functions such as radioactive waste treatment generated from decontamination procedures and replacement of HEPA filters, remote equipment maintenance, material receiving, change rooms, health physics, analytical laboratory, laundry, and administration are also on the ground level.

The spent fuel transfer cells are located on the second level with ports located directly over the cask unloading, and the cask loading and decon rooms below. Lag storage pits for PWR or BWR fuel assemblies provide operating flexibility in the transfer cells in the event a direct fuel assembly transfer to storage can not be made or when an extra handling step is required prior to storage (e.g., "basket" loading for multiple assembly transfer to a drywell or the VSB). Other functions located on the second level are the operating galleries, the control room, supply and exhaust air equipment rooms, electrical and mechanical equipment rooms, and supply and exhaust air fans and filters; the transfer cell crane maintenance rooms are located on the second level mezzanine.

Space is provided on the third level for lifting of transfer cell crane components from the crane maintenance room (directly below) for decontamination and extensive repair/replacement procedures.

The SFHB levels are served by stairways, a passenger elevator, and a freight elevator.

The building is provided with normal, standby, and uninterruptible power (UPS) supply electrical systems. Normal and standby power is distributed from the MRS site main substation adjacent to the Standby Generator Building. The UPS system is located in the SFHB.

Water for domestic, process, and fire protection is obtained from the MRS site water supply system. Hot water for the building heating system is provided by a hot water boiler in the SFHB mechanical equipment room.

The heating, ventilating, and air conditioning (HVAC) system is a once-through, cascading system. Ventilation zoning and differential air flow control ensures flow of air from areas of lower potential contamination to areas of higher potential contamination.

The building construction is a combination of reinforced concrete and structural steel framing systems. The incoming air control vestibule, the receiving/inspection area, and the outgoing air control vestibule are structural steel framing clad with insulated metal panels. The remainder of the structure is constructed of reinforced concrete of thicknesses corresponding to the shielding, earthquake, and tornado-missile impact (if necessary) design requirements. The exterior wall concrete surfaces are insulated and covered with metal panels.

The SFHB arrangement and HVAC flow diagram is shown on Drawings A-301 through A-305.

4.2.2 RECEIVING BUILDING

If dual purpose (storage/shipping) casks are utilized by the waste management system, the casks will be received and stored at the MRS prior to the completion of the SFHB. The early handling of these casks requires a limited completion of the site improvements and the construction of security fencing, a modified Inspection Gatehouse, and a Receiving Building (RB).

4.2.2.1 Operation

The process for receiving the casks at the MRS Facility Inspection Gatehouse is as described for the single-phase facility. However, after inspection and data input to the computer system, the onsite railcar mover transfers the railcar and cask to the RB.

The sequence of operations in the RB starts with the receipt of the dual purpose shipping cask from the MRS Inspection Gatehouse. After removal of the personnel barriers and impact limiters, the cask is disengaged from supports on the railcar and transferred onto a trailer equipped with a specially designed skid. The cask is lifted by the receiving area 150-ton crane with a specially designed lifting yoke. An onsite tractor moves the trailer to the storage field. The lifting yoke accompanies the cask and is used by a mobile crane at the storage field where the cask is placed on a concrete cradle.

4.2.2.2 Design

Site development which includes infrastructure construction, site preparation, onsite roads and rail spurs, the main electrical substation, and limited site distribution, water treatment, and limited sanitary sewer collection must be completed prior to the receipt of the cask shipments. In addition, double fence security and associated surveillance systems are required for the "operating" portion of the site.

The Inspection Gatehouse for the inspection of the arriving casks and railcars is required. To preclude the early construction and operation of other security buildings in the construction area of the site, the current design for the gatehouse is modified to provide the necessary administrative and alarm monitoring areas for the MRS site area utilized in this early phase. The administrative area is increased to accommodate additional office area plus related support space. Since the Security Building and Protected Area Gatehouse housing the alarm monitoring systems (AMS) will not be available, space has also been provided to house an interim AMS for the first two years of operation. A small computer room is also provided to log and track the necessary waste characteristics and cask shipment data until the main MRS computerized inventory system is operational.

The RB is designed to receive the casks and prepare the casks for transfer to storage. The primary building area is a receiving bay equipped with rails to accommodate the rail cars and a 150-ton bridge crane for the lifting of casks. The auxiliary hook of the crane is used to remove personnel barriers and impact limiters. The RB also contains spaces for administration maintenance, mechanical, and electrical functions. The facility is designed to handle a maximum of 750 MTU/year of spent fuel received in dual purpose casks from reactors.

The RB is complete with normal electrical power obtained from the MRS site main substation and water from the site water supply system. Hot water for the building heating system is provided by a hot water boiler in the RB.

Mechanical ventilation is provided for the receiving area, mechanical and electrical equipment rooms, and toilet areas. The administration/inspection offices and maintenance room is served by a second heating, ventilation, and air conditioning system.

The building is constructed of structural steel framing with insulated metal panel walls and roof.

In the storage area, the dual purpose casks are stored horizontally on reinforced concrete cradles supported by reinforced concrete footings.

The arrangement of the RB is shown on Drawing A-201.

4.3 STORAGE OPTIONS

Four methods for onsite storage of spent fuel were evaluated for the study: 1) concrete storage casks, 2) drywells, 3) open-cycle vault and 4) dual purpose casks. The first two options were presented in the CDR, although the capacity and design of each unit must be modified and the quantity of storage units will vary with the receipt schedules.

4.3.1 CONCRETE STORAGE CASKS

The concrete storage cask system operation and the design of the cask is described in the following sub-sections.

4.3.1.1 Operation

The casks are fabricated at the Cask Manufacturing Facility located in the industrial area of the MRS Facility site. When a storage cask is required, a cask is loaded into a cask transporter for delivery to the SFHB. A member of the security staff inspects the cask prior to transfer and accompanies the cask and transporter through the gates in the double security fence into the protected area of the site. The cask transporter enters the building through the transfer/discharge corridor and is moved into the cask loadout and decon room. The transporter aligns the cask with the loading port and the contamination barrier is remotely lowered to seal with the top of the cask.

The loading operation begins with the removal of the cell port plug by a lifting/transfer mechanism and the cask shielding plug by the in-cell crane. Intact spent fuel is loaded into the cask by the in-cell crane. After filling the cask, the shielding plugs are replaced and the contamination barrier lifted. The transporter and cask are moved to the transfer corridor where the outer lid is lowered onto the cask and seal welded to the cask liner.

The transporter delivers the cask to the storage yard via the Storage Facility Gate Station. A mobile crane lifts the cask from the transporter and places the cask on the previously prepared storage pad. Upon removal of the cask, the transporter returns to the Cask Manufacturing Facility for a new cask and the process is repeated.

Retrieval of the storage casks for unloading of stored material reverses the above process. After unloading, the cask can be decommissioned or is returned to the storage area until the initiation of facility decommissioning (two years prior to the last fuel shipment from the MRS).

4.3.1.2 Design

The concrete storage casks provide a double sealed, self-shielded, dry storage unit for intact spent-fuel assemblies. The storage casks are cylindrical, reinforced concrete structures with a stepped, carbon-steel-lined cavity and contain internal grids or racks to maintain proper fuel spacing. A cylindrical concrete shield plug with a mechanized seal fits into the open top of the cavity and a steel cover plate is seal-welded to the liner flange to close the cask. An air annulus is provided between the liner and the concrete in the spent fuel casks to provide additional heat removal capability and to maintain concrete temperatures within acceptable limits. If required, the cask cavity can be inerted although the present design does not reflect this capability (e.g., pipe connections for the evacuation and backfilling operations). All casks have been designed with the same height and exterior configuration; the casks are 22 ft high by 12 ft dia (outside diameter).

The maximum MRS onsite storage capacity applicable to all phased construction options is 15,000 MTU of spent fuel. This scenario is limited to the storage of intact spent fuel; therefore the capacity (MTU) of the concrete storage casks are identical for like fuel types and all construction options. The storage casks can contain 32 PWR (13.76 MTU) or 80 BWR (14.4 MTU) of intact spent fuel assemblies. The maximum onsite storage capacity (15,000 MTU) for the single phase construction options requires a total of 1,074 (730 PWR and 344 BWR) concrete storage casks. The concrete storage cask requirement for the two-phase construction option is described in Section 4.3.4.

The storage area required for a 15,000 storage capacity including access roads, alarm and isolation zones, and facility set-backs is approximately 79 acres for the single phase construction option. Drawings C-301 and -302 show the total site arrangement for the concrete storage cask system for a single and two-phase construction option.

4.3.2 DRYWELLS

The drywell storage system operation and the design of the drywell are described in the following sub-sections.

4.3.2.1 Operation

Operations are initiated by the loading of an empty fuel basket and drywell shield plug. In the discharge corridor of the SFHB, a new empty basket and a shield plug is loaded into the transporter. The transporter is moved into the cask loadout and decon room. As with the cask concept, the transporter aligns its cask with the loading port and the contamination barrier is remotely lowered to seal with the top of the cask. The shielded transporter is designed for top-loading and bottom-unloading. The upper gate of the transporter shield is opened, the cell port plug removed, the empty fuel basket removed and transferred to lag storage, and a basket of intact spent fuel is loaded into

the transporter. After the cell plug is replaced and the upper gate closed, the transporter exits the building and enters the storage yard via the storage Facility Gate Station.

In the storage yard, the temporary cover over the prepared drywell is removed and the drywell inspected prior to the arrival of the loaded transporter. The transporter is positioned over the drywell and the shield lowered to rest on the concrete pad. The lower gate is opened, the transporter winch lowers the basket into the drywell, and the winch is retracted. The drywell shield plug, temporarily stored in the base of the transporter shield, is moved into position below the winch and is grappled and lowered into position. The lower gate is closed, the transporter shield lifted, and the transporter returns to the SFHB while a drywell cover is welded in place, sealing the drywell, and the monitoring system is connected.

Retrieval of the stored waste for shipment to the repository reverses the above process and the drywell can be decommissioned.

4.3.2.2 Design

Drywells provide a passive method for safely storing spent fuel by using the surrounding geologic medium to attenuate radiation and to dissipate the decay heat generated by the waste. The drywell storage unit consists of a carbon steel liner, a shield plug with a mechanical seal, and a seal-welded coverplate. The liner is placed vertically in a bored hole in the ground and grouted in place. A 5-ft diameter by 18-inch deep reinforced concrete pad surrounds the top of the liner at the ground surface. The liner and seal-welded coverplate are designed to protect the stored waste. If required, the design of the drywell can be modified to permit inerting of the cavity prior to sealing.

The drywell liner for this scenario has a 30-in diameter and is spaced at 21 ft. on-center in each direction. It was sized to accommodate a rack of either 4 PWR (1.72 MTU) or 8 BWR (1.44 MTU) intact spent fuel assemblies. As noted in Section 4.3.1.2 this scenario is limited to the storage of intact spent fuel assemblies, therefore the capacity and configuration of the drywells are identical for like fuel types and all construction options. The maximum onsite storage capacity (15000 MTU) for the single phase construction option requires a total of 9281 (5843 PWR and 3438 BWR) drywells. The drywell storage requirement for the two-phase construction option is described in Section 4.3.4.

The storage area required for a 15,000 MTU storage capacity including access roads, alarm and isolation zones, and facility set-backs is approximately 153 acres for the single phase construction option. Drawings C-321 and -322 show a total site arrangement of the drywell storage system for a single and two-phase construction option.

4.3.3 OPEN-CYCLE VAULT

The open cycle vault storage system operation and design are described in the following sub-sections.

4.3.3.1 Operation

The open cycle vault storage system operations begin with the movement of a shielded transfer cask (TC), supported on a motorized railcart, being positioned under a loading port in the cask loadout and decon room of the SFHB. The rail cart is remotely operated between the SFHB and the VSB cask unloading port along a transfer corridor. Two TCs on carts are provided for this operation, each on a separate track and each serving one SFHB port and one of two VSB ports. After movement of the TC to a position below a SFHB loading port, the TC is aligned with the port, the contamination barrier is remotely lowered to seal with the cask, the port shield plug is removed by the process cell crane and set aside, and the TC sliding shield gate at the top of the transfer cask is opened. A basket containing either 4-PWR or 8-BWR spent fuel assemblies is then loaded into the TC by the process cell crane, the port shield plug is replaced, and the TC shield gate is closed.

After disengagement of the TC from the SFHB loading port, the TC is moved to the VSB and mated to a VSB unloading port. The VSB unloading port is opened by a sliding mechanism and a bridge-mounted fuel handling machine (FHM) is positioned over the unloading port. The TC and FHM shield gates are opened, the FHM winch and grapple lifts the fuel basket into the FHM fuel basket cavity, and the FHM shield gate is closed. The FHM is moved from its position over the unloading port and the port is closed. The FHM is moved to and mated with a storage tube from which the cover plate has previously been removed. The FHM storage tube shield plug cavity is positioned over the shield plug and lifts the shield plug, with its winch and grapple, into the cavity. The FHM is repositioned to place the fuel basket cavity over the storage tube, the shield gate is opened, and the winch and grapple lower the fuel basket into the storage tube. The FHM is repositioned and the shield plug is installed on the top of the storage tube, the FHM shield gates are closed, and the FHM is transferred to the unloading port to begin another operating cycle. After removal of the FHM a cover plate is installed over the storage tube and the tube is inerted.

Retrieval of the stored spent fuel for shipment to the repository is by a reverse sequence of operations. Upon complete retrieval and shipment of spent fuel to the repository, the VSB is decommissioned.

4.3.3.2 Design

The VSB is a multiple-story structure comprised of a TC transfer corridor, a shielded TC unloading decon and equipment maintenance room, a shielded storage tube vault with means for passive ventilation of the vault area, an operating chamber above the storage vault, storage room for low-level solid radwaste (such as filters), a liquid radwaste storage tank system, storage, mechanical and electrical equipment rooms, health physics control area, and administrative office space. Drawings A-101, A-102, A-103, and A-104 show the configuration of the VSB.

Personnel access to the TC unloading/decon room and the operating chamber above the storage tube vault is by way of the health physics control area through airlocks and a stairway.

The TC transfer corridor connects the SFHB and the VSB. The corridor is equipped with two sets of rails to accommodate the two shielded TC railcars. Personnel access to the transfer corridor, if required, is via the SFHB transfer/discharge area.

The VSB TC unloading room is a shielded room equipped with viewing windows for operator observation while manning the control console for operation of the shield doors, TC railcart travel and unloading port/TC shield mating mechanism. The storage tube vault area contains a number of carbon steel pipe storage tubes oriented vertically between the storage vault floor and the operating chamber above. The storage tubes are set into a carbon steel stool piece attached to the vault floor and pass through carbon steel sleeves attached to the heavy shield concrete floor of the operating chamber above. The storage tube port has a stepped concrete shield plug and a seal ring.

The storage tubes for a basket of intact spent fuel assemblies, 4-PWR or 8-BWR, are 30 inches in diameter and spaced 5 ft on center in 5 rows along the airflow path. Drawing A-102 shows the storage tube arrangement. Each storage tube vault module (30 ft x 174 ft) contains two storage areas each containing 50 30-inch diameter tubes side by side, separated by an exhaust air shaft. Once the SFHB is in service, one year of spent fuel storage (3000 MTU) requires 1857 30-inch diameter storage tubes (approximately 18-1/2 modules). The cooling air flow in each of the vault areas enters through an exterior louvered opening, flows across the storage tubes, and exits through the vertical exhaust shaft. The flow is caused by the pressure differential between the air inlet and exhaust (resulting from the heating and expansion of the air) in the storage vault. The supply air inlet and air shaft outlet design permits a sufficient quantity of air flowing through the system to maintain the fuel within safe storage limits.

The operating chamber above the storage vault provides access to the storage tubes and to the transfer cask load-out port by use of the FHM. The chamber is equipped with a bridge crane upon which the FHM is mounted. The chamber is also modular in design for easy expansion along with the storage vault.

The VSB includes systems to monitor the environment in and around the storage tubes, the vault, and operating areas of the facility for radiation and contaminated airborne particulates.

The VSB is complete with normal and standby power obtained from the MRS site main substation and the Standby Generator Building.

Water for domestic, process, and fire protection is distributed from the MRS site water supply system. Hot water for the building heating system is provided by a hot water boiler.

The heating, ventilating, and air conditioning (HVAC) system in areas other than the storage tube vault, as described earlier, is a once-through cascading system. Ventilation zoning and differential air flow control directs air from areas of lower potential contamination to areas of higher potential contamination. The operating chamber above the storage tube vault is provided with roof ventilators and, during winter, heating from space heaters. Mechanical and electrical equipment rooms and storage rooms have ventilation

and heating systems independent of the vault system. Heating, ventilating, and air conditioning is provided in the administrative office area, including the health physics area.

The building is constructed of reinforced concrete and structural steel framing. The operating chamber above the storage tube vault is structural steel framing clad with insulated metal panels on the walls and roof. The remainder of the structure is constructed of reinforced concrete of thicknesses corresponding to the shielding, earthquake, and tornado-missile impact (if necessary) design requirements.

For the purpose of this study and to minimize the VSB length, the maximum single phase construction option storage capacity is contained in five vault buildings, two containing 18 modules and three with 19 modules for a total capacity of 9300 30-inch storage tubes or approximately 15,000 MTU of spent fuel. The VSB requirement for the two-phase construction option is described in Section 4.3.4.

The storage area required for a 15,000 MTU storage capacity including access roads, alarm and isolation zones, and facility set-backs is approximately 73 acres for the single phase construction option. Drawings C-331 and -332 show a total site arrangement for an open-cycle vault storage system for single and two-phase construction options.

4.3.4 DUAL PURPOSE CASK STORAGE

In the two-phase construction case for this scenario, dual purpose casks (DP) containing bare, intact spent fuel assemblies are received at the RB, transferred to an onsite trailer, and transported to storage. The DP casks are lifted from the trailer by a mobile crane and placed horizontally on concrete saddles. A maximum of 1,100 MTU of spent fuel could be received and stored in 106 DP casks at the MRS. The quantity of spent fuel assemblies stored in DP casks reduces the amount of storage required for any of the other storage options to 13,900 MTU.

The number of concrete storage casks required to store 13,900 MTU of intact spent fuel is 677 PWR and 319 BWR for a total of 996 intact spent fuel casks. The storage area required for this construction option, including dual purpose and concrete storage casks, is approximately 78 acres including access roads, alarm and isolation zones, and facility set-backs.

The number of 30-inch drywells required to store 13,900 MTU of intact spent fuel is 5415 PWR and 3185 BWR for a total of 8600 intact spent fuel drywells. The storage area required for this construction option, including dual purpose casks and drywells, is approximately 147 acres including access roads, alarm and isolation zones, and facility set-backs.

The number of 30-inch vault storage tubes required to store 13,900 MTU of intact spent fuel is the same as noted for the 30-inch drywell. The 8600 storage tubes are contained in four buildings containing 17 storage modules and one building containing 18 storage modules. The storage area required for

this construction option, including dual purpose cask and Vault Storage Buildings, is approximately 73 acres including access roads, alarm and isolation zones, and facility set-backs.

4.4 COST DATA

This section presents the rationale for the cost data applicable for Scenarios 3 and 4, (see Tables 4-2 through 4-37). Rationale which is identical to that presented in Section 3.4 is noted by reference; only scenario specific deviations are described herein.

4.4.1 MANAGEMENT AND INTEGRATION

This cost center presents the rationale for development of cost associated with all A/E and operating contractor activities required prior to initial operations. Since scenario-specific deviations occur in elements of this cost center, each cost element is addressed.

4.4.1.1 Site Selection and Investigation

The activities associated with this cost center are as described in Section 3.4.1.1.

4.4.1.2 Design

The activities associated with this cost center are as described in Section 3.4.1.2 except as modified by the scenario specific requirements described in the following paragraphs.

Proof-of-Principle Tests. This scenario does not require the consolidation and packaging of spent fuel. Therefore, the proof-of-principle test associated with canister/container integrity and spent fuel hardware volume reduction is not required resulting in a 50% reduction in the total estimated testing cost presented in Section 3.4.1.2.

Advanced Conceptual Design. Since this scenario requires facilities which were not included in the MRS CDR, an advanced conceptual design phase is required prior to initiation of license design. Advanced conceptual design costs are included for the Spent Fuel Handling Building, Vault Storage Building, Receiving Building, and the site development design associated with these buildings.

License Application and Final Procurement and Construction Design. All storage and construction options will require license application and final procurement and construction design phases. The cost developed for these phases is in accordance with the rationale presented in Section 3.4.1.2.

License Support. As noted in Section 3.4.1.2, the license support cost is based on an assumed licensing duration. Since the duration is assumed to be 24 months for this scenario, the cost allocated for this activity is based on an average of 11 man-years/year for the prelicense and licensing duration (36 months).

Title III Services. The cost for this element was developed from the constructed value of the total facility required for each storage and construction option in accordance with the rationale presented in Section 3.4.1.2.

4.4.1.3 Operating Contractor Support

The rationale for development of this cost center is presented in Section 3.4.1.3.

4.4.1.4 Construction Management

The cost for this activity was developed from the constructed value of the total facility required for each storage and construction option in accordance with the rationale presented in Section 3.4.1.4.

4.4.1.5 Preoperational Testing and Personnel Training

The rationale for development of this cost center is presented in Section 3.4.1.5.

4.4.2 CONSTRUCTION

The rationale for development of costs associated with the construction of Scenarios 3 and 4 MRS Facility is in accordance with that presented in Section 3.4.2.

4.4.3 ANNUAL OPERATING COSTS

The cost developed for all elements of this cost center is in accordance with the rationale presented in Section 3.4.3.

4.4.4 STAFFING ALLOCATION

The cost developed for this cost center is in accordance with Section 3.4.4

4.4.5 DECOMMISSIONING

The cost percentiles developed for this cost center are in accordance with the rationale presented in Section 4.4.5.

4.5 DESIGN AND CONSTRUCTION SCHEDULES

The design and construction schedules for Scenarios 3 and 4 are presented on Figures 4-3 through 4-6. As stated in Section 3.5, the schedule durations for construction are based on an evaluation of the preconceptual design and the construction labor required. The overall construction plus cold test of the SFHB requires 30 months. The waste receipt schedule for the first year of SFHB operation should be reduced to permit hot testing of the facility at a reasonable rate. This reduction would require the SFHB to receive the maximum average annual quantity of spent fuel in the second year and/or increases the last operating year receipt rate. From an operations perspective, it may be more desirable to maintain the current second year quantity at 2025 MTU and

add the additional receipt to the last year. This option provides a progressive ramp up of receipt and of associated operating staff training and testing. For the two-phase construction option, the reduction could be absorbed by the use of additional dual purpose casks in the second year.

The critical path for all construction phase and storage options commences with the selection of the site(s) and includes site evaluation, ACD, LA, license approval, and facility construction and cold tests. NCR license approval is assumed to be 24 months which cannot be initiated until completion of LA and establishes the construction start milestone. The receipt of waste (plant startup) is determined by the construction duration and cold testing of the receiving and storage facilities required. The single phase construction option requires completion of all support facilities and the SFHB prior to waste receipt. In accordance with the MRS CDR construction schedules, all support facilities can be constructed in approximately 24 months. Therefore, the construction and cold testing of the SFHB (30 months) determines the waste receipt milestone for the cask or drywell storage option. The single phase vault storage option waste receipt milestone is determined by the 35-month duration required for construction and cold testing of the VSB. All two phase waste receipt milestones are determined by the construction and cold testing (12 months) required for the Inspection Gatehouse, Receiving Building and the dual purpose cask storage area. In all options it has been assumed that the storage facilities are ongoing with plant operations and will be completed when the maximum scheduled onsite storage capacity is completed.

Scenario: 3/4
Construction Phase: Single
Storage Concept: Cask

Date: 10/21/88
Revision: 2

		Percent of H & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6		41	48	11 (Rev. 1)									
Design														
Proof-of-Principle Tests (3 Tests)	0.5		41	54	5 (Rev. 2)									
Advanced Conceptual Design	5.4 (Rev. 2)				100									
License Application Design	19.4 (Rev. 2)					67	33							
Licensing Support	4.2						75	50	25					
Final Procurement and Construction Design	12.9 (Rev. 2)						50	50						
Title III Support	10.8 (Rev. 2)								15	55	30			
Operating Contractor Support														
Design	4.0				10	73	33	29	5					
Construction	5.0							4	14	60	18	4		
Construction Management	32.3 (Rev. 2)								15	55	30			
Preoperational Testing and Personnel Training	32.7						7	11	17	24	41			

TABLE 4-2
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 3/4
Construction Phase: Single
Storage Concept: Cost

Date: 10/21/88
Revision: 1

COST CENTER/Cost Element	Building Area	Millions in 1988 \$		
		Facility Cost	Equipment Cost	Total Cost
CASK OPERATIONS				
Receiving	N/A	3.352	--	3.352
Cask Log Storage	N/A	2.996	--	2.996
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Cask Unloading	31420	7.432	2.852	10.284
Assembly Log Storage	4080	3.074	0.270	3.344
Processing	17524	9.639	7.615	17.254
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121
Building Support Facilities	101916	28.165	4.990	33.155
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	N/A
Cask Unloading				
Assembly Log Storage				
Processing				
Volume Reduction				
Canister/Container Closure				
Canister/Container Log Storage				
Interim Storage Loading/Unloading				
WHS/Repository Cost Handling				
Building Support Facilities				
INTERIM STORAGE OPERATIONS				
Storage Facility	N/A	\$7500/cask	7.810	--
Storage Units	N/A		See Consumables, Table 4-5	
Receiving Building	N/A	N/A	N/A	N/A
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Waste Preparation	N/A	32.193	--	32.193 (Rev. 1)
Offsite Preparation	N/A	16.295	--	16.295
Administration	N/A	2.605	0.424	3.029
Other Support Facilities	N/A	42.130	18.915	61.045

TABLE 4-3
CONSTRUCTION COSTS

Scenario 3/4
Construction Phase: Single
Storage Concept: Cask

Date: 9/23/88
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cont Element	1st Year										
	-6	-5	-4	-3	-2	-1	Operations	+1	+2	+3	+4
CASK OPERATIONS				50	50						
Receiving											
Cask Log Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				15	55	30					
Cask Unloading											
Assembly Log Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				N/A	N/A	N/A					
Cask Unloading											
Assembly Log Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Log Storage											
Interim Storage Loading/Unloading											
HRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS				15	55	30					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				25	50	25					
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 4-4
CONSTRUCTION COST DISTRIBUTION

Scenario 3/4
Construction Phase: Single
Storage Concept: Cask

Date: 9/73/88
Revision: 0

COST CENTER/Cost Element	Equipment Maintenance/Replacement (\$/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.014 N/Year Fixed
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS				\$2.140 N/Year Fixed
SPENT FUEL HANDLING BUILDING				
Cask Unloading	2.0			
Assembly Lag Storage	1.0			
Processing	1.5	1.0		
Interim Storage Loading/Unloading	1.2		24.0	
Building Support Facilities	1.2	4.3	12.3	Drums = \$100/Unit
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	
Cask Unloading				
Assembly Lag Storage				
Processing				
Volume Reduction				
Canister/Container Closure				
Canister/Container Lag Storage				
Interim Storage Loading/Unloading				
WRS/Repository Cost Handling				
Building Support Facilities				
INTERIM STORAGE OPERATIONS				\$0.030 N/Year Fixed
Storage Facilities	2.0	0.0	93	Cost = \$0.197 N/Unit
Storage Units				
Receiving Building	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.530 N/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	33.4	37.3	
Other Support Facilities	1.6	55.9	24.0	

TABLE 4-5
ANNUAL OPERATING COSTS

Scenario: 3/4
Construction Phase: Single
Storage Concept: Cask

Date: 1/20/09
Revision: 2

COST CENTER/Functional Activity by Crew -----	Processing Time/Unit Processed (in minutes) -----	FTE/Crew -----	Annual \$/FTE -----	Notes -----
CASK OPERATIONS				
Receive & inspect transport casks; Inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 315/cask Rail = 615/cask	4.5	\$53,900	
Unload transport casks	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading	PMR = 510/cask (Rev. 1) BWR = 1230/cask (Rev. 2)	1.5	\$53,900	
Building support staff	N/A	51	\$53,900	
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks into process cells				
Consolidate and canister fuel				
Volume-reduce/package WFC				
Weld/decon/test canisters				
Canister handling:				
log storage				
storage cask loading/unloading				
NRS transport cask loading				
Building support staff				
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Storage cask preparation & closing/reopening	210/cask	4	\$53,900	If cask is reused, add 30 min. (Rev. 1)
Storage placement (incl. 45 min. to obtain new cask)	145/cask	6	\$53,900	If cask is reused, reduce by 45 min. (Rev. 2)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff (excl. Cask Mfg. Facility of 11)	N/A	264	\$53,900	

TABLE 4-6
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 3/4
Construction Phase: Single
Storage Concept: Cask

Date: 10/11/00
Revision: 1

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	3						100		
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	N/A								
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
NRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	3		80	40					
Storage Facility									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1					50	50		
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Zero, intact SF casks = 12% (Rev. 1)

TABLE 4-7
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 3/4
Construction Phase: Two
Storage Concept: Cask

Date: 10/21/88
Revision: 2

		Percent of H & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6				55	45 (Rev. 1)								
Design														
Proof-of-Principle Tests (3 Tests)	0.3				55	45 (Rev. 2)								
Advanced Conceptual Design	3.4 (Rev.2)					33	67							
License Application Design	19.4 (Rev. 2)						33	67						
Licensing Support	4.2								50	50				
Final Procurement and Construction Design	12.9 (Rev. 2)								100					
Title III Support	10.8 (Rev. 2)										15	55	30	
Operating Contractor Support														
Design	4.0					10	23	33	29	5				
Construction	5.0									4	14	60	18	4
Construction Management	32.3 (Rev. 2)										15	55	30	
Preoperational Testing and Personnel Training	32.7								7	11	17	24	41	

TABLE 4-8
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 3/4
Construction Phase: Two
Storage Concept: Cask

Date: 10/21/88
Revision: 1

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					(1) Site development costs: Storage cask = \$7500/cask Dual purpose cask = \$31,000/cask
Receiving	N/A	3.163	0.829	3.994	
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					(2) Storage cask equipment cost = \$7.810 M Dual purpose cask equipment cost = \$3.940 M
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.832	10.264	
Assembly Lag Storage	4080	3.074	0.270	3.344	
Processing	12524	9.639	7.615	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	101916	28.165	4.990	33.155	
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	N/A	
Cask Unloading					
Assembly Lag Storage					
Processing					
Volume Reduction					
Canister/Container Closure					
Canister/Container Lag Storage					
Interim Storage Loading/Unloading					
WRS/Repository Cask Handling					
Building Support Facilities					
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	(2)	--	
Storage Units	N/A		See Consumables, Table 4-11		
Receiving Building	N/A	1.607	1.006	2.613	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	32.193	--	32.193 (Rev. 1)	
Offsite Preparation	N/A	16.293	--	16.293	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	42.130	18.913	61.043	

TABLE 4-9
CONSTRUCTION COSTS

Scenarios 3/4
Construction Phase: Two
Storage Concept: Cask

Date : 9/23/88
Revision : 0

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				50	50						
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				15	55	30					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interin Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				N/A	N/A	N/A					
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interin Storage Loading/Unloading											
RRS/Repository Cask Handling											
Building Support Facilities											
INTERIN STORAGE OPERATIONS				15	55	30					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				25	50	25					
Basis Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 4-10
CONSTRUCTION COST DISTRIBUTION

Scenario 3/4
Construction Phases Two
Storage Concepts Cash

Date : 11/4/88
Revision : 1

COST CENTER/Cost Element	Equipment Maintenance/Replacement (\$/Year)			Conservables
	Annual	10 Year	20 Year	
CASK OPERATIONS				90.020 M/Year Fixed
Receiving	2.0			
Cask Lag Storage				
WASTE HANDLING OPERATIONS				92.140 M/Year Fixed
SPENT FUEL HANDLING BUILDING				
Cask Unloading	2.0			
Assembly Lag Storage	1.0			
Processing	1.3	1.0		
Interim Storage Loading/Unloading	1.2		24.0	
Building Support Facilities	1.2	4.3	12.3	Grass = \$100/Unit
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	(Rev. 1)
Cask Unloading				
Assembly Lag Storage				
Processing				
Volume Reduction				
Canister/Container Closure				
Canister/Container Lag Storage				
Interim Storage Loading/Unloading				
WRS/Repository Cost Handling				
Building Support Facilities				
INTERIM STORAGE OPERATIONS				
Storage Facilities	2.0	0.0	95	1st Year = 90.006 M/Year Fixed 90.030 M/Year Fixed Cash = 90.197 M/Unit
Storage Units				
Receiving Building	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS				91.530 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	35.4	37.3	
Other Support Facilities	1.6	35.9	24.0	

TABLE 4-11
ANNUAL OPERATING COSTS

Scenario: 3/4
Construction Phase: Two
Storage Concept: Cask

Date : 1/20/89
Revision : 2

COST CENTER/Functional Activity by Crew -----	Processing Time/Unit Processed (in minutes) -----	FTE/Crew -----	Annual \$/FTE -----	Notes -----
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	FTE/crew increases to 8 for first 3 years of operation
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	
Unload transport casks	PMR = 150(T);340(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading	PMR = 510/cask (Rev. 1) BMR = 1230/cask (Rev. 2)	1.5	\$53,900	
Building support staff	N/A	51	\$53,900	
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks into process cells				
Consolidate and canister fuel				
Volume-reduce/package NFBC				
Weld/decom/test canisters				
Canister handling:				
log storage				
storage cask loading/unloading				
NRS transport cask loading				
Building support staff				
INTERIM STORAGE OPERATIONS				
Receiving Building staff	230/cask	17	\$53,900	
Storage cask preparation & closing/reopening	210/cask	4	\$53,900	If cask is reused, add 30 min. (Rev. 1)
Storage placement (incl. 45 min. to obtain new cask)	145/cask	6	\$53,900	If cask is reused, reduce by 45 min. (Rev. 2)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff (excl. Cask Mfg. Facility of 11)	N/A	264	\$53,900	

TABLE 4-12
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 3/4
Construction Phase: Two
Storage Concepts: Cost

Date: 10/11/00
Revision: 1

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	5						100		
Receiving									
Cask Log Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Log Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	N/A								
Cask Unloading									
Assembly Log Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Log Storage									
Interim Storage Loading/Unloading									
WRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		40	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1					50	50		
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Note, intact SF cask = 12% (Rev. 1)

TABLE 4-13
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 3/4
Construction Phases: Single
Storage Concepts: Drywell

Date: 10/21/88
Revision: 2

		Percent of M & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6		41	48	11 (Rev. 1)									
Design														
Proof-of-Principle Tests (3 Tests)	0.5		41	54	5 (Rev. 2)									
Advanced Conceptual Design	3.4 (Rev. 2)				100									
License Application Design	19.4 (Rev. 2)					47	33							
Licensing Support	4.2						25	50	25					
Final Procurement and Construction Design	12.9 (Rev. 2)						50	50						
Title III Support	10.8 (Rev. 2)								15	55	30			
Operating Contractor Support														
Design	4.0				10	23	33	29	5					
Construction	5.0							4	14	60	18	4		
Construction Management	32.3 (Rev. 2)								15	55	30			
Preoperational Testing and Personnel Training	32.7						7	11	17	24	41			

TABLE 4-14
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 3/4
Construction Phase: Single
Storage Concept: Drywell

Date: 11/4/88
Revision: 2

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	3.352	--	3.352	(1) Site development cost included in drywell cost. See consumable unit cost, Table 4-17
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Lag Storage	4080	3.074	0.270	3.344	
Processing	12524	9.639	7.615	17.254	
Interim Storage Loading/Unloading	17170	15.082	0.439	15.521	
Building Support Facilities	101916	20.165	4.990	25.155	
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	N/A	
Cask Unloading					
Assembly Lag Storage					
Processing					
Volume Reduction					
Canister/Container Closure					
Canister/Container Lag Storage					
Interim Storage Loading/Unloading					
RRS/Repository Cask Handling					
Building Support Facilities					
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	3.312	--	
Storage Units	N/A		See Consumables, Table 4-17		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	25.280	--	25.280 (Rev. 1)	
Offsite Preparation	N/A	16.293	--	16.293	
Administration	N/A	2.805	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 2)	

TABLE 4-15
CONSTRUCTION COSTS

Scenarios 3/4
Construction Phase: Single
Storage Concept: Drywell

Date : 9/23/89
Revision : 0

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				50	50						
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				15	55	30					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interior Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				N/A	N/A	N/A					
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interior Storage Loading/Unloading											
RRB/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS				15	55	30					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				25	50	25					
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 4-16
CONSTRUCTION COST DISTRIBUTION

Scenario: S/4
Construction Phase: Single
Storage Concept: Drywell

Date: 9/23/88
Revision: 0

COST CENTER/Cont Element	Equipment Maintenance/Replacement (\$/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.014 M/Year Fixed
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS				\$2.140 M/Year Fixed
SPENT FUEL HANDLING BUILDING				
Cask Unloading	2.0			
Assembly Lag Storage	1.0			
Processing	1.5	1.0		
Interim Storage Loading/Unloading	1.2		24.0	
Building Support Facilities	1.2	4.3	12.3	Drums = \$100/Unit
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	
Cask Unloading				
Assembly Lag Storage				
Processing				
Volume Reduction				
Canister/Container Closure				
Canister/Container Lag Storage				
Interim Storage Loading/Unloading				
WHS/Repository Cost Handling				
Building Support Facilities				
INTERIM STORAGE OPERATIONS				\$0.030 M/Year Fixed
Storage Facilities	1.6	3.0	50	30" Drywell = \$13,000/Unit
Storage Units				
Receiving Building	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	35.4	37.3	
Other Support Facilities	1.6	55.9	24.0	

TABLE 4-17
ANNUAL OPERATING COSTS

Scenario: 3/4
Construction Phase: Single
Storage Concept: Drywell

Date : 10/11/88
Revision : 1

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	
Unload transport casks	PWR = 150(T);340(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PWR = 95/4 assemblies BWR = 95/8 assemblies	1.5	\$53,900	
Building support staff	N/A	39	\$53,900	(Rev. 1)
RECEIVING AND UNLOADING BUILDING	N/A	N/A	N/A	
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks into process cells				
Consolidate and canister fuel				
Volume-reduce/package WFC				
Build/demon/test canisters				
Canister handling:				
log storage				
storage cask loading/unloading				
NRS transport cask loading				
Building support staff				
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter Operation (incl. loading of shield plug and intact SF basket)	75/trip from SFMB	1	\$53,900	If drywell is reused, reduce by 15 min. (Rev. 1)
Storage placement	50/drywell	3.5	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 4-18
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 3/4
Construction Phase: Single
Storage Concept: Drywell

Date: 10/11/00
Revision: 1

COST CENTER/Cost Element	%	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	0	+1	+2	+3	+4	+5
CASK OPERATIONS	5						100		
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	N/A								
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
WRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1					50	50		
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Bare, intact SF drywell = 17%
(Rev. 1)

TABLE 4-19
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario 3/4
Construction Phase: Two
Storage Concept: Drywell

Date: 10/21/00
Revision: 2

COST CENTER/Cost Element	Cost (Millions \$)	Percent of H & I Cost per Year Prior to Operations												
		-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6				33	45 (Rev. 1)								
Design														
Proof-of-Principle Tests (3 Tests)	0.5				33	45 (Rev. 2)								
Advanced Conceptual Design	5.4 (Rev. 2)					33	67							
License Application Design	19.4 (Rev. 2)						33	67						
Licensing Support	4.2								30	30				
Final Procurement and Construction Design	12.9 (Rev. 2)								100					
Title III Support	10.8 (Rev. 2)										15	35	30	
Operating Contractor Support														
Design	4.0					10	23	33	29	5				
Construction	5.0									4	14	60	18	4
Construction Management	32.3 (Rev. 2)										15	35	30	
Preoperational Testing and Personnel Training	32.7								7	11	17	24	41	

TABLE 4-20
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 3/4
Construction Phase: Two
Storage Concept: Drywell

Date: 11/4/80
Revision: 2

COST CENTER/Cost Element	Building Area	Millions in 1980 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	5.165	0.829	5.994	(1) Site development cost included in drywell unit cost. See consumable unit cost, Table 4-23 Dual purpose cask site development cost = \$31,000/cask
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING					(2) Drywell equipment cost = \$3.311 M Dual purpose cask equipment cost = \$3.946 M
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Lag Storage	4080	3.074	0.270	3.344	
Processing	12524	9.639	7.615	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	101916	20.165	4.990	33.155	
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	N/A	
Cask Unloading					
Assembly Lag Storage					
Processing					
Volume Reduction					
Canister/Container Closure					
Canister/Container Lag Storage					
Interim Storage Loading/Unloading					
MRS/Repository Cask Handling					
Building Support Facilities					
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	(2)	--	
Storage Units	N/A		See Consumables, Table 4-23		
Receiving Building	N/A	1.607	1.006	2.613	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	25.280	--	25.280 (Rev. 1)	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 2)	

TABLE 4-21
CONSTRUCTION COSTS

Scenario: 3/4
Construction Phase: Two
Storage Concept: Drywell

Date: 9/23/00
Revision: 0

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				90	90						
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				15	95	30					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interior Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING OUTLOADING				N/A	N/A	N/A					
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Container/Container Closure											
Container/Container Lag Storage											
Interior Storage Loading/Unloading											
HRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS				19	95	30					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				25	90	25					
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 4-22
CONSTRUCTION COST DISTRIBUTION

Scenario: 3/4
Construction Phase: Two
Storage Concepts: Drywell

Date: 9/23/00
Revision: 0

COST CENTER/Cost Element	Equipment Maintenance/Replacement (1/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.020 M/Year Fixed
Receiving				
Cask Log Storage				
WASTE HANDLING OPERATIONS				\$2.140 M/Year Fixed
SPENT FUEL HANDLING BUILDING				
Cask Unloading	2.0			
Assembly Log Storage	1.0			
Processing	1.3	1.8		
Interior Storage Loading/Unloading	1.2		24.0	
Building Support Facilities	1.2	4.3	12.3	Drum = \$100/Unit
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	
Cask Unloading				
Assembly Log Storage				
Processing				
Volume Reduction				
Canister/Container Closure				
Canister/Container Log Storage				
Interior Storage Loading/Unloading				
WRS/Repository Cask Handling				
Building Support Facilities				
INTERIM STORAGE FACILITIES				
Storage Facilities	1.4	3.0	30	\$0.020 M/Year Fixed
Storage Units				30° Drywell = \$13,000/Unit
Receiving Building	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.350 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	33.4	37.3	
Other Support Facilities	1.4	33.9	24.0	

TABLE 4-23
ANNUAL OPERATING COSTS

Scenario: 3/4
Construction Phase: Two
Storage Concept: Drywell

Date: 10/11/00
Revision: 1

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	FTE/crow increases to 8 for first 4 years of operations
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for meshdown)	Truck = 315/cask Rail = 615/cask	4.5	\$53,900	
Unload transport casks	PMR = 150(T);540(R) BWR = 230(T);1000(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 93/4 assemblies BWR = 93/8 assemblies	1.5	\$53,900	
Building support staff	N/A	39	\$53,900	(Rev. 1)
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for meshdown)				
Unload transport casks into process cells				
Consolidate and canister fuel				
Volume-reduce/package HFBC				
Weld/docum/test canisters				
Canister handling				
Tag storage				
storage cask loading/unloading				
HRS transport cask loading				
Building support staff				
INTERIM STORAGE OPERATIONS				
Receiving Building staff	230/cask	17	\$53,900	
Transporter operation (incl. loading of shield plug and intact HF basket)	75/trip from SFHD	1	\$53,900	If drywell is reused, reduce by 15 min. (Rev. 1)
Storage placement	50/drywell	3.5	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 4-24
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 3/4
Construction Phase: Two
Storage Concept: Drywell

Date: 10/11/88
Revision: 1

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	5						100		
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	N/A								
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
WBS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		80	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1					50	50		
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Note, Initial SF Drywell = 121
(Rev. 1)

TABLE 4-25
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: S/4
Construction Phase: Single
Storage Concept: Vault

Date: 10/10/88
Revision: 0

		Percent of N & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6	9	33	38										
Design														
Proof-of-Principle Tests (3 Tests)	0.3	10	54	36										
Advanced Conceptual Design	10.1			22	78									
License Application Design	27.9				28	67	5							
Licensing Support	4.2						46	50	4					
Final Procurement and Construction Design	18.6						92	8						
Title III Support	15.5								36	39	25			
Operating Contractor Support														
Design	4.0			10	73	31	28	5	3					
Construction	5.0							4	14	60	18	4		
Construction Management	48.3								36	39	25			
Preoperational Testing and Personnel Training	32.7						7	11	17	24	41			

TABLE 4-26
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenarios 3/4
Construction Phase: Single
Storage Concepts: Vault

Note: 11/4/88
Revision: 1

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	3.352	--	3.352	(1) Fixed cost for storage building
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Lag Storage	4080	3.074	0.270	3.344	
Processing	12924	9.639	7.615	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	101916	28.165	4.990	33.155	
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	N/A	
Cask Unloading					
Assembly Lag Storage					
Processing					
Volume Reduction					
Canister/Container Closure					
Canister/Container Lag Storage					
Interim Storage Loading/Unloading					
WRS/Repository Cask Handling					
Building Support Facilities					
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	16.040	9.770	25.810(1)	
Storage Units	N/A		See Compendium, Table 4-29		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	40.290	--	40.290	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 1)	

TABLE 4-27
CONSTRUCTION COSTS

Scenario: 3/4
Construction Phase: Single
Storage Concepts Vault

Date: 10/18/00
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASH OPERATIONS				50	50						
Receiving											
Cash Log Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				39	43	18					
Cash Unloading											
Assembly Log Storage											
Processing											
Interior Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				N/A	N/A	N/A					
Cash Unloading											
Assembly Log Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Log Storage											
Interior Storage Loading/Unloading											
RRS/Repository Cash Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS				33	36	31					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				25	50	25					
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 4-20
CONSTRUCTION COST DISTRIBUTION

Scenario: 3/4
Construction Phase: Single
Storage Concept: Vault

Date: 11/4/88
Revision: 1

COST CENTER/Cost Element	Equipment Maintenance/Replacement (%/Year)			Consumables	Notes
	Annual	10 Year	20 Year		
CASK OPERATIONS					
Receiving				80.014 M/Year Fixed	(1) Cost per storage building
Cask Log Storage					
WASTE HANDLING OPERATIONS					
SPECIAL FUEL HANDLING BUILDING				82.140 M/Year Fixed	
Cask Unloading	2.0				
Assembly Log Storage	1.0				
Processing	1.5	1.8			
Interior Storage Loading/Unloading	1.2		24.0		
Building Support Facilities	1.2	4.3	12.3	Trucks = \$180/Unit	
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A		
Cask Unloading					
Assembly Log Storage					
Processing					
Volume Reduction					
Canister/Container Closure					
Canister/Container Log Storage					
Interior Storage Loading/Unloading					
MRS/Repository Cask Handling					
Building Support Facilities					
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0 (1)	0.3 (1)	0.6 (1)	88.827 M/Year Fixed (1); 88.0006 M/Year/Position (Rev. 1) BF Basket Position (30") = 636,700/Unit	
Storage Units					
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				81.550 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	55.9	24.0		

TABLE 4-29
ANNUAL OPERATING COSTS

Scenario: 3/4
Construction Phase: Single
Storage Concept: Vault

Date: 10/10/88
Revision: 0

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/PWRB transport casks for unloading/shipment (incl. 75 min. for meshdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	
Unload transport casks	PMR = 150(T);540(R) BWR = 230(T);1000(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/4 assemblies BWR = 95/8 assemblies	1.5	\$53,900	
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/PWRB transport casks for unloading/shipment (incl. 75 min. for meshdown)				
Unload transport casks into process cells				
Consolidate and canister fuel				
Volume-reduce/package HFBC				
Hold/demon/test canisters				
Canister handling:				
tag storage				
storage cask loading/unloading				
PWRB transport cask loading				
Building support staff				
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter Operation (incl. loading of intact BF basket)	100/trip from SPWB	3	\$53,900	Time based on 15,000 HTU onsite storage
Storage placement	80/position	10	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 4-30
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenarios 3/4
Construction Phases Single
Storage Concept: Vault

Date : 10/18/00
Revision : 0

COST CENTER/Cost Element	1 of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	0	+1	+2	+3	+4	+5
CASK OPERATIONS	3						100		
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Interior Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	N/A								
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interior Storage Loading/Unloading									
WRS/Repository Cost Handling									
Building Support Facilities									
INTERIOR STORAGE OPERATIONS	3		20	40	40				
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1					30	30		
Debris Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Here, intact SF vault = 17%

TABLE 4-31
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 3/4
Construction Phase: Two
Storage Concept: Vault

Date: 10/10/88
Revision: 0

		Percent of H & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6				55	45								
Design														
Proof-of-Principle Tests (3 Tests)	0.5				55	45								
Advanced Conceptual Design	10.1					33	67							
License Application Design	27.9						33	67						
Licensing Support	4.2								50	50				
Final Procurement and Construction Design	18.6								100					
Title III Support	15.5										39	39	22	
Operating Contractor Support														
Design	4.0					10	25	35	29	5				
Construction	5.0									4	14	60	18	4
Construction Management	46.5										39	39	22	
Preoperational Testing and Personnel Training	32.7								7	11	17	24	41	

TABLE 4-32
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 3/4
Construction Phase: Two
Storage Concept: Vault

Date: 11/4/88
Revision: 1

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					(1) Fixed cost per storage building
Receiving	N/A	5.165	0.829	5.994	
Cask Log Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					(2) Dual purpose cask: Site development = \$31,000/cask; Equipment = \$3,940 M (Rev. 1)
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Log Storage	4080	3.074	0.270	3.344	
Processing	12924	9.639	7.615	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	101916	28.165	4.990	33.155	
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	N/A	
Cask Unloading					
Assembly Log Storage					
Processing					
Volume Reduction					
Canister/Container Closure					
Canister/Container Log Storage					
Interim Storage Loading/Unloading					
WRS/Repository Cask Handling					
Building Support Facilities					
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	16.040	9.770	25.810 (1 & 2) (Rev. 1)	
Storage Units	N/A		Rev Consumables, Table 4-35		
Receiving Building	N/A	1.607	1.006	2.613	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	40.290	--	40.290	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 1)	

TABLE 4-33
CONSTRUCTION COSTS

Scenario: 3/4
Construction Phase: Two
Storage Concept: Vault

Date: 10/10/88
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				30	30						
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				43	43	14					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				N/A	N/A	N/A					
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
HRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS				34	34	26					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				23	30	23					
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 4-34
CONSTRUCTION COST DISTRIBUTION

Scenario: 3/4
Construction Phase: Two
Storage Concept: Vault

Date: 11/4/88
Revision: 1

COST CENTER/Cost Element	Equipment Maintenance/Replacement (Z/Year)			Consumables	Notes
	Annual	10 Year	20 Year		
CASK OPERATIONS				90.020 M/Year Fixed	(1) Cost per storage building
Receiving					
Cask Lag Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING				92.140 M/Year Fixed	
Cask Unloading	2.0				
Assembly Lag Storage	1.0				
Processing	1.5	1.8			
Interim Storage Loading/Unloading	1.2		24.0		
Building Support Facilities	1.2	4.3	12.3	Drums = \$100/Unit	
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A		
Cask Unloading					
Assembly Lag Storage					
Processing					
Volume Reduction					
Canister/Container Closure					
Canister/Container Lag Storage					
Interim Storage Loading/Unloading					
WRS/Repository Cask Handling					
Building Support Facilities					
INTERIM STORAGE FACILITIES				90.827 M/Year Fixed;	
Storage Facilities	2.0 (1)	0.3 (1)	0.6 (1)	90.0006 M/Year/Position (Rev. 1)	
Storage Units				SF Basket Position (30") = 636,700/Unit	
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				61.550 M/Year Fixed	
Waste Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	35.9	24.0		

TABLE 4-35
ANNUAL OPERATING COSTS

Scenario: 3/4
Construction Phase: Two
Storage Concept: Vault

Date: 10/10/88
Revision: 0

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 36/cask	4	\$53,900	FTE/crow increases to 8 for first 4 years of operations
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks	PWR = 150(T);540(R) BWR = 230(T);1000(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PWR = 95/4 assemblies BWR = 95/8 assemblies	1.5	\$53,900	
Building support staff	N/A	39	\$53,900	
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks into process cells				
Consolidate and canister fuel				
Volume-reduce/package HFBC				
Hold/decan/test canisters				
Canister handling:				
log storage				
storage cask loading/unloading				
WRS transport cask loading				
Building support staff				
INTERIM STORAGE OPERATIONS				
Receiving Building staff	230/cask	17	\$53,900	
Transporter operation (incl. loading of intact BF basket)	100/trip from SFMB	3	\$53,900	Time based on 15,000 MTB onsite storage
Storage placement	80/position	18	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 4-34
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 3/4
Construction Phase: Yes
Storage Concept: Vault

Date: 10/10/00
Revision: 0

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	5						100		
Receiving									
Cask Log Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Log Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	N/A								
Cask Unloading									
Assembly Log Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Log Storage									
Interim Storage Loading/Unloading									
RRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		20	40	40				
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1					50	50		
Site Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Note, intact HF vault = 12%

TABLE 4-37
DECOMMISSIONING COSTS AND DISTRIBUTION

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 4-3

Scenario 3/4 Single Phase Cask or Drywell Storage

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 4-4

Scenario 3/4 Two Phase Cask or Drywell Storage

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 4-5
Scenario 3/4 Single Phase Vault Storage

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 4-6
Scenario 3/4 Two Phase Vault Storage

SECTION 5

SECTION 5

SCENARIO 5

Of the scenarios defined for the study, Scenario 5 reflects the CDR with the fewest design modifications. As with the CDR, spent fuel is received, consolidated, placed in canisters, temporarily stored if required, and shipped to the repository. The primary difference in operation is the use of square canisters in lieu of the 12-inch diameter stainless steel canisters designed for the CDR. The new canister configurations, as presented in Section 5.1.1, reduce the number of fuel assemblies per canister thus increasing the quantity of canisters handled and stored. The CDR canister was designed to receive one intact PWR, two intact BWR, consolidated fuel rods from three PWR, or consolidated fuel rods from seven BWR fuel assemblies. Figures 5-1, 5-2, and 5-3 indicate the basic functional flow for this scenario, including phased construction.

5.1 SPECIFIC CRITERIA AND ASSUMPTIONS

Scenario 5 design parameters are based on criteria and assumptions specific to this scenario. These criteria and assumptions are in addition to, or modifications of, the general criteria/assumptions presented in Section 2.

5.1.1 SCENARIO CRITERIA

Criteria specific to Scenario 5 are derived from (a) TSLCC assumptions, (b) the study scope of work, (c) meetings of the study participants, and/or (d) the Task A Report. Scenario 5 criteria are as follows:

- (1) Intact spent fuel assemblies are placed in square stainless steel canisters (as shown in Section 1) with a cross section of 9.1 inches square for PWR and 6.0 inches square for BWR. (a, c, and d)
- (2) At the repository, the canisters will be placed in containers. (d)
- (3) Consolidated spent fuel is placed in stainless steel canisters with a cross section of 9.1 inches by 9.1 inches. (a and d)
- (4) Consolidated spent fuel canisters have a capacity of 2 PWR or 5 BWR assemblies per square canister. (a)
- (5) No "half-square" canisters for consolidated fuel are utilized. (c)
- (6) Maximum rail cask capacities for consolidated canistered fuel from the MRS is 28 9-inch squares. (c)
- (7) Maximum rail cask capacities for intact canistered fuel from the MRS are 28 9-inch squares for PWR or 61 6-inch squares for BWR. (a)

Figure 5-1
Scenario 5 Single Phase Construction

Figure 5-2
Scenario 5 Two Phase Construction

Figure 5-3
Scenario 5 Three Phase Construction

- (8) Volume-reduced nonfuel-bearing components (NFBC) will be placed in 55-gallon drums. (a, c, and d)
- (9) NFBC drums will be bound together in a vertical stack of 5 drums prior to storage or shipment to the repository. (a)
- (10) NFBC drum quantities are based on an average of 7 fuel assembly skeletons per drum, utilizing the spent fuel mix presented in Section 2.1.1, Item 1. (a)

5.1.2 SCENARIO ASSUMPTIONS

The following assumptions were made specifically for Scenario 5:

- (1) Only the operating schedules presented in Tables 2-1 through 2-6 are applicable since no HLW is to be received.
- (2) The consolidation equipment of the CDR can be modified to accommodate the forming of the square bundles with no appreciable cost impact.
- (3) The clean canister carousels can be modified to accommodate a combination of 9-inch and 6-inch canisters at no increase in capital cost.
- (4) Canister closure, decontamination, and weld NDE equipment will accommodate the square canister without a cost impact.
- (5) All site support buildings presented in the CDR are required except as modified and/or noted in Table 5-1.

Table 5-1

SUPPORT BUILDING MODIFICATIONS

<u>Building</u>	<u>Modification</u>
Inspection Gatehouse	Increase of administration and support areas for "three-phase" MRS
Storage Area Gate Station	Delete for vault storage option
Site Services	Revise mock-up equipment to reflect R & H process cell
Standby Generator	Revise equipment and building to reflect new load requirements
Sewage Treatment	Proportion to site personnel quantity
Water Treatment	Modify storage tank and distribution to reflect revised requirements

5.2 WASTE HANDLING OPERATIONS

As with the MRS CDR, the waste-handling operations are performed in the Receiving and Handling (R&H) Building. If two-phase construction is utilized, the construction of the Spent Fuel Handling Building (SFHB) is required to perform interim operations until the R&H Building construction is completed. Three-phase construction requires the addition of the Receiving Building (RB) to the two-phase facility configuration to receive dual purpose casks. The SFHB and RB operations are described in Section 4 and apply to this scenario in the two and three phase construction cases.

5.2.1 RECEIVING AND HANDLING BUILDING

The R&H Building is the primary operating building of the MRS Facility. It is designed to receive transport casks containing spent fuel; unload, consolidate, and canister the spent fuel; temporarily store the canisters, as required; and load waste packages into shipping casks or into onsite storage.

5.2.1.1 Operations

As with the SFHB of Scenarios 3 and 4, the sequence of operations in the R&H Building starts with the receipt of shipping casks from the Inspection Gatehouse or from the onsite storage areas for cask shipments. The onsite rail cask storage is modified to provide storage capability adjacent to both receiving bays of the R&H Building.

The R & H Building contains four shielded process cells equipped to handle intact spent fuel assemblies, to disassemble and consolidate spent fuel assemblies, and to reduce the volume of non-fuel bearing components (NFBC). Two shielded canyon cells, each serving two process cells, are equipped to canister intact or consolidated spent fuel, place canisters in the lag storage vault, transfer canisters to on-site storage, and place canisters in shipping casks.

Shipping casks and carriers arriving at the R&H Building in the receiving, inspection, and shipping area are washed, if required, and the casks transferred to cask carts. Casks containing spent fuel are routed to cask handling and decontamination rooms located beneath the shielded process cells.

Here the cask's external surface is decontaminated, if required; the interior environment is sampled; gas-pressure measurements are taken; the outer cask lid is removed; the cask inner lid bolts are loosened; and special adapters are installed. The cask cart with cask is then moved into a cask unloading room and mated to an unloading port located in the shielded process cell floor. The unloading port shield plug and the cask inner lid are removed and the spent-fuel assemblies are removed by the in-cell power mast crane. The spent-fuel assemblies are visually inspected, inventoried, and either placed into a lag storage pit for future processing or are routed directly to the disassembly/consolidation station. The lag storage capacity of each process cell is 180 PWR or 320 BWR fuel assemblies. Upon visual inspection or from

reactor records, any assembly that is judged to be damaged or would have a high probability of damage during consolidation is routed to a dedicated upender and is packaged intact. Similarly, the high heat content and/or non-standard fuel may also be packaged intact.

The disassembly and consolidation equipment is fitted with the appropriate module and tooling for a specific PWR or BWR assembly. The in-cell power mast crane transfers PWR or BWR assemblies to a vertically-oriented clamping module on the upender. The upper end fittings are removed from two PWR assemblies after each assembly has been transferred to the downender. After the upender is moved to the horizontal position, all fuel rods of the two assemblies are gripped and subsequently pulled from the assemblies. The extracted rods are reconfigured into a square array and pushed into a 9-inch canister. Simultaneously with the reconfiguration step, the lower end fittings are freed and the skeletons transferred to the shredder. All end fittings, upon removal, are placed independently in a waiting NFBC drum.

The process is similar for BWR assemblies except that five assemblies are prepared for fuel rod extraction by removing both the upper and lower end fittings prior to engaging the grippers. The lower end fittings are cut after the upender is placed in the horizontal position. Another step prior to extraction is required for BWR assemblies with center tie rods containing fuel. These rods must be rotated 45° prior to the rod gripping and extraction operations.

Simultaneously with the disassembly and consolidation operations, a clean canister on an upender is aligned with the axial centerline of the consolidated spent fuel rod bundle to permit insertion of the bundle into the canister. The canister upender, is a mobile transportation and positioning cart mounted on rails to align the canister with the consolidation station, and the weld/decon station. The filled canister is then positioned by the upender at a weld/decon/test chamber and the canister pushed into the chamber. The chamber is closed, air is evacuated from both the canister and the chamber, both are backfilled with an argon-helium gas mixture, a lid is welded on the canister, and the weld leak tested.

At the end of the leak test cycle, the exterior of the canister is decontaminated by a liquid Freon system. After decontamination, the unit is removed from the welding station and an ultrasonic test (UT) is performed on the weld. Packaged spent fuel is transferred to the in-building lag storage vault, loaded into a shipping cask, or transported to onsite storage.

The disassembly of spent-fuel assemblies and the consolidation of fuel rods leave behind nonfuel components, such as end fittings, grids, guide tubes, and non-fuel tie rods. The end fittings are placed directly into 55-gal drums. The other components are removed from the clamping module by a dedicated robot and are shredded before placement in 55-gal drums. All secondary scrap drums are sealed, decontaminated, and transferred to the canyon cell discharge area for shipment or storage.

To achieve the 1,000 MTU consolidated fuel canister capacity of the canyon cell vaults, the center-to-center spacing of the canisters was reduced from the 2-ft. 6-inch spacing shown in the CDR. With the closer spacing it is not

structurally feasible to provide an independent floor plug above each canister location. In addition, the increased quantity of canisters could adversely affect the canyon cell crane operations if each canister and associated plug was handled each time a filled canister was placed in storage. Therefore a rack for 12 canisters is placed in close proximity of each weld station in the canyon cell. If a series of canisters is to be placed in vault lag storage rather than into interim storage or a shipping cask, the canisters are placed in the rack. The cover is removed from a vault lag storage location, the filled rack transferred to the storage vault, and the cover replaced. A second storage location is opened, the empty rack transferred to the "fill" area, and the location closed. A similar process is used when canisters are removed from the vault for loading into onsite storage or a shipping cask, utilizing a rack location in the discharge area of the canyon cell. Except for rack loading or unloading, these two "spare" rack locations do not contain canisters and do not have covers. The HVAC distribution is tailored to compensate for the two open rack locations.

To minimize the quantity of drywell or vault positions and associated interim storage operating times, canistered intact spent fuel will be transported and stored utilizing baskets containing 4 PWR or 8 BWR canisters. Empty baskets are placed in the drywell transporter in the discharge area of the R&H Building or the transfer cask at the Vault Storage Building (VSB). After mating to the loadout port of the canyon cell, the canisters of intact spent fuel are transferred individually to the transporter containing the basket. Similarly, in two-phase construction the drywell and vault storage options require the utilization of baskets carrying 4 PWR or 8 BWR bare intact spent fuel assemblies in order to reduce operating time to interim storage from the SFHB. This operation is described in Section 4.2.2.1 for Scenarios 3 and 4 and applies to this scenario as well for bare intact fuel assemblies.

5.2.1.2 Design

Aspects of the CDR design require modification to accommodate the specific requirements of Scenario 5. The changes relate to the revised canister configuration and capacity and only affect the R&H Building.

The R&H Building for Scenario 5 is modified from the CDR design because of (1) the change to the canister configuration, (2) the increased quantity of canisters resulting from the change to the square canisters, (3) the vault storage capacity and configuration, (4) deletion of the repository "container" handling and welding operations, and (5) the VSB option.

Facility arrangement modifications in the canyon cells include:

- (1) The addition of a welding station because of the increased number of canisters resulting from the use of the 9-inch and 6-inch square canisters.
- (2) The changes to the lag storage vaults in the canyon cells to accommodate the canister configuration and spacing requirements.

- (3) Changes to the loadout area in the VSB option to provide an enclosed transfer corridor between the R&H Building and the VBS to accommodate equipment to transfer spent fuel canisters to the VSB.
- (4) Canyon cell vault floor openings revised from one opening or port per canister (CDR) to large floor hatches permitting access to a canyon cell vault compartment.
- (5) The canyon cell lag storage vault compartments change to accommodate new rack configurations.

R&H Building equipment changes include the following:

- (1) The rod reconfiguration subsystem of the disassembly/ consolidation station would require design changes to accommodate the 9-inch canisters.
- (2) The clean canister feed system requires redesign to handle the 9-inch and 6-inch square canisters.
- (3) The decontamination/inerting chamber requires redesign to accommodate the square canister configurations.
- (4) Design changes to the welding and weld test equipment, and possibly the welding method, are required to weld the lids on the square canisters.
- (5) The canister cutting station changes due to the square canister configurations. (The cutting equipment needs to accommodate not only the square configuration but also two sizes of canisters.)
- (6) The canyon cell lag storage vault ventilation system requires redesign based on the new vault heat load capacity and rack configuration.
- (7) The canister upender design changes to handle the square canister configurations.
- (8) The canister and repository overpack equipment in the Canyon Cells is not required.
- (9) A rail cart design is required to handle spent fuel canisters from the R&H Building to the VSB for that storage option.
- (10) The Canyon Cell vault storage rack requires redesign to accommodate the square canisters and to permit the transfer of a filled rack within the canyon cell.

Drawings A-501 thru A-505 show the arrangement of the R&H Building for Scenario 5. Note that the total capacity of the canyon cell storage vault is approximately 910 MTU of canistered spent fuel, of which 5% is canistered intact.

5.3 STORAGE OPTIONS

Four options for onsite storage of spent fuel canisters and NFBC drums are applicable for Scenario No. 5: 1) concrete storage cask, 2) drywell, 3) open-cycle storage vault and 4) dual purpose casks.

5.3.1 CONCRETE STORAGE CASKS

The operation and design of the concrete storage cask system is the same as that described for Scenarios 3 and 4 except for the preparation (consolidation) and packaging of the spent fuel. The spent fuel received at the R & H Building is either consolidated and packaged in 9-inch square canisters (PWR and BWR) or packaged intact in 9-inch square (PWR) or 6-inch square (BWR) canisters. The NFBC resulting from consolidation is packaged in 55 gallon drums.

The single phase construction option (operation of the R & H Building only) requires concrete cask storage of canistered intact and consolidated spent fuel and drums of NFBC. Due to storage cask thermal limitations, the storage cask capacity is 16 consolidated PWR canisters or 20 BWR canisters. The storage cask capacity for intact spent fuel canisters is 28 PWR canisters or 70 BWR canisters. The storage cask capacity for NFBC drums is sized limited to 15 drums per cask. The total number of casks required for the maximum allowable onsite storage (15,000 MTU) is 1477. This includes 62 casks for intact canistered spent fuel; 955 casks for consolidated canistered spent fuel; and 460 casks of NFBC drums.

The site arrangement for the single phase construction option cask system is shown on Drawing C-501. The storage area required for a 15,000 MTU capacity is approximately 91 acres including access roads, alarm and isolation zones, and facility set-backs.

As noted above, the two-phase construction option requires the storage of bare intact spent fuel assemblies that are received at the SFHB. In accordance with the Waste Acceptance Schedules presented in Section 2, the maximum SFHB throughput is approximately 8000 MTU. For the purpose of this study it is assumed that the maximum storage condition onsite is 8000 MTU of bare intact spent fuel and 7000 MTU of canistered spent fuel and its associated NFBC waste. The capacity of the bare and canistered spent fuel casks are as noted for the single phase construction option. The total number of casks required for the maximum allowable onsite storage (15,000 MTU) is 1264. This includes 573 bare intact spent fuel casks; 446 canistered consolidated spent fuel casks; 30 canistered intact spent fuel casks; and 215 casks of NFBC drums.

The site arrangement for the two-phase construction option cask system is shown on Drawing C-502. The storage area required for a 15,000 MTU capacity is approximately 87 acres including access roads, alarm and isolation zones, and facility set-backs.

The concrete storage cask requirement for the three-phase construction option is discussed in Section 5.3.4.

5.3.2 DRYWELLS

The operation and design of the drywell storage system for the single phase construction option of this scenario is essentially the same as that described in Scenarios 3 and 4 (Sections 4.3.2.1 and 4.3.2.2) with the exceptions as noted for the concrete storage cask with regard to canistering of spent fuel and NFBC drums. One consolidated PWR or BWR canister is placed in a 16-inch diameter drywell spaced 12 ft on-center in each direction. Four canistered intact PWR spent fuel assemblies or eight canistered intact BWR spent fuel assemblies are placed in a 30-inch diameter drywell spaced 21 ft on-center. Five NFBC drums are placed in a 30-inch diameter drywell spaced 6 ft on-center and 12 ft between rows. The total number of drywells required for the maximum allowable onsite storage capacity (15,000 MTU) is 18,172. This includes 16,327 16-inch drywells of canistered consolidated PWR and BWR spent fuel, 464 30-in. drywells of canistered PWR or BWR intact spent fuel; and 1381 30-inch drywells of NFBC drums.

The site arrangement for the single phase construction option drywell system is shown on Drawing C-521. The storage area required for 15,000 MTU capacity is approximately 113 acres including access roads, alarm and isolation zones, and facility set-backs.

The two-phase construction option requires the storage of bare intact spent fuel (8000 MTU) which is received in the SFHB. As noted in Scenarios 3 and 4 Section 4.3.2.2, intact spent fuel is stored in 30-inch drywells spaced 21 ft on-center in each direction that contain either 4 PWR or 8 BWR assemblies. For this option the canistered intact spent fuel is also stored in the same configuration as the bare intact spent fuel. The total number of drywells required for the maximum allowable onsite storage capacity (15,000 MTU) is 13,429. This includes 5165 30-inch bare or canistered intact spent fuel drywells; 7619 16-inch canistered consolidated spent fuel drywells; and 645 30-inch drywells of NFBC drums.

The site arrangement for the two-phase construction option drywell system is shown on Drawing C-522. The storage area required for 15,000 MTU capacity is approximately 123 acres including access roads, alarm and isolation zones, and facility set-backs.

The drywell storage requirement for the three-phase construction option is discussed in Section 5.3.4.

5.3.3 OPEN-CYCLE STORAGE VAULT

Design and operation of the single phase construction option for this scenario is essentially the same as described for Scenarios 3 and 4 except for the storage tube size and spacing and the number of storage modules required for each vault building. Each canister of consolidated spent fuel is stored in a 16-inch diameter storage tube spaced 3 ft on-center in each direction. The total number of 16-inch storage tubes per module is 288. The canisters of intact spent fuel and NFBC drums are stored in a 30-inch diameter storage tube spaced on 5 ft centers in each direction. The total number of 30-inch storage tubes per module is 100 with each containing five NFBC drums, four canistered intact PWR spent fuel assemblies, or eight canistered BWR assemblies. For the

purpose of this study, the maximum storage capacity (15,000 MTU) is contained in five vault buildings. The total number of 16-inch storage tubes required is 16,327 and the total number of 30-inch storage tubes is 1845. Therefore, the total vault complex consists of five vault buildings consisting of 57 modules of 16-inch storage tubes and 19 modules of 30-inch storage tubes for the 15,000 MTU of stored spent fuel.

The site arrangement for the single phase construction option vault storage system is shown on Drawing C-531. The storage area required for 15,000 MTU capacity is approximately 65 acres including access roads, alarm and isolation zones, and facility set-backs.

The two-phase construction option requires the storage of 8000 MTU of bare intact spent fuel. The storage tube loading and configuration for this fuel is the same as noted for Scenarios 3 and 4. Therefore for the maximum onsite storage capacity the number of 30-inch bare and canistered intact spent fuel storage tubes required is 5165 and the number of canistered consolidated and intact spent fuel 16-inch storage tubes required is 7619. In addition 645 30-inch storage tubes are required for the NFBC drums. Therefore, the total vault complex consists of five vault buildings containing 27 16-inch storage tube modules and 58 30-inch storage tubes modules as required for the 15,000 MTU of spent fuel.

The site arrangement for the two-phase construction option vault storage system is shown on Drawing C-532. The storage area required for 15,000 MTU capacity is approximately 85 acres including access roads, alarm and isolation zones, and facility set-backs.

The vault storage requirement for the three-phase construction option is discussed in Section 5.3.4.

5.3.4 DUAL PURPOSE CASK STORAGE

For the three-phase construction case in this scenario, dual purpose casks (DP) containing bare intact spent fuel assemblies are received at the RB, unloaded, and transported to storage as described for Scenarios 3 and 4. A maximum of 1,100 MTU of spent fuel is received in 106 DP casks. The quantity of spent fuel stored in DP casks reduces the amount of storage required for any of the other storage options to 13,900 MTU as discussed below.

Of the remaining 13,900 MTU, 6900 MTU is received in the SFHB and transferred to storage as bare intact fuel assemblies and 7000 MTU is received in the R & H Building and stored as canistered consolidated or intact spent fuel. Using the same cask loadings as presented in the single phase construction option the total number of storage casks required is 1185. This includes 494 casks of bare intact spent fuel; 446 casks of canistered consolidated spent fuel; 30 casks of canistered intact spent fuel; and 215 casks containing NFBC drums.

The site arrangement for the three-phase construction option cask storage system is shown on Drawing C-503. The storage area required for a 15,000 MTU capacity is approximately 87 acres including access roads, alarm and isolation zones, and facility set-backs.

The total number of drywells required to store the remaining 13,900 MTU of spent fuel is 12,533. This includes 7619 16-inch drywells for canistered consolidated spent fuel; 4269 30-inch drywells for bare intact spent fuel; 216 30-inch drywells for canistered intact spent fuel; and 645 30-inch drywells for NFBC drums.

The site arrangement for the three-phase construction drywell system is shown on Drawing C-523. The storage area required for a 15,000 MTU capacity is approximately 123 acres including access roads, alarm and isolation zones, and facility set-backs.

The total number of storage tubes (open-cycle vault) required to store the remaining 13,900 MTU of spent fuel is 12,749. This includes 4269 30-inch tubes for bare intact spent fuel; 7619 16-inch tubes for canistered consolidated spent fuel; 216 30-inch tubes for canistered intact spent fuel; and 645 30-inch tubes for NFBC drums.

The site arrangement for the three-phase construction vault storage system is shown on Drawing C-533. The storage area required for 15,000 MTU capacity is approximately 85 acres including access roads, alarm and isolation zones, and facility set-backs.

5.4 COST DATA DEVELOPMENT

This section presents the rationale for the cost data applicable to Scenario 5, Tables 5-2 through 5-55. Rationale identical to that presented in Section 3.4 is noted by reference; therefore, only scenario-specific deviations are described herein.

5.4.1 MANAGEMENT AND INTEGRATION

This cost center presents the rationale for development of costs associated with all A/E and operating contractor activities required prior to initial operations.

5.4.1.1 Site Selection and Investigation

The activities associated with this cost element are as discussed in Section 3.4.1.1.

5.4.1.2 Design

The activities associated with this cost center are described in Section 3.4.1.2, and modified as required by the scenario-specific requirements described herein.

Proof of Principle Tests. All tests described in Section 3.4.1.2 are required for this scenario; therefore the cost allocated to this element is \$1 million.

Advanced Conceptual Design. Since this scenario requires facilities which were not included in the MRS CDR, as noted in Section 3.4.1.2, advanced conceptual designs (ACDs) are required prior to initiation of license application design. For two- and three-phase construction and for all construction phases for the

vault storage option, ACD costs are included for the SFHB, VSB, RB, and the site development design associated with these buildings. Note that the R&H Building arrangement (CDR) is not affected by the equipment modifications and therefore an ACD is not required.

License Application and Final Procurement and Construction Design. All storage and construction phase options will require license application and final procurement and construction design phases. The costs developed for these phases are in accordance with the rationale presented in Section 3.4.1.2.

License Support. As noted in Section 3.4.1.2, the license support cost is based on an assumed licensing duration of 30 months. Therefore, the cost allocated for this activity is based on an average of 11 manyears/year for a prelicense and license duration of 42 months.

Title III Support. The cost for this element was developed from the constructed value of the total MRS facility required for each storage and construction phase option in accordance with the rationale presented in Section 3.4.1.2.

5.4.1.3 Operating Contractor Support

The rationale for development of this cost is presented in Section 3.4.1.3.

5.4.1.4 Construction Management

The cost for this activity was developed from the constructed value of the total MRS facility required for each storage and construction phase option in accordance with the rationale presented in Section 3.4.1.4.

5.4.1.5 Preoperational Testing and Personnel Training

The rationale for development of this cost is presented in Section 3.4.1.5.

5.4.2 CONSTRUCTION

The rationale for development of costs associated with the construction cost center of Scenario 5 MRS facilities is in accordance with that presented in 3.4.2.

5.4.3 ANNUAL OPERATING COSTS

The cost developed for all elements of this cost center is in accordance with the rationale presented in Section 3.4.3.

5.4.4 STAFFING ALLOCATIONS

The cost developed for this cost center is in accordance with Section 3.4.4.

5.4.5 DECOMMISSIONING

The decomissioning cost percentiles applied to the various facilities included in this cost center are in accordance with Section 3.4.5.

5.5 DESIGN AND CONSTRUCTION SCHEDULES

The design and construction schedules of the various storage options and construction phases for Scenario 5 are presented on Figures 5-4 through 5-9. As stated in Section 3.5, the schedule durations for construction are based on an evaluation of the preconceptual design and the construction labor required.

The critical path for all construction phases and storage options commences with selection of site(s) and includes site investigation, ACD, LA design, license approval, facility construction, and cold tests. The major facilities for this scenario include the R&H Building, SFHB, and/or the VSB. The SFHB and VSB require an ACD to be completed in sufficient time to form the basis for the LA design. The schedules for this scenario provide for the completion of the ACD 18 to 21 months prior to completing the LA design, thus providing sufficient schedule time to complete the LA design for these buildings. Since the R&H Building is presented in the CDR, it is assumed that no ACD is required for this building and the LA design can be initiated when a site(s) is selected. To complete this design phase, input data is required from the site investigation and from proof-of-principle tests, and adequate time is required for incorporation. The schedules shown for this scenario provide for 11 to 14 months and 16 to 19 months for incorporation of proof-of-principle test data and geotechnical data respectively. NRC license approval is assumed to require 30 months which cannot be initiated until the completion of the LA design and establishes the construction start milestone. The receipt of waste (plant startup) is determined by the construction duration of the receiving and storage facilities required for each phase. For all single-phase storage options, this is established by the R&H Building construction and cold test duration (53 months). For the two-phase cask and drywell options, it is established by the SFHB (30 months) and for the two-phase vault option, by the VSB (35 months). The receipt of waste for all three-phase options is established by the construction duration of the Inspection Gatehouse, RB, and dual purpose cask storage area (12 months). To meet the operational objectives (canistered consolidated spent fuel) and/or to minimize the use of dual purpose casks, all handling and storage facilities must be constructed on schedule. Therefore, the construction of all facilities are on the critical path.

Scenario: 3
Construction Phase: Single
Storage Concept: Cask

Date: 10/21/00
Revision: 3

Storage Concept Data		Percent of M & I Cost per Year Prior to Operations											
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	41	47	12 (Rev. 2)									
Design													
Proof-of-Principle Tests (6 Tests)	1.0	41	54	5 (Rev. 3)									
Advanced Conceptual Design	N/A												
License Application Design	38.3		41	54	5								
Licensing Support	5.2				37	40	23						
Final Procurement and Construction Design	25.6				73	27							
Title III Support	30.2						2	20	29	29	20		
Operating Contractor Support													
Design	9.9	11	30	31	14	11	3						(Rev. 1)
Construction	10.0					5	15	23	20	19	13		5 (Rev. 1)
Construction Management	56.1						2	20	29	29	20		
Preoperational Testing and Personnel Training	66.0					3	5	10	17	24	41		(Rev. 1)

TABLE 5-2
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario 3
Construction Phase: Single
Storage Concepts: Cost

Date: 9/2/00
Revision: 0

COST CENTER/Cost Element	Building Area	Millions in 1998 \$		
		Facility Cost	Equipment Cost	Total Cost
CASK OPERATIONS				
Receiving	N/A	3.392	--	3.392
Cask Lag Storage	N/A	2.996	--	2.996
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDINGS	N/A	N/A	N/A	N/A
Cask Unloading				
Assembly Lag Storage				
Processing				
Interim Storage Loading/Unloading				
Building Support Facilities				
RECEIVING AND HANDLING BUILDING				
Cask Unloading	85672	11.970	10.403	22.373
Assembly Lag Storage	4864	1.505	0.855	2.360
Processing	59733	18.441	66.719	85.160
Volume Reduction	13237	3.932	8.449	12.401
Canister/Container Closure	26470	7.903	28.265	36.168
Canister/Container Lag Storage	48384	14.489	15.371	29.860
Interim Storage Loading/Unloading	27533	8.279	15.618	23.897
WRS/Repository Cask Handling	21709	6.386	9.936	16.322
Building Support Facilities	421418	127.015	107.493	234.508
INTERIM STORAGE OPERATIONS				
Storage Facilities	N/A	\$7500/cask	7.010	--
Storage Units	N/A		See Comsumables, Table 3-	
Receiving Building	N/A	N/A	N/A	N/A
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Onsite Preparation	N/A	36.137	--	36.137
Offsite Preparation	N/A	16.295	--	16.295
Administration	N/A	2.605	0.429	3.029
Other Support Facilities	N/A	42.130	18.915	61.045

TABLE 5-3
CONSTRUCTION COSTS

Scenario 3
Construction Phase: Single
Storage Concept: Cash

Date: 10/21/00
Revision: 1

Percent of Facility/Construction Cost by Year Prior to Start-up											
COST CENTER/Cost Element	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	
<hr/>											
CASH OPERATIONS			10	90							
Receiving											
Cash Log Storage											
<hr/>											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING		N/A	N/A	N/A	N/A	N/A					
Cash Unloading											
Assembly Log Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
<hr/>											
RECEIVING AND HANDLING BUILDING		2	20	29	29	20					
Cash Unloading											
Assembly Log Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Log Storage											
Interim Storage Loading/Unloading											
WHS/Depository Cash Handling											
Building Support Facilities											
<hr/>											
INTERIM STORAGE OPERATIONS			17	33	33	17					
Storage Facilities											
Storage Units											
Receiving Building											
<hr/>											
BALANCE OF PLANT AND SUPPORT OPERATIONS			50	30	20 (Rev. 1)						
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 3-4
CONSTRUCTION COST DISTRIBUTION

Scenario: S
Construction Phase: Single
Storage Concept: Cask

Date: 1/20/89
Revision: 1

COST CENTER/Cost Element	Equipment Maintenance/Replacement (\$/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.014 M/Year Fixed
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Cask Unloading				
Assembly Lag Storage				
Processing				
Interim Storage Loading/Unloading				
Building Support Facilities				
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed
Cask Unloading	0.7		3.4	
Assembly Lag Storage	1.0			
Processing	1.2	31.8	3.7	
Volume Reduction	1.2		0.5	
Canister/Container Closure	1.0		1.4	Drums = \$520/Unit
Canister/Container Lag Storage	0.5		11.8	Canisters = \$1800/9"; \$1400/6" (Rev. 1)
Interim Storage Loading/Unloading	0.6		3.3	
WRS/Repository Cask Handling	1.4		6.6	
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit
INTERIM STORAGE OPERATIONS				
Storage Facilities	2.0	0.8	95	\$0.050 M/Year Fixed
Storage Units				Casks = \$0.197 M/Unit
Receiving Building	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	35.4	37.3	
Other Support Facilities	1.6	55.9	24.0	

TABLE 5-5
ANNUAL OPERATING COSTS

Scenario: 5
Construction Phase: Single
Storage Concept: Cask

Date : 1/20/89
Revision : 2

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; Inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks				
Storage loading/unloading				
Building support staff				
RECEIVING AND HANDLING BUILDING				
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and canister fuel	PMR = 171/canister BMR = 363/canister	2.5	\$53,900	Canister intact = 55/canister
Volume-reduce/package NFBC	Approx. 430/5 drum "cage" (86/drum, average)	1	\$53,900	
Weld/decon/test canisters	190/canister	1.2	\$53,900	
Canister handling:		3	\$53,900	
lag storage	730/rack of 12 canisters			
storage cask loading/unloading	PMR = 450/intact; 270/consol. (Rev. 2) BMR = 1080/intact; 330/consol.			
	NFBC = 75/cage			
HRS transport cask loading	530/9";1025/6";170/NFBC cage;215/RH-LLW (Rev. 1)			
Building support staff	N/A	146	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Storage cask preparation & closing/reopening	210/cask	4	\$53,900	If cask is reused, add 30 min. (Rev. 1)
Storage placement (incl. 45 min. to obtain new cask)	145/cask	6	\$53,900	If cask is reused, reduce by 45 min. (Rev. 2)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff (excl. Cask Mfg. Facility of II)	N/A	264	\$53,900	

TABLE 5-6
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario 3
Construction Phase: Single
Storage Concept: Cook

Date: 9/2/00
Revision: 0

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASE OPERATIONS	3							100	
Receiving									
Cost Log Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	N/A								
Cost Unloading									
Assembly Log Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cost Unloading									
Assembly Log Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Log Storage									
Interim Storage Loading/Unloading									
WRS/Repository Cost Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

TABLE S-7
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 5
Construction Phase: Two
Storage Concept: Cost

Date: 10/21/88
Revision: 3

Storage Concept Costs		Percent of N & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6			55	45 (Rev. 2)									
Design														
Proof-of-Principle Tests (6 Tests)	1.0			55	45 (Rev. 3)									
Advanced Conceptual Design	3.8			67	33 (Rev. 3)									
License Application Design	45.1				45	55 (Rev. 3)								
Licensing Support	5.2						40	40	20 (Rev. 3)					
Final Procurement and Construction Design	30.1						80	20	(Rev. 3)					
Title III Support	34.0								20	23	26	22	9	
Operating Contractor Support														
Review	9.9			11	30	31	14	11	3					
Construction	10.8							5	13	23	20	19	13	5 (Rev. 1)
Construction Management	67.4								20	23	26	22	9	(Rev. 1)
Preoperational Testing and Personnel Training	66.8							3	5	10	17	24	41	(Rev. 1)

TABLE 3-8
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 3
Construction Phase: Two
Storage Concept: Cask

Date: 10/21/00
Revision: 2

COST CENTER/Cost Element	Building Area	Millions in 1988 \$		
		Facility Cost	Equipment Cost	Total Cost
CASK OPERATIONS				
Receiving	N/A	3.332	--	3.332
Cask Lag Storage	N/A	2.996	--	2.996
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Cask Unloading	31420	7.432	2.852	10.284
Assembly Lag Storage	4080	3.074	0.270	3.344
Processing	12524	9.639	7.613	17.254
Interior Storage Loading/Unloading	17170	13.602	0.439	14.041
Building Support Facilities	92916	25.146	2.923	28.069 (Rev. 1)
RECEIVING AND HANDLING BUILDING				
Cask Unloading	89672	11.970	10.403	22.373
Assembly Lag Storage	4864	1.903	0.853	2.756
Processing	90733	10.441	66.719	77.160
Volume Reduction	13237	3.932	8.449	12.381
Canister/Container Closure	26474	7.903	20.263	28.166
Canister/Container Lag Storage	48384	14.409	13.371	27.780
Interior Storage Loading/Unloading	27533	8.279	13.610	21.889
WRS/Repository Cost Handling	21709	6.506	9.936	16.442
Building Support Facilities	421410	127.015	107.493	234.508
INTERIM STORAGE OPERATIONS				
Storage Facilities	N/A	\$7500/cask	7.810	--
Storage Units	N/A		See Consumables, Table 5-11	
Receiving Building	N/A	N/A	N/A	N/A
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Onsite Preparation	N/A	39.893	--	39.893 (Rev. 2)
Offsite Preparation	N/A	16.293	--	16.293
Administration	N/A	2.603	0.424	3.027
Other Support Facilities	N/A	42.130	18.915	61.045

TABLE 5-9
CONSTRUCTION COSTS

Scenario: 3
 Construction Phase: Two
 Storage Concept: Cook

Date: 9/2/88
 Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cont Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASE OPERATIONS				10	90						
Receiving											
Cook Log Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				25	65	30					
Cook Unloading											
Assembly Log Storage											
Processing											
Interior Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				20	20	25	25	10			
Cook Unloading											
Assembly Log Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Log Storage											
Interior Storage Loading/Unloading											
HRS/Repository Cook Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS				10	60	30					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				30	30	20					
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 3-10
 CONSTRUCTION COST DISTRIBUTION

Scenario: 3
Construction Phase: Two
Storage Concept: Cask

Date : 1/20/89
Revision : 2

COST CENTER/Cost Element	Equipment Maintenance/Replacement (X/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.014 M/Year Fixed
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; \$0.970 M/Year -Standby (Rev. 1)
Cask Unloading	2.0			
Assembly Lag Storage	1.0			
Processing	1.5	1.8		
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed
Building Support Facilities	1.1	1.9	12.9	
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed
Cask Unloading	0.7		3.4	
Assembly Lag Storage	1.0			
Processing	1.2	31.8	3.7	
Volume Reduction	1.2		0.5	Drums = \$320/Unit
Canister/Container Closure	1.0		1.4	Canisters = \$1800/9"; \$1400/6" (Rev. 2)
Canister/Container Lag Storage	0.5		11.8	
Interim Storage Loading/Unloading	0.6		3.3	
WRS/Repository Cask Handling	1.4		6.6	
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit
INTERIM STORAGE OPERATIONS				
Storage Facilities	2.0	0.8	95	\$0.030 M/Year Fixed
Storage Units				Casks = \$0.197 M/Unit
Receiving Building				
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	35.4	37.3	
Other Support Facilities	1.6	55.9	24.0	

TABLE S-11
ANNUAL OPERATING COSTS

Scenario: 5
Construction Phase: Two
Storage Concept: Cask

Date : 1/20/89
Revision : 2

COST CENTER/Functional Activity by Crew -----	Processing Time/Unit Processed (in minutes) -----	FTE/Crew -----	Annual \$/FTE -----	Notes -----
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/MRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading	PMR = 510/cask (Rev. 1) BMR = 1230/cask (Rev. 2)	1.3	\$53,900	Load/unload onsite transfer cask : PMR = 530; BMR = 1070
Building support staff	N/A	51	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/MRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and canister fuel	PMR = 171/canister BMR = 363/canister	2.5	\$53,900	Canister intact = 55/canister
Volume-reduce/package MFBC	Approx. 430/5 drum "cage" (86/drum, average)	1	\$53,900	
Meld/decon/test canisters	190/canister	1.2	\$53,900	
Canister handling: lag storage	730/rack of 12 canisters	3	\$53,900	
storage cask loading/unloading	PMR = 450/intact; 270/consol. (Rev. 2) BMR = 1080/intact; 330/consol. MFBC = 75/cage			
MRS transport cask loading	530/9";1025/6";170/MFBC cage;215/RH-LLW (Rev. 1)			
Building support staff	N/A	146	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Storage cask preparation & closing/reopening	210/cask	4	\$53,900	If cask is reused, add 30 min. (Rev. 1)
Storage placement (incl. 45 min. to obtain new cask)	145/cask	6	\$53,900	If cask is reused, reduce by 45 min. (Rev. 2)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff (excl. Cask Mfg. Facility of 11)	N/A	264	\$53,900	

TABLE 5-12
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 5
Construction Phase: Ten
Storage Concept: Cask

Date: 10/11/00
Revision: 1

Storage Concept: Cost		Percent of Decommissioning Cost by Year After Last Year of Operations								
COST CENTER/Cost Element	% of Total Constr. Cost	Last Year Operations								
		-2	-1	+1	+2	+3	+4	+5	+6	
CASK OPERATIONS	3						100			
Receiving										
Cask Log Storage										
WASTE HANDLING OPERATIONS										
SPENT FUEL HANDLING BUILDING	12			10	90	10				
Cask Unloading										
Assembly Log Storage										
Processing										
Interim Storage Loading/Unloading										
Building Support Facilities										
RECEIVING AND HANDLING BUILDING	12			10	20	75	30	15		
Cask Unloading										
Assembly Log Storage										
Processing										
Volume Reduction										
Canister/Container Closure										
Canister/Container Log Storage										
Interim Storage Loading/Unloading										
HRS/Repository Cask Handling										
Building Support Facilities										
INTERIM STORAGE OPERATIONS	3		60	40						
Storage Facilities										
Storage Units										
Receiving Building										
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100		
Onsite Preparation										
Offsite Preparation										
Administration										
Other Support Facilities										

Note, intact SF cask = 121 (Rev. 1)

TABLE S-13
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario 5
Construction Phase: Three
Storage Concept: Cask

Date: 10/21/88
Revision: 3

		Percent of H & I Cost per Year Prior to Operations											
COST CENTER/Cost Element	Cost (Millions \$)	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	0.6	18	32	30 (Rev. 2)									
Design													
Proof-of-Principle Tests (6 Tests)	1.0	18	34	28 (Rev. 3)									
Advanced Conceptual Design	3.8		100	(Rev. 3)									
License Application Design	45.1		18	55	27								
Licensing Support	5.2				20	40	40						
Final Procurement and Construction Design	30.1				40	60							
Title III Support	34.0							20	23	26	22	9	
Operating Contractor Support													
Design	9.9		11	30	31	14	11	3					
Construction	10.8						5	15	23	20	19	13	5
Construction Management	67.4							20	23	26	22	9	
Preoperational Testing and Personnel Training	66.8 (Rev. 1)						3	3	10	17	24	41	

TABLE S-14
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 5
Construction Phases Three
Storage Concept: Cask

Date: 10/21/88
Revision: J

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					(1) Site development:
Receiving	N/A	5.165	0.829	5.994	Storage cask = \$7500/cask
Cask Lag Storage	N/A	2.996	--	2.996	Dual purpose cask = \$31,000/cask
WASTE HANDLING OPERATIONS					(2) Storage cask equipment = \$7.816 M
SPENT FUEL HANDLING BUILDING					Dual purpose cask equip. = \$3,940 M
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Lag Storage	9080	3.074	0.270	3.344	
Processing	12524	9.639	7.615	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	25.146	2.923	28.069 (Rev. 2)	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.303	0.835	2.138	
Processing	59733	16.441	66.719	83.160	
Vehicle Radiation	13237	3.952	8.449	12.401	
Canister/Container Closure	26474	7.903	28.265	36.168	
Canister/Container Lag Storage	48384	14.489	15.371	29.860	
Interim Storage Loading/Unloading	27533	8.279	15.618	23.897	
WRS/Repository Cask Handling	21709	6.986	9.936	16.922	
Building Support Facilities	421418	177.015	107.493	284.508	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	(2)	-- (Rev. 1)	
Storage Units	N/A		See Consumables, Table S-17		
Receiving Building	N/A	1.607	1.006	2.613	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	39.895	--	39.895 (Rev. 3)	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	42.130	18.915	61.045	

TABLE S-15
CONSTRUCTION COSTS

Scenario 3
Construction Phase: Three
Storage Concept: Cask

Date: 9/2/00
Revision: 0

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS						100					
Receiving											
Cask Log Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING						75	45	30			
Cask Unloading											
Assembly Log Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING						20	20	25	25	10	
Cask Unloading											
Assembly Log Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Log Storage											
Interim Storage Loading/Unloading											
WRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS											
Storage Facilities						100					
Storage Units											
Receiving Building						100					
BALANCE OF PLANT AND SUPPORT OPERATIONS						50	30	20			
Site Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 5-16
CONSTRUCTION COST DISTRIBUTION

Scenario: 5
Construction Phase: Three
Storage Concept: Cask

Date: 1/20/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (1/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.020 M/Year Fixed
Receiving	2.0			
Cask Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby (Rev. 2)
Cask Unloading	2.0			
Assembly Lag Storage	1.0			
Processing	1.5	1.8		
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed
Building Support Facilities	1.1	1.9	12.9	
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed
Cask Unloading	0.7		3.4	
Assembly Lag Storage	1.0			
Processing	1.2	31.8	3.7	
Volume Reduction	1.2		0.5	
Canister/Container Closure	1.0		1.4	Drums = \$520/Unit Canisters = \$1800/9"; \$1400/6" (Rev. 3)
Canister/Container Lag Storage	0.5		11.8	
Interim Storage Loading/Unloading	0.6		3.3	
HRS/Repository Cask Handling	1.4		6.6	
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit
INTERIM STORAGE OPERATIONS				
Storage Facilities	2.0	0.8	95	1st Year Ops. = \$0.006 M Fixed (Rev. 1); Other Ops. Years = \$0.050 M/Year Casks = \$0.197 M/Unit (Rev. 1)
Storage Units				
Receiving Building	2.0			
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.350 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	35.4	37.3	
Other Support Facilities	1.6	55.9	24.0	

TABLE 5-17
ANNUAL OPERATING COSTS

Scenario: 5
Construction Phase: Three
Storage Concept: Cask

Date: 1/20/89
Revision: 2

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	FTE/crew increases to 8 for first 4 years of operations
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask: 375/cask
Unload transport casks	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading	PMR = 510/cask (Rev. 1) BMR = 1230/cask (Rev. 2)	1.5	\$53,900	Load/unload onsite transfer cask: PMR = 530; BMR = 1070
Building support staff	N/A	51	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and canister fuel	PMR = 171/canister BMR = 363/canister	2.5	\$53,900	Canister intact = 55/canister
Volume-reduce/package NFBC	Approx. 430/5 drum "cage" (86/drum, average)	1	\$53,900	
Hold/decom/test canisters	190/canister	1.2	\$53,900	
Canister handling: lag storage		3	\$53,900	
storage cask loading/unloading	730/rack of 12 canisters PMR = 450/intact; 270/consol. (Rev. 2) BMR = 1080/intact; 330/consol. NFBC = 75/cage			
NRS transport cask loading	530/9";1025/6";170/NFBC cage;215/RH-LLM (Rev. 1)			
Building support staff	N/A	146	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	230/cask	17	\$53,900	
Storage cask preparation & closing/reopening	210/cask	4	\$53,900	If cask is reused, add 30 min. (Rev. 1)
Storage placement (incl. 45 min. to obtain new cask)	145/cask	6	\$53,900	If cask is reused, reduce by 45 min. (Rev. 2)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff (excl. Cask Mfg. Facility of 11)	N/A	264	\$53,900	

TABLE 5-18
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 3
Construction Phase: Three
Storage Concept: Cask

Date: 10/11/88
Revision: 1

COST CENTER/Cost Element	1 of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Log Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	00	10		
Cask Unloading									
Assembly Log Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Log Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Log Storage									
Interim Storage Loading/Unloading									
HRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Base, intact HF casks = 122 (Rev. 1)

TABLE 5.19
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: S
Construction Phases Single
Storage Concepts Drywell

Date: 10/21/88
Revision: 2

		Percent of M & I Cost per Year Prior to Operations											
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	41	47	12 (Rev. 1)									
Design													
Proof-of-Principle Tests (6 Tests)	1.0	41	54	5 (Rev. 2)									
Advanced Conceptual Design	N/A												
License Application Design	38.3		41	54	5								
Licensing Support	5.2				37	40	23						
Final Procurement and Construction Design	25.6				73	27							
Title III Support	30.2						2	20	29	29	20		
Operating Contractor Support													
Design	9.9	11	30	31	14	11	3						
Construction	10.8					5	15	23	20	19	13	5	
Construction Management	56.1						2	20	29	29	20		
Preoperational Testing and Personnel Training	66.0					3	5	10	17	24	41		

TABLE 3-20
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 3
Construction Phases: Single
Storage Concepts: Drywell

Date: 11/4/00
Revision: 2

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	3.352	--	3.352	(1) Site development costs included in drywell unit cost. See consumables, Table 5-23
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	N/A	
Cask Unloading					
Assembly Lag Storage					
Processing					
Interim Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85472	11.978	10.403	22.373	
Assembly Lag Storage	4864	1.505	0.855	2.360	
Processing	99733	18.441	66.719	85.160	
Volume Reduction	13237	3.952	8.449	12.401	
Canister/Container Closure	26479	7.983	28.265	36.168	
Canister/Container Lag Storage	48384	14.489	15.371	29.860	
Interim Storage Loading/Unloading	27533	8.279	15.618	23.897	
WRS/Repository Cask Handling	21709	4.386	9.936	16.322	
Building Support Facilities	421418	127.015	107.493	234.508	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	3.311	--	
Storage Units	N/A		See Consumables, Table 5-23		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Debate Preparation	N/A	28.638	--	28.638 (Rev. 1)	
Offsite Preparation	N/A	16.795	--	16.795	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 2)	

TABLE 5-21
CONSTRUCTION COSTS

Scenario: S
Construction Phase: Single
Storage Concept: Drywell

Date: 10/21/00
Revision: 1

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASE OPERATIONS			10	90							
Receiving											
Cask Log Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING		N/A	N/A	N/A	N/A	N/A					
Cask Unloading											
Assembly Log Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING		2	20	29	29	20					
Cask Unloading											
Assembly Log Storage											
Processing											
Vibration Reduction											
Canister/Container Closure											
Canister/Container Log Storage											
Interim Storage Loading/Unloading											
HRS/Regulatory Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS			17	33	33	17					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS			30	30	20 (Rev. 1)						
Biosite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE S-27
CONSTRUCTION COST DISTRIBUTION

Scenario: 5
Construction Phase: Single
Storage Concept: Drywell

Date: 1/20/89
Revision: 1

COST CENTER/Cost Element	Equipment Maintenance/Replacement (%/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.014 M/Year Fixed
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Cask Unloading				
Assembly Lag Storage				
Processing				
Interim Storage Loading/Unloading				
Building Support Facilities				
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed
Cask Unloading	0.7		3.4	
Assembly Lag Storage	1.0			
Processing	1.2	31.8	3.7	
Volume Reduction	1.2		0.3	
Canister/Container Closure	1.0		1.4	Drums = \$520/Unit
Canister/Container Lag Storage	0.5		11.8	Canisters = \$1800/9"; \$1400/6" (Rev. 1)
Interim Storage Loading/Unloading	0.6		3.3	
WRS/Repository Cask Handling	1.4		6.6	
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit
INTERIM STORAGE OPERATIONS				
Storage Facilities	1.6	3.0	58	\$0.050 M/Year Fixed
Storage Units				Consol. SF Canister Drywell (Rev. 1)
				(16" dia.) = \$5800/Unit; Intact SF Canister
				Drywell (30" dia.) = \$13,000/Unit
				WFC Drywell (30" dia.) = \$12,200/Unit
Receiving Building	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.530 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	35.4	37.3	
Other Support Facilities	1.6	55.9	24.0	

TABLE 5-23
ANNUAL OPERATING COSTS

Scenario: 3
Construction Phase: Single
Storage Concept: Drywell

Date: 1/20/89
Revision: 2

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks				
Storage loading/unloading				
Building support staff				
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and canister fuel	PMR = 171/canister BWR = 363/canister	2.5	\$53,900	Canister intact = 55/canister
Volume-reduce/package NFBC	Approx. 430/5 drum "cage" (86/drum, average)	1	\$53,900	(Rev. 1)
Weld/decom/test canisters	190/canister	1.2	\$53,900	
Canister handling:		3	\$53,900	
lag storage	730/rack of 12 canisters			
transporter loading/unloading	Consol. SF = 45/load; NFBC = 45/load; Intact SF = 90/PMR load; 150/BWR load	(Rev. 2)		
NRS transport cask loading	530/9";1025/6";170/NFBC cage;215/RN-LLM	(Rev. 1)		
Building support staff	N/A	146	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter operation (incl. loading of shield plug)	60/trip	1	\$53,900	If drywell is reused, reduce by 15 min. (Rev. 1)
Storage placement	30/drywell	3.5	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 5-24
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario 3
Construction Phase: Single
Storage Concept: Drywell

Date: 9/6/88
Revision: 0

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations								
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5	+6
CASK OPERATIONS	5							100		
Receiving										
Cask Log Storage										
WASTE HANDLING OPERATIONS										
SPENT FUEL HANDLING BUILDING	N/A									
Cask Unloading										
Assembly Log Storage										
Processing										
Interior Storage Loading/Unloading										
Building Support Facilities										
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15	
Cask Unloading										
Assembly Log Storage										
Processing										
Volume Reduction										
Caskster/Container Closure										
Caskster/Container Log Storage										
Interior Storage Loading/Unloading										
HRS/Repository Cask Handling										
Building Support Facilities										
INTERIM STORAGE OPERATIONS	5		60	40						
Storage Facilities										
Storage Units										
Receiving Building										
BALANCE OF PLANT AND SUPPORT OPERATIONS	1								100	
Onsite Preparation										
Offsite Preparation										
Administration										
Other Support Facilities										

TABLE 3-75
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 5
Construction Phase: Two
Storage Concept: Drywell

Date: 10/21/00
Revision: 3

		Percent of M & I Cost per Year Prior to Operations													
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	
MANAGEMENT AND INTEGRATION															
Site Selection/Investigation	8.6			55	45 (Rev. 2)										
Design															
Proof-of-Principle Tests (6 Tests)	1.0			55	45 (Rev. 3)										
Advanced Conceptual Design	3.8			67	33 (Rev. 3)										
License Application Design	43.1				45	55 (Rev. 3)									
Licensing Support	5.2						40	40	20 (Rev. 3)						
Final Procurement and Construction Design	30.1						80	20	(Rev. 3)						
Title III Support	34.0								20	25	26	22	9		
Operating Contractor Support															
Design	9.9			11	30	31	14	11	3						
Construction	10.8							9	13	23	20	19	13	5	
Construction Management	67.4								20	23	26	22	9	(Rev. 1)	
Preoperational Testing and Personnel Training	66.8							3	3	10	17	24	41		

TABLE S-26
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario 5
Construction Phase: Two
Storage Concept: Drywell

Date : 11/4/88
Revision : 3

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	3.352	--	3.352	(1) Site development cost for drywell included in drywell unit cost. See consumables, Table 5-29
Cask Log Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Log Storage	4080	3.074	0.270	3.344	
Processing	12524	9.639	7.615	17.254	
Interin Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	25.146	2.923	28.069 (Rev. 1)	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Log Storage	4844	1.305	0.855	2.160	
Processing	59733	18.481	64.719	83.200	
Volume Reduction	13237	3.952	8.449	12.401	
Canister/Container Closure	26474	7.983	28.265	36.248	
Canister/Container Log Storage	48384	14.489	15.371	29.860	
Interin Storage Loading/Unloading	27533	8.279	15.618	23.897	
WHS/Repository Cask Handling	21709	4.586	9.936	14.522	
Building Support Facilities	421418	127.015	107.475	234.490	
INTERIN STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	3.311	--	
Storage Units	N/A		See Consumables, Table 5-29		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	32.390	--	32.390 (Rev. 2)	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 3)	

TABLE 5-27
CONSTRUCTION COSTS

Scenario 3
Construction Phase: Two
Storage Concept: Drywell

Date: 9/6/88
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				10	90						
Receiving											
Cask Log Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				25	45	30					
Cask Unloading											
Assembly Log Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				20	20	25	25	10			
Cask Unloading											
Assembly Log Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Log Storage											
Interim Storage Loading/Unloading											
HRS/Repository Cost Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS				10	60	30					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				50	30	20					
Site Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 3-20
CONSTRUCTION COST DISTRIBUTION

Scenario: 3
Construction Phase: Two
Storage Concept: Drywell

Date: 1/20/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (\$/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.014 M/Year Fixed
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby (Rev. 2)
Cask Unloading	2.0			
Assembly Lag Storage	1.0			
Processing	1.5	1.8		
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed (Rev. 1)
Building Support Facilities	1.1	1.9	12.9	
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed
Cask Unloading	0.7		3.4	
Assembly Lag Storage	1.0			
Processing	1.2	31.8	3.7	
Volume Reduction	1.2		0.5	Drums = \$520/Unit
Canister/Container Closure	1.0		1.4	Canisters = \$1800/9"; \$1400/6" (Rev. 3)
Canister/Container Lag Storage	0.5		11.8	
Interim Storage Loading/Unloading	0.6		3.3	
WRS/Repository Cask Handling	1.4		6.6	
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit
INTERIM STORAGE OPERATIONS				
Storage Facilities	2.0	0.8	95	\$0.030 M/Year Fixed
Storage Units				Bare, Intact SF Drywell (Rev. 3) (30" dia.) = \$13,000/Unit; Consol. SF Canister Drywell (16" dia.) = \$5800/Unit; Intact SF Canister Drywell (30" dia.) = \$13,000/Unit; NFBC Drywell (30" dia.) = \$12,200/Unit
Receiving Building	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.350 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	35.4	37.3	
Other Support Facilities	1.6	35.9	24.0	

TABLE 5-29
ANNUAL OPERATING COSTS

Scenario: S
Construction Phase: Two
Storage Concept: Drywell

Date : 1/20/89
Revision : 2

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; Inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/4 assemblies BMR = 95/8 assemblies (Rev. 1)	1.5	\$53,900	Load/unload onsite transfer cask : PMR = 530; BMR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and canister fuel	PMR = 171/canister BMR = 363/canister	2.5	\$53,900	Canister intact = 55/canister
Volume-reduce/package NFBC	Approx. 430/5 drum "cage" (86/drum, average)	1	\$53,900	
Weld/decon/test canisters	190/canister	1.2	\$53,900	
Canister handling:		3	\$53,900	
Tag storage	730/rack of 12 canisters			
transporter loading/unloading	Consol. SF = 45/load; NFBC = 45/load; (Rev. 2) Intact SF = 90/PMR load; 150/BMR load			
NRS transport cask loading	530/9";1025/6";170/NFBC cage;215/RM-LLW (Rev. 1)			
Building support staff	N/A	146	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter Operation (incl. loading of shield plug, and intact SF basket as required)	60/trip from R & H Building 75/trip from SFHB	1	\$53,900	If drywell is reused, reduce by 15 min. (Rev. 1)
Storage placement	50/drywell	3.3	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE S-30
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario 5
Construction Phase: Two
Storage Concept: Drywell

Date: 10/11/98
Revision: 1

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	0	+1	+2	+3	+4	+5
CASE OPERATIONS	5							100	
Receiving									
Cask Log Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Log Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Log Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Log Storage									
Interim Storage Loading/Unloading									
RRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facility									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Note, (total SF drywell) = 12%
(Rev. 1)

TABLE 5-31
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 3
Construction Phases Three
Storage Concepts Drywell

Date: 10/21/88
Revision: 2

		Percent of M & I Cost per Year Prior to Operations											
COST CENTER/Cost Element	Cost (Millions \$)	-----											
		-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5

MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	18	52	30 (Rev. 1)									
Design													
Proof-of-Principle Tests (6 Tests)	1.0	18	54	28 (Rev. 2)									
Advanced Conceptual Design	3.8		100	(Rev. 2)									
License Application Design	45.1		18	55	27								
Licensing Support	5.2				20	40	40						
Final Procurement and Construction Design	38.1				40	60							
Title XII Support	34.0							20	23	26	22	9	
Operating Contractor Support													
Design	9.9		11	30	31	14	11	3					
Construction	10.8						5	15	23	20	19	13	5
Construction Management	67.4							20	23	26	22	9	
Preoperational Testing and Personnel Training	66.8						3	5	10	17	24	41	

TABLE 5-32
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 3
Construction Phase: Three
Storage Concept: Drywell

Date: 11/4/88
Revision: 3

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					(Rev. 1) (1) Site development cost included in
Receiving	N/A	5.165	0.829	5.994 (Rev. 1)	drywell unit cost. See consumables,
Cask Lag Storage	N/A	2.996	--	2.996 (Rev. 1)	Table 5-35
WASTE HANDLING OPERATIONS					Dual purpose cask site development
SPENT FUEL HANDLING BUILDING					cost = \$31,000/cask
Cask Unloading	31420	7.432	2.852	10.284	(2) Drywell equipment cost = \$3.311 M
Assembly Lag Storage	4080	3.074	0.270	3.344	Dual purpose cask equip. = \$3.940 M
Processing	12524	9.639	7.615	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	25.146	2.923	28.069 (Rev. 1)	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.505	0.855	2.360	
Processing	99733	18.441	64.719	83.160	
Volume Reduction	13237	3.952	8.449	12.401	
Canister/Container Closure	26474	7.903	20.265	28.168	
Canister/Container Lag Storage	48384	14.489	15.371	29.860	
Interim Storage Loading/Unloading	27533	8.279	15.618	23.897	
WRS/Repository Cask Handling	21789	6.584	9.934	16.512	
Building Support Facilities	421418	127.015	107.493	234.508	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	(2)	--	
Storage Units	N/A		See Consumables, Table 5-35		
Receiving Building	N/A	1.807	1.004	2.813	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Basite Preparation	N/A	32.390	--	32.390 (Rev. 2)	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 3)	

TABLE 5-33
CONSTRUCTION COSTS

Scenario: S
Construction Phase: Three
Storage Concept: Drywell

Date: 7/6/88
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASE OPERATIONS						100					
Receiving											
Cost Log Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING						25	45	30			
Cost Unloading											
Assembly Log Storage											
Processing											
Interior Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND ASSEMBLING BUILDING						20	20	25	25	10	
Cost Unloading											
Assembly Log Storage											
Processing											
Volume Reduction											
Container/Container Closure											
Container/Container Log Storage											
Interior Storage Loading/Unloading											
WHS/Repository Cost Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS											
Storage Facility						100					
Storage Units											
Receiving Building						100					
BALANCE OF PLANT AND SUPPORT OPERATIONS						50	30	20			
Site Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE S-34
CONSTRUCTION COST DISTRIBUTION

Scenario: 9
Construction Phase: Three
Storage Concept: Drywell

Date: 1/20/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (1/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.020 M/Year Fixed
Receiving	2.0			
Cask Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby (Rev. 2)
Cask Unloading	2.0			
Assembly Lag Storage	1.0			
Processing	1.5	1.8		
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed
Building Support Facilities	1.1	1.9	12.9	
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed
Cask Unloading	0.7		3.4	
Assembly Lag Storage	1.0			
Processing	1.2	31.8	3.7	
Volume Reduction	1.2		0.5	
Canister/Container Closure	1.0		1.4	Drums = \$520/Unit
Canister/Container Lag Storage	0.5		11.8	Canisters = \$1800/9"; \$1400/6" (Rev. 3)
Interim Storage Loading/Unloading	0.6		3.3	
WHS/Repository Cask Handling	1.4		6.6	
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit
INTERIM STORAGE OPERATIONS				
Storage Facilities	1.6	3.0	53	1st Year Ops. = \$0.006 M Fixed; Other Ops. Years = \$0.050 M/Year
Storage Units				Bare, Intact SF Drywell (Rev.3) (30" dia.) = \$13,000/Unit; Consol. SF Canister Drywell (16" dia.) = \$5800/Unit; Intact SF Canister Drywell (30" dia.) = \$13,000/Unit; MFRC Drywell (30" dia.) = \$12,200/Unit
Receiving Building	2.0			
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	35.4	37.3	
Other Support Facilities	1.6	55.9	24.0	

TABLE 5-35
ANNUAL OPERATING COSTS

Scenario: 5
Construction Phase: Three
Storage Concept: Drywell

Date: 1/20/89
Revision: 2

COST CENTER/Functional Activity by Crew -----	Processing Time/Unit Processed (in minutes) -----	FTE/Crew -----	Annual \$/FTE -----	Notes -----
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	FTE/crew increases to 8 for first 4 years of operations
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/4 assemblies BMR = 95/8 assemblies (Rev. 1)	1.5	\$53,900	Load/unload onsite transfer cask : PMR = 530; BMR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and canister fuel	PMR = 171/canister BMR = 363/canister	2.5	\$53,900	Canister intact = 55/canister
Volume-reduce/package WFBC	Approx. 430/5 drum "cage" (86/drum, average)	1	\$53,900	
Weld/decon/test canisters	190/canister	1.2	\$53,900	
Canister handling:		3	\$53,900	
lag storage	730/rack of 12 canisters			
transporter loading/unloading	Consol. SF = 45/load; WFBC = 45/load (Rev. 2) Intact SF = 90/PMR load; 130/BMR load			
HRS transport cask loading	530/9";1025/6";170/WFBC cage;215/RN-LLW (Rev. 1)			
Building support staff	N/A	146	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	230/cask	17	\$53,900	
Transporter operation (incl. loading of shield plug, and intact SF basket as required)	60/trip from R & H Building 75/trip from SFHB	1	\$53,900	If drywell is reused, reduce by 15 min. (Rev. 1)
Storage placement	50/drywell	3.5	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 5-36
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario 9
Construction Phase Three
Storage Concept: Drywell

Date : 10/11/00
Revision : 1

COST CENTER/Cost Element	%	Percent of Decommissioning Cost by Year After Last Year of Operations								
		-2	-1	0	+1	+2	+3	+4	+5	+6
CASK OPERATIONS	3							100		
Receiving										
Cask Log Storage										
WASTE HANDLING OPERATIONS										
SPENT FUEL HANDLING BUILDING	12				10	80	10			
Cask Unloading										
Assembly Log Storage										
Processing										
Interim Storage Loading/Unloading										
Building Support Facilities										
RECEIVING AND HANDLING BUILDING	12				10	20	20	30	15	
Cask Unloading										
Assembly Log Storage										
Processing										
Volume Reduction										
Canister/Container Closure										
Canister/Container Log Storage										
Interim Storage Loading/Unloading										
WMS/Repository Cask Handling										
Building Support Facilities										
INTERIM STORAGE OPERATIONS	5		60	40						
Storage Facilities										
Storage Units										
Receiving Building										
BALANCE OF PLANT AND SUPPORT OPERATIONS	1								100	
Waste Preparation										
Offsite Preparation										
Administration										
Other Support Facilities										

Note, intact SF drywell = 12%
(Rev. 1)

TABLE 9-37
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 3
Construction Phase: Single
Storage Concept: Vault

Date: 10/10/00
Revision: 0

		Percent of H & I Cost per Year Prior to Operations											
COST CENTER/Cost Element	Cost (Millions \$)	Percent of H & I Cost per Year Prior to Operations											
		-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	41	48	11									
Design													
Proof-of-Principle Tests (6 Tests)	1.0	36	54	10									
Advanced Conceptual Design	5.1	33	67										
License Application Design	44.7		41	55	4								
Licensing Support	3.2				37	40	23						
Final Procurement and Construction Design	29.9				73	27							
Title III Support	33.3						11	26	26	22	13		
Operating Contractor Support													
Design	9.9	11	30	31	14	11	3						
Construction	10.0					3	15	23	20	19	13	5	
Construction Management	44.0						11	26	26	22	13		
Preoperational Testing and Personnel Training	46.8					3	3	10	17	24	41		

TABLE S-30
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 5
Construction Phase: Single
Storage Concept: Vault

Date: 11/4/88
Revision: 1

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	3.332	--	3.332	(1) Fixed cost per storage building
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	N/A	
Cask Unloading					
Assembly Lag Storage					
Processing					
Interim Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.503	0.853	2.356	
Processing	39733	18.441	66.719	85.160	
Volume Reduction	13237	3.932	8.449	12.401	
Canister/Container Closure	26474	7.903	20.263	28.166	
Canister/Container Lag Storage	48384	14.489	15.371	29.860	
Interim Storage Loading/Unloading	27333	8.279	15.618	23.897	
WRS/Repository Cask Handling	21709	6.386	9.936	16.322	
Building Support Facilities	421418	127.013	107.493	234.506	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	16.040	9.770	25.810 (1)	
Storage Units	N/A		See Consumables, Table 3-41		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Waste Preparation	N/A	42.830	--	42.830	
Offsite Preparation	N/A	16.293	--	16.293	
Administration	N/A	2.603	0.424	3.027	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 1)	

TABLE 3-39
CONSTRUCTION COSTS

Scenario: 5
 Construction Phase: Single
 Storage Concept: Vault

Date: 10/10/88
 Revision: 0

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS			10	90							
Receiving											
Cask Log Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING		N/A	N/A	N/A	N/A	N/A					
Cask Unloading											
Assembly Log Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING		2	20	29	29	20					
Cask Unloading											
Assembly Log Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Log Storage											
Interim Storage Loading/Unloading											
HRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS				33	37	30					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS			50	30	20						
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 5-40
 CONSTRUCTION COST DISTRIBUTION

Scenario: 5
Construction Phase: Single
Storage Concept: Vault

Date: 1/20/89
Revision: 2

COST CENTER/Cost Element	Equipment Maintenance/Replacement (1/Year)			Consumables	Notes
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.014 M/Year Fixed	(1) Cost per storage building
Receiving					
Cask Lag Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A		
Cask Unloading					
Assembly Lag Storage					
Processing					
Interim Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.5		
Canister/Container Closure	1.0		1.4	Drums = \$520/Unit	
Canister/Container Lag Storage	0.5		11.8	Canisters = \$1800/4"; \$1400/6" (Rev. 2)	
Interim Storage Loading/Unloading	0.6		3.3		
WRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0 (1)	0.3 (1)	0.6 (1)	\$0.827 M/Year Fixed (1);	
Storage Units				\$0.0002 M/Year/Position (Rev. 1)	
Receiving Building	N/A	N/A	N/A	SF Canister Position (16") = \$16,500/Unit	
				WFBC Position (30") = \$36,700/Unit	
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	55.9	24.0		

TABLE S-41
ANNUAL OPERATING COSTS

Scenario: 3
Construction Phase: Single
Storage Concept: Vault

Date: 10/10/88
Revision: 0

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 93/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks				
Storage loading/unloading				
Building support staff				
RECEIVING AND HANDLING BUILDING				
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PWR = 190(T);540(R) BWR = 230(T);1080(R) PWR = 171/canister BWR = 363/canister	1.5	\$53,900	
Consolidate and canister fuel	Approx. 430/5 drum "cage" (86/drum, average)	2.5	\$53,900	Canister intact = 55/canister
Volume-reduce/package WFC	190/canister	1	\$53,900	
Hold/decon/test canisters	730/rack of 12 canisters	1.2	\$53,900	
Canister handling:	45/transporter load	3	\$53,900	
lay storage	530/9";1025/6";170/WFC cage;215/RM-LLW			
transporter loading/unloading				
HRS transport cask loading				
Building support staff	N/A	146	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter operation	90/trip	2	\$53,900	Time based on 15,000 RTU onsite storage
Storage placement	85/position	18	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE S-42
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 5
Construction Phase: Single
Storage Concept: Vault

Date: 10/18/88
Revision: 0

COST CENTER/Cost Element	%	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	0	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	N/A								
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
WRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		20	40	40				
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

TABLE 5-43
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 3
Construction Phase: Two
Storage Concept: Vault

Date: 10/18/88
Revision: 0

		Percent of M & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6		14	52	34									
Design														
Proof-of-Principle Tests (6 Tests)	1.0		14	55	31									
Advanced Conceptual Design	8.9			100										
License Application Design	51.3			14	55	31								
Licensing Support	5.2					17	40	40	3					
Final Procurement and Construction Design	34.4					33	67							
Title III Support	37.4								27	30	24	14	5	
Operating Contractor Support														
Design	4.9			11	30	31	14	11	3					
Construction	10.8							5	15	23	20	19	13	5
Construction Management	78.1								27	30	24	14	5	
Preoperational Testing and Personnel Training	66.8							3	5	10	17	24	41	

TABLE 3-44
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: S
Construction Phase: Two
Storage Concept: Vault

Date: 11/4/88
Revision: 1

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	3.352	--	3.352	(1) Fixed cost per storage building
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Lag Storage	4080	3.074	0.270	3.344	
Processing	12524	9.639	7.615	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	25.146	2.923	28.069	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.505	0.855	2.360	
Processing	59733	18.441	64.719	83.160	
Volume Reduction	13237	3.932	8.449	12.401	
Canister/Container Closure	26474	7.903	28.265	36.168	
Canister/Container Lag Storage	48384	14.489	15.371	29.860	
Interim Storage Loading/Unloading	27333	8.279	15.618	23.897	
RRS/Repository Cask Handling	21709	6.906	9.936	16.522	
Building Support Facilities	421418	127.015	107.493	234.508	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	16.040	9.770	25.810 (1)	
Storage Units	N/A		See Consumables, Table 3-47		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	46.610	--	46.610	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 1)	

TABLE 3-49
CONSTRUCTION COSTS

Scenario: 3
Construction Phase: Yon
Storage Concepts: Vault

Date: 10/18/00
Revision: 0

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				10	90						
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				25	45	30					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				20	20	25	25	10			
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
NRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS				33	37	30					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				50	30	20					
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE S-46
CONSTRUCTION COST DISTRIBUTION

Scenario: 3
Construction Phase: Two
Storage Concept: Vault

Date : 1/20/89
Revision : 2

COST CENTER/Cost Element	Equipment Maintenance/Replacement (I/Year)			Consumables	Notes
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.014 M/Year Fixed	(1) Cost per storage building
Receiving					
Cask Lag Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations;	
Cask Unloading	2.0			\$0.970 M/Year - Standby	(Rev. 1)
Assembly Lag Storage	1.0				
Processing	1.5	1.8			
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed	
Building Support Facilities	1.1	1.9	12.9		
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.5	Drums = \$520/Unit	
Canister/Container Closure	1.0		1.4	Canisters = \$1800/9"; \$1400/6"	(Rev. 2)
Canister/Container Lag Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
WRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0 (1)	0.3 (1)	0.6 (1)	\$0.827 M/Year Fixed (1);	
Storage Units				\$0.0003 M/Year/Position (Rev. 1)	
				SF Canister Position (16") = \$16,500/Unit	
				WFCB Position (30") = \$36,700/Unit	
				Bare, Intact SF Position (30") = \$36,700/Unit	
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	55.9	24.0		

TABLE 5-47
ANNUAL OPERATING COSTS

Scenario: S
Construction Phase: Two
Storage Concept: Vault

Date : 10/18/88
Revision : 0

COST CENTER/Functional Activity by Crew -----	Processing Time/Unit Processed (in minutes) -----	FTE/Crew -----	Annual \$/FTE -----	Notes -----
CASK OPERATIONS				
Receive & inspect transport casks; Inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/MRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/4 assemblies BMR = 95/8 assemblies	1.5	\$53,900	Load/unload onsite transfer cask : PMR = 530; BMR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/MRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and canister fuel	PMR = 171/canister BMR = 363/canister	2.5	\$53,900	Canister intact = 55/canister
Volume-reduce/package NFBC	Approx. 430/5 drum "cage" (86/drum, average)	1	\$53,900	
Weld/decom/test canisters	190/canister	1.2	\$53,900	
Canister handling:		3	\$53,900	
lag storage	730/rack of 12 canisters			
transporter loading/unloading	45/transport load			
MRS transport cask loading	530/9";1025/6";170/NFBC cage;215/RH-LLM			
Building support staff	N/A	146	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter Operation (incl. loading of intact SF basket as required)	85/trip from R & H Building 97/trip from SFMB	2 3	\$53,900	Times based on 15,000 MTU of onsite storage
Storage placement	85/canister position 80/bare,intact SF position	18 18	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE S-4B
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 5
Construction Phase: Two
Storage Concept: Vault

Date: 10/10/00
Revision: 0

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations								
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5	+6
CASK OPERATIONS	5							100		
Receiving										
Cask Lag Storage										
WASTE HANDLING OPERATIONS										
SPENT FUEL HANDLING BUILDING	12				10	80	10			
Cask Unloading										
Assembly Lag Storage										
Processing										
Interim Storage Loading/Unloading										
Building Support Facilities										
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15	
Cask Unloading										
Assembly Lag Storage										
Processing										
Volume Reduction										
Canister/Container Closure										
Canister/Container Lag Storage										
Interim Storage Loading/Unloading										
NRS/Repository Cask Handling										
Building Support Facilities										
INTERIM STORAGE OPERATIONS	5		20	40	40					
Storage Facilities										
Storage Units										
Receiving Building										
BALANCE OF PLANT AND SUPPORT OPERATIONS	1								100	
Onsite Preparation										
Offsite Preparation										
Administration										
Other Support Facilities										

Bare, intact SF vault = 17%

TABLE S-49
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 3
Construction Phase: Three
Storage Concept: Vault

Date: 10/18/88
Revision: 0

		Percent of N & I Cost per Year Prior to Operations											
COST CENTER/Cost Element	Cost (Millions \$)	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	18	51	31									
Design													
Proof-of-Principle Tests (6 Tests)	1.0	18	55	27									
Advanced Conceptual Design	8.9		100										
License Application Design	51.5		18	53	27								
Licensing Support	5.2				20	40	40						
Final Procurement and Construction Design	34.4				40	60							
Title III Support	37.4							30	30	23	14	3	
Operating Contractor Support													
Design	9.9		11	30	31	14	11	3					
Construction	10.8						3	13	23	20	19	13	3
Construction Management	78.1							30	30	23	14	3	
Preoperational Testing and Personnel Training	66.8						3	3	10	17	24	41	

TABLE S-30
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario 5
Construction Phase: Three
Storage Concept: Vault

Date: 11/4/88
Revision: 1

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					(1) Fixed cost per storage building
Receiving	N/A	5.165	0.829	5.994	
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					(2) Dual purpose cask: Site development = \$31,000/cask; Equipment = \$3,940 M (Rev. 1)
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Lag Storage	4080	3.074	0.270	3.344	
Processing	12524	9.839	7.615	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	25.146	2.923	28.069	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	89672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.305	0.835	2.340	
Processing	99733	18.441	66.719	85.160	
Volume Reduction	13237	3.952	8.449	12.401	
Canister/Container Closure	26474	7.903	28.265	36.168	
Canister/Container Lag Storage	48384	14.489	15.371	29.860	
Interim Storage Loading/Unloading	27533	8.279	15.618	23.897	
NRS/Repository Cask Handling	21709	6.386	9.936	16.322	
Building Support Facilities	421418	127.015	107.493	234.508	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	16.040	9.770	25.810 (1 & 2)	(Rev. 1)
Storage Units	N/A		See Consumables, Table 3-53		
Receiving Building	N/A	1.607	1.006	2.613	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	46.610	--	46.610	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060	(Rev. 1)

TABLE 3-51
CONSTRUCTION COSTS

Scenario: 3
Construction Phase: Three
Storage Concept: Vault

Date: 10/18/88
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS						100					
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING						25	45	30			
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING						20	20	25	25	10	
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
WRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS											
Storage Facilities						36	37	27			
Storage Units											
Receiving Building						100					
BALANCE OF PLANT AND SUPPORT OPERATIONS						50	30	20			
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE S-32
CONSTRUCTION COST DISTRIBUTION

Scenario: 3
Construction Phase: Three
Storage Concept: Vault

Date : 1/20/89
Revision : 2

COST CENTER/Cost Element	Equipment Maintenance/Replacement (X/Year)			Consumables	Notes
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.020 M/Year Fixed	(1) Cost per storage building
Receiving	2.0				
Cask Lag Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby	(Rev. 1)
Cask Unloading	2.0				
Assembly Lag Storage	1.0				
Processing	1.3	1.8			
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed	
Building Support Facilities	1.1	1.9	12.9		
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.5	Drums = \$520/Unit	
Canister/Container Closure	1.0		1.4	Canisters = \$1800/9"; \$1400/6"	(Rev. 2)
Canister/Container Lag Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
WRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0 (1)	0.3 (1)	0.6 (1)	1st Year Ops. = \$0.006 M Fixed Other Ops. Years = \$0.827 M/Year (1); \$0.0003 M/Year/Position (Rev. 1) SF Canister Position (16") = \$16,500/Unit WFCB Position (30") = \$36,700/Unit Bare, Intact SF Position (30") = \$36,700/Unit	
Storage Units					
Receiving Building	2.0				
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	55.9	24.0		

TABLE 5-53
ANNUAL OPERATING COSTS

Scenario: S
Construction Phase: Three
Storage Concept: Vault

Date : 10/18/88
Revision : 0

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	FTE/crew increases to 8 for first 4 years of operations
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/MRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/4 assemblies BMR = 95/8 assemblies	1.5	\$53,900	Load/unload onsite transfer cask : PMR = 530; BMR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/MRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and canister fuel	PMR = 171/canister BMR = 363/canister	2.5	\$53,900	Canister intact = 55/canister
Volume-reduce/package MFBC	Approx. 430/5 drum "cage" (86/drum, average)	1	\$53,900	
Weld/decon/test canisters	190/canister	1.2	\$53,900	
Canister handling:		3	\$53,900	
lag storage	730/rack of 12 canisters			
transporter loading/unloading	45/transporter load			
MRS transport cask loading	530/9";1025/6";170/MFBC cage;215/RH-LLW			
Building support staff	N/A	146	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	230/cask	17	\$53,900	
Transporter operation (incl. loading of intact SF basket as required)	85/trip from R & H Building 95/trip from SFHB	2 3	\$53,900	Times based on 15,000 MTU onsite storage
Storage placement	85/canister position 80/bare, intact SF position	18 21.5	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE S-54
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 3
Construction Phase: Three
Storage Concept: Vault

Date : 10/18/88
Revision : 0

COST CENTER/Cost Element	1 of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	00	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage loading/unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
WRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		20	40	40				
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1								100
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Bare, intact SF vault = 12%

TABLE 5-55
DECOMMISSIONING COSTS AND DISTRIBUTION

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 5-4

Scenario 5 Single Phase Cask or Drywell Storage

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 5-5

Scenario 5 Two Phase Cask or Drywell Storage

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 5-6

Scenario 5 Three Phase Cask or Drywell Storage

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 5-7

Scenario 5 Single Phase Vault Storage

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 5-8

Scenario 5 Two Phase Vault Storage

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 5-9
Scenario 5 Three Phase Vault Storage

SECTION 6

SCENARIOS 6 AND 7

The primary MRS functions required by Scenarios 6 and 7 are identical, except for the container repair function in Scenario 6. For these scenarios, spent fuel is received, placed as intact assemblies into emplacement containers, stored as required, and shipped to the repository for disposal. Since containerizing is performed at the MRS, HLW may also be received, stored, containerized, and shipped. Figures 6-1, 6-2, and 6-3 indicate the basic flow for this scenario, including phased construction.

6.1 SPECIFIC CRITERIA AND ASSUMPTIONS

Criteria and assumptions specific to Scenarios 6 and 7 are required in addition to those presented in Section 2. This additional information forms the basis for the design and related data for these scenarios.

6.1.1 SCENARIO CRITERIA

Criteria specific to Scenarios 6 and 7 is derived from a) TSLCC assumptions, b) the study scope of work, c) meetings of the study participants, and/or (d) Task A Report. Scenarios 6 and 7 criteria are as follows:

- (1) MRS will place intact spent fuel directly into 28-inch diameter stainless steel emplacement containers (as shown in Section 1) having a capacity of 4 intact PWR; 10 intact BWR or 3 intact PWR and 4 intact BWR fuel assemblies combined in one container. (b, c, and d)
- (2) The rail casks from the MRS to the repository have a capacity of 4 repository emplacement containers. (c)
- (3) Containers produced by the MRS will be inspected at the repository during cask unloading operations. (b, c, and d)
- (4) For Scenario 6, defective containers received at the repository will be returned to the MRS for repair or replacement (b, c, and d)
- (5) Less than 1% of the containers will be defective and require repair or replacement. (c)

6.1.2 SCENARIO ASSUMPTIONS

In addition to the criteria and the general assumptions, the following was assumed for Scenarios 6 and 7:

- (1) Since spent fuel is not consolidated, remotely-handled LLW (RH-LLW) will not be generated at the MRS.

Notes:

1) Scenario 6 only

Figure 6-1
Scenarios 6 & 7 Single Phase Construction

Notes:

1) Scenario 8 only

Figure 6-2
Scenarios 6 & 7 Two Phase Construction

Figure 6-3
Scenarios 6 & 7 Time Phase Construction

- (2) Clean canister carousels can be modified to accommodate the 28-inch container without an equipment cost impact.
- (3) Canister upender can be modified to accommodate the 28-inch container without an appreciable increase in cost.
- (4) All process cells must receive adequate quantities on a routine basis of both BWR and PWR fuel assemblies to accommodate the "preferred" loading configuration of 3 PWR and 4 BWR assemblies per container.
- (5) Process cell upender design can be modified to incorporate indexing for loading intact spent fuel into the appropriate container location (container upender remains "fixed" during loading).
- (6) For Scenario 6, repair/replacement operations for containers returned from the repository can be performed as an off-normal or scheduled basis and will not interrupt normal operations.
- (7) Containers are fabricated with fixed internal spacers or dividers to maintain the required fuel assembly array during horizontal loading of the container.
- (8) Canister closure, decontamination, and weld NDE equipment can be modified to accept the container with negligible cost impact.
- (9) All support buildings presented in the Conceptual Design Report (CDR) are required, except as modified and/or noted in Table 6-1.

Table 6-1 - Support Building Modifications

<u>Building</u>	<u>Modification</u>
Inspection Gatehouse	Increase of administration and support areas for "three-phase" MRS
Storage Area Gate Station	Delete for vault storage option
Site Services	Revise mock-up equipment to reflect R&H process cell
Standby Generator	Revise equipment and building to reflect new load requirements
Sewage Treatment	Proportion to site personnel quantity
Water Treatment	Modify storage tank and distribution to reflect revised requirements
Steam Generator	Reduce equipment and building to reflect deletion of RH-LLW treatment system

6.2 WASTE HANDLING OPERATIONS

The waste handling operations are performed in the Receiving and Handling Building (R&H) as in Scenario 5 except that the spent fuel received is not consolidated but is packaged intact in repository emplacement containers. High level waste (HLW) is also received in this Scenario and the canisters are placed in repository emplacement containers prior to shipment to the repository. If two phase construction is utilized, the construction of the Spent Fuel Handling Building (SFHB) is required to receive and transfer spent fuel to storage until the R&H building construction is completed. Three-phase construction requires the addition of the Receiving Building (RB) to the two-phase construction to allow receipt of dual purpose casks. The SFHB and RB operation and design are described in Section 4 for Scenarios 3 and 4 and do not change for this scenario.

6.2.1 RECEIVING AND HANDLING BUILDING

The R&H Building is the primary operating building of the MRS facility. The building is designed to receive casks containing spent fuel or HLW canisters; unload and containerize the spent fuel; temporarily store the spent fuel containers or HLW canisters as required; containerize HLW; and load waste containers into shipping casks or transfer spent fuel containers or HLW canisters to onsite storage.

6.2.1.1 Operations

The sequence of operations in the R&H Building, as in previous scenarios, starts with the receipt of shipping casks from the Inspection Gatehouse or from the onsite storage area for cask shipments. The process up through the unloading of the spent fuel into the process cells is the same as that described for Scenario 5. After unloading of the spent fuel from the shipping cask, the assemblies are placed into the in-process lag storage compartments until a sufficient quantity of both PWR and BWR assemblies to allow loading of containers in the "preferred" container (3 PWR and 4 BWR). For every ten "preferred" containers, one container of only PWR fuel is produced. This container loading operation may not require the use of in-process lag storage if a PWR-container is available in the clean container carousel. The lag storage capacity of each process cell is 180 PWR or 320 BWR fuel assemblies.

For Scenarios 6 and 7, process-cell upenders are designed to receive the assemblies and push them into the appropriate container. Spent fuel assemblies are lifted from the in-process lag storage compartments by the in-cell crane and transferred to an upender (which is in a vertical position) and clamped in position. The upender is lowered to a horizontal position and the spent fuel assembly loaded into a container located in the Canyon Cell (weld-test-decon area). Two spent fuel upenders are available in each of the four process cells. One upender handles only PWR fuel to load the PWR-only container and has the capability to index vertically or horizontally to align with each of the four fuel positions of the stationary container. The second upender has an added capability to rotate, permitting proper alignment with any fuel position of the PWR/BWR container or the BWR-only container. The container upender located in the Canyon Cell is a mobile transportation and positioning cart similar to that used in the MRS CDR and serves both process cell upenders. By

adding the indexing motions to the fuel upenders, it minimizes the complexity of the container upender operation and the related potential for equipment failure. If the more complex PWR/BWR upender fails, PWR fuel can still be containerized using the second fuel upender.

After loading the container, the sequence of operations for inerting, welding, testing, and decontamination of the container is the same as described for Scenario 5.

The operations for handling and containerizing of HLW canisters are performed in the shipping cask loading end of one of the Canyon Cells and requires the use of two upenders. Normally only the Canyon Cell with two weld stations is utilized, although transfer of canisters between Canyon Cells can be made. The sequence of operations for cask receipt and unloading of HLW is similar to that for spent fuel assemblies. Once the HLW canister is unloaded from the shipping cask by the in-cell power mast crane, it is transferred to interim storage or is placed in the "canister" upender (in a vertical position), clamped, and lowered to a horizontal position. The upender is translated to the weld/decon station, where the second upender containing an empty container is positioned, and the canister inserted into the empty container by the roller mechanisms on the upender. The upender holding the container is rotated and positioned at the weld/decon station. The subsequent operations for welding and decon of the container are similar to that for the spent fuel container, except for the elimination of the inerting operation.

After the spent fuel is containerized, the containers are either placed in the lag storage vault in the Canyon Cell, loaded into a transport cask, or transferred to interim storage (sealed storage cask, drywell, or vault).

The storage operations described in Section 4.2.2.1 for Scenarios 3 and 4 apply to this scenario for bare, intact fuel assemblies. In two phase construction, the drywell and vault storage options require the utilization of baskets carrying 4 PWR or 8 BWR intact spent fuel assemblies in order to reduce operating time to storage. This operation requires that empty baskets be placed in the transporter/emplacer in the discharge area of the SFHB or the transfer cask at the Vault Storage Building (VSB).

For Scenario 6 container repair operations, defective containers returned from the repository are handled on a non-scheduled basis as time permits. The sequence of operations from receipt of the shipping cask through the mating of the cask to the canyon cell port is the same as for the unloading of HLW canisters. In subsequent operations, the unloading port shield plug is removed by the in-cell power mast crane while the equipment maintenance hatch is translated open. The unloading port plug crane grapple is exchanged for a container grapple, the container lifted from the shipping cask, the crane moved to the equipment maintenance hatch and the container lowered to an upender in the remote handled equipment maintenance cell. The container is clamped in the vertical upender, the grapple released and the equipment maintenance hatch is closed. The upender is rotated to a horizontal position and translated to a cutting machine where the container cover is removed. After this operation, the upender is translated back to a position under the equipment maintenance hatch and the upender raised to a vertical position. Following this operation, the process cell equipment maintenance hatch is

opened, the spent fuel assemblies lifted from the container by the process cell crane and placed in lag storage, and the equipment maintenance hatch closed. From this operation forward the process for recontainerizing the spent fuel assembly follows the normal containerizing sequence of operations.

The defective container is evaluated to determine if repairs can be economically performed. Repairs are made in the remote maintenance cell, the external surface of the container is decontaminated, and the container placed back in service by way of the canyon cell maintenance hatch. Containers that cannot be repaired are cut up in small enough segments to be placed in 55 gallon drums for shipment offsite as LLW. Approximately eleven drums are required for the segments of one container.

6.2.1.2 Design

For Scenarios 6 and 7, the R&H Building is modified from the design developed for the CDR prepared for the MRS proposal to Congress. The modifications result from (1) the change from a canister to a repository-specific container for spent fuel assemblies and HLW canisters, (2) the exclusion of spent-fuel consolidation, (3) the lag storage configuration and capacity, (4) deletion of the repository "overpack" handling and welding operations, and (5) the open-cycle vault storage option interface.

Facility arrangement modifications include:

- (1) The reduction in size of process cells resulting from the deletion of the consolidation process.
- (2) The changes to the canyon cell lag storage vaults to accommodate the repository-specific container configuration and spacing (5 ft on-center).
- (3) Deletion of the high-activity roadwaste treatment and NFBC packaging areas since consolidation of spent fuel is not required.
- (4) Changes to loadout area, in the "vault" storage mode option, to provide an enclosed transfer corridor between the R&H Building and the VSB to accommodate equipment to transfer materials to the VSB.

R&H Building equipment changes include the following:

- (1) Deletion of the spent fuel assembly, disassembly, and rod reconfiguration equipment in the process cells.
- (2) Deletion of the NFBC volume reduction equipment in the process cells.
- (3) Change to the upender design in canyon cells to accommodate the repository-specific container.
- (4) Change to the decontamination/inerting chamber in canyon cells to accommodate the repository-specific container.

- (5) Deletion of the NFBC drum handling, lidding, and drum supply equipment.
- (6) Addition of container volume reduction equipment for Scenario 6 only.
- (7) Change to the clean canister supply equipment to accommodate the repository-specific container size.
- (8) Change to the canister welding equipment to accommodate the repository-specific container size.
- (9) Change to the canister cutting equipment to accommodate the repository-specific container size.
- (10) Deletion of the "overpack" equipment in canyon cells.
- (11) Change to the lag storage vault to accommodate the repository-specific container spacing.
- (12) Rail cart design is required to handle spent fuel containers and HLW canisters from the R&H Building to the VSB for that storage option.
- (13) Change to the intact spent fuel upender to incorporate vertical and horizontal indexing motions for PWR-only container loading.
- (14) Addition of a multi-motion spent fuel upender to accommodate the loading requirements of the PWR/BWR container.
- (15) Change to the canyon cell lag storage vault ventilation system equipment based on the spent fuel container heat load and spacing.

The R&H Building arrangement is shown on Drawings A-601 through A-606. the capacity of the lag storage vault system is 835 MTU.

6.3 STORAGE OPTIONS

Four options for onsite storage of spent fuel and HLW are applicable to these scenarios: 1) concrete storage cask, 2) drywell, 3) open-cycle vault, and 4) dual purpose cask.

6.3.1 CONCRETE STORAGE CASKS

The design and operation of the concrete storage cask system is the same as described for Scenario 3 and 4 except for the packaging of the spent fuel. For the single phase construction option the spent fuel received at the R&H Building is packaged in repository specific containers with a capacity of 4 PWR, 10 BWR, or a combination of 3 PWR and 4 BWR assemblies. Due to size limitations, the storage cask capacity is four containers of spent fuel or HLW. The total number of casks required for the maximum allowable onsite storage (15000 MTU of spent fuel and 2,400 MTU of HLW) is 3091. This includes 1719 casks containing the preferred container (3 PWR and 4 BWR), 172 casks containing the PWR only container; and 1200 casks of HLW.

The site arrangement for the single phase construction option cask system is similar to that shown on Drawing C-501 except the R&H Building "footprint" is slightly smaller. The storage area required for the maximum storage capacity is approximately 133 acres including access roads, alarm and isolation zones, and facility set-backs.

The two phase construction option requires the storage of the bare intact spent fuel which is received at the SFHB. It is assumed that the maximum storage condition consists of 8000 MTU of bare intact spent fuel; 7000 MTU of containerized intact spent fuel; and 2400 MTU of HLW. The cask capacity for bare intact spent fuel is the same as noted for Scenario 3 and 4 and the cask capacity for containers of intact spent fuel or HLW is as noted for the single phase construction option. The total number of casks required for the maximum allowable onsite storage is 2655. This includes 573 casks of bare intact spent fuel, 882 casks of containerized intact spent fuel, and 1200 casks of HLW.

The site arrangement for the two phase construction option cask system is similar to that shown on the drawing except the "footprint" of the R&H Building is slightly smaller. The storage area required for the maximum storage capacity is approximately 115 acres including access roads, alarm and isolation zones, and facility set-backs.

The concrete storage cask requirement for the three phase construction option is discussed in Section 6.3.4.

6.3.2 DRYWELLS

The operation and design of this system for Scenarios 6 and 7 is the same as for Scenarios 3 and 4 with the same exceptions as noted for the concrete storage cask system described above with regards to the container. The containerized (3 PWR/4 BWR or 4 PWR) spent fuel drywell is 30 inches in diameter and spaced 23 ft on-center and 23 ft between rows and the bare intact drywell (4 PWR or 8 BWR) is 30 inches in diameter spaced 21 ft on-center each direction. Drywells for HLW canisters are also required for this scenario and are the same size except the spacing is 6-ft on-center in rows spaced 12-ft apart. For the single phase construction option the spent fuel is received and packaged in the repository-specific containers (3 PWR and 4 BWR or 4 PWR per container). The total number of drywells required for maximum allowable onsite storage (15,000 MTU of spent fuel and 2400 MTU of HLW) is 12,362. This includes 7562 30-in. containerized intact spent fuel dry wells and 4800 30-in. drywells of HLW.

The site arrangement for the single phase construction option drywell system is similar to that shown on Drawing C-521 except the R&H Building "footprint" is slightly smaller. The storage area required for the maximum storage capacity is approximately 168 acres including access roads, alarm and isolation zones, and facility set-backs.

The two phase construction option requires the storage of bare intact spent fuel which is received at the SFHB. It is assumed that the maximum storage condition consists of 8000 MTU of bare intact spent fuel, 7000 MTU of containerized intact spent fuel and 2400 MTU of HLW. The total number of drywells for the maximum onsite storage is 13278. This includes 4949 30-in.

drywells of bare intact spent fuel, 3529 30-in. drywells of containerized intact spent fuel, and 4800 30-in. drywells of HLW.

The site arrangement for the two phase construction option drywell system is similar to that shown on Drawing C-522 except the "footprint" of the R&H Building is slightly smaller. The storage area required for the maximum storage capacity is approximately 184 acres including access roads, alarm and isolation zones, and facility set-backs.

The drywell storage requirement for the three phase construction option is discussed in Section 6.3.4.

6.3.3 OPEN-CYCLE STORAGE VAULT

The design and operation of this system for Scenario 6 and 7 is the same as that described for Scenario 3 and 4 except that each 30-in. storage tube can contain racks of bare intact spent fuel and/or one container of intact spent fuel or HLW.

For the single phase construction option, all spent fuel is packaged in a repository specific container. The total number of 30-in. storage tubes required for maximum onsite storage is 12,362. This includes 7562 30-in. storage tubes containing containerized intact spent fuel and 4800 30-in. tubes containing containers of HLW. The storage vault complex consists of five vault buildings each containing 25 modules of 30-in. storage tubes.

The site arrangement for the single phase construction option vault storage system is similar to that shown on Drawing C-531 except the "footprint" of the R&H Building is slightly smaller and the vault buildings are larger. The storage area required for the maximum storage capacity is approximately 65 acres including access roads, alarms and isolation zones, and facility set-backs.

The two phase construction option requires the storage of bare intact spent fuel in the same configuration as noted for Scenario 3 and 4. Assuming the same quantity as noted for Scenario 5 (8000 MTU) the total number of 30-in. storage tubes required for the maximum storage capacity is 13278. This includes 4949 30-in. storage tubes containing bare intact spent fuel; 3529 30-in. storage tubes containing containerized intact spent fuel; and 4800 30-in. storage tubes containing HLW. For this phased construction option the storage vault complex consists of five vault buildings, three containing 26 vault modules and two containing 27 vault modules.

The site arrangement for the two phase construction option vault storage system is similar to that shown on Drawing C-532 except the "footprint" of the R&H Building is slightly smaller and the vault buildings are larger. The storage area required for the maximum storage capacity is approximately 86 acres including access roads, alarms and isolation zones, and facility set-backs.

The vault storage requirements for the three phase construction option are discussed in Section 6.3.4.

6.3.4 DUAL PURPOSE CASK STORAGE

In Scenario 6 and 7 for three-phase construction, dual purpose (DP) casks are received and handled as described in Scenario 3 and 4. A maximum of 1,100 MTU of bare, intact spent fuel in 106 DP casks is received and stored at the MRS, thus adjusting the amount of allowable storage options to 13,900 MTU. Of the remaining 13900 MTU, 6900 MTU is received in the SFHB and transferred to storage as bare intact fuel assembly and 7000 MTU is received in the R&H Building and stored as containerized intact spent fuel. Using the same cask loading as presented with single phase construction option the total number of concrete storage casks required is 2576. This includes 494 casks of bare intact spent fuel; 882 casks of containerized intact spent fuel and 1200 casks containing HLW.

The site arrangement for the three phase construction option cask storage system is similar to that shown on Drawing C-503 except the "footprint" of the R&H Building is slightly smaller. The storage area required for a 15000 MTU capacity is approximately 111 acres including access roads, alarm and isolation zones, and facility set-backs.

The total number of drywells required to store the remaining 13,900 MTU of spent fuel is 12598. This includes 3529 30-in. drywells for containerized intact spent fuel; 4269 30-in. drywells for bare intact spent fuel; and 4800 30-in. drywells for HLW.

The site arrangement for the three phase construction drywell system is similar to that shown on Drawing C-523 except the "footprint" of the R&H building is slightly smaller. The storage area required for a 15000 MTU capacity is approximately 172 acres including access roads, alarm and isolation zones, and facility set-backs.

The total number of storage tubes required to store the remaining 13900 MTU of spent fuel is 12598. This includes 4269 30-in. tubes for bare intact spent fuel; 3529 30-in. tubes containerized intact spent fuel; and 4800 30-in tubes for HLW. For this phased construction option, the storage vault complex consist of five vault buildings, four containing 25 vault modules and one containing 26 vault modules.

The site arrangement for the three phase instruction vault storage system is similar to that shown on Drawing C-533 except the "footprint" of the R&H Building is slightly smaller. The storage area required for 15000 MTU capacity is approximately 85 acres including access roads, alarm and isolation zones, and facility set-backs.

6.4 COST DATA DEVELOPMENT

This section presents the rationale for the cost data applicable to Scenarios 6 and 7, Tables 6-2 through 6-109. Rationale identical to that presented in Section 3.4 is noted by reference; therefore, only scenario-specific deviations are described herein.

6.4.1 MANAGEMENT AND INTEGRATION

This cost center presents the rationale for development of costs associated with all A/E and operating contractor activities required prior to initial operations.

6.4.1.1 Site Selection and Investigation

The activities associated with this cost element are as discussed in Section 3.4.1.1.

6.4.1.2 Design

The activities associated with this cost center are described in Section 3.4.1.2, modified as required by the scenario-specific requirements described herein.

Proof of Principle Tests. All tests described in Section 3.4.1.2 are required for this scenario; therefore the cost allocated to this element is \$1 million.

Advanced Conceptual Design. Since this scenario requires facilities which were not included in the MRS CDR, advanced conceptual designs (ACDs) are required prior to initiation of license application design. For all construction phases and storage options ACD costs are included for the modified R&H Building, SFHB, VSB, RB, and the site development design associated with these buildings. The costs developed for this element is in accordance with the rationale presented in Section 3.4.12.

License Application and Final Procurement and Construction Design. All storage and construction phase options will require license application and final procurement and construction design phases. The costs developed for these phases are in accordance with the rationale presented in Section 3.4.1.2.

License Support. As noted in Section 3.4.1.2, the license support cost is based on an assumed licensing duration of 30 months. Therefore, the cost allocated for this activity is based on an average of 11 manyears/year for a prelicense and license duration of 42 months.

Title III Support. The cost for this element was developed from the constructed value of the total MRS facility required for each storage and construction phase option in accordance with the rationale presented in Section 3.4.1.2.

6.4.1.3 Operating Contractor Support

The rationale for development of this cost is presented in Section 3.4.1.3.

6.4.1.4 Construction Management

The cost for this activity was developed from the constructed value of the total MRS facility required for each storage and construction phase option in accordance with the rationale presented in Section 3.4.1.4.

6.4.1.5 Preoperational Testing and Personnel Training

The rationale for development of this cost is presented in Section 3.4.1.5.

6.4.2 CONSTRUCTION

The rationale for development of costs associated with the construction cost center of Scenario 6 or 7 MRS facilities is in accordance with that presented in Section 3.4.2.

6.4.3 ANNUAL OPERATING COSTS

The cost developed for all elements of this cost center is in accordance with the rationale presented in Section 3.4.3.

6.4.4 STAFFING ALLOCATIONS

The cost developed for this cost center is in accordance with Section 3.4.4.

6.4.5 DECOMMISSIONING

The cost percentiles applied to the various facilities included in this cost center are in accordance with Section 3.4.5.

6.5 DESIGN AND CONSTRUCTION SCHEDULES

The design and construction schedules for Scenarios 6 and 7 are presented on Figures 6-4 through 6-9. As stated in Section 3.5, the schedule durations for construction are based on an evaluation of the preconceptual design and the construction labor required.

The critical path for all construction phases and storage options commences with selection of site(s) and includes site evaluation, ACD, LA design license approval, facility construction, and cold tests. The major facilities for this scenario include the modified R&HB, SFHB, and the VSB. The modified R&HB Building, SFHB, and VSB require an ACD to be completed in sufficient time to form the basis for the LA design. The schedules for this scenario provide a 9 month ACD duration for the modified R&HB Building completed prior to the initiation of the LA design effort. The ACD for the SFHB and VSB is progressed concurrently with the R&HB and, depending upon the construction phase, is completed prior to initiation of LA design or four months later. The LA design phase for the modified R&HB Building is scheduled for 22 months and the SFHB and VSB is scheduled for 18 to 22 months thus providing sufficient schedule time to complete the LA design for these buildings. To complete this design phase, input data is required from the site investigation and proof-of-principle tests and adequate time are required for incorporation. The schedules shown for this scenario provide for 12 to 15 months and 12 to 19 months for incorporation of proof-of-principle test data and geotechnical data respectively. NRC license approval is assumed to require 30 months which cannot be initiated until the completion of the LA design and establishes the construction start milestone. The receipt of waste (plant startup) is determined by the construction duration of the receiving and storage facilities required for each phase. For all single-phase storage options, this

is established by the modified R&H Building construction and cold test duration (53 months). For the two-phase cask and drywell options, it is established by the SFHB (30 months), and for the two-phase vault option by the VSB (35 months). The receipt of waste for all three-phase options is established by the construction duration of the Inspection Gatehouse, RB, and dual purpose cask storage area (12 months). To meet the operational objectives (containerized intact spent fuel) and/or to minimize the use of dual purpose casks, all handling and storage facilities must be constructed on schedule. Therefore, the construction of all facilities are on the critical path.

Scenario: 6
Construction Phase: Single
Storage Concept: Cask

Date: 10/21/88
Revision: 2

		Percent of N & I Cost per Year Prior to Operations											
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	55	45 (Rev. 1)										
Design													
Proof-of-Principle Tests (6 Tests)	1.0	55	45 (Rev. 2)										
Advanced Conceptual Design	7.9	67	33										
License Application Design	33.8		41	54	5								
Licensing Support	5.2				37	40	23						
Final Procurement and Construction Design	22.5				73	27							
Title III Support	26.0						2	20	27	29	20		
Operating Contractor Support													
Design	9.9	11	30	31	14	11	3						
Construction	10.8					5	15	23	20	19	13	5	
Construction Management	51.9						2	20	27	29	20		
Preoperational Testing and Personnel Training	66.8					3	5	10	17	24	41		

TABLE 6-2
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 6
Construction Phase: Single
Storage Concept: Cost

Date: 10/11/00
Revision: 1

COST CENTER/Cost Element	Building Area	Millions in 1988 \$		
		Facility Cost	Equipment Cost	Total Cost
CASK OPERATIONS				
Receiving	N/A	3.332	--	3.332
Cost Log Storage	N/A	2.996	--	2.996
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	N/A
Cask Unloading				
Assembly Log Storage				
Processing				
Interim Storage Loading/Unloading				
Building Support Facilities				
RECEIVING AND HANDLING BUILDING				
Cask Unloading	85672	11.970	10.403	22.373
Assembly Log Storage	4864	1.477	0.833	2.312
Processing	26749	8.209	33.724	41.929
Volume Reduction	N/A	N/A	N/A	N/A
Canister/Container Closure	26474 (Rev. 1)	0.293	21.863	22.156
Canister/Container Log Storage	48384	14.934	13.371	28.305
Interim Storage Loading/Unloading	27333	9.700	13.618	23.318
WRS/Repository Cask Handling	21709	6.364	9.936	16.300
Building Support Facilities	376972	116.024	112.307	228.331
INTERIM STORAGE OPERATIONS				
Storage Facilities	N/A	97500/cask	7.810	--
Storage Units	N/A		See Consumables, Table 6-3	
Receiving Building	N/A	N/A	N/A	N/A
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Onsite Preparation	N/A	36.137	--	36.137
Offsite Preparation	N/A	16.293	--	16.293
Administration	N/A	2.603	0.424	3.027
Other Support Facilities	N/A	42.130	18.913	61.043

TABLE 6-3
CONSTRUCTION COSTS

Scenario 6
Construction Phase: Single
Storage Concept: Cask

Date : 10/21/00
Revision : 1

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS			10	90							
Receiving											
Cask Log Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING		N/A	N/A	N/A	N/A	N/A					
Cask Unloading											
Assembly Log Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING		2	20	29	29	20					
Cask Unloading											
Assembly Log Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Log Storage											
Interim Storage Loading/Unloading											
WMS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS			17	33	33	17					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS			30	30	20 (Rev. 1)						
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 6-4
CONSTRUCTION COST DISTRIBUTION

Scenario: 6
Construction Phase: Single
Storage Concept: Cask

Date: 1/20/89
Revision: 2

COST CENTER/Cost Element	Equipment Maintenance/Replacement (\$/Year)			Consumables	
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.014 N/Year Fixed	
Receiving					
Cask Lag Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A		
Cask Unloading					
Assembly Lag Storage					
Processing					
Interim Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING				\$6.188 N/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	N/A	N/A	N/A		
Canister/Container Closure	1.0		1.4	Containers = \$31,000/SF Unit; \$17,000/MLW Unit	(Rev. 1) (Rev. 2)
Canister/Container Lag Storage	0.3		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
WRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0	0.8	95	\$0.050 N/Year Fixed	
Storage Units				Casks = \$0.197 N/Unit	
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 N/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	55.9	24.0		

TABLE 6-5
ANNUAL OPERATING COSTS

Scenario: 6
Construction Phase: Single
Storage Concept: Cask

Date: 1/26/89
Revision: 2

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; Inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/PWR transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks				
Storage loading/unloading				
Building support staff				
RECEIVING AND HANDLING BUILDING				
Prepare reactor/PWR transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PWR = 150(T);540(R) BWR = 230(T);1080(R)	1.9	\$53,900	
Containerize intact fuel	All PWR = 320/container PWR + BWR = 680/container	2.5	\$53,900	Requires all 4 cells to handle both PWR and BWR fuel
Volume-reduce/package WFC	N/A	N/A	N/A	
Weld/decon/test container	190/container	1.5 w/o HLM 1.6 w/ HLM	\$53,900	
Canister handling: log storage	90/container	3	\$53,900	
storage cask loading/unloading	90/cask of 4 containers (Rev. 1)			
PWR transport cask loading	170(SF);170(HLM) (Rev. 1)			
Building support staff	N/A	148 w/o HLM 151 w/ HLM	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Storage cask preparation & closing/reopening	210/cask	4	\$53,900	If cask is reused, add 30 min. (Rev. 1)
Storage placement (incl. 45 min. to obtain new cask)	145/cask	6	\$53,900	If cask is reused, reduce by 45 min. (Rev. 2)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff (excl. Cask Mfg. Facility of 11)	N/A	264	\$53,900	

TABLE 6-6
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 6
Construction Phase: Single
Storage Concept: Cask

Date: 9/16/00
Revision: 0

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	0	+1	+2	+3	+4	+5
CASK OPERATIONS	9							100	
Receiving									
Cask Log Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	N/A								
Cask Unloading									
Assembly Log Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	75	30	15
Cask Unloading									
Assembly Log Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Log Storage									
Interim Storage Loading/Unloading									
HRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	9		60	60					
Storage Facility									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

TABLE 6-7
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 6
Construction Phase: Two
Storage Concept: Cask

Date: 10/21/88
Revision: 2

		Percent of M & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6		14	32	34 (Rev. 2)									
Design														
Proof-of-Principle Tests (6 Tests)	1.0		14	34	32 (Rev. 2)									
Advanced Conceptual Design	11.7			77	23 (Rev. 2)									
License Application Design	40.6				45	55 (Rev. 2)								
Licensing Support	3.2						40	40	20 (Rev. 2)					
Final Procurement and Construction Design	27.0						80	20	(Rev. 2)					
Title III Support	29.0								20	23	26	22	9	
Operating Contractor Support														
Design	9.9			11	30	31	14	11	3					
Construction	10.8							5	15	23	20	19	13	5
Construction Management	63.2								20	23	26	22	9	
Preoperational Testing and Personnel Training	66.8							3	5	10	17	24	41	

TABLE 6-8
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario 6
Construction Phase: Two
Storage Concepts: Cask

Date: 10/21/00
Revision: 2

COST CENTER/Cost Element	Millions in 1988 \$			
	Building Area	Facility Cost	Equipment Cost	Total Cost
CASK OPERATIONS				
Receiving	N/A	3.352	--	3.352
Cask Lag Storage	N/A	2.996	--	2.996
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Cask Unloading	31420	7.432	2.852	10.284
Assembly Lag Storage	4000	3.074	0.270	3.344
Processing	12324	9.639	7.615	17.254
Interior Storage Loading/Unloading	17170	15.682	0.439	16.121
Building Support Facilities	92916	25.146	2.923	28.069 (Rev. 1)
RECEIVING AND HANDLING BUILDING				
Cask Unloading	85672	11.970	10.403	22.373
Assembly Lag Storage	4864	1.477	0.855	2.332
Processing	26749	8.205	33.724	41.929
Volume Reduction	N/A	N/A	N/A	N/A
Canister/Container Closure	26474 (Rev. 1)	8.205	21.863	30.068
Canister/Container Lag Storage	48384	14.934	15.371	30.305
Interior Storage Loading/Unloading	27333	8.700	15.618	24.318
RRS/Repository Cost Handling	21709	6.964	9.936	16.500
Building Support Facilities	376972	116.024	112.307	228.331
INTERIM STORAGE OPERATIONS				
Storage Facilities	N/A	\$7500/cask	7.810 (Rev. 1)	--
Storage Units	N/A		See Compendium, Table 6-11	
Receiving Building	N/A	N/A	N/A	N/A
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Onsite Preparation	N/A	39.893	--	39.893 (Rev. 2)
Offsite Preparation	N/A	16.295	--	16.295
Administration	N/A	2.605	0.024	3.029
Other Support Facilities	N/A	42.130	18.915	61.045

TABLE 6-9
CONSTRUCTION COSTS

Scenario: 6
Construction Phase: Two
Storage Concept: Cost

Date: 9/16/88
Revision: 0

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				10	90						
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				25	45	30					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interin Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				20	20	25	25	10			
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interin Storage Loading/Unloading											
NCS/Repository Cost Handling											
Building Support Facilities											
INTERIN STORAGE OPERATIONS				10	60	30					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				30	30	20					
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 6-10
CONSTRUCTION COST DISTRIBUTION

Scenario: 6
Construction Phase: Two
Storage Concept: Cask

Date: 1/20/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (X/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.014 M/Year Fixed
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby (Rev. 2)
Cask Unloading	2.0			
Assembly Lag Storage	1.0			
Processing	1.5	1.8		
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed
Building Support Facilities	1.1	1.9	12.9	
RECEIVING AND HANDLING BUILDING				\$6.168 M/Year Fixed
Cask Unloading	0.7		3.4	
Assembly Lag Storage	1.0			
Processing	1.2	31.8	3.7	
Volume Reduction	N/A	N/A	N/A	(Rev. 1)
Cask/Container Closure	1.0		1.4	Containers = \$31,000/SF Unit; (Rev. 3) \$17,000/MLW Unit
Cask/Container Lag Storage	0.5		11.8	
Interim Storage Loading/Unloading	0.6		3.3	
WHS/Repository Cask Handling	1.4		6.6	
Building Support Facilities	0.7	11.1	18.2	Dress = \$100/Unit
INTERIM STORAGE OPERATIONS				
Storage Facilities	2.0	0.8	95	\$0.050 M/Year Fixed
Storage Units				Casks = \$0.197 M/Unit
Receiving Building	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	35.4	37.3	
Other Support Facilities	1.6	55.9	24.0	

TABLE 6-11
ANNUAL OPERATING COSTS

Scenario: 6
Construction Phase: Two
Storage Concept: Cask

Date: 1/20/89
Revision: 2

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask: 375/cask
Unload transport casks	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading	PMR = 510/cask (Rev. 1) BWR = 1230/cask (Rev. 2)	1.5	\$53,900	Load/unload onsite transfer cask: PMR = 530; BWR = 1070
Building support staff	N/A	51	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Containerize intact fuel	All PMR = 320/container PMR + BWR = 680/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BWR
Volume-reduce/package WFC	N/A	N/A	N/A	
Hold/docum/test containers	190/container	1.5 w/o MLM 1.6 w/ MLM	\$53,900	
Container handling:		3	\$53,900	
lag storage	90/container			
storage cask loading/unloading	90/cask of 4 containers			
NRS transport cask loading	170(SF);170(MLM) (Rev. 1)			
Building support staff	N/A	140 w/o MLM 151 w/ MLM	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Storage cask preparation & closing/reopening	210/cask	4	\$53,900	If cask is reused, add 30 min. (Rev. 1)
Storage placement (incl. 45 min. to obtain new cask)	145/cask	6	\$53,900	If cask is reused, reduce by 45 min. (Rev. 2)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff (excl. Cook Mfg. Facility of 11)	N/A	264	\$53,900	

TABLE 6-12
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 6
Construction Phase: Two
Storage Concept: Cost

Date: 10/11/00
Revision: 1

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	00	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
RRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Note, total of costs = 122 (Rev. 1)

TABLE 6-13
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 6
Construction Phase: Three
Storage Concept: Cask

Date: 11/4/88
Revision: 3

		Percent of M & I Cost per Year Prior to Operations											
COST CENTER/Cost Element	Cost (Millions \$)												
		-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	28	50	22 (Rev. 1)									
Design													
Proof-of-Principle Tests (6 Tests)	1.0	27	54	19 (Rev. 2)									
Advanced Conceptual Design	11.7	8	92	(Rev. 3)									
License Application Design	40.6		18	55	27								
Licensing Support	5.2				20	40	40						
Final Procurement and Construction Design	27.0				40	60							
Title III Support	29.8							20	23	26	22	9	
Operating Contractor Support													
Design	9.9	3	11	28	30	14	11	3 (Rev. 3)					
Construction	10.8						5	15	23	20	19	13	5
Construction Management	63.2							20	23	26	22	9	
Preoperational Testing and Personnel Training	66.8						3	5	18	17	24	41	

TABLE 6-14
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 4
Construction Phase: Three
Storage Concept: Cask

Date: 10/21/88
Revision: 2

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	5.163	0.829	5.994	(1) Site development
Cask Lag Storage	N/A	2.996	--	2.996	Storage cask = \$7500/cask Dual purpose cask = \$31,000/cask
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING					(2) Storage cask equipment = \$7,810 M Dual purpose cask equip. = \$3,940 M
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Lag Storage	4080	3.074	0.270	3.344	
Processing	12524	9.639	7.613	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	25.146	2.923	28.069	(Rev.1)
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.477	0.853	2.332	
Processing	26749	0.205	33.734	41.929	
Volume Reduction	N/A	N/A	N/A	N/A	
Canister/Container Closure	26474 (Rev. 1)	0.205	21.063	30.068	
Canister/Container Lag Storage	48384	14.934	19.371	30.305	
Interim Storage Loading/Unloading	27353	0.700	15.618	24.318	
HQS/Repository Cask Handling	21709	6.564	9.934	16.500	
Building Support Facilities	376972	116.024	112.307	228.331	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	(2)	--	
Storage Units	N/A		See Compendium, Table 6-17		
Receiving Building	N/A	1.607	1.006	2.613	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	39.895	--	39.895	(Rev. 2)
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.603	0.424	3.029	
Other Support Facilities	N/A	42.130	18.915 (Rev. 1)	61.045	

TABLE 6-15
CONSTRUCTION COSTS

Scenario: 6
Construction Phase: Three
Storage Concept: Cask

Date: 9/16/88
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				100					
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING				25	45	30			
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING				70	20	25	25	10	
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
NRS/Repository Cost Modeling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS									
Storage Facilities				100					
Storage Units									
Receiving Building				100					
BALANCE OF PLANT AND SUPPORT OPERATIONS				50	30	20			
Site Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

TABLE 6-16
CONSTRUCTION COST DISTRIBUTION

Scenario: 4
Construction Phase: Three
Storage Concept: Cask

Date: 1/20/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (%/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.020 M/Year Fixed
Receiving	2.0			
Cask Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby (Rev. 2)
Cask Unloading	2.0			
Assembly Lag Storage	1.0			
Processing	1.3	1.8		
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed
Building Support Facilities	1.1	1.9	12.9	
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed
Cask Unloading	0.7		3.4	
Assembly Lag Storage	1.0			
Processing	1.2	31.8	3.7	
Volume Reduction	N/A	N/A	N/A	(Rev. 1)
Canister/Container Closure	1.0		1.4	Containers = \$31,000/SF Unit; \$17,000/MLW Unit (Rev. 3)
Canister/Container Lag Storage	0.3		11.8	
Interim Storage Loading/Unloading	0.6		3.3	
WRS/Repository Cask Handling	1.4		6.6	
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit
INTERIM STORAGE OPERATIONS				
Storage Facilities	2.0	0.8	93	1st Year Ops. = \$0.006 M Fixed; Other Ops. Years = \$0.030 M/Year Casks = \$0.197 M/Unit
Storage Units				
Receiving Building	2.0			
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.350 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	33.4	37.3	
Other Support Facilities	1.6	53.9	24.0	

TABLE 6-17
ANNUAL OPERATIONS COSTS

Scenario: 6
Construction Phase: Three
Storage Concept: Cask

Date: 1/20/89
Revision: 2

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; Inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	FTE/crew increases to 8 for first 4 years of operations
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask: 375/cask
Unload transport casks	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Storage landing/unloading	PMR = 510/cask (Rev. 1) BMR = 1230/cask (Rev. 2)	1.5	\$53,900	Load/unload onsite transfer cask: PMR = 530; BMR = 1070
Building support staff		51	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Containerize intact fuel	All PMR = 320/container PMR + BMR = 680/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BMR fuel
Volume-reduce/package NFIC	N/A	N/A	N/A	
Weld/decon/test canisters	190/container	1.5 w/o MLN 1.6 w/ MLN	\$53,900	
Container handling:		3	\$53,900	
Inq storage	90/container			
storage cask loading/unloading	90/cask of 4 containers			
NRS transport cask loading	170(SF);170/MLN (Rev. 1)			
Building support staff	N/A	148 w/o MLN 151 w/ MLN	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	230/cask	17	\$53,900	
Storage cask preparation & closing/reopening	210/cask	4	\$53,900	If cask is reused, add 30 min. (Rev. 1)
Storage placement (incl. 45 min. to obtain new cask)	145/cask	6	\$53,900	If cask is reused, reduce by 45 min. (Rev. 2)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff (excl. Cask Mfg. Facility of IS)	N/A	264	\$53,900	

TABLE 6-18
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario 4
Construction Phase: Three
Storage Concepts: Cask

Date: 10/11/00
Revision: 1

COST CENTER/Cost Element	%	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	0	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
WHS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Waste Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Note, intact SF costs = 12% (Rev. 1)

TABLE 4-19
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 6
Construction Phase: Single
Storage Concept: Drywell

Date: 10/21/88
Revision: 2

		Percent of M & I Cost per Year Prior to Operations											
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	55	45 (Rev. 1)										
Design													
Proof-of-Principle Tests (6 Tests)	1.0	55	45 (Rev. 2)										
Advanced Conceptual Design	7.9	67	33										
License Application Design	33.8		41	54	5								
Licensing Support	5.2				37	40	23						
Final Procurement and Construction Design	22.5				73	27							
Title III Support	26.0						2	20	29	29	20		
Operating Contractor Support													
Design	9.9	11	30	31	14	11	3						
Construction	10.8					5	15	73	20	19	13	5	
Construction Management	51.9						2	20	29	29	20		
Preoperational Testing and Personnel Training	66.8					3	5	10	17	24	41		

TABLE 6-20
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 6
Construction Phase: Single
Storage Concept: Drywell

Date: 11/4/88
Revision: 3

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	3.332	--	3.332	(1) Site development costs included in drywell unit cost. See consumables, Table 6-23
Cask Log Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	N/A	
Cask Unloading					
Assembly Log Storage					
Processing					
Interim Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Log Storage	4064	1.477	0.855	2.332	
Processing	26749	0.203	33.724	41.929	
Volume Reduction	N/A	N/A	N/A	N/A	
Coister/Container Closure	26474 (Rev. 1)	0.203	21.063	30.068	
Coister/Container Log Storage	40304	14.934	19.371	30.303	
Interim Storage Loading/Unloading	27533	0.700	19.610	24.310	
RRR/Repository Cost Handling	21709	6.364	9.936	16.300	
Building Support Facilities	376972	116.024	112.307	228.331	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	3.311	--	
Storage Units	N/A		See Consumables, Table 6-23		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	20.638	--	20.638 (Rev. 2)	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.603	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 3)	

TABLE 6-21
CONSTRUCTION COSTS

Scenarios: A
Construction Phase: Single
Storage Concept: Drywell

Date: 10/21/00
Revision: 1

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS			10	90							
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING		N/A	N/A	N/A	N/A	N/A					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING		2	20	29	29	20					
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
RRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS			17	33	33	17					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS			30	30	20 (Rev. 1)						
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 6-22
CONSTRUCTION COST DISTRIBUTION

Scenario: A
Construction Phase: Single
Storage Concept: Drywell

Date: 1/20/89
Revision: 2

COST CENTER/Cost Element	Equipment Maintenance/Replacement (%/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.014 M/Year Fixed
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Cask Unloading				
Assembly Lag Storage				
Processing				
Interim Storage Loading/Unloading				
Building Support Facilities				
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed
Cask Unloading	0.7		3.4	
Assembly Lag Storage	1.0			
Processing	1.2	31.8	3.7	
Volume Reduction	N/A	N/A	N/A	(Rev. 1)
Canister/Container Closure	1.0		1.4	Containers = \$31,000/SF Unit; (Rev. 2) \$17,000/MLW Unit
Canister/Container Lag Storage	0.5		11.8	
Interim Storage Loading/Unloading	0.6		3.3	
WRS/Repository Cask Handling	1.4		6.6	
Building Support Facilities	0.7	11.1	18.2	Buses = \$100/Unit
INTERIM STORAGE OPERATIONS				
Storage Facilities	1.6	3.0	38	\$0.050 M/Year Fixed
Storage Units				SF Container Drywell (30" dia.) = \$13,100/Unit; MLW (30" dia.) = \$12,200/Unit (Rev. 2)
Receiving Building	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.350 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	35.4	37.3	
Other Support Facilities	1.6	55.9	24.0	

TABLE 6-23
ANNUAL OPERATING COSTS

Scenario: A
Construction Phase: Single
Storage Concept: Drywell

Date: 10/11/88
Revision: 1

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 99/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for meshdown)				
Unload transport casks				
Storage loading/unloading				
Building support staff				
RECEIVING AND HANDLING BUILDING				
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for meshdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Containerize intact fuel	All PMR = 320/container PMR + BWR = 680/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BWR fuel
Volume-reduce/package WFC	N/A	N/A	N/A	
Weld/decom/test containers	190/container	1.5 w/o MLN 1.6 w/ MLN	\$53,900	
Container handling: lag storage	90/container	3	\$53,900	
transporter loading/unloading	45/transporter load			
WRS transport cask loading	170(SF);170(MLN) (Rev. 1)			
Building support staff	N/A	148 w/o MLN 151 w/ MLN	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter operation (incl. loading of shield plug)	60/trip	1	\$53,900	If drywell is reused, reduce by 15 min. (Rev. 1)
Storage placement	30/drywell	3.3 w/o MLN 2.7 w/ MLN	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE A-24
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 6
Construction Phase: Single
Storage Concept: Drywell

Date: 9/16/88
Revision: 0

COST CENTER/Cost Element	X of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	0	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	N/A								
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
WRS/Repository Cost Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Waste Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

TABLE 6-25
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 6
Construction Phase: Two
Storage Concept: Drywell

Date: 10/21/88
Revision: 2

		Percent of M & I Cost per Year Prior to Operations													
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	
MANAGEMENT AND INTEGRATION															
Site Selection/Investigation	8.6		14	52	34 (Rev. 2)										
Design															
Proof-of-Principle Tests (6 Tests)	1.0		14	54	32 (Rev. 2)										
Advanced Conceptual Design	11.7			77	23 (Rev. 2)										
License Application Design	46.6				45	55 (Rev. 2)									
Licensing Support	5.2					40	40	20 (Rev. 2)							
Final Procurement and Construction Review	77.0					80	20	(Rev. 2)							
Title III Support	29.8							20	23	24	22	9			
Operating Contractor Support															
Design	9.9			11	30	31	14	11	3						
Construction	10.8							5	15	23	20	19	13	5	
Construction Management	63.2								20	23	24	22	9		
Preoperational Testing and Personnel Training	66.8							3	9	10	17	24	41		

TABLE 6-26
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 6
Construction Phase: Two
Storage Concept: Drywell

Date: 11/4/88
Revision: 3

COST CENTER/Cost Element	Millions in 1988 \$				Notes
	Building Area	Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	3.352	--	3.352	(1) Site development cost for drywell included in drywell unit cost. See consumables, Table 6-29
Cost Log Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING					
Cost Unloading	31420	7.432	2.832	10.264	
Assembly Log Storage	4080	3.074	0.270	3.344	
Processing	12520	9.639	7.615	17.254	
Interior Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	25.146	2.923	28.069 (Rev. 1)	
RECEIVING AND HANDLING BUILDING					
Cost Unloading	85672	11.970	10.403	22.373	
Assembly Log Storage	4864	1.477	0.835	2.312	
Processing	26749	8.205	33.724	41.929	
Volume Reduction	N/A	N/A	N/A	N/A	
Canister/Container Closure	26474 (Rev. 1)	8.205	21.863	30.068	
Canister/Container Log Storage	48384	14.934	15.371	30.305	
Interior Storage Loading/Unloading	27533	8.700	15.618	24.318	
WRS/Repository Cost Handling	21709	6.564	9.936	16.500	
Building Support Facilities	376972	116.024	112.307	228.331	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	3.311	--	
Storage Units	N/A		See Consumables, Table 6-29		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	32.390	--	32.390 (Rev. 2)	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 3)	

TABLE 6-27
CONSTRUCTION COSTS

Scenario: 6
Construction Phase: Two
Storage Concept: Drywell

Date: 9/16/00
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				10	90						
Receiving											
Cost Log Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				25	45	30					
Cask Unloading											
Assembly Log Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				20	20	25	25	10			
Cask Unloading											
Assembly Log Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Log Storage											
Interim Storage Loading/Unloading											
HRS/Repository Cost Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS				10	40	50					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				50	30	20					
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 6-28
CONSTRUCTION COST DISTRIBUTION

Scenario: 6
Construction Phase: Two
Storage Concept: Drywell

Date: 1/20/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (1/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.014 M/Year Fixed
Cask/Log Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby (Rev. 2)
Cask Unloading	2.0			
Assembly Log Storage	1.0			
Processing	1.5	1.8		
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed (Rev. 1)
Building Support Facilities	1.1	1.9	12.9	
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed
Cask Unloading	0.7		3.4	
Assembly Log Storage	1.0			
Processing	1.2	31.8	3.7	
Volume Reduction	N/A	N/A	N/A	(Rev. 1)
Canister/Container Closure	1.0		1.4	Containers = \$31,000/SF Unit; \$17,000/MLM Unit (Rev. 3)
Canister/Container Log Storage	0.3		11.8	
Interim Storage Loading/Unloading	0.6		3.3	
NRS/Repository Cask Handling	1.4		6.6	
Building Support Facilities	0.7	11.1	18.2	(Rev. 1) Doses = \$100/Unit
INTERIM STORAGE OPERATIONS				
Storage Facilities	2.0	0.8	95	\$0.050 M/Year Fixed Bare, Intact SF Drywell (30" dia.) = \$13,000/Unit; SF Container Drywell (30" dia.) = \$13,100/Unit; MLM Canister Drywell (30" dia.) = \$12,200/Unit (Rev. 3)
Storage Units				
Receiving Building	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	35.4	37.3	
Other Support Facilities	1.6	55.9	24.0	

TABLE 6-29
ANNUAL OPERATING COSTS

Scenario: 6
Construction Phase: Two
Storage Concept: Drywell

Date: 10/11/88
Revision: 1

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/4 assemblies BMR = 95/8 assemblies (Rev. 1)	1.5	\$53,900	Load/unload onsite transfer cask : PMR = 530; BMR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and canister fuel	All PMR = 320/container PMR + BMR = 680/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BMR fuel
Volume-reduce/package NRC	N/A	N/A	N/A	
Weld/decom/test containers	190/canister	1.5 w/o HLN 1.6 w/ HLN	\$53,900	
Container handling:		3	\$53,900	
lag storage	90/container			
transporter loading/unloading	45/transport load			
NRS transport cask loading	170(SF);170(HLN) (Rev. 1)			
Building support staff	N/A	148 w/o HLN 151 w/ HLN	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter Operation (incl. loading of shield plug, and intact SF basket as required)	40/trip from R & H Building 75/trip from SFHB	1	\$53,900	If drywell is reused, reduce by 15 min. (Rev. 1)
Storage placement	50/drywell	3.5 w/o HLN 2.7 w/ HLN	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 6-30
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 6
Construction Phase Two
Storage Concept: Drywell

Date: 10/11/00
Revision: 1

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
HRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Waste Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Base, intact SF drywell = 121
(Rev. 1)

TABLE 6-31
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario 6
Construction Phase: Three
Storage Concepts: Drywell

Date: 11/4/88
Revision: 3

COST CENTER/Cost Element	Cost (Millions \$)	Percent of M & I Cost per Year Prior to Operations												
		-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5	+6
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6	28	50	22 (Rev. 1)										
Design														
Proof-of-Principle Tests (6 Tests)	1.0	27	54	19 (Rev. 2)										
Advanced Conceptual Design	11.7	8	92	(Rev. 3)										
License Application Design	40.6		18	55	27									
Licensing Support	5.2				20	40	40							
Final Procurement and Construction Design	27.8				40	60								
Title III Support	29.8							20	23	26	27	9		
Operating Contractor Support														
Design	9.9	3	11	20	30	14	11	3 (Rev. 3)						
Construction	10.8						5	15	23	20	19	13	5	
Construction Management	63.2							20	23	26	22	9		
Preoperational Testing and Personnel Training	66.8						3	5	10	17	24	41		

TABLE 6-32
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 6
Construction Phase: Three
Storage Concept: Drywell

Date: 11/4/88
Revision: 3

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	9.165	0.829	9.994	(1) Site development cost included in drywell unit cost. See consensibles, Table 4-33
Cask Lag Storage	N/A	2.996	--	2.996	Dual purpose cask site development cost = \$31,000/cask
WASTE HANDLING OPERATIONS					(2) Drywell equipment cost = \$3.311 M
SPENT FUEL HANDLING BUILDING					Dual purpose cask equip. = \$3.940 M
Cask Unloading	31470	7.432	2.852	10.284	
Assembly Lag Storage	4080	3.074	0.270	3.344	
Processing	12524	9.639	7.615	17.254	
Interior Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	29.146	2.923	28.069 (Rev. 1)	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	89672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.477	0.855	2.332	
Processing	26749	8.205	33.724	41.929	
Volume Reduction	N/A	N/A	N/A	N/A	
Canister/Container Closure	26474 (Rev. 1)	8.205	21.863	30.068	
Canister/Container Lag Storage	48384	14.934	15.371	30.305	
Interior Storage Loading/Unloading	27533	8.700	15.618	24.318	
RRS/Repository Cask Handling	21709	6.564	9.936	16.500	
Building Support Facilities	376972	116.024	112.387	228.331	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	(2)	--	
Storage Units	N/A		See Consensibles, Table 4-33		
Receiving Building	N/A	1.607	1.006	2.613	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	32.390	--	32.390 (Rev. 2)	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 3)	

TABLE 4-33
CONSTRUCTION COSTS

Scenario: 6
Construction Phase: Three
Storage Concept: Drywell

Date: 9/16/88
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				100					
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING				25	45	30			
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND ASSEMBLING BUILDING				20	20	25	25	10	
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
WRS/Repository Cost Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS									
Storage Facilities				100					
Storage Units									
Receiving Building				100					
BALANCE OF PLANT AND SUPPORT OPERATIONS				50	30	20			
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

TABLE 6-34
CONSTRUCTION COST DISTRIBUTION

Scenario: 6
Construction Phases: Three
Storage Concept: Drywell

Date: 1/20/89
Revision: 2

COST CENTER/Cost Element	Equipment Maintenance/Replacement (\$/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.020 M/Year Fixed
Receiving	2.0			
Cask Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby (Rev. 2)
Cask Unloading	2.0			
Assembly Lag Storage	1.0			
Processing	1.5	1.8		
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed
Building Support Facilities	1.1	1.9	12.9	
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed
Cask Unloading	0.7		3.4	
Assembly Lag Storage	1.0			
Processing	1.2	31.8	3.7	
Volume Reduction	N/A	N/A	N/A	(Rev. 1)
Canister/Container Closure	1.0		1.4	Containers = \$31,000/SF Unit; (Rev. 2) \$17,000/MLN Unit
Canister/Container Lag Storage	0.5		11.8	
Interim Storage Loading/Unloading	0.6		3.3	
WRS/Repository Cask Handling	1.4		6.6	
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit
INTERIM STORAGE OPERATIONS				
Storage Facilities	1.6	3.0	38	1st Year Ops. = \$0.006 M Other Ops. Years = \$0.050 M/Year Bare, Intact SF Drywell (30" dia.) = \$13,000/Unit; SF Container Drywell (30" dia.) = \$13,100/Unit; MLN Canister Drywell (30" dia.) = \$12,200/Unit (Rev. 2)
Storage Units				
Receiving Building	2.0			
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed
Shuttle Preparation				
Offsite Preparation				
Administration	3.1	55.4	37.3	
Other Support Facilities	1.6	55.9	24.0	

TABLE 6-35
ANNUAL OPERATING COSTS

Scenario: A
Construction Phase: Three
Storage Concept: Drywell

Date: 10/11/88
Revision: 1

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	FTE/crew increases to 8 for first 4 years of operations
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask: 375/cask
Unload transport casks	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/4 assemblies BMR = 95/8 assemblies (Rev. 1)	1.5	\$53,900	Load/unload onsite transfer cask: PMR = 530; BMR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and canister fuel	All PMR = 320/container PMR + BMR = 680/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BMR fuel
Volume-reduce/package WFC	N/A	N/A	N/A	
Weld/dacron/test containers	190/canister	1.5 w/o HLM 1.6 w/ HLM	\$53,900	
Container handling: lag storage	90/container	3	\$53,900	
transporter loading/unloading	45/transport load			
NRS transport cask loading	170(SF);170(HLM) (Rev. 1)			
Building support staff	N/A	148 w/o HLM 151 w/ HLM	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	230/cask	17	\$53,900	
Transporter Operation (incl. loading of shield plug, and intact SF basket as required)	60/trip from R & H Building 75/trip from SFNB	1	\$53,900	If drywell is reused, reduce by 15 min. (Rev. 1)
Storage placement	50/drywell	3.5 w/o HLM 2.7 w/ HLM	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 6-36
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 6
Construction Phase: Three
Storage Concept: Drywell

Date: 10/11/00
Revision: 1

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
WRS/Repository Cost Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Basis Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Here, intact SF drywell = 12%
(Rev. 1)

TABLE 6-37
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 6
Construction Phase: Single
Storage Concept: Vault

Date: 10/18/88
Revision: 0

		Percent of N & I Cost per Year Prior to Operations											
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	55	45										
Design													
Proof-of-Principle Tests (6 Tests)	1.0	55	45										
Advanced Conceptual Design	14.7	47	33										
License Application Design	43.2		41	35	4								
Licensing Support	5.2				37	40	73						
Final Procurement and Construction Design	29.5				80	20							
Title III Support	31.0						10	24	24	24	18		
Operating Contractor Support													
Design	9.9	11	30	31	14	11	3						
Construction	10.8					5	15	23	20	19	13	5	
Construction Management	67.5						10	24	24	24	18		
Preoperational Testing and Personnel Training	66.8					3	5	10	17	24	41		

TABLE 6-38
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 6
Construction Phase: Single
Storage Concept: Vault

Date: 11/4/88
Revision: 1

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					(1) Fixed cost per storage building
Receiving	N/A	3.332	--	3.332	
Cost Log Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	N/A	
Cost Unloading					
Assembly Log Storage					
Processing					
Interior Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING					
Cost Unloading	85672	11.970	10.403	22.373	
Assembly Log Storage	4864	1.477	0.895	2.332	
Processing	26749	0.205	33.724	41.929	
Volume Reduction	N/A	N/A	N/A	N/A	
Canister/Container Closure	26474	0.205	21.063	30.068	
Canister/Container Log Storage	48304	14.934	15.371	30.305	
Interior Storage Loading/Unloading	27533	0.700	19.618	24.318	
WCS/Repository Cost Handling	21709	6.364	9.936	16.300	
Building Support Facilities	376972	116.024	112.307	228.331	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	16.040	9.770	25.810 (1)	
Storage Units	N/A		See Comenables, Table 6-41		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	42.830	--	42.830	
Offsite Preparation	N/A	16.293	--	16.293	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 1)	

TABLE 6-39
CONSTRUCTION COSTS

Scenario: 4
Construction Phase: Single
Storage Concept: Vault

Date: 10/10/00
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cont Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS			10	90							
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING		N/A	N/A	N/A	N/A	N/A					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING		2	20	20	29	20					
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
NMS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS		10	24	24	24	10					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS			30	30	20						
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 6-40
CONSTRUCTION COST DISTRIBUTION

Scenario: 6
Construction Phase: Single
Storage Concept: Vault

Date: 1/20/89
Revision: 2

COST CENTER/Cost Element	Equipment Maintenance/Replacement (\$/Year)			Consumables	Notes
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.014 M/Year Fixed	(1) Cost per storage building
Receiving					
Cask Lag Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A		
Cask Unloading					
Assembly Lag Storage					
Processing					
Interim Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	
Cask Unloading	0.7		3.6		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	N/A	N/A	N/A		
Canister/Container Closure	1.0		1.4	Containers = \$31,000/SF Unit; \$17,000/MLM Unit	(Rev. 2)
Canister/Container Lag Storage	0.3		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
WRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0 (1)	0.3 (1)	0.6 (1)	\$0.827 M/Year Fixed (1); \$0.0006 M/Year/Position (Rev. 1) SF Container or MLM Canister Position (30") = \$36,700/Unit	
Storage Units					
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed	
Basite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	35.9	24.0		

TABLE 6-41
ANNUAL OPERATING COSTS

Scenario: 6
Construction Phase: Single
Storage Concept: Vault

Date: 10/18/88
Revision: 0

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE MANULING OPERATIONS				
SPEW FUEL MANULING BUILDING	N/A	N/A	N/A	
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for meshdown) Unload transport casks				
Storage loading/unloading				
Building support staff				
RECEIVING AND MANULING BUILDING				
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for meshdown) Unload transport casks into process cells	Truck = 515/cask Rail = 613/cask PUR = 130(T);540(R) DUR = 730(T);1080(R)	4.3 1.5	\$53,900 \$53,900	
Containerize intact fuel	All PUR = 320/container PUR + DUR = 680/container	2.5	\$53,900	Requires all 4 cells to handle both PUR and DUR fuel
Volume-reduce/package HFC Hold/docum/test containers	N/A 190/container	N/A 1.3 w/o HLN 1.6 w/ HLN	N/A \$53,900	
Container handling: lay storage transporter loading/unloading HRS transport cask loading Building support staff	90/container 43/transporter load 170(SF);170(HLN) N/A	N/A 148 w/o HLN 151 w/ HLN	N/A \$53,900 \$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter operation	90/trip 85/position w/o HLN 90/position w/ HLN	2 32 w/o HLN 21.5 w/ HLN	\$53,900 \$53,900	Time based on 15,000 HTU onsite storage
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 6-42
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 4
Construction Phase: Single
Storage Concept: Vault

Date: 10/18/88
Revision: 0

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations								
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5	+6
CASK OPERATIONS	5							100		
Receiving										
Cask Lag Storage										
WASTE HANDLING OPERATIONS										
SPENT FUEL HANDLING BUILDING	N/A									
Cask Unloading										
Assembly Lag Storage										
Processing										
Interim Storage Loading/Unloading										
Building Support Facilities										
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15	
Cask Unloading										
Assembly Lag Storage										
Processing										
Volume Reduction										
Canister/Container Closure										
Canister/Container Lag Storage										
Interim Storage Loading/Unloading										
RRS/Repository Cask Handling										
Building Support Facilities										
INTERIM STORAGE OPERATIONS	5		20	40	40					
Storage Facilities										
Storage Units										
Receiving Building										
BALANCE OF PLANT AND SUPPORT OPERATIONS	1								100	
Onsite Preparation										
Offsite Preparation										
Administration										
Other Support Facilities										

TABLE 6-43
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 6
Construction Phase: Two
Storage Concept: Vault

Date: 10/18/88
Revision: 0

		Percent of M & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6		14	52	34									
Design														
Proof-of-Principle Tests (6 Tests)	1.0		14	55	41									
Advanced Conceptual Design	18.5		8	92										
License Application Design	50.0			14	55	31								
Licensing Support	5.2					17	40	40	3					
Final Procurement and Construction Design	34.0					33	67							
Title III Support	34.8								27	30	24	14	5	
Operating Contractor Support														
Design	7.9		3	11	28	30	14	11	3					
Construction	10.8							5	15	23	20	19	13	5
Construction Management	78.8								27	30	24	14	5	
Preoperational Testing and Personnel Training	66.8							3	5	10	17	24	41	

TABLE 6-44
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario 6
Construction Phase Two
Storage Concepts: Vault

Date: 11/4/88
Revision: 1

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					(1) Fixed cost per storage building
Receiving	N/A	3.352	--	3.352	
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Lag Storage	4080	3.074	0.270	3.344	
Processing	17524	9.639	7.615	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	29.146	2.923	28.069	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.477	0.835	2.312	
Processing	26749	8.205	33.724	41.929	
Volume Reduction	N/A	N/A	N/A	N/A	
Canister/Container Closure	26474	8.205	21.063	29.068	
Canister/Container Lag Storage	48304	14.934	15.371	30.305	
Interim Storage Loading/Unloading	27333	8.700	15.618	24.318	
WRS/Repository Cost Handling	21709	6.364	9.936	16.300	
Building Support Facilities	376972	116.024	112.307	228.331	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	16.040	9.770	25.810 (1)	
Storage Units	N/A		See Consumables, Table 6-47		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	46.610	--	46.610	
Offsite Preparation	N/A	16.293	--	16.293	
Administration	N/A	2.685	0.424	3.079	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 1)	

TABLE 6-45
CONSTRUCTION COSTS

Scenario: A
Construction Phase: Two
Storage Concept: Vault

Date: 10/10/00
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				10	90						
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				25	45	30					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				20	20	25	25	10			
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
RRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS				33	37	30					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				50	30	20					
Basis Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 4-46
CONSTRUCTION COST DISTRIBUTION

Scenario: 4
Construction Phase: Two
Storage Concept: Vault

Date: 1/20/89
Revision: 2

COST CENTER/Cost Element	Equipment Maintenance/Replacement (X/Year)			Consumables	Notes
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.014 M/Year Fixed	(1) Cost per storage building
Receiving					
Cask Lag Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby	(Rev. 1)
Cask Unloading	2.0				
Assembly Lag Storage	1.0				
Processing	1.3	1.8			
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed	
Building Support Facilities	1.1	1.9	12.9		
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	N/A	N/A	N/A		
Canister/Container Closure	1.0		1.4	Containers = \$31,000/SF Unit; \$17,000/MLN Unit	(Rev. 2)
Canister/Container Lag Storage	0.3		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
RMS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Dress = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0 (1)	0.3 (1)	0.6 (1)	\$0.827 M/Year Fixed (1); \$0.0006 M/Year/Position (Rev. 1)	
Storage Units				SF Container or MLN Canister Position (30") = \$36,700/Unit; Bare, Intact SF Position (30") = \$36,700/Unit	
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.350 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	35.9	24.0		

TABLE 6-47
ANNUAL OPERATING COSTS

Scenario: 6
Construction Phase: Ten
Storage Concept: Vault

Date: 10/18/88
Revision: 0

COST CENTER/Functional Activity by Crew -----	Processing Time/Unit Processed (in minutes) -----	FTE/Crew -----	Annual \$/FTE -----	Notes -----
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask: 375/cask
Unload transport casks	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/4 assemblies BWR = 95/8 assemblies	1.5	\$53,900	Load/unload onsite transfer cask: PMR = 530; BWR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and canister fuel	All PMR = 320/container PMR + BWR = 680/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BWR fuel
Volume-reduce/package WFC Weld/decon/test containers	N/A	N/A	N/A	
	190/canister	1.5 w/o HLN 1.6 w/ HLN	\$53,900	
Container handling: lag storage	90/container	3	\$53,900	
transporter loading/unloading	45/transport load			
WRG transport cask loading	170(SF);170(HLN)			
Building support staff	N/A	148 w/o HLN 151 w/ HLN	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter Operation (incl. loading of intact SF basket as required)	85/trip from R & H Building 97/trip from SFMB	2 3	\$53,900	Times based on 15,000 MTU of onsite storage
Storage placement	83/position w/o HLN 90/position w/ HLN 80/bare, intact SF position	32 w/o HLN 21.5 w/ HLN 21.5	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 6-48
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 6
Construction Phase: Two
Storage Concept: Vault

Date: 10/10/00
Revision: 0

		Percent of Decommissioning Cost by Year After Last Year of Operations								
COST CENTER/Cost Element	% of Total Constr. Cost	Last Year Operations								
		-2	-1		+1	+2	+3	+4	+5	+6
CASK OPERATIONS	3							100		
Receiving										
Cask Log Storage										
WASTE HANDLING OPERATIONS										
SPENT FUEL HANDLING BUILDING	12				10	00	10			
Cask Unloading										
Assembly Log Storage										
Processing										
Interior Storage Loading/Unloading										
Building Support Facilities										
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15	
Cask Unloading										
Assembly Log Storage										
Processing										
Volume Reduction										
Canister/Container Closure										
Canister/Container Log Storage										
Interior Storage Loading/Unloading										
HRS/Repository Cask Handling										
Building Support Facilities										
INTERIM STORAGE OPERATIONS	3		20	40	40					
Storage Facilities										
Storage Units										
Receiving Building										
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100		
Offsite Preparation										
Offsite Preparation										
Administration										
Other Support Facilities										

Note, intact SF vault = 121

TABLE 6-49
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 6
Construction Phase: Three
Storage Concept: Vault

Date: 11/4/88
Revision: 1

		Percent of M & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5	+6
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6	27	50	23										
Design														
Proof-of-Principle Tests (6 Tests)	1.0	27	55	18										
Advanced Conceptual Design	18.5	8	92	(Rev. 1)										
License Application Design	50.0		18	55	27									
Licensing Support	5.2				20	40	40							
Final Procurement and Construction Design	34.0				40	60								
Title III Support	34.6							30	30	23	14	3		
Operating Contractor Support														
Design	9.9	3	11	28	30	14	11	3 (Rev. 1)						
Construction	18.8						5	15	23	20	19	13	5	
Construction Management	78.8							30	30	23	14	3		
Preoperational Testing and Personnel Training	66.8						3	5	10	17	24	41		

TABLE 6-30
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario 4
Construction Phase: Three
Storage Concepts: Vault

Date: 11/4/88
Revision: 1

COST CENTER/Cost Element	Millions in 1988 \$				Notes
	Building Area	Facility Cost	Equipment Cost	Total Cost	
CASE OPERATIONS					
Receiving	N/A	3.163	0.829	3.994	(1) Fixed cost per storage building
Cost Log Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					(2) Dual purpose costs: Site development = \$31,000/cask; Equipment = \$3,940 M (Rev. 1)
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.832	10.264	
Assembly Log Storage	4000	3.074	0.270	3.344	
Processing	12324	9.639	7.613	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	29.146	2.923	28.069	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	89672	11.970	10.403	22.373	
Assembly Log Storage	4064	1.477	0.833	2.332	
Processing	26749	8.209	33.724	41.929	
Volume Reduction	N/A	N/A	N/A	N/A	
Canister/Container Closure	26474	8.203	21.863	30.068	
Canister/Container Log Storage	48384	14.934	15.371	30.305	
Interim Storage Loading/Unloading	27333	8.780	15.618	24.318	
HRS/Repository Cost Handling	21709	6.364	9.936	16.900	
Building Support Facilities	376972	116.024	112.307	228.331	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	16.040	9.770	25.810 (1 & 2) (Rev. 1)	
Storage Units	N/A		See Comenables, Table 6-33		
Receiving Building	N/A	1.807	1.006	2.813	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Service Preparation	N/A	46.610	--	46.610	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 1)	

TABLE 6-51
CONSTRUCTION COSTS

Scenario: 6
Construction Phase: Three
Storage Concept: Vault

Date: 10/10/00
Revision: 0

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-3	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS						100					
Receiving											
Cask Log Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING						25	45	30			
Cask Unloading											
Assembly Log Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING						20	20	25	25	10	
Cask Unloading											
Assembly Log Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Log Storage											
Interim Storage Loading/Unloading											
HRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS											
Storage Facilities						36	37	27			
Storage Units											
Receiving Building						100					
BALANCE OF PLANT AND SUPPORT OPERATIONS						50	30	20			
Waste Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 4-52
CONSTRUCTION COST DISTRIBUTION

Scenario 6
Construction Phase: Three
Storage Concept: Vault

Date : 1/20/89
Revision : 2

COST CENTER/Cost Element	Equipment Maintenance/Replacement (%/Year)			Consumables	Notes
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.020 M/Year Fixed	(1) Cost per storage building
Receiving	2.0				
Cask Lag Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby (Rev. 1)	
Cask Unloading	2.0				
Assembly Lag Storage	1.0				
Processing	1.5	1.8			
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed	
Building Support Facilities	1.1	1.9	12.9		
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	N/A	N/A	N/A		
Canister/Container Closure	1.0		1.4	Containers = \$31,000/SF Unit; \$17,000/MLM Unit (Rev. 2)	
Canister/Container Lag Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
WRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0 (1)	0.3 (1)	0.6 (1)	1st Year Ops. = \$0.006 M Other Ops. Years = \$0.827 M/Year Fixed (1); \$0.0006 M/Year/Position (Rev. 1) SF Container or MLM Canister Position (30") = \$36,700/Unit; Bare, Intact SF Position (30") = \$36,700/Unit	
Storage Units					
Receiving Building	2.0				
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	55.9	24.0		

TABLE 6-33
ANNUAL OPERATING COSTS

Scenario: 6
Construction Phase: Three
Storage Concept: Vault

Date: 10/18/88
Revision: 0

COST CENTER/Functional Activity by Crew -----	Processing Time/Unit Processed (in minutes) -----	FTE/Crew -----	Annual \$/FTE -----	Notes -----
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	FTE/crew increases to 8 for first 4 years of operations
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 315/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PMR = 150(T);540(R) BMR = 230(T);1000(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/4 assemblies BMR = 95/8 assemblies	1.5	\$53,900	Load/unload onsite transfer cask : PMR = 530; BMR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 315/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and canister fuel	All PMR = 320/container PMR + BMR = 680/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BMR fuel
Volume-reduce/package WFC	N/A	N/A	N/A	
Weld/decon/test containers	190/canister	1.5 w/o HLW 1.6 w/ HLW	\$53,900	
Container handling: lag storage	90/container	3	\$53,900	
transporter loading/unloading	45/transport load			
NRS transport cask loading	170(SF);170(MLW)			
Building support staff	N/A	148 w/o HLW 151 w/ HLW	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	230/cask	17	\$53,900	
Transporter Operation (incl. loading of intact SF basket as required)	85/trip from R & H Building 95/trip from SFMB	2 3	\$53,900	Times based on 15,000 MTU of onsite storage
Storage placement	85/position w/o HLW 90/position w/ HLW 80/bare, intact SF position	32 w/o HLW 21.5 w/ HLW 21.5	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 4-54
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 6
Construction Phase: Three
Storage Concept: Vault

Date: 10/18/88
Revision: 0

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	3							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	13
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
HRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		20	40	40				
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1								100
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Bare, intact SF vault = 12%

TABLE 6-53
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 7
Construction Phase: Single
Storage Concept: Cost

Date: 10/21/88
Revision: 2

		Percent of M & I Cost per Year Prior to Operations											
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	35	45 (Rev. 1)										
Design													
Proof-of-Principle Tests (6 Tests)	1.0	55	45 (Rev. 2)										
Advanced Conceptual Design	7.9	67	33										
License Application Design	33.8		41	34	9								
Licensing Support	5.2				37	40	23						
Final Procurement and Construction Design	22.5				73	27							
Title III Support	26.0						2	20	29	29	20		
Operating Contractor Support													
Design	9.9	11	30	31	14	11	3						
Construction	10.0					5	15	23	20	19	13	5	
Construction Management	51.9						2	20	29	29	20		
Preoperational Testing and Personnel Training	66.8					3	5	10	17	20	41		

TABLE 6-36
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenarios 7
Construction Phase: Single
Storage Concept: Cost

Date : 10/11/88
Revision : 1

COST CENTER/Cost Element	Millions in 1988 \$			
	Building Area	Facility Cost	Equipment Cost	Total Cost
CASK OPERATIONS				
Receiving	N/A	3.392	--	3.392
Cask Lag Storage	N/A	2.996	--	2.996
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	N/A
Cask Unloading				
Assembly Lag Storage				
Processing				
Interim Storage Loading/Unloading				
Building Support Facilities				
RECEIVING AND HANDLING BUILDING				
Cask Unloading	85672	11.970	10.403	22.373
Assembly Lag Storage	4864	1.477	0.855	2.332
Processing	26749	8.203	33.724	41.929
Volume Reduction	N/A	N/A	N/A	N/A
Canister/Container Closure	26474	0.203	21.063	30.060
Canister/Container Lag Storage	48384	14.934	15.371	30.305
Interim Storage Loading/Unloading	27333	0.790	15.618	24.318
WRE/Repository Cask Handling	21709	6.964	9.936	18.500
Building Support Facilities	378972 (Rev. 1)	116.024	107.037	223.061
INTERIM STORAGE OPERATIONS				
Storage Facilities	N/A	\$7300/cask	7.810	--
Storage Units	N/A		See Composables, Table 6-59	
Receiving Building	N/A	N/A	N/A	N/A
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Onsite Preparation	N/A	36.137	--	36.137
Offsite Preparation	N/A	16.293	--	16.293
Administration	N/A	2.605	0.424	3.029
Other Support Facilities	N/A	42.130	18.913	61.043

TABLE 6-57
CONSTRUCTION COSTS

Scenario 7
Construction Phase: Single
Storage Concept: Cost

Date: 10/21/00
Revision: 1

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS			10	90							
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING		N/A	N/A	N/A	N/A	N/A					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING		2	20	29	29	20					
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Container/Container Closure											
Container/Container Lag Storage											
Interim Storage Loading/Unloading											
WRS/Repository Cost Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS			17	33	33	17					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS			30	30	20 (Rev. 1)						
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 6-36
CONSTRUCTION COST DISTRIBUTION

Scenario: 7
Construction Phases: Single
Storage Concept: Cask

Date: 1/20/89
Revision: 2

COST CENTER/Cost Element	Equipment Maintenance/Replacement (2/Year)			Consumables	
	Annual	10 Year	20 Year		
CASK OPERATIONS				90.014 M/Year Fixed	
Receiving					
Cask Lag Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A		
Cask Unloading					
Assembly Lag Storage					
Processing					
Interim Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	N/A	N/A	N/A		(Rev.1)
Canister/Container Closure	1.0		1.4	Containers = \$31,000/SF Unit; \$17,000/MLN Unit	(Rev. 2)
Canister/Container Lag Storage	0.3		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
WMS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0	0.8	95	90.030 M/Year Fixed	
Storage Units				Casks = 90.197 M/Unit	
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.530 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	33.4	37.3		
Other Support Facilities	1.6	33.9	24.0		

TABLE 6-59
ANNUAL OPERATING COSTS

Scenario: 7
Construction Phase: Single
Storage Concept: Cask

Date: 1/20/89
Revision: 2

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; Inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/MRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks				
Storage loading/unloading				
Building support staff				
RECEIVING AND HANDLING BUILDING				
Prepare reactor/MRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask	4.3	\$53,900	
Unload transport casks into process cells	Rail = 615/cask PMR = 150(T);540(R) BMR = 230(T);1090(R)	1.5	\$53,900	
Containerize intact fuel	All PMR = 320/container PMR + BMR = 680/container (Rev. 1)	2.5	\$53,900	Requires all 4 cells to handle both PMR and BMR fuel
Volume-reduce/package MFBC	N/A	N/A	N/A	
Mold/decon/test container	190/container	1.5 w/o MLN 1.6 w/ MLN	\$53,900	
Canister handlings		3	\$53,900	
log storage	90/container			
storage cask loading/unloading	90/cask of 4 containers			
MRS transport cask loading	170(SF);170(MLN) (Rev. 1)			
Building support staff	N/A	146 w/o MLN 147 w/ MLN	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Storage cask preparation & closing/reopening	210/cask	4	\$53,900	If cask is reused, add 30 min. (Rev. 1)
Storage placement (incl. 45 min. to obtain new cask)	145/cask	6	\$53,900	If cask is reused, reduce by 45 min. (Rev. 2)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff (excl. Cask Mfg. Facility of II)	N/A	264	\$53,900	

TABLE 6-60
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 7
Construction Phase: Single
Storage Concept: Cask

Date: 9/16/00
Revision: 0

COST CENTER/Cost Element	%	Percent of Decommissioning Cost by Year After Last Year of Operations								
		-2	-1	0	+1	+2	+3	+4	+5	+6
CASK OPERATIONS	9							100		
Receiving										
Cask Log Storage										
WASTE HANDLING OPERATIONS										
SPENT FUEL HANDLING BUILDING	N/A									
Cask Unloading										
Assembly Log Storage										
Processing										
Interim Storage Loading/Unloading										
Building Support Facilities										
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15	
Cask Unloading										
Assembly Log Storage										
Processing										
Volume Reduction										
Canister/Container Closure										
Canister/Container Log Storage										
Interim Storage Loading/Unloading										
WCS/Repository Cost Handling										
Building Support Facilities										
INTERIM STORAGE OPERATIONS	5		60	40						
Storage Facility										
Storage Units										
Receiving Building										
BALANCE OF PLANT AND SUPPORT OPERATIONS	1								100	
Onsite Preparation										
Offsite Preparation										
Administration										
Other Support Facilities										

TABLE 6-61
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 7
Construction Phase: Two
Storage Concept: Cask

Date: 10/21/88
Revision: 2

Storage Concept: Cost		Percent of M & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6		14	32	34 (Rev. 2)									
Design														
Proof-of-Principle Tests (6 Tests)	1.0		14	34	32 (Rev. 2)									
Advanced Conceptual Design	11.7			77	23 (Rev. 2)									
License Application Design	40.6				43	55	(Rev. 2)							
Licensing Support	5.2						40	40	20 (Rev. 2)					
Final Procurement and Construction Design	27.0						80	20	(Rev. 2)					
Title III Support	29.0								20	23	26	22	9	
Operating Contractor Support														
Design	9.9			11	30	31	14	11	3					
Construction	10.0							5	15	23	20	19	13	5
Construction Management	63.2								20	23	26	22	9	
Preoperational Testing and Personnel Training	66.8							3	5	10	17	24	41	

TABLE A-62
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 7
Construction Phase: Two
Storage Concept: Cask

Date: 10/21/88
Revision: 2

COST CENTER/Cost Element	Millions in 1988 \$			
	Building Area	Facility Cost	Equipment Cost	Total Cost
CASK OPERATIONS				
Receiving	N/A	3.332	--	3.332
Cask Lag Storage	N/A	2.996	--	2.996
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Cask Unloading	31420	7.432	2.852	10.284
Assembly Lag Storage	4080	3.074	0.270	3.344
Processing	12524	9.639	7.613	17.254
Interior Storage Loading/Unloading	17170	15.682	0.439	16.121
Building Support Facilities	92916	25.146	2.923	28.069 (Rev. 1)
RECEIVING AND HANDLING BUILDING				
Cask Unloading	85672	11.970	10.403	22.373
Assembly Lag Storage	4864	1.477	0.853	2.332
Processing	26749	8.203	33.724	41.929
Volume Reduction	N/A	N/A	N/A	N/A
Canister/Container Closure	26474 (Rev. 1)	8.293	21.843	30.088
Canister/Container Lag Storage	68384	14.934	13.371	30.305
Interior Storage Loading/Unloading	27533	8.700	13.618	24.318
RRS/Repository Cask Handling	21709	6.364	9.936	16.980
Building Support Facilities	376972 (Rev. 1)	116.024	107.037	223.061
INTERIM STORAGE OPERATIONS				
Storage Facilities	N/A	\$7900/cask	7.810	--
Storage Units	N/A		See Consumables, Table 4-63	
Receiving Building	N/A	N/A	N/A	N/A
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Onsite Preparation	N/A	39.893	--	39.893 (Rev. 2)
Offsite Preparation	N/A	16.293	--	16.293
Administration	N/A	2.603	0.424	3.027
Other Support Facilities	N/A	42.130	18.913	61.043

TABLE 4-63
CONSTRUCTION COSTS

Scenario: 7
Construction Phase: Ten
Storage Concept: Cask

Date: 9/16/88
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				10	90						
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				25	45	30					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				20	20	25	25	10			
Cask Unloading											
Assembly Lag Storage											
Processing											
Vibration Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
WRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS				10	60	30					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				50	30	20					
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 6-64
CONSTRUCTION COST DISTRIBUTION

Scenario: 7
Construction Phase: Two
Storage Concept: Cask

Date : 1/20/89
Revision : 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (\$/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.014 M/Year Fixed
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby (Rev. 2)
Cask Unloading	2.0			
Assembly Lag Storage	1.0			
Processing	1.5	1.8		
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed
Building Support Facilities	1.1	1.9	12.9	
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed
Cask Unloading	0.7		3.4	
Assembly Lag Storage	1.0			
Processing	1.2	31.8	3.7	
Volume Reduction	N/A	N/A	N/A	(Rev. 1)
Canister/Container Closure	1.0		1.4	Containers = \$31,000/BF Unit; \$17,000/MLM Unit (Rev. 3)
Canister/Container Lag Storage	0.3		11.8	
Interim Storage Loading/Unloading	0.6		3.3	
RRS/Repository Cask Handling	1.4		6.6	
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit
INTERIM STORAGE OPERATIONS				
Storage Facilities	2.0	0.8	95	\$0.050 M/Year Fixed
Storage Units				Casks = \$0.197 M/Unit
Receiving Building	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	33.4	37.3	
Other Support Facilities	1.6	55.9	24.0	

TABLE 4-65
ANNUAL OPERATING COSTS

Scenario: 7
Construction Phase: Two
Storage Concept: Cask

Date: 1/20/89
Revision: 2

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading	PMR = 510/cask (Rev. 1) BMR = 1230/cask (Rev. 2)	1.5	\$53,900	Load/unload onsite transfer cask : PMR = 530; BMR = 1070
Building support staff	N/A	51	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Containerize intact fuel	All PMR = 320/container PMR + BMR = 680/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BMR
Volume-reduce/package NFBC	N/A	N/A	N/A	
Weld/decon/test containers	190/container	1.5 w/o MLM 1.6 w/ MLM	\$53,900	
Container handling: lag storage	90/container	3	\$53,900	
storage cask loading/unloading	90/cask of 4 containers			
HRS transport cask loading	170(SF);170(MLM) (Rev. 1)			
Building support staff	N/A	146 w/o MLM 147 w/ MLM	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Storage cask preparation & closing/reopening	210/cask	4	\$53,900	If cask is reused, add 30 min. (Rev. 1)
Storage placement (incl. 45 min. to obtain new cask)	145/cask	6	\$53,900	If cask is reused, reduce by 45 min. (Rev. 2)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff (excl. Cask Mfg. Facility of 11)	N/A	264	\$53,900	

TABLE 6-66
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 7
Construction Phase: Two
Storage Concept: Cash

Date: 10/11/00
Revision: 1

COST CENTER/Cost Element	%	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	0	+1	+2	+3	+4	+5
CASH OPERATIONS	9							100	
Receiving									
Cash Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cash Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cash Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
HRS/Repository Cash Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Onsite Preparation									
Offsite Preparation									
Administration									
Other-Support Facilities									

Bare, intact SF casks = 12%
(Rev. 1)

TABLE 6-67
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 7
Construction Phase: Three
Storage Concept: Cask

Date: 11/4/88
Revision: 3

		Percent of M & I Cost per Year Prior to Operations											
COST CENTER/Cost Element	Cost (Millions \$)	Percent of M & I Cost per Year Prior to Operations											
		-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	28	90	22 (Rev. 1)									
Design													
Proof-of-Principle Tests (6 Tests)	1.0	27	94	19 (Rev. 2)									
Advanced Conceptual Design	11.7	8	92	(Rev. 3)									
License Application Design	46.6		18	95	27								
Licensing Support	5.2				20	40	40						
Final Procurement and Construction Design	27.0				40	60							
Title III Support	29.8							20	23	26	22	9	
Operating Contractor Support													
Design	9.9	3	11	28	30	14	11	3 (Rev. 3)					
Construction	10.8						5	15	23	20	19	13	5
Construction Management	63.2							20	23	26	22	9	
Preoperational Testing and Personnel Training	64.8						3	5	10	17	24	41	

TABLE 6-68
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: J
Construction Phase: Three
Storage Concept: Cask

Date: 10/21/88
Revision: 2

COST CENTER/Cost Element	Millions in 1988 \$				Notes
	Building Area	Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					(1) Site development: Storage cost = \$7500/cask Dual purpose cask = \$31,000/cask
Receiving	N/A	5.165	0.829	5.994	
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					(2) Storage cask equipment = \$7.810 M Dual purpose cask equip. = \$3.940 M
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Lag Storage	4080	3.874	0.270	3.344	
Processing	12924	9.639	7.615	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	25.146	2.923	28.069 (Rev.1)	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.477	0.855	2.332	
Processing	26749	8.205	33.724	41.929	
Volume Reduction	N/A	N/A	N/A	N/A	
Canister/Container Closure	26474 (Rev. 1)	0.295	21.863	30.068	
Canister/Container Lag Storage	48384	14.934	15.371	30.305	
Interim Storage Loading/Unloading	27533	8.780	15.618	24.318	
RRS/Repository Cask Handling	21709	6.364	9.936	16.900	
Building Support Facilities	378972 (Rev. 1)	116.024	107.037	223.061	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	(2)	--	
Storage Units	N/A		See Consumables, Table 6-71		
Receiving Building	N/A	1.607	1.006	2.613	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	39.895	--	39.895 (Rev. 2)	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	42.130	18.915	61.045	

TABLE 6-69
CONSTRUCTION COSTS

Scenario: 7
 Construction Phase: Three
 Storage Concept: Cask

Date: 9/16/88
 Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS						100					
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING						75	45	30			
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING						20	20	25	25	10	
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
HRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS											
Storage Facilities						100					
Storage Units											
Receiving Building						100					
BALANCE OF PLANT AND SUPPORT OPERATIONS						50	30	20			
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 6-70
 CONSTRUCTION COST DISTRIBUTION

Scenario: 7
Construction Phase: Three
Storage Concept: Cast

Date: 1/20/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (%/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.020 M/Year Fixed
Receiving	2.0			
Cast Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby (Rev. 2)
Cast Unloading	2.0			
Assembly Lag Storage	1.0			
Processing	1.5	1.8		
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed
Building Support Facilities	1.1	1.9	12.9	
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed
Cast Unloading	0.7		3.4	
Assembly Lag Storage	1.0			
Processing	1.2	31.8	3.7	
Volume Reduction	N/A	N/A	N/A	(Rev. 1)
Canister/Container Closure	1.0		1.4	Containers = \$31,000/SF Unit; \$17,000/MLW Unit (Rev. 3)
Canister/Container Lag Storage	0.3		11.8	
Interim Storage Loading/Unloading	0.8		3.3	
HRS/Repository Cask Handling	1.4		6.6	
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit
INTERIM STORAGE OPERATIONS				
Storage Facilities	2.0	0.8	95	1st Year Ops. = \$0.006 M Fixed; Other Ops. Years = \$0.030 M/Year Cast = \$0.197 M/Unit
Storage Units				
Receiving Building	2.0			
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	33.4	37.3	
Other Support Facilities	1.6	33.9	24.0	

TABLE 6-71
ANNUAL OPERATING COSTS

Scenario 7
Construction Phase: Three
Storage Concept: Cask

Date: 1/20/89
Revision: 2

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	FTE/crew increases to 8 for first 4 years of operations
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask: 375/cask
Unload transport casks	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading	PMR = 510/cask (Rev. 1) BMR = 1230/cask (Rev. 2)	1.5	\$53,900	Load/unload onsite transfer cask; PMR = 530; BMR = 1070
Building support staff		51	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Containerize intact fuel	All PMR = 320/container PMR + BMR = 680/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BMR fuel
Value-reduce/package WFC	N/A	N/A	N/A	
Weld/decom/test canisters	190/container	1.5 w/o MLM 1.6 w/ MLM	\$53,900	
Container handling:		3	\$53,900	
ing storage	90/container			
storage cask loading/unloading	90/cask of 4 containers			
NRS transport cask loading	170(SF);170/MLM (Rev. 1)			
Building support staff	N/A	146 w/o MLM 147 w/ MLM	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	230/cask	17	\$53,900	
Storage cask preparation & closing/reopening	210/cask	4	\$53,900	If cask is reused, add 30 min. (Rev. 1)
Storage placement (incl. 45 min. to obtain new cask)	145/cask	6	\$53,900	If cask is reused, reduce by 45 min. (Rev. 2)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff (excl. Cask Mfg. Facility of 11)	N/A	264	\$53,900	

TABLE 6-72
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 7
 Construction Phase: Three
 Storage Concept: Cask

Date: 10/11/88
 Revision: 1

COST CENTER/Cost Element	%	Percent of Decommissioning Cost by Year After Last Year of Operations								
		-2	-1	0	+1	+2	+3	+4	+5	+6
CASK OPERATIONS	5							100		
Receiving										
Cask Log Storage										
WASTE HANDLING OPERATIONS										
SPENT FUEL HANDLING BUILDING	12				10	80	10			
Cask Unloading										
Assembly Log Storage										
Processing										
Interim Storage Loading/Unloading										
Building Support Facilities										
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15	
Cask Unloading										
Assembly Log Storage										
Processing										
Volume Reduction										
Canister/Container Closure										
Canister/Container Log Storage										
Interim Storage Loading/Unloading										
WRS/Repository Cost Handling										
Building Support Facilities										
INTERIM STORAGE OPERATIONS	5		60	40						
Storage Facilities										
Storage Units										
Receiving Building										
BALANCE OF PLANT AND SUPPORT OPERATIONS	1								100	
Onsite Preparation										
Offsite Preparation										
Administration										
Other Support Facilities										

Note, intact SF costs = 12% (Rev. 1)

TABLE 6-73
 DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 7
Construction Phase: Single
Storage Concept: Drywell

Date: 10/21/88
Revision: 2

COST CENTER/Cost Element	Cost (Millions \$)	Percent of M & I Cost per Year Prior to Operations											
		-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	0.6	55	45 (Rev. 1)										
Design													
Proof-of-Principle Tests (6 Tests)	1.0	55	45 (Rev. 2)										
Advanced Conceptual Design	7.9	67	33										
License Application Design	33.8		41	54	5								
Licensing Support	5.2				37	40	23						
Final Procurement and Construction Design	22.5				73	27							
Title III Support	26.0						2	20	29	29	20		
Operating Contractor Support													
Design	9.9	11	30	31	14	11	3						
Construction	10.8					5	15	23	20	19	13	5	
Construction Management	51.9						2	20	29	29	20		
Preoperational Testing and Personnel Training	66.8					3	5	10	17	24	41		

TABLE 6-74
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario 7
Construction Phase: Single
Storage Concept: Drywell

Date: 11/4/00
Revision: 3

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		* Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	3.352	--	3.352	(1) Site development costs included in drywell unit cost. See consumables, Table 6-77
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	N/A	
Cask Unloading					
Assembly Lag Storage					
Processing					
Interior Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.477	0.835	2.332	
Processing	26749	8.205	33.724	41.929	
Volume Reduction	N/A	N/A	N/A	N/A	
Canister/Container Closure	26474 (Rev. 1)	9.205	21.063	30.068	
Canister/Container Lag Storage	46384	14.934	15.371	30.305	
Interior Storage Loading/Unloading	27533	8.700	15.610	24.310	
HRS/Repository Cask Handling	21709	6.564	9.936	16.500	
Building Support Facilities	376972 (Rev. 1)	116.024	107.037	223.061	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	3.311	--	
Storage Units	N/A		See Consumables, Table 6-77		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	20.638	--	20.638 (Rev. 2)	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.005	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 3)	

TABLE 6-75
CONSTRUCTION COSTS

Scenarios 7
Construction Phase: Single
Storage Concept: Drywell

Date : 10/21/00
Revision : 1

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS			10	90							
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING		N/A	N/A	N/A	N/A	N/A					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING		2	20	29	29	20					
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
HRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS			17	33	33	17					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS			30	30	20 (Rev. 1)						
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 4-7A
CONSTRUCTION COST DISTRIBUTION

Scenario: 7
Construction Phase: Single
Storage Concept: Drywell

Date: 1/20/89
Revision: 2

COST CENTER/Cost Element	Equipment Maintenance/Replacement (\$/Year)			Consumption
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.014 M/Year Fixed
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Cask Unloading				
Assembly Lag Storage				
Processing				
Interim Storage Loading/Unloading				
Building Support Facilities				
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed
Cask Unloading	0.7		3.4	
Assembly Lag Storage	1.0			
Processing	1.2	31.8	3.7	
Volume Reduction	N/A	N/A	N/A	(Rev. 1)
Canister/Container Closure	1.0		1.4	Containers = \$31,000/SF Unit; (Rev. 2)
				\$17,000/MLW Unit
Canister/Container Lag Storage	0.5		11.8	
Interim Storage Loading/Unloading	0.6		3.3	
WRS/Repository Cask Handling	1.4		6.6	
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit
INTERIM STORAGE OPERATIONS				
Storage Facilities	1.6	3.0	58	\$0.050 M/Year Fixed
Storage Units				SF Container Drywell (30" dia.) = \$13,100/Unit;
				MLW (30" dia.) = \$12,200/Unit (Rev. 2)
Receiving Building	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	35.4	37.3	
Other Support Facilities	1.6	55.9	24.0	

TABLE 6-77
ANNUAL OPERATING COSTS

Scenario 7
Construction Phase: Single
Storage Concept: Drywell

Date: 10/11/88
Revision: 1

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$33,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for meshdown)				
Unload transport casks				
Storage loading/unloading				
Building support staff				
RECEIVING AND HANDLING BUILDING				
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for meshdown)	Truck = 515/cask Rail = 615/cask	4.3	\$33,900	
Unload transport casks into process cells	PMR = 190(T);540(R) DWR = 230(T);1000(R)	1.5	\$33,900	
Containerize intact fuel	All PMR = 320/container PMR + DWR = 600/container	2.9	\$33,900	Requires all 4 cells to handle both PMR and DWR fuel
Volume-reduce/package WFC	N/A	N/A	N/A	
Build/decan/test containers	190/container	1.5 w/o HLW 1.6 w/ HLW	\$33,900	
Container handling:		3	\$33,900	
log storage	90/container			
transporter loading/unloading	45/transporter load			
WRS transport cask loading	170(SF);170(MLW) (Rev. 1)			
Building support staff	N/A	146 w/o HLW 147 w/ HLW	\$33,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter operation (incl. loading of shield plug)	60/trip	1	\$33,900	If drywell is reused, reduce by 15 min. (Rev. 1)
Storage placement	50/drywell	3.5 w/o HLW 2.7 w/ HLW	\$33,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$33,900	

TABLE 6-7B
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 7
Construction Phase: Single
Storage Concept: Drywell

Date: 9/16/00
Revision: 0

COST CENTER/Cost Element	%	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	0	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Log Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	N/A								
Cask Unloading									
Assembly Log Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Log Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Log Storage									
Interim Storage Loading/Unloading									
NRC/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facility									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

TABLE 6-79
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 7
Construction Phase: Yes
Storage Concept: Drywell

Date: 10/21/00
Revision: 2

		Percent of M & I Cost per Year Prior to Operations													
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	
MANAGEMENT AND INTEGRATION															
Site Selection/Investigation	8.6		14	52	34 (Rev. 2)										
Design															
Proof-of-Principle Tests (6 Tests)	1.0		14	54	32 (Rev. 2)										
Advanced Conceptual Design	11.7			77	23 (Rev. 2)										
License Application Design	40.6				45	55 (Rev. 2)									
Licensing Support	5.2						40	40	20 (Rev. 2)						
Final Procurement and Construction Design	27.0						80	20 (Rev. 2)							
Title III Support	29.8								20	23	26	22	9		
Operating Contractor Support															
Design	9.9			11	30	31	14	11	3						
Construction	10.8							5	15	23	20	19	13	5	
Construction Management	63.2								20	23	26	22	9		
Preoperational Testing and Personnel Training	64.8							3	5	10	17	24	41		

TABLE 6-80
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 7
Construction Phases Two
Storage Concept: Drywell

Date: 11/4/00
Revision: 3

COST CENTER/Cost Element	Millions in 1988 \$				Notes
	Building Area	Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	3.332	--	3.332	(1) Site development cost for drywell included in drywell unit cost. See consumables, Table 6-B5
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.892	10.284	
Assembly Lag Storage	4080	3.074	0.270	3.344	
Processing	12524	9.639	7.615	17.294	
Interior Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	25.144	2.923	28.069 (Rev. 1)	
RECEIVING AND MODELING BUILDING					
Cask Unloading	85672	11.978	10.403	22.373	
Assembly Lag Storage	4864	1.477	0.835	2.332	
Processing	26749	8.203	33.724	41.929	
Volume Reduction	N/A	N/A	N/A	N/A	
Canister/Container Closure	26474 (Rev. 1)	8.205	21.863	30.068	
Canister/Container Lag Storage	48384	14.934	15.371	30.305	
Interior Storage Loading/Unloading	27333	8.700	15.618	24.318	
HRS/Repository Cost Handling	21709	6.564	9.936	16.500	
Building Support Facilities	376972 (Rev. 1)	116.024	107.037	223.061	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	3.311	--	
Storage Units	N/A		See Consumables, Table 6-B5		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	32.390	--	32.390 (Rev. 2)	
Offsite Preparation	N/A	16.293	--	16.293	
Administration	N/A	2.603	0.424	3.027	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 3)	

TABLE 6-B1
CONSTRUCTION COSTS

Scenario: 7
Construction Phases: Two
Storage Concept: Drywell

Date: 9/6/88
Revision: 0

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				10	90						
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				25	45	30					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interin Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				20	20	25	25	10			
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interin Storage Loading/Unloading											
WRS/Repository Cost Handling											
Building Support Facilities											
INTERIN STORAGE OPERATIONS				10	60	30					
Storage Facility											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				50	30	20					
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 6-82
CONSTRUCTION COST DISTRIBUTION

Scenario: 7
Construction Phases: Two
Storage Concept: Drywell

Date: 1/20/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (%/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.014 M/Year Fixed
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby (Rev. 2)
Cask Unloading	2.0			
Assembly Lag Storage	1.0			
Processing	1.3	1.8		
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed (Rev. 1)
Building Support Facilities	1.1	1.9	12.9	
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed
Cask Unloading	0.7		3.4	
Assembly Lag Storage	1.0			
Processing	1.2	31.8	3.7	
Volume Reduction	N/A	N/A	N/A	(Rev. 1)
Canister/Container Closure	1.0		1.4	Containers = \$31,000/SF Unit; \$17,000/MLM Unit (Rev. 3)
Canister/Container Lag Storage	0.5		11.8	
Interim Storage Loading/Unloading	0.6		3.3	
WES/Repository Cask Handling	1.4		6.6	
Building Support Facilities	0.7	11.1	18.2	(Rev. 1) Buses = \$100/Unit
INTERIM STORAGE OPERATIONS				
Storage Facilities	2.0	0.8	95	\$0.090 M/Year Fixed PWR and BWR Intact SF Drywell (30" dia.) = \$13,000/Unit; SF Container Drywell (30" dia.) = \$13,100/Unit; MLM Canister Drywell (30" dia.) = \$12,200/Unit (Rev. 3)
Storage Units				
Receiving Building	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.530 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	33.4	37.3	
Other Support Facilities	1.6	55.9	24.0	

TABLE 6-83
ANNUAL OPERATING COSTS

Scenario: 7
Construction Phase: Two
Storage Concept: Drywell

Date: 10/11/88
Revision: 1

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 315/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask: 375/cask
Unload transport casks	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/4 assemblies BMR = 95/8 assemblies (Rev. 1)	1.5	\$53,900	Load/unload onsite transfer cask: PMR = 330; BMR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 315/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and canister fuel	All PMR = 320/container PMR + BMR = 680/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BMR fuel
Volume-reduce/package NFBC	N/A	N/A	N/A	
Weld/decon/test containers	190/canister	1.5 w/o HLM 1.6 w/ HLM	\$53,900	
Container handling: lag storage	90/container	3	\$53,900	
transporter loading/unloading	45/transport load			
NRS transport cask loading	170(SF);170(HLM) (Rev. 1)			
Building support staff	N/A	146 w/o HLM 147 w/ HLM	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter Operation (incl. loading of shield plug, and intact SF basket as required)	60/trip from R & H Building 75/trip from SFHB	1	\$53,900	If drywell is reused, reduce by 15 min. (Rev. 1)
Storage placement	50/drywell	3.5 w/o HLM 2.7 w/ HLM	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 6-84
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario 7
Construction Phase: Top
Storage Concept: Drywell

Date : 10/11/00
Revision : 1

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	0	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
HRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Basis Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Note, intact SF drywells = 12%
(Rev. 1)

TABLE 6-05
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario 7
Construction Phase: Three
Storage Concept: Drywell

Date: 11/4/88
Revision: 3

		Percent of M & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5	+6
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6	28	30	22 (Rev. 1)										
Design														
Proof-of-Principle Tests (6 Tests)	1.0	27	34	19 (Rev. 2)										
Advanced Conceptual Design	11.7	8	92	(Rev. 3)										
License Application Design	40.6		18	55	27									
Licensing Support	3.2				20	40	40							
Final Procurement and Construction Design	27.0				40	60								
Title III Support	29.8							20	23	26	22	9		
Operating Contractor Support														
Design	9.9	3	11	28	30	14	11	3 (Rev. 3)						
Construction	10.8						5	15	23	20	19	13	5	
Construction Management	63.2							20	23	26	22	9		
Preoperational Testing and Personnel Training	66.8						3	9	10	17	24	41		

TABLE 6-86
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 7
Construction Phase: Three
Storage Concepts: Drywell

Date: 11/4/88
Revision: 3

COST CENTER/Cost Element	Millions in 1988 \$				Notes
	Building Area	Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					(1) Site development cost included in drywell unit cost. See consumables, Table 6-89
Receiving	N/A	5.165	0.829	5.994	Dual purpose cask site development cost = \$31,000/cask
Cask Lag Storage	N/A	2.996	--	2.996	(2) Drywell equipment cost = \$3.311 M
WASTE HANDLING OPERATIONS					Dual purpose cask equip. = \$3.940 M
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Lag Storage	4880	3.074	0.270	3.344	
Processing	17524	9.639	7.615	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	25.146	2.923	28.069 (Rev. 1)	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.463	22.373	
Assembly Lag Storage	4864	1.477	0.853	2.332	
Processing	26749	8.203	33.724	41.929	
Volume Reduction	N/A	N/A	N/A	N/A	
Canister/Container Closure	26474 (Rev. 1)	8.203	21.063	30.068	
Canister/Container Lag Storage	48304	14.934	15.371	30.305	
Interim Storage Loading/Unloading	27333	8.700	15.618	24.318	
RRS/Repository Cost Handling	21709	6.564	9.936	16.500	
Building Support Facilities	376972 (Rev. 1)	116.024	107.037	223.061	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	(2)	--	
Storage Units	N/A		See Consumables, Table 6-89		
Receiving Building	N/A	1.607	1.006	2.613	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	32.390	--	32.390 (Rev. 2)	
Offsite Preparation	N/A	16.293	--	16.293	
Administration	N/A	2.603	0.424	3.027	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 3)	

TABLE 6-87
CONSTRUCTION COSTS

Scenario: 7
Construction Phase: Three
Storage Concept: Drywell

Date : 9/16/88
Revision : 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS						100					
Receiving											
Cask Log Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING						25	45	30			
Cask Unloading											
Assembly Log Storage											
Processing											
Interior Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND UNLOADING BUILDING						20	20	25	25	10	
Cask Unloading											
Assembly Log Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Log Storage											
Interior Storage Loading/Unloading											
HRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS											
Storage Facilities						100					
Storage Units											
Receiving Building						100					
BALANCE OF PLANT AND SUPPORT OPERATIONS						50	30	20			
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 4-88
CONSTRUCTION COST DISTRIBUTION

Scenario: 7
Construction Phase: Three
Storage Concept: Drywell

Date: 1/20/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (%/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.020 M/Year Fixed
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby (Rev. 2)
Cask Unloading	2.0			
Assembly Lag Storage	1.0			
Processing	1.5	1.8		
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed
Building Support Facilities	1.1	1.9	12.9	
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed
Cask Unloading	0.7		3.4	
Assembly Lag Storage	1.0			
Processing	1.2	31.8	3.7	
Volume Reduction	N/A	N/A	N/A	(Rev. 1)
Canister/Container Closure	1.0		1.4	Containers = \$31,000/SF Unit; \$17,000/HLW Unit (Rev. 3)
Canister/Container Lag Storage	0.3		11.8	
Interim Storage Loading/Unloading	0.6		3.3	
MRS/Repository Cask Handling	1.4		6.6	
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit
INTERIM STORAGE OPERATIONS				
Storage Facilities	1.6	3.0	58	1st Year Ops. = \$0.006 M; Other Ops. Years = \$0.030 M/Year Bare, Intact SF Drywell (30" dia.) = \$13,000/Unit; SF Container Drywell (30" dia.) = \$13,100/Unit; HLW Canister Drywell (30" dia.) = \$12,200/Unit (Rev. 3)
Storage Units				
Receiving Building	2.0			
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	35.4	37.3	
Other Support Facilities	1.6	55.9	24.0	

TABLE 6-89
ANNUAL OPERATING COSTS

Scenario: 7
Construction Phase: Three
Storage Concept: Drywell

Date: 10/11/88
Revision: 1

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	FTE/crew increases to 8 for first 4 years of operation
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask: 375/cask
Unload transport casks	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/4 assemblies BWR = 95/8 assemblies (Rev. 1)	1.5	\$53,900	Load/unload onsite transfer cask: PMR = 530; BWR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and canister fuel	All PMR = 320/container PMR + BWR = 680/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BWR fuel
Volume-reduce/package WFC	N/A	N/A	N/A	
Hold/decom/test containers	190/canister	1.5 w/o HLW 1.6 w/ HLW	\$53,900	
Container handling:		3	\$53,900	
lag storage	90/container			
transporter loading/unloading	45/transport load			
WRS transport cask loading	170(SF);170(MLW) (Rev. 1)			
Building support staff	N/A	146 w/o HLW 147 w/ HLW	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	230/cask	17	\$53,900	
Transporter Operation (incl. loading of shield plug, and intact SF basket as required)	60/trip from R & H Building 75/trip from SFMB	1	\$53,900	If drywell is reused, reduce by 15 min. (Rev. 1)
Storage placement	30/drywell	3.5 w/o HLW 2.7 w/ HLW	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 6-90
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 7
Construction Phase: Three
Storage Concept: Drywell

Date: 10/11/00
Revision: 1

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
RMS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Baro, intact HF drywells = 122
(Rev. 1)

TABLE 6-91
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 7
Construction Phase: Single
Storage Concept: Vault

Date: 10/10/88
Revision: 0

		Percent of M & I Cost per Year Prior to Operations											
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	55	45										
Design													
Proof-of-Principle Tests (6 Tests)	1.0	55	45										
Advanced Conceptual Design	14.7	47	33										
License Application Design	43.2		41	55	4								
Licensing Support	5.2				37	40	23						
Final Procurement and Construction Design	29.5				80	20							
Title III Support	31.0						10	24	24	24	18		
Operating Contractor Support													
Design	9.9	11	30	31	14	11	3						
Construction	10.8					5	15	23	20	19	13	5	
Construction Management	67.5						10	24	24	24	18		
Preoperational Testing and Personnel Training	66.8					3	5	10	17	24	41		

TABLE 6-92
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 7
Construction Phase: Single
Storage Concept: Vault

Date: 11/4/88
Revision: 1

COST CENTER/Cont Element	Millions in 1988 \$				Notes
	Building Area	Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					(1) Fixed cost per storage building
Receiving	N/A	3.352	--	3.352	
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	N/A	
Cask Unloading					
Assembly Lag Storage					
Processing					
Interim Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.477	0.855	2.332	
Processing	26749	8.205	33.724	41.929	
Volume Reduction	N/A	N/A	N/A	N/A	
Canister/Container Closure	26474	8.205	21.863	30.068	
Canister/Container Lag Storage	48384	14.934	15.371	30.305	
Interim Storage Loading/Unloading	27533	8.780	15.618	24.318	
HRS/Repository Cask Handling	21709	4.564	9.936	16.500	
Building Support Facilities	376972	116.024	107.037	223.061	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	16.040	9.770	25.810 (1)	
Storage Units	N/A		See Consumables, Table 4-95		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	42.858	--	42.858	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 1)	

TABLE 4-93
CONSTRUCTION COSTS

Scenario: 7
Construction Phase: Single
Storage Concept: Vault

Date: 10/10/00
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cont Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS			10	90							
Receiving											
Cask Log Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING OUTLIDG		N/A	N/A	N/A	N/A	N/A					
Cask Unloading											
Assembly Log Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING		2	20	29	29	20					
Cask Unloading											
Assembly Log Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Log Storage											
Interim Storage Loading/Unloading											
WRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS		10	24	24	24	18					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS			50	30	20						
Offsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 6-94
CONSTRUCTION COST DISTRIBUTION

Scenarios 7
Construction Phase: Single
Storage Concept: Vault

Date : 1/20/89
Revision : 2

COST CENTER/Cost Element	Equipment Maintenance/Replacement (1/Year)			Consumables	Notes
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.014 M/Year Fixed	(1) Cost per storage building
Receiving					
Cask Lag Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A		
Cask Unloading					
Assembly Lag Storage					
Processing					
Interim Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	N/A	N/A	N/A		
Canister/Container Closure	1.0		1.4	Containers = \$31,000/SF Unit; \$17,000/MLM Unit	(Rev. 2)
Canister/Container Lag Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
RMS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0 (1)	0.3 (1)	0.6 (1)	\$0.827 M/Year Fixed (1); \$0.0006 M/Year/Position SF Container or MLM Canister Position (30") = \$36,700/Unit	(Rev. 1)
Storage Units					
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.350 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	55.9	24.0		

TABLE 6-95
ANNUAL OPERATING COSTS

Scenario: 7
Construction Phase: Single
Storage Concept: Vault

Date: 10/18/00
Revision: 0

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$33,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for shutdown) Unload transport casks				
Storage loading/unloading				
Building support staff				
RECEIVING AND HANDLING BUILDING				
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for shutdown) Unload transport casks into process cells	Truck = \$15/cask Rail = \$15/cask PWR = 150(T);540(R) BWR = 230(T);1000(R) All PWR = 320/container PWR + BWR = 680/container	4.3 1.3	\$33,900 \$33,900	
Containerize intact fuel	All PWR = 320/container PWR + BWR = 680/container	2.5	\$33,900	Requires all 4 cells to handle both PWR and BWR fuel
Volume-reduce/package W/DC Hold/docum/test containers	N/A 190/container	N/A 1.3 w/o HLW 1.6 w/ HLW	N/A \$33,900	
Container handling: ing storage transporter loading/unloading WRS transport cask loading Building support staff	90/container 45/transporter load 170(SF);170(MLW) N/A	3 146 w/o HLW 147 w/ HLW	\$33,900 \$33,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff Transporter operation Storage placement	N/A 90/trip 85/position w/o HLW 90/position w/ HLW	N/A 2 32 w/o HLW 21.5 w/ HLW	N/A \$33,900 \$33,900	Time based on 13,000 RTU onsite storage
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$33,900	

TABLE 6-96
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 7
 Construction Phase: Single
 Storage Concept: Vault

Date: 10/10/00
 Revision: 0

COST CENTER/Cost Element	%	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	0	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	N/A								
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Cask/Container Closure									
Cask/Container Lag Storage									
Interim Storage Loading/Unloading									
WMS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		20	40	40				
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

TABLE A-97
 DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 7
Construction Phase: Two
Storage Concept: Vault

Date: 10/10/89
Revision: 0

		Percent of M & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6		14	92	34									
Design														
Proof-of-Principle Tests (6 Tests)	1.0		14	93	41									
Advanced Conceptual Design	18.5		8	92										
License Application Design	30.0			14	99	31								
Licensing Support	9.2					17	48	48	3					
Final Procurement and Construction Design	34.0					33	67							
Title III Support	34.8								77	30	24	14	5	
Operating Contractor Support														
Design	9.9		3	11	28	30	14	11	3					
Construction	10.8							9	19	23	20	19	13	9
Construction Management	78.8								27	30	24	14	5	
Preoperational Testing and Personnel Training	66.8							3	9	10	17	24	41	

TABLE 6-98
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 7
Construction Phase: Two
Storage Concepts: Vault

Date: 11/4/88
Revision: 1

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	3.352	--	3.352	(1) Fixed cost per storage building
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.832	10.264	
Assembly Lag Storage	4000	3.074	0.270	3.344	
Processing	12524	9.639	7.615	17.254	
Interin Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	25.146	2.923	28.069	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85472	11.970	10.403	22.373	
Assembly Lag Storage	4064	1.477	0.833	2.312	
Processing	26749	8.203	33.724	41.927	
Volume Reduction	N/A	N/A	N/A	N/A	
Container/Container Closure	26474	8.203	21.863	30.066	
Container/Container Lag Storage	48384	14.934	15.371	30.305	
Interin Storage Loading/Unloading	27333	8.700	15.618	24.318	
WBS/Repository Cask Handling	21709	6.364	9.936	16.300	
Building Support Facilities	376972	116.024	107.037	223.061	
INTERIN STORAGE OPERATIONS					
Storage Facilities	N/A	16.040	9.770	25.810 (1)	
Storage Units	N/A		See Consumables, Table 6-101		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	46.610	--	46.610	
Offsite Preparation	N/A	16.293	--	16.293	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 1)	

TABLE 6-99
CONSTRUCTION COSTS

Scenario: 7
Construction Phases: Two
Storage Concept: Vault

Date: 10/10/88
Revision: 0

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				10	90						
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				25	45	30					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				20	20	25	25	10			
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
WHD/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS				33	37	30					
Storage Facilities											
Storage Batts											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				30	30	20					
Basite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 6-100
CONSTRUCTION COST DISTRIBUTION

Scenario: 7
Construction Phases Two
Storage Concept: Vault

Date: 1/20/87
Revision: 2

COST CENTER/Cost Element	Equipment Maintenance/Replacement (1/Year)			Consumables	Notes
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.014 M/Year Fixed	(1) Cost per storage building
Receiving					
Cask Lag Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby	(Rev. 1)
Cask Unloading	2.0				
Assembly Lag Storage	1.0				
Processing	1.5	1.8			
Interim Storage Loading/Unloading	1.2		24.0	Transfer Costs = \$3.9 M Fixed	
Building Support Facilities	1.1	1.9	12.9		
RECEIVING AND HANDLING BUILDING				\$6.198 M/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	N/A	N/A	N/A		
Canister/Container Closure	1.0		1.4	Containers = \$31,000/SF Unit; \$17,000/HLW Unit	(Rev. 2)
Canister/Container Lag Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
AMS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0 (1)	0.3 (1)	0.6 (1)	\$0.827 M/Year Fixed (1); \$0.0006 M/Year/Position (Rev. 1) SF Container or HLW Canister Position (30") = \$36,700/Unit; Bare, Intact SF Position (30") = \$36,700/Unit	
Storage Units					
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	55.9	24.0		

TABLE 6-101
ANNUAL OPERATING COSTS

Scenario: 7
Construction Phase: Two
Storage Concept: Vault

Date: 10/18/88
Revision: 0

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/MRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PWR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PWR = 95/4 assemblies BWR = 95/8 assemblies	1.5	\$53,900	Load/unload onsite transfer cask : PWR = 530; BWR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/MRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PWR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and canister fuel	All PWR = 320/container PWR + BWR = 680/container	2.5	\$53,900	Requires all 4 cells to handle both PWR and BWR fuel
Volume-reduce/package NFBC	N/A	N/A	N/A	
Weld/decon/test containers	190/canister	1.5 w/o HLM 1.6 w/ HLM	\$53,900	
Container handling:		3	\$53,900	
lag storage	90/container			
transporter loading/unloading	45/transport load			
MRS transport cask loading	170(SF);170(HLM)			
Building support staff	N/A	146 w/o HLM 147 w/ HLM	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter Operation (incl. loading of intact SF basket as required)	85/trip from R & H Building 97/trip from SFNB	2 3	\$53,900	Times based on 15,000 MTU onsite storage
Storage placement	85/position w/o HLM 90/position w/ HLM 80/bare, intact SF position	32 w/o HLM 21.5 w/ HLM 21.5	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 6-102
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenarios 7
Construction Phase Two
Storage Concept: Vault

Date : 10/10/00
Revision : 0

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Interior Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interior Storage Loading/Unloading									
RRB/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		20	40	40				
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1								100
Bolt Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Baro, intact SF vault = 12%

TABLE 6-103
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 7
Construction Phase: Three
Storage Concept: Vault

Date: 11/4/88
Revision: 1

		Percent of M & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5	+6
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6	27	30	23										
Design														
Proof-of-Principle Tests (6 Tests)	1.0	27	33	18										
Advanced Conceptual Design	18.3	8	92		(Rev. 1)									
License Application Design	30.0		18	33	27									
Licensing Support	3.2				20	40	40							
Final Procurement and Construction Design	34.0				40	60								
Title III Support	34.8							30	30	23	14	3		
Operating Contractor Support														
Design	9.9	3	11	28	38	14	11	3	(Rev. 1)					
Construction	18.8						5	15	23	20	19	13	3	
Construction Management	78.8							30	30	23	14	3		
Preoperational Testing and Personnel Training	66.8						3	5	10	17	24	41		

TABLE 6-104
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 7
Construction Phase: Three
Storage Concept: Vault

Date: 11/4/88
Revision: 1

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	5.165	0.829	5.994	(1) Fixed cost per storage building
Cask Log Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					(2) Dual purpose cask: Site development = 831,000/cask; Equipment = 83,940 M (Rev. 1)
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Log Storage	4080	3.074	0.270	3.344	
Processing	12524	9.639	7.615	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	25.146	2.923	28.069	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	89672	11.970	10.403	22.373	
Assembly Log Storage	4864	1.477	0.853	2.332	
Processing	26749	8.205	33.724	41.929	
Volume Reduction	N/A	N/A	N/A	N/A	
Canister/Container Closure	26474	8.205	21.863	30.068	
Canister/Container Log Storage	48384	14.934	15.371	30.305	
Interim Storage Loading/Unloading	27533	8.700	15.618	24.318	
NRS/Repository Cost Handling	21789	6.364	9.936	16.300	
Building Support Facilities	376972	116.024	107.037	223.061	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	16.040	9.770	25.810 (1 & 2)	(Rev. 1)
Storage Units	N/A		See Consoles, Table 6-107		
Receiving Building	N/A	1.607	1.006	2.613	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	46.610	--	46.610	
Offsite Preparation	N/A	16.293	--	16.293	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060	(Rev. 1)

TABLE 6-105
CONSTRUCTION COSTS

Scenario: 7
Construction Phases: Three
Storage Concepts: Vault

Date: 10/10/00
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS						100					
Receiving											
Cost Log Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING						25	45	30			
Cask Unloading											
Assembly Log Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING						20	20	25	25	10	
Cask Unloading											
Assembly Log Storage											
Processing											
Volume Reduction											
Container/Container Closure											
Container/Container Log Storage											
Interim Storage Loading/Unloading											
HRS/Repository Cost Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS											
Storage Facilities						34	37	27			
Storage Units											
Receiving Building						100					
BALANCE OF PLANT AND SUPPORT OPERATIONS						30	30	20			
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 6-10a
CONSTRUCTION COST DISTRIBUTION

Scenarios 7
Construction Phases Three
Storage Concept: Vault

Date : 1/20/89
Revision : 2

COST CENTER/Cost Element	Equipment Maintenance/Replacement (X/Year)			Consumables	Notes
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.020 M/Year Fixed	(1) Cost per storage building
Receiving					
Cask Lag Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby	(Rev. 1)
Cask Unloading	2.0				
Assembly Lag Storage	1.0				
Processing	1.5	1.8			
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed	
Building Support Facilities	1.1	1.9	12.9		
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	N/A	N/A	N/A		
Canister/Container Closure	1.0		1.4	Containers = \$31,000/SF Unit; \$17,000/MLM Unit	(Rev. 2)
Canister/Container Lag Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
WRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0 (1)	0.3 (1)	0.6 (1)	1st Year Ops. = \$0.006 M Other Ops. Years = \$0.827 M/Year Fixed (1); \$0.0006 M/Year/Position (Rev. 1) SF Container or MLM Canister Position (30") = \$36,700/Unit; Bare, Intact SF Position (30") = \$36,700/Unit	
Storage Units					
Receiving Building	2.0				
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	35.9	24.0		

TABLE 6-107
ANNUAL OPERATING COSTS

Scenario: 7
Construction Phase: Three
Storage Concept: Vault

Date : 10/18/88
Revision : 0

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	FTE/crow increases to 8 for first 4 years of operation
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/4 assemblies BMR = 95/8 assemblies	1.5	\$53,900	Load/unload onsite transfer cask : PMR = 530; BMR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and canister fuel	All PMR = 320/container PMR + BMR = 680/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BMR fuel
Volume-reduce/package NFBC	N/A	N/A	N/A	
Weld/decon/test containers	190/canister	1.5 w/o HLN 1.6 w/ HLN	\$53,900	
Container handling:		3	\$53,900	
lag storage	90/container			
transporter loading/unloading	45/transport load			
NRS transport cask loading	170(SF);170(HLN)			
Building support staff	N/A	146 w/o HLN 147 w/ HLN	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	230/cask	17	\$53,900	
Transporter Operation (incl. loading of intact SF basket as required)	85/trip from R & H Building 95/trip from SFHB	2 3	\$53,900	Times based on 13,000 NTU onsite storage
Storage placement	85/position w/o HLN 90/position w/ HLN 80/bare, intact SF position	32 w/o HLN 21.5 w/ HLN 21.5	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 6-10B
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario 7
Construction Phase Three
Storage Concept: Vault

Date : 10/10/00
Revision : 0

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Log Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	00	10		
Cask Unloading									
Assembly Log Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Log Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Log Storage									
Interim Storage Loading/Unloading									
IRS/Depository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		20	40	40				
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Barv, intact SF vault = 12%

TABLE 6-109
DECOMMISSIONING COSTS AND DISTRIBUTION

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 6-4
Scenarios 6 & 7 Single Phase Cask or Drywell Storage

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 6-5
Scenarios 6 & 7 Two Phase Cask or Drywell Storage

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 6-6
Scenarios 6 & 7 Three Phase Cask or Drywell Storage

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 6-7
Scenarios 6 & 7 Single Phase Vault Storage

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 6-8
Scenarios 6 & 7 Two Phase Vault Storage

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 6-9
Scenarios 6 & 7 Three Phase Vault Storage

SECTION 7

SCENARIOS 8 AND 9

The basic functions of the MRS presented in the Conceptual Design Report (CDR) apply to Scenarios 8 and 9, although the consolidated fuel rods are placed directly into the emplacement container. Since the MRS produces the final disposal container, high level waste (HLW) may be received by the MRS. For Scenario 8, a container is returned to the MRS for repair or replacement if it fails to meet the inspection criteria at the repository. Figures 7-1, 7-2, and 7-3 indicate the basic flow for this scenario, including phased construction.

7.1 SPECIFIC CRITERIA AND ASSUMPTIONS

Design parameters for Scenarios 8 and 9 are based on criteria and assumptions specific to these scenarios. These criteria and assumptions are in addition to, or modifications of, those presented in Section 2.

7.1.1 SCENARIO CRITERIA

The following criteria are specific to Scenarios 8 and 9 and are derived from a) TSLCC assumptions, b) the study scope of work, c) meetings of the study participants, and/or d) Task A Report. Scenarios 8 and 9 criteria are as follows:

- (1) MRS will place spent fuel directly into 26-inch diameter stainless steel emplacement containers (as shown in Section 1) having a capacity of 6 consolidated PWR, 18 consolidated BWR, 3 intact PWR, or 6 intact BWR fuel assemblies. (b, c, and d)
- (2) Rail casks from MRS to the repository have a capacity of 4 repository emplacement containers. (c)
- (3) Containers produced by the MRS will be inspected at the repository during cask unloading operations. (b, c, and d)
- (4) For Scenario 8, defective containers received at the repository will be returned to the MRS for repair or replacement. (b, c, and d)
- (5) Less than 1% of the containers will be defective and will require repair or replacement. (c)
- (6) Shredded MFBC will be placed in the emplacement containers as shown in the Task A Report. (a, c, and d)

Notes:

1) Scenario 8 only

Figure 7-1
Scenarios 8 & 9 Single Phase Construction

Notes:

1) Scenario 8 only

Figure 7-2
Scenarios 8 & 9 Two Phase Construction

Figure 7-3
Scenarios 8 & 9 Three Phase Construction

7.1.2 SCENARIO ASSUMPTIONS

The following is applicable to only Scenarios 8 and/or 9:

- (1) Consolidation equipment can be modified to form trapezoidal fuel bundles for insertion into the container.
- (2) Canister upender can be modified to accommodate the 26-inch container and to rotate the container in 60° increments for proper loading, without an appreciable increase in cost.
- (3) Canister closure, decontamination, and weld NDE equipment can be modified to accept the container with negligible cost impact.
- (4) Clean canister carousel can be modified to accommodate the 26-inch container with no cost impact.
- (5) Containers are fabricated with solid, fixed internal spacers or dividers to maintain the trapezoidal configuration of the fuel rod bundle during horizontal container loading operations.
- (6) For Scenario 8, repair/replacement operations for containers returned from the repository can be performed as an off-normal or scheduled basis and will not interrupt normal operations.
- (7) Process cell area will accommodate additional equipment required to load and store end fitting canisters.
- (8) Non-fuel bearing component (NFBC) reduction station can be modified to load NFBC canisters with shredded material.
- (9) NFBC drum handling equipment (CDR) can be modified to handle both shredded material canisters and end fitting canisters.
- (10) Center space of consolidated spent fuel container has a minimum free diameter of eleven inches.
- (11) Intact BWR spent fuel containers can accept square canisters with a cross section of six inches in each of the seven spaces (including the center).
- (12) Intact spent fuel container loading upender can be modified to receive loose end fittings, shredded NFBC canisters, and end fitting canisters without a cost impact.
- (13) PWR and BWR fuel assemblies will be handled in all process cells.
- (14) All site support buildings presented in the CDR are required except as modified and/or noted in Table 7-1.

7.2 WASTE HANDLING OPERATIONS

The waste handling operations would be performed in the Receiving and Handling (R&H) Building, as in Scenario 5, except that the consolidated spent fuel, intact spent fuel assemblies, NFBC and HLW would be packaged in repository emplacement containers. In the two-phase construction case, the construction of the Spent Fuel Handling Building (SFHB) would be required to receive and transfer spent fuel to storage until the R&H Building construction is completed. Three-phase construction requires the utilization of the Receiving Building (RB) to allow receipt of dual purpose casks prior to construction completion of the SFHB. The RB and SFHB operation and designs are described in Section 4 for Scenarios 3 and 4 and do not change for this scenario.

7.2.1 RECEIVING AND HANDLING BUILDING

The R&H Building, as the primary operating building of the MRS facility, is designed to receive casks containing spent fuel or HLW; unload, disassemble, consolidate, and containerize the spent fuel; reduce the volume and containerize the spent fuel assemblies' NFBC; temporarily store the containers in the in-building lag storage vault; containerize HLW; and load containers into shipping casks or transfer spent fuel containers, NFBC containers, or HLW canisters to onsite storage.

Table 7-1

SUPPORT BUILDING MODIFICATIONS

<u>Building</u>	<u>Modification</u>
Inspection Gatehouse	Increase of administration and support areas for "three-phase" MRS
Storage Area Gate Station	Delete for vault storage option
Site Services	Revise mock-up area and equipment reduction to reflect R&H process cell
Standby Generator	Revise equipment and building to reflect new load requirements
Sewage Treatment	Proportion to site personnel quantity
Water Treatment	Modify storage tank and distribution to reflect revised requirements

7.2.1.1 Operations

Spent fuel handling operations in the R&H Building from the receipt and unloading of shipping casks to the transfer of packaged material to onsite storage or to a shipping cask are similar to those described for Scenario 5 (Section 5.2.1.1) with the following exceptions:

- (1) Reconfigured fuel rods from the disassembled fuel assemblies match the trapezoid form of the emplacement container segment;
- (2) NFBC is placed in the center of the consolidated fuel container and, in the case of BWR fuel, in an intact spent fuel container;
- (3) Only one PWR assembly is reconfigured at a time and loaded into a container segment;
- (4) Only three BWR assemblies are handled for each container segment; and
- (5) Special NFBC canisters, not drums, are required.

Except for NFBC handling, the sequence of process cell operations for the consolidation of the spent fuel remains unchanged. As required for these scenarios, the volume-reduced NFBC is to be placed in the center of the consolidated spent fuel container. Since the baseline for this study is the MRS CDR, the R&H Building process cell design was evaluated to define a NFBC handling method to conform to the container loading requirement. This evaluation included: 1) size and volume of the NFBC; 2) minimizing the cell design impact; and 3) use of the current volume-reduction shredder (cold tested during the MRS CDR effort). Based on the volume-reduction tests, it was calculated that the NFBC resulting from the consolidation of six PWR assemblies can be accommodated in the center of the respective container. However, the volume resulting from 18 BWR assemblies exceeds the available volume in the center of a container. To allow for the transfer of the NFBC from the shredder discharge to the container loading port in the cell wall, the use of an auxiliary package (NFBC canister) is required. In addition, the excess BWR NFBC must be contained and stored in the process cell until enough material is accrued to fill an NFBC-only container. Volume-reduction calculations for the shredder system show that a total of 90 BWR assemblies can be consolidated before a sufficient quantity of excess BWR NFBC canisters are available for filling the NFBC-only container. This quantity (90 BWR assemblies per one NFBC-only container) is less than the quantity (108 BWR assemblies per one NFBC container) projected in the repository Site Characterization Plan-Conceptual Design Report (SCP-CDR). The SCP-CDR NFBC volume-reduction method utilizes a shear and compaction system instead of the MRS shredding system.

The following describes the containerizing of the NFBC.

For PWR fuel consolidation, the center space accommodates the NFBC volume resulting from the consolidation of the six assemblies per container. The intact spent fuel loading upender is modified to provide a continuous channel or trough to accept either intact spent fuel, loose end fittings, or canisters of shredded NFBC material. (For NFBC loading, this upender remains in the horizontal position.) Severed end fittings are transferred to the upender as part of the overall consolidation process, e.g. instead of placement in an NFBC canister. The remainder of the skeleton is shredded and the shredded material is discharged into a 36-inch long canister constructed from 10-inch schedule 10 stainless steel pipe. After a canister is filled with the scrap from two skeletons, a lid is mechanically attached and the canister placed in the upender. While the third canister is being prepared, the container upender

with the container of PWR fuel rods is moved from the consolidation loading port to the intact spent fuel loading port in the process cell/canyon cell wall. Upon completion of the third NFBC canister transfer to the upender, the material in the upender is pushed into the center position of the container. The container of fuel rods and associated NFBC is then moved to the welding station for container inerting, closure, and decontamination (as described in Sec on 5.2.1.1).

The configuration of BWR fuel assembly NFBC differs from PWR in three primary aspects: 1) the end fittings have a smaller cross section; 2) the end fittings are longer; and 3) after removing the end fittings and the fuel rods, the remaining NFBC to be volume-reduced is much less. Because of the configuration of the end fittings, it is not possible to load two end fittings side-by-side in the center of the container. As with the PWR assemblies, severed end fittings would have to be placed end-to-end, creating a less efficient packing ratio of the available volume. In addition, to containerize the NFBC from 18 BWR assemblies requires more volume than exists in the center of the container. Using a similar approach as with the PWR, four canisters of material are placed in the center of the BWR container. The end fittings from four BWR assemblies are placed in two 10-inch NFBC canisters prior to the positioning of each canister under the shredder discharge chute. These two canisters, in addition to two canisters containing only shredded NFBC material, are placed in the intact spent fuel upender for insertion into the center of the consolidated spent fuel container. The remaining material (14 end fittings) is loaded into six-inch square canisters, 56 inches in length. The filled square canisters are stored vertically in a storage rack until a total of five BWR consolidated spent fuel containers have been completed. At the end of the fifth container loading cycle, an intact BWR fuel container (container 1D) is positioned at the intact spent fuel loading port. The canisters of end fittings are loaded into the waiting containers (three canisters in each of the seven container spaces).

Upon completion of the weld NDE, the container is transferred to the canyon cell lag storage vault, onsite interim storage, or a MRS-to-repository transport cask.

The handling of HLW canisters and the repair of defective containers (Scenario 8 only), the process is identical to that described in Section 6.2.1.1.

In two-phase construction, the drywell and vault storage options require the loading of baskets carrying 4 PWR or 8 BWR bare, intact spent fuel assemblies into the transporter in order to reduce the operating time between the SFHB and storage. This operation, as well as the loading of sealed storage casks, is described in Section 4 for Scenarios 3 and 4. Similarly, the operations for dual-purpose cask receipt and handling are presented in Section 3.

7.2.1.2 Design

The R&H Building in Scenarios 8 and 9 was modified from the design developed for the CDR prepared for the MRS proposal to Congress. The modifications result from: (1) the change to a repository-specific container for consolidated or intact spent fuel assemblies, NFBC canisters, and HLW

canisters; (2) the lag storage configuration and capacity; (3) deletion of the repository "overpack" handling and welding operations; and (4) the Vault Storage Building (VSB) option.

Facility arrangement modifications include:

- (1) The change to the lag storage vault in the canyon cells to accommodate the repository-specific container configuration and spacing (5 ft on-center).
- (2) Changes to loadout area to provide an enclosed transfer corridor between the VSB and the R&H Building to accommodate equipment to transfer spent fuel, HLW and NFBC containers to the VSB.

R&H Building equipment changes would include the following:

- (1) Changes to the design of the upender clamping module and the rod reconfiguration subsystem of the disassembly/consolidated station to accommodate the repository-specific container segment capacity and internal configuration.
- (2) Changes to the intact spent fuel upender to accommodate the NFBC loading operations, including indexing to align with the appropriate container space prior to NFBC loading.
- (3) Changes to the NFBC reduction system to accommodate the new canister.
- (4) Addition of end fitting canister loading, handling, and storage capacity in each process cell.
- (5) Changes in the NFBC drum handling equipment to accommodate the two new canister configurations.
- (6) Deletion of the NFBC drum decontamination equipment.
- (7) Deletion of the capability to transfer NFBC drums to the canyon cells.
- (8) Change to the canyon cell lag storage vault to accommodate the repository-specific container spacing.
- (9) Change to the upender design in Canyon Cells 5 and 6 to accommodate the repository-specific container configuration and the rotation of the container.
- (10) Change to the decontamination/inerting chamber design in Canyon Cells 5 and 6 to accommodate the repository-specific container.
- (11) Change to the weld/test equipment design to accommodate the repository-specific container and possibly the welding method to weld lids on the container.
- (12) Canister cutting station design change to accommodate the repository-specific container.

- (13) Clean canister feed system equipment design changes to accommodate the repository-specific container.
- (14) Change to the canyon cell lag storage vault ventilation system equipment based on the spent fuel container spacing and heat load.
- (15) Deletion of the canister "overpack" equipment in Canyon Cells 5 and 6.
- (16) A rail cart design and transfer cask would be required to handle spent fuel and NFBC containers or HLW canisters for transfer to the VSB for that storage mode option.

The R&H Building arrangement is identical to that shown for Scenario 5, Drawings A-501 through A-505, except for 1) the deletion of a welding station; 2) the relocation of a welding station to the discharge area (same as the CDR); and 3) the configuration of the openings into the canyon cell lag storage vault positions in the canyon cells. The capacity of the R&H Building lag storage vaults is approximately 1100 MTU with 5% of the spent fuel containerized intact and without NFBC container storage. If NFBC-only containers are also placed in the canyon cell vault, the capacity reduces to 1045 MTU.

7.3 STORAGE OPTIONS

Four onsite storage options for spent fuel, NFBC, and HLW are applicable to Scenarios 8 and 9: 1) concrete storage cask, 2) drywell, 3) open-cycle storage vault, and 4) dual purpose vault.

7.3.1 CONCRETE STORAGE CASKS

The design and operation of the concrete storage cask system is the same as described for Scenarios 3 and 4 except for the packaging of the spent fuel. For the single phase construction option the spent fuel received at the R&H Building is packaged in repository-specific containers with a capacity of six consolidated PWR, 18 consolidated BWR, three intact PWR or 6 intact BWR assemblies. In addition, the NFBC from every five containers of BWR consolidated assemblies will require an additional container for their disposal. Due to size limitations, the storage cask capacity is four containers of spent fuel, NFBC or HLW. The total number of casks required for the maximum allowable onsite storage (15000 MTU of spent fuel and 2,400 MTU of HLW) is 2717. This includes 1288 casks containing containers of consolidated PWR and BWR assemblies, 156 casks containing containers of intact PWR and BWR assemblies, 73 casks containing BWR NFBC, and 1200 casks of HLW.

The site arrangement for the single phase construction option cask system is similar to that shown on Drawing C-501. The storage area required for the maximum storage capacity is approximately 117 acres including access roads, alarm and isolation zones, and facility set-backs.

The two phase construction option requires the storage of the bare intact spent fuel which is received at the SFHB. It is assumed that the maximum storage condition consists of 8000 MTU of bare intact spent fuel; 7000 MTU of containerized consolidated and intact spent fuel; and 2400 MTU of HLW. The

cask capacity for bare intact spent fuel is the same as noted for Scenario 3 and 4 and the cask capacity for containers of spent fuel, NFBC or HLW was noted for the single phase construction option. The total number of casks required for the maximum allowable onsite storage is 2481. This includes 573 casks of bare intact spent fuel, 601 casks of containerized consolidated spent fuel, 73 casks of containerized intact spent fuel, 34 casks of BWR NFBC, and 1200 casks of HLW.

The site arrangement for the two phase construction option casks system is similar to that shown on Drawing C-502. The storage area required for this maximum storage capacity is approximately 107 acres including access roads, alarm and isolation zones, and facility set-backs.

The concrete storage casks requirement for the three phase construction option is discussed in Section 7.3.4.

7.3.2 DRYWELLS

The operation and design of the drywell storage system for this scenario is the same as for Scenario 3 and 4 except that the consolidated spent fuel is placed in a repository-specific container prior to loading and storage in the drywells. All drywells are 30 in. in diameter. The containerized consolidated spent fuel drywells are spaced 32 ft on-center in each direction; containerized intact and bare intact drywells are spaced 21 ft on-center in each direction; and the containerized BWR NFBC and HLW drywells are spaced 6 ft on-center and 12 ft between rows. Each drywell contains one container of spent fuel (consolidated or intact), one basket of bare intact spent fuel, one container of BWR NFBC, or one container of HLW.

For the single phase construction option the spent fuel is received and packaged in the repository-specific containers. The total number of drywells required for maximum allowable onsite storage (15,000 MTU of spent fuel and 2400 MTU of HLW) is 10862. This includes 5153 30-in. containerized consolidated spent fuel drywells; 619 30-in. containerized intact spent fuel drywells; 290 30-in. containerized BWR NFBC drywells; and 4800 30-in. drywells of HLW.

The site arrangement for the single phase construction option drywell system is shown on Drawing C-521. The storage area required for the maximum storage capacity is approximately 225 acres including access roads, alarm and isolation zones, and facility set-backs.

The two phase construction option requires the storage of bare intact spent fuel which is received at the SFHB. It is assumed that the maximum storage condition consists of 8000 MTU of bare intact spent fuel, 7000 MTU of containerized consolidated and intact spent fuel and 2400 MTU of HLW. The total number of drywells for the maximum onsite storage is 12578. This includes 2404 30-in. containerized consolidated drywells; 4949 30-in. bare intact spent fuel drywells; 289 30-in. containerized intact spent fuel drywells; 136 30-in. drywells of containerized BWR NFBC; and 4800 30-in. drywells of HLW.

The site arrangement for the two phase construction option drywell system is shown on Drawing C-522. The storage area required for the maximum storage capacity is approximately 208 acres including access roads, alarm and isolation zones, and facility set-backs.

The drywell storage requirement for the three phase construction option is discussed in Section 7.3.4.

7.3.3 OPEN-CYCLE STORAGE VAULT

The design and operation of this system for Scenario 8 and 9 is the same as that described for Scenario 3 and 4 except that each 30-in storage tube can contain one rack of bare intact spent fuel and/or one container of consolidated or intact spent fuel or HLW.

For the single phase construction option, all spent fuel is packaged in a repository-specific container. The total number of 30-in storage tubes required for maximum onsite storage is 10862. This includes 5153 30-in storage tubes containing consolidated spent fuel; 619 30-in storage tubes containing containerized intact spent fuel; 290 30-in. storage tubes containing BWR NFBC; and 4800 30-in. tubes containing containers of HLW. The storage vault complex consists of five vault buildings, four containing 21 storage modules, and one containing 25 storage modules.

The site arrangement for the single phase construction option vault storage system is shown on Drawing C-531. The storage area required for the maximum storage capacity is approximately 65 acres including access roads, alarm and isolation zones, and facility set-backs.

The two phase construction option requires the storage of bare intact spent fuel in the same configuration as noted for Scenarios 3 and 4. Assuming the same quantity as noted for Scenario 5 (8000 MTU), the total number of 30-in. storage tubes required for the maximum storage capacity is 12578. This includes 4949 30-in. storage tubes containing bare intact spent fuel; 2404 30-in. storage tubes containing containerized consolidated spent fuel; 289 30-in. storage tubes containing containerized intact spent fuel; 136 30-in. storage tubes containing BWR NFBC; and 4800 30-in. storage tubes containing HLW. For this phased construction option the storage vault complex consists of five vault buildings, four containing 26 vault modules, and one containing 25 vault modules.

The site arrangement for the two phase construction option vault storage system is shown on Drawing C-532. The storage area required for the maximum storage capacity is approximately 85 acres including access roads, alarm and isolation zones, and facility set-backs.

The vault storage requirements for the three phase construction option is discussed in Section 7.3.4.

7.3.4 DUAL PURPOSE CASK STORAGE

In the three-phase construction case, for these scenarios, dual purpose casks containing bare intact spent fuel assemblies will be received at the RB and

are transported to storage as in Scenario 3 and 4; a maximum of 1,100 MTU of spent fuel in 106 DP casks is assumed to be received. This quantity of DP casks adjusts the amount stored in any of the other storage options to 13,900 MTU.

Of the remaining 13900 MTU, 6900 MTU is received in the SFHB and transferred to storage as bare intact fuel assemblies and 7000 MTU is received in the R&H Building and stored as containerized consolidated or intact spent fuel. Using the same cask loadings as presented in the single phase construction option the total number of storage casks required is 2402. This includes 494 casks of bare intact spent fuel; 601 casks of containerized consolidated spent fuel; 73 casks of containerized intact spent fuel; 34 casks of BWR NFBC; and 1200 casks of HLW.

The site arrangement for the three phase construction option cask storage system is shown on Drawing C-503. The storage area required for a 15000 MTU capacity is approximately 104 acres including access roads, alarm and isolation zones, and facility set-backs.

The total number of drywells required to store the remaining 13,900 MTU of spent fuel is 11898. This includes 2404 30-in drywells for containerized consolidated spent fuel; 4269 30-in. drywells for bare intact spent fuel; 289 30-in. drywells for containerized intact spent fuel; 136 30-in. drywells for BWR NFBC; and 4800 30-in. drywells for HLW.

The site arrangement for the three phase construction drywell system is shown on Drawing C-523. The storage area required for a 15000 MTU capacity is approximately 197 acres including access roads, alarm and isolation zones, and facility set-backs.

The total number of storage tubes required to store the remaining 13900 MTU of spent fuel is 11,898. This includes 4269 30-in. storage tubes for bare intact spent fuel; 2404 30-in. storage tubes for containerized consolidated spent fuel; 289 30-in. storage tubes for containerized intact spent fuel; 136 30-in. storage tubes for BWR NFBC; and 4800 30-in. storage tubes for HLW. For this phased construction option, the storage vault complex consists of five vault buildings, four containing 24 vault modules and one containing 25 vault modules.

The site arrangement for the three phase construction vault storage system is shown on Drawing C-533. The storage area required for 15000 MTU capacity is approximately 85 acres including access roads, alarm and isolation zones, and facility set-backs.

7.4 COST DATA DEVELOPMENT

This section presents the rationale for the cost data applicable to Scenarios 8 and 9, Tables 7-2 through 7-109. Rationale identical to that presented in Section 3.4 is noted by reference; therefore, only scenario-specific deviations are described herein.

7.4.1 MANAGEMENT AND INTEGRATION

This cost center presents the rationale for development of costs associated with all A/E and operating contractor activities required prior to initial operations.

7.4.1.1 Site Selection and Investigation

The activities associated with this cost element are as discussed in Section 3.4.1.1.

7.4.1.2 Design

The activities associated with this cost center are described in Section 3.4.1.2, modified as required by the scenario-specific requirements described herein.

Proof of Principle Tests. All tests described in Section 3.4.1.2 are required for this scenario; therefore the cost allocated to this element is \$1 million.

Advanced Conceptual Design. Since this scenario requires facilities which were not included in the MRS CDR, advanced conceptual designs (ACDs) will be required prior to initiation of license application design. For two- and three-phase construction and for all construction phases for the vault storage option advanced conceptual design costs have been included for the SFHB, VSB, RB, and the site development design associated with these buildings. The cost developed for this element is in accordance with the rationale presented in Section 3.4.1.2.

License Application and Final Procurement and Construction Design. All storage and construction phase options require license application and final procurement and construction design phases. The costs developed for these phases are in accordance with the rationale presented in Section 3.4.1.2.

License Support. As noted in Section 3.4.1.2, the license support cost is based on an assumed licensing duration of 30 months. Therefore, the cost allocated for this activity is based on an average of 11 manyears/year for a prelicense, and license duration of 42 months.

Title III Support. The cost for this element was developed from the constructed value of the total MRS facility required for each storage and construction phase option in accordance with the rationale presented in Section 3.4.1.2.

7.4.1.3 Operating Contractor Support

The rationale for development of this cost is presented in Section 3.4.1.3.

7.4.1.4 Construction Management

The cost for this activity was developed from the constructed value of the total MRS facility required for each storage and construction phase option in accordance with the rationale presented in Section 3.4.1.4.

7.4.1.5 Preoperational Testing and Personnel Training

The rationale for development of this cost is presented in Section 3.4.1.5.

7.4.2 CONSTRUCTION

The rationale for development of costs associated with the construction cost center of Scenario 8 or 9 MRS facilities is in accordance with that presented in Section 3.4.2.

7.4.3 ANNUAL OPERATING COSTS

The cost developed for all elements of this cost center is in accordance with the rationale in Section 3.4.3.

7.4.4 STAFFING ALLOCATIONS

The cost developed for this cost center is in accordance with Section 3.4.4.

7.4.5 DECOMMISSIONING

The cost percentiles applied to the various facilities included in this cost center are in accordance with Section 3.4.5.

7.5 DESIGN AND CONSTRUCTION SCHEDULES

The design and construction schedules for Scenarios 8 and 9 are presented on Figures 7-4 through 7-9. As stated in Section 3.5, the schedule durations for construction are based on an evaluation of the preconceptual design and the construction labor required.

The critical path for all construction phases and storage options commences with selection of site(s) and includes site evaluation, ACD (when required), LA design, license approval, facility construction, and cold tests. The major facilities for this scenario include the R&HB, SFHB, and the VSB. The SFHB and VSB require an ACD to be completed in sufficient time to form the basis for the LA design. The schedules for this scenario provide for the completion of the ACD 17 to 22 months prior to completing the LA design, thus providing sufficient schedule time to complete the LA design for these buildings. Since the R&HB ACD is presented in the CDR, it is assumed that no ACD is required for this building and the LA design can be initiated when a site(s) is selected. To complete this design phase, input data is required from the site evaluation and proof-of-principle tests and adequate time are required for incorporation. The schedules shown for this scenario provide for 11 to 14 months and 16 to 18 months for incorporation of proof-of-principle test data and geotechnical data respectively. NRC license approval is assumed to be 30 months which cannot be initiated until the completion of the LA design and establishes the construction start milestone. The receipt of waste (plant startup) is determined by the construction duration of the receiving and storage facilities required for each phase. For all single-phase storage options, this is established by the R&HB construction and cold test duration (53 months). For the two-phase cask and drywell options it is established by the SFHB (30 months), and for the two-phase vault option it is established by

the VSB (35 months). The receipt of waste for all three-phase options is established by the construction duration of the Inspection Gatehouse, Receiving Building, and dual cask storage area (12 months). To meet the operational objectives (containerized consolidated SF) and/or minimize the use of dual purpose casks, all handling and storage facilities must be constructed on schedule. Therefore, the construction of all facilities are on the critical path.

Scenario: B
Construction Phase: Single
Storage Concept: Cask

Date: 10/21/88
Revision: 2

		Percent of M & I Cost per Year Prior to Operations											
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	\$6.6	41	42	12 (Rev. 1)									
Design													
Proof-of-Principle Tests (6 Tests)	1.0	41	34	5 (Rev. 2)									
Advanced Conceptual Design	N/A												
License Application Design	38.3		41	34	5								
Licensing Support	5.2				37	40	23						
Final Procurement and Construction Design	25.6				73	27							
Title III Support	36.2						2	20	29	29	20		
Operating Contractor Support													
Design	9.9	11	30	31	14	11	3						
Construction	10.8					5	15	23	20	19	13	5	
Construction Management	36.1						2	20	29	29	20		
Preoperational Testing and Personnel Training	66.0					3	5	10	17	24	41		

TABLE 7-2
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 0
Construction Phase: Single
Storage Concept: Cost

Date: 11/23/88
Revision: 1

COST CENTER/Cost Element	Building Area	Millions in 1988 \$		
		Facility Cost	Equipment Cost	Total Cost
CASK OPERATIONS				
Receiving	N/A	3.352	--	3.352
Cost Log Storage	N/A	2.996	--	2.996
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	N/A
Cask Unloading				
Assembly Log Storage				
Processing				
Interim Storage Loading/Unloading				
Building Support Facilities				
RECEIVING AND HANDLING BUILDING				
Cask Unloading	85672	11.970	10.403	22.373
Assembly Log Storage	4864	1.305	0.855	2.160
Processing	34733	18.441	66.719	85.160
Volume Reduction	13237	3.992	8.522	12.474 (Rev. 1)
Canister/Container Closure	26474	7.903	21.663	29.566
Canister/Container Log Storage	48384	14.409	15.371	29.780
Interim Storage Loading/Unloading	27533	8.279	19.618	27.897
WRS/Repository Cask Handling	21709	6.386	9.936	16.322
Building Support Facilities	421418	127.015	112.763	239.778
INTERIM STORAGE OPERATIONS				
Storage Facilities	N/A	\$7500/cask	7.810	--
Storage Units	N/A		See Consumables, Table 7-5	
Receiving Building	N/A	N/A	N/A	N/A
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Onsite Preparation	N/A	36.137	--	36.137
Offsite Preparation	N/A	16.295	--	16.295
Administration	N/A	2.605	8.420	11.025
Other Support Facilities	N/A	42.130	18.915	61.045

TABLE 7-3
CONSTRUCTION COSTS

Scenario: B
Construction Phase: Single
Storage Concept: Cask

Date : 10/21/00
Revision : 1

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS			10	90							
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING		N/A	N/A	N/A	N/A	N/A					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interin Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING		2	20	29	29	20					
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interin Storage Loading/Unloading											
WRS/Repository Cost Handling											
Building Support Facilities											
INTERIN STORAGE OPERATIONS			17	33	33	17					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS			50	30	20 (Rev. 1)						
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 7-4
CONSTRUCTION COST DISTRIBUTION

Scenario: B
Construction Phase: Single
Storage Concept: Cast

Date: 1/20/89
Revision: 2

COST CENTER/Cost Element	Equipment Maintenance/Replacement (X/Year)			Consumables	Notes (Rev. 2)
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.014 M/Year Fixed	(1) PMR = \$30,500/Unit (\$29,000 + \$1500 for 3 HFBC canisters)
Receiving					DMR = \$38,900/Unit (\$29,000 + \$2000 for 4 HFBC canisters + 1/5 of HFBC-only container w/ 21 end fitting canisters)
Cast Lag Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A		
Cast Unloading					(2) PMR or DMR = \$29,000/Unit
Assembly Lag Storage					
Processing					(3) MLM = \$17,000/Unit
Interim Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING				\$4.188 M/Year Fixed	
Cast Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.3		(Included in container cost)
Canister/Container Closure	1.0		1.4		Consolidated fuel & HFBC (1)
					Intact fuel (2)
					MLM (3)
Canister/Container Lag Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
HRS/Repository Cast Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2		Drums = \$100/Unit
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0	0.8	95		\$8.050 M/Year Fixed
Storage Units					Casks = \$0.197 M/Unit
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	35.9	24.0		

TABLE 7-5
ANNUAL OPERATING COSTS

Scenario: 8
Construction Phase: Single
Storage Concept: Cask

Date: 1/20/89
Revision: 3

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks				
Storage loading/unloading				
Building support staff				
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 513/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PHR = 150(T);340(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and containerize fuel/NFBC	Consolidated: PHR = 834/container; (Rev. 2) BWR = 2070/container (Rev. 2)	2.5	\$53,900	Requires all 4 cells to handle both PHR and BWR fuel Includes BWR NFBC-only container loading (Rev. 2)
Volume-reduce/package NFBC	Intact: PHR = 255/container;BWR = 510/container PHR = 165/container; (Rev. 2) BWR = 303/container (Rev. 2)	1	\$53,900	
Weld/decom/test containers	190/container	1.5 w/o MLW 1.6 w/ MLW	\$53,900	
Container handling: lag storage	90/container	3	\$53,900	
storage cask loading/unloading	90/cask of 4 containers			
NRS transport cask loading	170(SF);170(NFBC);170(MLW);215(RH-LLW)			
Building support staff	N/A	156 w/o MLW 161 w/ MLW	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Storage cask preparation & closing/reopening	210/cask	4	\$53,900	If cask is reused, add 30 min. (Rev. 1)
Storage placement (incl. 45 min. to obtain new cask)	145/cask	6	\$53,900	If cask is reused, reduce by 45 min. (Rev. 3)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff (excl. Cask Mfg. Facility of II)	N/A	264	\$53,900	

TABLE 7-6
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: B
Construction Phase: Single
Storage Concept: Cask

Date: 9/9/00
Revision: 0

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	3							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	N/A								
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	75	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Cask/Container Closure									
Cask/Container Lag Storage									
Interim Storage Loading/Unloading									
WMS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

TABLE 7-7
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: B
Construction Phase: Two
Storage Concept: Cask

Date: 10/21/88
Revision: 2

		Percent of M & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6			55	45 (Rev. 1)									
Design														
Proof-of-Principle Tests (6 Tests)	1.0			55	45 (Rev. 2)									
Advanced Conceptual Design	3.8			67	33 (Rev. 2)									
License Application Design	45.1				45	55 (Rev. 2)								
Licensing Support	5.2						40	40	20 (Rev. 2)					
Final Procurement and Construction Design	30.1						80	20	(Rev. 2)					
Title III Support	34.0								20	23	26	22	9	
Operating Contractor Support														
Design	9.9			11	30	31	14	11	3					
Construction	10.8							5	15	23	20	19	13	5
Construction Management	67.4								20	23	26	22	9	
Preoperational Testing and Personnel Training	66.8							3	5	10	17	24	41	

TABLE 7-8
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: B
Construction Phase: Two
Storage Concept: Cask

Date: 11/23/00
Revision: 3

COST CENTER/Cost Element	Building Area	Millions in 1988 \$		
		Facility Cost	Equipment Cost	Total Cost
CASK OPERATIONS				
Receiving	N/A	3.352	--	3.352
Cask Lag Storage	N/A	2.996	--	2.996
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Cask Unloading	31420	7.432	2.832	10.264
Assembly Lag Storage	4080	3.074	0.270	3.344
Processing	12524	9.639	7.615	17.254
Interior Storage Loading/Unloading	17170	15.682	0.439	16.121
Building Support Facilities	92916	25.146	2.923	28.069 (Rev. 1)
RECEIVING AND HANDLING BUILDING				
Cask Unloading	85672	11.970	10.403	22.373
Assembly Lag Storage	4864	1.905	0.833	2.738
Processing	59733	18.441	66.719	85.160
Volume Reduction	13237	3.952	8.522	12.474 (Rev. 3)
Canister/Container Closure	26474	7.903	21.863	29.766
Canister/Container Lag Storage	48384	14.489	15.371	29.860
Interior Storage Loading/Unloading	27533	8.279	15.618	23.897
WES/Repository Cask Handling	21709	4.306	9.936	14.242
Building Support Facilities	421418	127.615	112.763	239.778
INTERIM STORAGE OPERATIONS				
Storage Facilities	N/A	\$7500/cask	7.810 (Rev. 1)	--
Storage Units	N/A		See Construction, Table 7-11	
Receiving Building	N/A	N/A	N/A	N/A
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Onsite Preparation	N/A	39.895	--	39.895 (Rev. 2)
Offsite Preparation	N/A	16.293	--	16.293
Administration	N/A	2.603	0.424	3.027
Other Support Facilities	N/A	42.130	18.915	61.045

TABLE 7-9
CONSTRUCTION COSTS

Scenario: B
Construction Phase: Two
Storage Concepts: Cask

Date: 9/9/88
Revision: 0

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				10	90						
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				25	45	30					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				20	20	25	25	10			
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
RRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS				10	60	30					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				50	30	20					
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 7-10
CONSTRUCTION COST DISTRIBUTION

Scenario: B
Construction Phase: Two
Storage Concept: Cask

Date: 1/20/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (%/Year)			Consumables	Notes (Rev. 3)
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.014 M/Year Fixed	(1) PMR = \$30,500/Unit (\$29,000 + \$1500 for 3 NFBC canisters)
Receiving					DMR = \$38,900/Unit (\$29,000 + \$2000 for 4 NFBC canisters + 1/3 of NFBC-only container w/ 21 end fitting canisters)
Cask Lag Storage					
WASTE HANDLING OPERATIONS				\$2.126 M/Year - Operations;	
SPENT FUEL HANDLING BUILDING				\$0.970 M/Year - Standby (Rev. 1)	(2) PMR or DMR = \$29,000/Unit
Cask Unloading	2.0				
Assembly Lag Storage	1.0				
Processing	1.5	1.8			
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed	
Building Support Facilities	1.1	1.9	12.9		(3) MLN = \$17,000/Unit
RECEIVING AND HANDLING BUILDING				\$6.108 M/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.5		(Included in container cost)
Canister/Container Closure	1.0		1.4		Consolidated fuel and NFBC (1)
					Intact fuel (2)
					MLN (3)
Canister/Container Lag Storage	0.3		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
NFBC/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Brues = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0	0.8	95	\$0.050 M/Year Fixed	
Storage Units				Casks = \$0.197 M/Unit	
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.350 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	55.9	24.0		

TABLE 7-11
ANNUAL OPERATING COSTS

Scenario: 8
Construction Phase: Two
Storage Concept: Cask

Date: 1/20/89
Revision: 3

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; Inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask: 375/cask
Unload transport casks	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading	PMR = 510/cask (Rev. 1) BWR = 1230/cask (Rev. 3)	1.5	\$53,900	Load/unload onsite transfer cask: PMR = 530; BWR = 1070
Building support staff	N/A	51	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and containerize fuel/NFBC	Consolidated: PMR = 834/container; (Rev. 2) BWR = 2070/container (Rev. 2)	2.5	\$53,900	Requires all 4 cells to handle both PMR and BWR fuel Includes BWR NFBC-only container loading (Rev. 2)
Volume-reduce/package NFBC	Intact: PMR = 255/container; BWR = 510/container PMR = 165/container (Rev. 2) BWR = 303/container (Rev. 2)	1	\$53,900	
Weld/decon/test containers	190/canister	1.5 w/o MLM 1.6 w/ MLM	\$53,900	
Container handling: lag storage	90/container	3	\$53,900	
storage cask loading/unloading	90/cask of 4 containers			
NRS transport cask loading	170(SF);170(NFBC);170(MLM);215(RN-LLW)			
Building support staff	N/A	158 w/o MLM 161 w/ MLM	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Storage cask preparation & closing/reopening	210/cask	4	\$53,900	If cask is reused, add 30 min. (Rev. 1)
Storage placement (incl. 45 min. to obtain new cask)	145/cask	6	\$53,900	If cask is reused, reduce by 45 min. (Rev. 3)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff (excl. Cask Mfg. Facility of 11)	N/A	264	\$53,900	

TABLE 7-12
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: B
Construction Phase: Two
Storage Concept: Cask

Date : 10/11/88
Revision : 1

COST CENTER/Cost Element	%	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	0	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Log Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Log Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Log Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Log Storage									
Interim Storage Loading/Unloading									
HRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facility									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Route Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Note, intact SF costs = 12% (Rev. 1)

TABLE 7-13
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: B
Construction Phase: Three
Storage Concept: Cask

Date: 10/21/88
Revision: 2

		Percent of M & I Cost per Year Prior to Operations											
COST CENTER/Cost Element	Cost (Millions \$)												
		-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	18	32	30 (Rev. 1)									
Design													
Proof-of-Principle Tests (& Tests)	1.0	18	34	28 (Rev. 2)									
Advanced Conceptual Design	3.8		100	(Rev. 2)									
License Application Design	45.1		18	35	27								
Licensing Support	5.2				20	40	40						
Final Procurement and Construction Design	30.1				40	60							
Title III Support	34.0							20	23	26	22	9	
Operating Contractor Support													
Design	9.9		11	30	31	14	11	3					
Construction	10.8						3	15	23	20	19	13	3
Construction Management	67.4							20	23	26	22	9	
Preoperational Testing and Personnel Training	66.8						3	3	10	17	24	41	

TABLE 7-14
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 9
Construction Phase: Three
Storage Concept: Cask

Date: 11/23/88
Revision: 3

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	3.163	0.829	3.994	(1) Site development:
Cask Lag Storage	N/A	2.996	--	2.996	Storage cask = \$7500/cask Dual purpose cask = \$31,000/cask
WASTE HANDLING OPERATIONS					(2) Storage cask equipment = \$7,810 M
SPENT FUEL HANDLING BUILDING					Dual purpose cask equip. = \$3.940 M
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Lag Storage	4080	3.074	0.270	3.344	
Processing	12524	9.639	7.615	17.254	
Interior Storage Loading/Unloading	17170	19.682	0.439	16.121	
Building Support Facilities	92916	25.146	2.923	28.069 (Rev. 1)	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.503	0.853	2.360	
Processing	99733	18.441	46.719	65.160	
Volume Reduction	13237	3.932	8.522	12.474 (Rev. 3)	
Canister/Container Closure	26474	7.903	21.063	29.766	
Canister/Container Lag Storage	48384	14.489	15.371	29.860	
Interior Storage Loading/Unloading	27333	8.279	15.618	23.897	
WRS/Repository Cask Handling	21709	6.986	9.936	16.922	
Building Support Facilities	421410	127.015	112.763	239.778	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	(2)	--	
Storage Units	N/A		See Consumables, Table 7-17		
Receiving Building	N/A	1.607	1.006	2.613	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Grute Preparation	N/A	39.893	--	39.893 (Rev. 2)	
Offsite Preparation	N/A	16.293	--	16.293	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	42.130	18.915	61.045	

TABLE 7-15
CONSTRUCTION COSTS

Scenario: 8
Construction Phase: Three
Storage Concepts: Cask

Date: 9/9/88
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS						100					
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING						25	45	30			
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING						20	20	25	25	10	
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
RRB/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS											
Storage Facilities						100					
Storage Units											
Receiving Building						100					
BALANCE OF PLANT AND SUPPORT OPERATIONS						50	50	20			
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 7-16
CONSTRUCTION COST DISTRIBUTION

Scenario: 0
Construction Phase: Three
Storage Concept: Cask

Date: 1/26/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (1/Year)			Consumables	Notes (Rev. 3)
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.020 M/Year Fixed	(1) PWR = \$30,500/Unit (\$29,000 + \$1500 for 3 HFBC canisters)
Receiving	2.0				BWR = \$38,900/Unit (\$29,000 + \$2000 for 4 HFBC canisters + 1/5 of HFBC-only container w/ 21 end fitting canisters)
Cask Log Storage					
WASTE HANDLING OPERATIONS				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby (Rev. 1)	(2) PWR or BWR = \$29,000/Unit
SPENT FUEL HANDLING BUILDING				Transfer Casks = \$3.9 M Fixed	(3) MLW = \$17,000/Unit
Cask Unloading	2.0				
Assembly Log Storage	1.0				
Processing	1.5	1.8			
Interim Storage Loading/Unloading	1.2		24.0		
Building Support Facilities	1.1	1.9	12.9		
RECEIVING AND HANDLING BUILDING				\$6.108 M/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Log Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.5		(Included in container cost)
Canister/Container Closure	1.0		1.4		Consolidated fuel and HFBC (1) Intact fuel (2) MLW (3)
Canister/Container Log Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
MRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2		Drums = \$100/Unit
INTERIM STORAGE OPERATIONS				1st Year Ops. = \$0.006 M Fixed; Other Ops. Years = \$0.030 M/Year Casks = \$0.197 M/Unit	
Storage Facilities	2.0	0.8	95		
Storage Units					
Receiving Building	2.0				
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.530 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	33.4	37.3		
Other Support Facilities	1.6	33.9	24.0		

TABLE 7-17
ANNUAL OPERATING COSTS

Scenario: B
Construction Phase: Three
Storage Concept: Cask

Date: 1/20/89
Revision: 3

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	FTE/crew increases to 8 for first 4 years of operations
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask: 375/cask
Unload transport casks	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading	PMR = 510/cask (Rev. 1) BWR = 1230/cask (Rev. 3)	1.5	\$53,900	Load/unload onsite transfer cask: PMR = 530; BWR = 1070
Building support staff	N/A	51	\$53,900	(Rev. 1)
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and containerize fuel/NFBC	Consolidated: PMR = 834/container (Rev. 2) BWR = 2070/container (Rev. 2) Intact: PMR = 225/container; BWR = 510/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BWR fuel Includes BWR NFBC-only container loading (Rev. 2)
Volume-reduce/package NFBC	PMR = 165/container (Rev. 2) BWR = 303/container (Rev. 2)	1	\$53,900	
Weld/decom/test containers	190/canister	1.5 w/o MLM 1.6 w/ MLM	\$53,900	
Container handling:		3	\$53,900	
lag storage	90/container			
storage cask loading/unloading	90/cask of 4 containers			
NRS transport cask loading	170(SF);170(NFBC);170(MLM);215(RM-LLM)			
Building support staff	N/A	158 w/o MLM 161 w/ MLM	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	230/cask	17	\$53,900	
Storage cask preparation & closing/reopening	210/cask	4	\$53,900	If cask is reused, add 30 min. (Rev. 1)
Storage placement (incl. 45 min. to obtain new cask)	145/cask	6	\$53,900	If cask is reused, reduce by 45 min. (Rev. 3)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff (excl. Cask Mfg. Facility of 11)	N/A	264	\$53,900	

TABLE 7-18
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 0
Construction Phase: Three
Storage Concept: Cask

Date: 10/11/00
Revision: 1

COST CENTER/Cost Element	%	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	0	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	70	20	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
HRS/Repository Cost Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facility									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Born, intact SF casks = 12% (Rev. 1)

TABLE 7-19
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: B
Construction Phase: Single
Storage Concept: Drywell

Date : 10/21/00
Revision : 2

COST CENTER/Cost Element	Cost (Millions \$)	Percent of M & I Cost per Year Prior to Operations											
		-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	41	47	12 (Rev. 1)									
Design													
Proof-of-Principle Tests (6 Tests)	1.0	41	54	5 (Rev. 2)									
Advanced Conceptual Design	N/A												
License Application Design	38.3		41	54	5								
Licensing Support	5.2				37	40	23						
Final Procurement and Construction Design	25.6				73	27							
Title III Support	30.2						2	20	29	29	20		
Operating Contractor Support													
Design	9.9	11	30	31	14	11	3						
Construction	10.8					5	13	23	20	19	13	5	
Construction Management	56.1						2	20	29	29	20		
Preoperational Testing and Personnel Training	66.8					3	5	10	17	24	41		

TABLE 7-20
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: B
Construction Phase: Single
Storage Concept: Drywell

Date: 11/23/00
Revision: 3

COST CENTER/Cost Element	Millions in 1988 \$				Notes
	Building Area	Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	3.352	--	3.352	(1) Site development costs included in drywell unit cost. See consumables, Table 7-23
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	N/A	
Cask Unloading					
Assembly Lag Storage					
Processing					
Interim Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING OUTLATH					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.905	0.855	2.540	
Processing	59733	18.441	66.719	85.160	
Volume Reduction	15237	3.952	8.922	12.674 (Rev. 3)	
Canister/Container Closure	26474	7.903	21.063	29.766	
Canister/Container Lag Storage	40384	14.489	15.371	29.860	
Interim Storage Loading/Unloading	27333	8.279	15.618	23.897	
RRR/Repository Cask Handling	21709	6.586	9.936	16.322	
Building Support Facilities	421418	127.015	112.763	239.778	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	3.311	--	
Storage Units	N/A		See Consumables, Table 7-23		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Site Preparation	N/A	28.638	--	28.638 (Rev. 1)	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 2)	

TABLE 7-21
CONSTRUCTION COSTS

Scenario: B
Construction Phase: Single
Storage Concept: Drywell

Date: 10/21/00
Revision: 1

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS			10	90							
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING		N/A	N/A	N/A	N/A	N/A					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING		2	20	29	29	20					
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
WRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS			17	33	33	17					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS			50	30	20 (Rev. 1)						
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 7-22
CONSTRUCTION COST DISTRIBUTION

Scenario: B
Construction Phase: Single
Storage Concept: Drywell

Date: 1/20/89
Revision: 2

COST CENTER/Cost Element	Equipment Maintenance/Replacement (1/Year)			Consumables	Notes (Rev. 2)
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.014 M/Year Fixed	(1) PMR = \$30,500/Unit (\$29,000 + \$1500 for 3 NFBC canisters)
Receiving					DMR = \$38,900/Unit (\$29,000 + \$2000 for 4 NFBC canisters + 1/3 of NFBC-only container w/ 21 end fitting canisters)
Cask Log Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A		(2) PMR or DMR = \$29,000/Unit
Cask Unloading					
Assembly Log Storage					(3) MLN = \$17,000/Unit
Processing					
Interim Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Log Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.5	(Included in container cost)	
Canister/Container Closure	1.0		1.4	Consolidated fuel and NFBC (1)	
				Intact fuel (2)	
				MLN (3)	
Canister/Container Log Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
WRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Brace = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	1.6	3.0	58	\$0.850 M/Year Fixed	
Storage Units				Intact SF Container Drywell (Rev. 2)	
				(30" dia.) = \$13,000/Unit; Consol. SF	
				Container Drywell (30" dia.) = \$14,000/Unit;	
				NFBC and MLN Drywell (30" dia.) = \$12,200/Unit	
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	35.9	24.0		

TABLE 7-23
ANNUAL OPERATING COSTS

Scenario: 8
Construction Phase: Single
Storage Concept: Drywell

Date: 11/23/00
Revision: 2

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks				
Storage loading/unloading				
Building support staff				
RECEIVING AND HANDLING BUILDING				
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 519/cask Rail = 415/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 190(T);540(R) DWR = 230(T);1000(R)	1.5	\$53,900	
Consolidate and containerize fuel/WFBC	Consolidated: PMR = 834/container; (Rev. 2) DWR = 2070/container (Rev. 2) Intact: PMR = 255/container;DWR = 510/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and DWR fuel Includes DWR WFBC-only container loading (Rev. 2)
Volume-reduce/package WFBC	PMR = 165/container (Rev. 2) DWR = 303/container (Rev. 2)	1	\$53,900	
Weld/decon/test containers	190/container	1.5 w/o MLW 1.6 w/ MLW	\$53,900	
Container handling: lag storage	90/container	3	\$53,900	
transporter loading/unloading	45/transporter load			
WRS transport cask loading	170(SF);170(WFBC);170(MLW);210(RH-LLW)			
Building support staff	N/A	198 w/o MLW 161 w/ MLW	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter operation (incl. loading of shield plug)	60/trip	1	\$53,900	If drywell is reused, reduce by 15 min. (Rev. 1)
Storage placement	90/drywell	3.5 w/o MLW 2.7 w/ MLW	\$53,900	(Rev. 1)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 7-24
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 8
Construction Phase: Simple
Storage Concept: Drywell

Date: 9/9/88
Revision: 0

COST CENTER/Cost Element	I of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations								
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5	+6
CASK OPERATIONS	3							100		
Receiving										
Cask Log Storage										
WASTE HANDLING OPERATIONS										
SPENT FUEL HANDLING BUILDING	N/A									
Cask Unloading										
Assembly Log Storage										
Processing										
Interim Storage Loading/Unloading										
Building Support Facilities										
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15	
Cask Unloading										
Assembly Log Storage										
Processing										
Volume Reduction										
Canister/Container Closure										
Canister/Container Log Storage										
Interim Storage Loading/Unloading										
HRS/Repository Cost Handling										
Building Support Facilities										
INTERIM STORAGE OPERATIONS	3		60	60						
Storage Facilities										
Storage Units										
Receiving Building										
BALANCE OF PLANT AND SUPPORT OPERATIONS	1								100	
Onsite Preparation										
Offsite Preparation										
Administration										
Other Support Facilities										

TABLE 7-23
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario 8
Construction Phase: Two
Storage Concept: Drywell

Date: 10/21/88
Revision: 2

COST CENTER/Cost Element	Cost (Millions \$)	Percent of M & I Cost per Year Prior to Operations												
		-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6			35	45 (Rev. 1)									
Design														
Proof-of-Principle Tests (6 Tests)	1.0			55	45 (Rev. 2)									
Advanced Conceptual Design	3.0			67	33 (Rev. 2)									
License Application Design	45.1				45	55 (Rev. 2)								
Licensing Support	5.2					40	40	20 (Rev. 2)						
Final Procurement and Construction Design	30.1					80	20	(Rev. 2)						
Title III Support	34.0							20	23	26	22	9		
Operating Contractor Support														
Design	9.9			11	30	31	14	11	3					
Construction	10.8							5	15	23	20	19	13	5
Construction Management	67.4								20	23	26	22	9	
Preoperational Testing and Personnel Training	66.8							3	5	10	17	24	41	

TABLE 7-26
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 0
Construction Phase: Two
Storage Concept: Drywell

Date: 11/23/00
Revision: 4

Millions in 1988 \$					
COST CENTER/Cost Element	Building Area	Facility Cost	Equipment Cost	Total Cost	Notes
CASK OPERATIONS					
Receiving	N/A	3.352	--	3.352	(1) Site development cost for drywell included in drywell unit cost. See consumables, Table 7-29
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.892	10.284	
Assembly Lag Storage	4080	3.074	0.270	3.344	
Processing	12524	9.639	7.619	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	25.146	2.923	28.069 (Rev. 1)	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.903	22.373	
Assembly Lag Storage	4864	1.505	0.895	2.360	
Processing	99733	18.441	66.719	85.160	
Volume Reduction	13237	3.952	8.522	12.474 (Rev. 4)	
Canister/Container Closure	26474	7.983	21.863	29.746 (Rev. 3)	
Canister/Container Lag Storage	48384	14.409	15.371	29.860	
Interim Storage Loading/Unloading	27533	8.279	13.618	23.897	
WCS/Repository Cost Handling	21709	6.586	9.936	16.522	
Building Support Facilities	421418	127.013	112.763	239.778	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	3.311	--	
Storage Units	N/A		See Consumables, Table 7-29		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	32.390	--	32.390 (Rev. 2)	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 3)	

TABLE 7-27
CONSTRUCTION COSTS

Scenario: 8
Construction Phases: Two
Storage Concept: Drywell

Date: 9/9/88
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				10	90						
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				25	45	30					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				20	20	25	25	10			
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
WRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS				10	40	30					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				50	30	20					
Site Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 7-20
CONSTRUCTION COST DISTRIBUTION

Scenario: 8
Construction Phase: Two
Storage Concept: Brywell

Date: 1/20/89
Revision: 4

COST CENTER/Cost Element	Equipment Maintenance/Replacement (1/Year)			Consumables	Notes (Rev. 4)
	Annual	10 Year	20 Year		
CASK OPERATIONS				90.014 M/Year Fixed	(1) PWR = \$30,500/Unit (\$29,000 + \$1500 for 3 HFBC canisters)
Receiving					BWR = \$38,900/Unit (\$29,000 + \$2000 for 4 HFBC canisters + 1/5 of HFBC-only container w/ ZI and fitting canisters)
Cask Lag Storage					
WASTE HANDLING OPERATIONS				\$2.126 M/Year - Operations;	
SPENT FUEL HANDLING BUILDING				90.970 M/Year - Standby (Rev. 2)	(2) PWR or BWR = \$29,000/Unit
Cask Unloading	2.0				
Assembly Lag Storage	1.0				
Processing	1.5	1.8			
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed (Rev. 1)	(3) MLW = \$17,000/Unit
Building Support Facilities	1.1	1.9	12.9		
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.5	(Included in container cost)	
Canister/Container Closure	1.0		1.4	Consolidated fuel and HFBC (1)	
				Intact fuel (2)	
				MLW (3)	
Canister/Container Lag Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
NRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	(Rev. 1) Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS				90.038 M/Year Fixed	
Storage Facilities	2.0	0.8	95	Bare, Intact SF and Intact SF Container (Rev. 4)	
Storage Units				Brywell (30" dia.) = \$13,000/Unit; Consol. SF Container Brywell (30" dia.) = \$14,400/Unit; HFBC and MLW Brywell (30" dia.) = \$12,200/Unit	
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.530 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	55.9	24.0		

TABLE 1-29
ANNUAL OPERATING COSTS

Scenario: 8
Construction Phase: Two
Storage Concept: Drywell

Date: 11/23/88
Revision: 2

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; Inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/4 assemblies BWR = 95/8 assemblies (Rev. 1)	1.5	\$53,900	Load/unload onsite transfer cask : PMR = 530; BWR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and containerize fuel/NFBC	Consolidated: PMR = 834/container; (Rev. 2) BWR = 2070/container (Rev. 2) Intact: PMR = 255/container; BWR = 510/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BWR fuel includes BWR NFBC-only container loading (Rev. 2)
Volume-reduce/package NFBC	PMR = 165/container (Rev. 2) BWR = 303/container (Rev. 2)	1	\$53,900	
Weld/decon/test containers	190/container	1.5 w/o HLM 1.6 w/ HLM	\$53,900	
Container handling: lag storage	90/container	3	\$53,900	
transporter loading/unloading	45/transport load			
NRS transport cask loading	170(SF);170(NFBC);170(HLM);215(RH-LLW)			
Building support staff	N/A	158 w/o HLM 161 w/ HLM	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter Operation (incl. loading of shield plug, and intact SF basket as required)	60/trip from R & H Building 75/trip from SFNB	1	\$53,900	If drywell is reused, reduce by 15 min. (Rev. 1)
Storage placement	50/drywell	3.5 w/o HLM 2.7 w/ HLM	\$53,900	(Rev. 1)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 7-30
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario 8
Construction Phase: Two
Storage Concept: Drywell

Date: 10/11/00
Revision: 1

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	00	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
RRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Note, intact SF drywells = 122
(Rev. 1)

TABLE 7-31
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: B
Construction Phase: Three
Storage Concept: Drywell

Date: 10/21/88
Revision: 2

		Percent of R & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)													
		-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5	+6
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6	18	52	30 (Rev. 1)										
Design														
Proof-of-Principle Tests (6 Tests)	1.0	18	54	28 (Rev. 2)										
Advanced Conceptual Design	3.8		100	(Rev. 2)										
License Application Design	45.1		18	55	27									
Licensing Support	5.2				20	40	40							
Final Procurement and Construction Design	30.1				40	60								
Title III Support	34.0							20	23	26	22	9		
Operating Contractor Support														
Design	9.9		11	30	31	14	11	3						
Construction	10.8						5	15	75	20	19	13	9	
Construction Management	67.4							20	23	26	22	9		
Preoperational Testing and Personnel Training	66.8						3	5	10	17	24	41		

TABLE 7-32
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: B
Construction Phase: Three
Storage Concept: Drywell

Date: 11/23/88
Revision: 4

COST CENTER/Cost Element	Millions in 1988 \$				Notes
	Building Area	Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	3.163	0.829	3.994	(1) Site development cost included in drywell unit cost. See consumables, Table 7-33
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.852	10.284	Dual purpose cask site development cost = \$31,000/cask
Assembly Lag Storage	4080	3.074	0.270	3.344	
Processing	12324	9.639	7.613	17.254	(2) Drywell equipment cost = \$3.311 M
Interim Storage Loading/Unloading	17170	15.402	0.439	16.121	
Building Support Facilities	92916	25.144	2.923	28.069 (Rev. 1)	Dual purpose cask equip. = \$3.940 M
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.905	0.855	2.360	
Processing	39733	18.441	66.719	85.160	
Volume Reduction	13237	3.952	8.322	12.474 (Rev. 4)	
Container/Container Closure	26474	7.903	21.863	29.766 (Rev. 3)	
Container/Container Lag Storage	48384	14.489	15.371	29.860	
Interim Storage Loading/Unloading	27333	8.279	15.618	23.897	
RRS/Repository Cask Handling	21709	4.384	9.934	16.327	
Building Support Facilities	421418	127.015	112.763	239.778	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	(2)	--	
Storage Units	N/A		See Consumables, Table 7-33		
Receiving Building	N/A	1.407	1.006	2.413	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Waste Preparation	N/A	32.390	--	32.390 (Rev. 2)	
Offsite Preparation	N/A	16.293	--	16.293	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 3)	

TABLE 7-33
CONSTRUCTION COSTS

Scenario: 8
Construction Phase: Three
Storage Concept: Drywell

Date: 9/9/88
Revision: 0

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASH OPERATIONS						100					
Receiving											
Cash Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING						25	45	30			
Cash Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING						20	20	25	25	10	
Cash Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
HRS/Repository Cash Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS											
Storage Facilities						100					
Storage Units											
Receiving Building						100					
BALANCE OF PLANT AND SUPPORT OPERATIONS						50	30	20			
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 7-34
CONSTRUCTION COST DISTRIBUTION

Scenario: B
Construction Phase: Three
Storage Concept: Drywell

Date: 1/20/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (%/Year)			Consumables	Notes (Rev. 3)
	Annual	10 Year	20 Year		
CASK OPERATIONS				90.020 M/Year Fixed	(1) PWR = \$30,500/Unit (\$29,000 + \$1500 for 3 HFBC canisters) BWR = \$38,900/Unit (\$29,000 + \$2000 for 4 HFBC canisters + 1/5 of HFBC-only container w/ 21 and fitting canisters)
Receiving	2.0				
Cask Lag Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; 90.970 M/Year - Standby (Rev. 1)	(2) PWR or BWR = \$29,000/Unit
Cask Unloading	2.0				
Assembly Lag Storage	1.0				
Processing	1.5	1.8			
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed	
Building Support Facilities	1.1	1.9	12.9		(3) MLN = \$17,000/Unit
RECEIVING AND HANDLING BUILDING				\$6.108 M/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.5	(Included in container cost)	
Canister/Container Closure	1.0		1.4	Consolidated fuel and HFBC (1) Intact fuel (2) MLN (3)	
Canister/Container Lag Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
MRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Dumps = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	1.6	3.0	58	1st Year Ops. = \$0.006 M Fixed; Other Ops. Years = \$0.050 M/Year Bare, Intact SF and Intact SF Container (Rev. 3) Drywell (30" dia.) = \$13,000/Unit; Consol. SF Container Drywell (30" dia.) = \$14,400/Unit; HFBC and MLN Drywell (30" dia.) = \$12,200/Unit	
Storage Units					
Receiving Building	2.0				
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	39.4	37.3		
Other Support Facilities	1.6	55.9	24.0		

TABLE 7-33
ANNUAL OPERATING COSTS

Scenario: 8
Construction Phase: Three
Storage Concept: Drywell

Date: 11/23/88
Revision: 2

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	FTE/crow increases to 8 for first 4 years of operations
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/MRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PWR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PWR = 95/4 assemblies BWR = 95/8 assemblies (Rev. 1)	1.5	\$53,900	Load/unload onsite transfer cask : PWR = 530; BWR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/MRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PWR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and containerize fuel/WFBC	Consolidated: PWR = 834/container; (Rev. 2) BWR = 2070/container (Rev. 2) Intact: PWR = 255/container; BWR = 510/container	2.5	\$53,900	Requires all 4 cells to handle both PWR and BWR fuel Includes BWR WFBC-only container loading (Rev. 2)
Volume-reduce/package WFBC	PWR = 165/container (Rev. 2) BWR = 303/container (Rev. 2)	1	\$53,900	
Mold/decom/test containers	190/canister	1.5 w/o HLM 1.6 w/ HLM	\$53,900	
Container handling:		3	\$53,900	
lag storage	90/container			
transporter loading/unloading	45/transporter load			
MRS transport cask loading	170(SF);170(WFBC);170(HLM);215(RH-LLW)			
Building support staff	N/A	158 w/o HLM 161 w/ HLM	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	230/cask	17	\$53,900	
Transporter operation (incl. loading of shield plug, and intact SF basket as required)	60/trip from R & H Building 75/trip from SFHB	1	\$53,900	If drywell is reused, reduce by 15 min. (Rev. 1)
Storage placement	50/drywell	3.5 w/o HLM 2.7 w/ HLM	\$53,900	(Rev. 1)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 7-36
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: B
Construction Phase: Three
Storage Concept: Drywell

Date: 10/11/88
Revision: 1

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cool Log Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cool Unloading									
Assembly Log Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cool Unloading									
Assembly Log Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Log Storage									
Interim Storage Loading/Unloading									
HRS/Repository Cool Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Offsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Note, intact SF drywells = 12%
(Rev. 1)

TABLE 7-37
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: B
Construction Phase: Single
Storage Concept: Vault

Date : 10/18/88
Revision : 0

COST CENTER/Cost Element	Cost (Millions \$)	Percent of M & I Cost per Year Prior to Operations											
		-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	41	47	12									
Design													
Proof-of-Principle Tests (6 Tests)	1.0	36	55	9									
Advanced Conceptual Design	3.3	33	67										
License Application Design	45.4		41	34	3								
Licensing Support	5.2				37	40	23						
Final Procurement and Construction Design	30.3				73	27							
Title III Support	33.9						11	26	26	24	13		
Operating Contractor Support													
Design	9.9	11	30	31	14	11	3						
Construction	10.0					5	15	23	20	19	13	9	
Construction Management	67.0						11	26	26	24	13		
Preoperational Testing and Personnel Training	66.0					3	5	10	17	24	41		

TABLE 7-50
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: S
Construction Phase: Single
Storage Concept: Vault

Date: 11/23/00
Revision: 2

COST CENTER/Cost Element	Building Area	Millions in 1900 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	3.352	--	3.352	(1) Fixed cost per storage building
Cask Log Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	N/A	
Cask Unloading					
Assembly Log Storage					
Processing					
Interim Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Log Storage	4864	1.305	0.895	2.300	
Processing	59733	10.441	66.719	85.160	
Volume Reduction	13237	3.952	8.522	12.474 (Rev. 2)	
Canister/Container Closure	26474	7.903	21.863	29.766	
Canister/Container Log Storage	48384	14.409	15.371	29.840	
Interim Storage Loading/Unloading	27533	8.279	15.618	23.897	
WCS/Repository Cask Handling	21709	4.386	9.936	16.522	
Building Support Facilities	421410	127.013	112.763	239.770	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	16.040	9.770	25.810 (1)	
Storage Units	N/A		See Consumables, Table 7-41		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	42.898	--	42.898	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 1)	

TABLE 7-39
CONSTRUCTION COSTS

Scenario: I
Construction Phase: Single
Storage Concept: Vault

Date: 10/10/08
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS			10	90							
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING		N/A	N/A	N/A	N/A	N/A					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING		2	20	29	29	20					
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
WIS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS		13	26	26	24	13					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS			50	30	20						
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 7-40
CONSTRUCTION COST DISTRIBUTION

Scenario: 8
Construction Phase: Single
Storage Concept: Vault

Date: 1/20/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (1/Year)			Consumables	Notes (Rev. 3)
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.014 M/Year Fixed	(1) Cost per storage building
Receiving					
Cask Lag Storage					(2) PMR = \$30,500/Unit (\$29,000 + \$1500 for 3 HFBC canisters)
WASTE HANDLING OPERATIONS					SMR = \$38,900/Unit (\$29,000 + \$2000 for 4 HFBC canisters + 1/5 of HFBC-only container w/ 21 end fitting canisters)
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A		
Cask Unloading					
Assembly Lag Storage					
Processing					
Interim Storage Loading/Unloading					
Building Support Facilities					(3) PMR or SMR = \$29,000/Unit
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	
Cask Unloading	0.7		3.4		(4) MLM = \$17,000/Unit
Assembly Lag Storage	1.0				
Processing	1.2	33.8	3.7		
Volume Reduction	1.2		0.5	(Included in container cost)	
Canister/Container Closure	1.0		1.4	Consolidated fuel and HFBC (2)	
				Intact fuel (3)	
				MLM (4)	
Canister/Container Lag Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
HRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0 (1)	0.3 (1)	0.6 (1)	\$0.827 M/Year Fixed (1);	
				\$0.0006 M/Year/Position (Rev. 1)	
Storage Units				SF Container or MLM Canister Position	
				(30") = \$36,700/Unit	
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.330 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	55.9	24.0		

TABLE 7-41
ANNUAL OPERATING COSTS

Scenario: B
Construction Phase: Single
Storage Concept: Vault

Date: 11/23/88
Revision: 1

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/PWR transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks				
Storage loading/unloading				
Building support staff				
RECEIVING AND HANDLING BUILDING				
Prepare reactor/PWR transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 319/cask Rail = 613/cask	4.3	\$53,900	
Unload transport casks into process cells	PWR = 190(T);540(R) BWR = 238(T);1000(R)	1.5	\$53,900	
Consolidate and containerize fuel/WFC	Consolidated: PWR = 834/container; (Rev. 1) BWR = 2070/container (Rev. 1)	2.5	\$53,900	Requires all 4 cells to handle both PWR and BWR fuel Includes BWR WFC-only container loading (Rev. 1)
Volume-reduce/package WFC	Intact: PWR = 253/container; BWR = 510/container PWR = 163/container (Rev. 1) BWR = 303/container (Rev. 1)	1	\$53,900	
Weld/decom/test containers	190/container	1.5 w/o MLW 1.6 w/ MLW	\$53,900	
Container handling: ing storage	90/container	3	\$53,900	
transporter loading/unloading	45/transporter load			
PWR transport cask loading	170(SF);170(WFC);170(MLW);215(RH-LLW)			
Building support staff	N/A	150 w/o MLW 161 w/ MLW	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter operation	90/trip	2	\$53,900	Time based on 15,000 HTU onsite storage
Storage placement	85/position w/o MLW 90/position w/ MLW	32 w/o MLW 21.5 w/ MLW	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 7-42
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 8
Construction Phase: Single
Storage Concept: Vault

Date: 10/10/88
Revision: 0

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	N/A								
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
WBS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		20	40	40				
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Units Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

TABLE 7-43
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: B
Construction Phases Two
Storage Concept: Vault

Date: 10/10/00
Revision: 0

		Percent of H & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6		14	52	34									
Design														
Proof-of-Principle Tests (6 Tests)	1.0		14	55	31									
Advanced Conceptual Design	9.3			100										
License Application Design	52.1			14	55	31								
Licensing Support	5.2					17	40	40	3					
Final Procurement and Construction Design	34.0					33	67							
Title III Support	48.7								21	24	24	24	7	
Operating Contractor Support														
Design	9.9		3	11	20	30	14	11	3					
Construction	10.8							5	15	23	20	19	13	5
Construction Management	68.2								21	24	24	24	7	
Preoperational Testing and Personnel Training	66.8							3	5	10	17	24	41	

TABLE 7-44
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: B
Construction Phase: Two
Storage Concept: Vault

Date: 11/23/88
Revision: 2

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					(1) Fixed cost per storage building
Receiving	N/A	3.352	--	3.352	
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Lag Storage	4080	3.074	0.270	3.344	
Processing	12524	9.639	7.613	17.254	
Interior Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	25.146	2.923	28.069	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	89672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.503	0.833	2.340	
Processing	39733	18.441	66.719	85.160	
Volume Reduction	13237	3.932	8.322	12.474 (Rev. 2)	
Canister/Container Closure	76474	7.903	21.863	29.766 (Rev. 1)	
Canister/Container Lag Storage	48384	14.489	13.371	27.860	
Interior Storage Loading/Unloading	27533	8.279	15.618	23.897	
WIS/Repository Cask Handling	21709	6.586	9.936	16.522	
Building Support Facilities	421410	127.013	112.763	239.776	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	16.040	9.770	25.810 (1)	
Storage Units	N/A		See Consumables, Table 7-47		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Insite Preparation	N/A	46.610	--	46.610	
Offsite Preparation	N/A	16.293	--	16.293	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 1)	

TABLE 7-45
CONSTRUCTION COSTS

Scenario: B
Construction Phase: Two
Storage Concept: Vault

Date : 10/18/00
Revision : 0

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				10	90						
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				25	45	30					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				20	20	25	25	10			
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
WVS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS				33	37	30					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				50	50	20					
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 7-46
CONSTRUCTION COST DISTRIBUTION

Scenario: 8
Construction Phase: Two
Storage Concept: Vault

Date: 1/28/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (\$/Year)			Consumables	Notes (Rev. 3)
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.014 M/Year Fixed	(1) Cost per storage building
Receiving					
Cask Lag Storage					(2) PWR = \$30,500/Unit (\$29,000 + \$1500 for 3 HFBC canisters)
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby (Rev. 1)	BWR = \$38,900/Unit (\$29,000 + \$2000 for 4 HFBC canisters + 1/5 of HFBC-only container w/ 21 end fitting canisters)
Cask Unloading	2.0				
Assembly Lag Storage	1.0				
Processing	1.3	1.8			
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed	
Building Support Facilities	1.1	1.9	12.9		(3) PWR or BWR = \$29,000/Unit
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	
Cask Unloading	0.7		3.4		(4) HLW = \$17,000/Unit
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.5	(Included in container cost)	
Canister/Container Closure	1.0		1.4	Consolidated fuel and HFBC (2) Intact fuel (3) HLW (4)	
Canister/Container Lag Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
WRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0 (1)	0.3 (1)	0.6 (1)	\$0.827 M/Year Fixed (1); \$0.0006 M/Year/Position (Rev. 1) SF Container or HLW Canister Position (30") = \$36,700/Unit; Bore, Intact SF Position (30") = \$36,700/Unit	
Storage Units					
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.590 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	35.9	24.0		

TABLE 7-47
ANNUAL OPERATING COSTS

Scenario: 8
Construction Phase: Two
Storage Concepts: Vault

Date: 11/23/88
Revision: 1

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/4 assemblies BMR = 95/8 assemblies	1.5	\$53,900	Load/unload onsite transfer cost : PMR = 530; BMR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and containerize fuel/NFBC	Consolidated: PMR = 834/container; (Rev. 1) BMR = 2070/container (Rev. 1)	2.5	\$53,900	Requires all 4 cells to handle both PMR and BMR fuel Includes BMR NFBC-only container loading (Rev. 1)
Volume-reduce/package NFBC	Intact: PMR = 255/container; BMR = 510/container PMR = 165/container (Rev. 1) BMR = 303/container (Rev. 1)	1	\$53,900	
Weld/decom/test containers	190/container	1.5 w/o MLM 1.6 w/ MLM	\$53,900	
Container handling: lag storage	90/container	3	\$53,900	
transporter loading/unloading	45/transport load			
NRS transport cask loading	170(SF);170(NFBC);170(MLM);215(RH-LLM)			
Building support staff	N/A	158 w/o MLM 161 w/ MLM	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter Operation (incl. loading of intact SF basket as required)	85/trip from R & H Building 97/trip from SFHB	2 3	\$53,900	Times based on 15,000 Mtu onsite storage
Storage placement	85/position w/o MLM 90/position w/ MLM 80/bare, intact SF position	32 w/o MLM 21.5 w/ MLM 21.5	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 7-48
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: B
Construction Phase: Two
Storage Concept: Vault

Date: 10/10/98
Revision: 0

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations								
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5	+6
CASK OPERATIONS	5							100		
Receiving										
Cask Lag Storage										
WASTE HANDLING OPERATIONS										
SPENT FUEL HANDLING BUILDING	12				10	80	10			
Cask Unloading										
Assembly Lag Storage										
Processing										
Interim Storage Loading/Unloading										
Building Support Facilities										
RECEIVING AND HANDLING BUILDING	12				10	70	25	30	15	
Cask Unloading										
Assembly Lag Storage										
Processing										
Volume Reduction										
Canister/Container Closure										
Canister/Container Lag Storage										
Interim Storage Loading/Unloading										
HRS/Repository Cask Handling										
Building Support Facilities										
INTERIM STORAGE OPERATIONS	5		20	40	40					
Storage Facility										
Storage Units										
Receiving Building										
BALANCE OF PLANT AND SUPPORT OPERATIONS	1								100	
Onsite Preparation										
Offsite Preparation										
Administration										
Other Support Facilities										

Note, intact SF vault = 12%

TABLE 7-49
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 8
Construction Phases: Three
Storage Concept: Vault

Date : 10/18/88
Revision : 0

		Percent of R & I Cost per Year Prior to Operations												
COST-CENTER/Cost Element	Cost (Millions \$)	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5	+6
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6	18	52	30										
Design														
Proof-of-Principle Tests (6 Tests)	1.0	18	55	27										
Advanced Conceptual Design	9.3		100											
License Application Design	52.1		18	55	27									
Licensing Support	3.2				20	40	40							
Final Procurement and Construction Design	34.8				40	60								
Title III Support	48.7							30	30	23	14	3		
Operating Contractor Support														
Design	9.9		11	30	31	14	11	3						
Construction	16.8						5	15	23	20	19	13	5	
Construction Management	68.2							30	30	23	14	3		
Preoperational Testing and Personnel Training	66.8						3	5	10	17	24	41		

TABLE 7-50
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 0
Construction Phase: Three
Storage Concept: Vault

Date: 11/23/80
Revision: 2

Billions in 1980 \$

COST CENTER/Cost Element	Building Area	Facility Cost	Equipment Cost	Total Cost	Notes
CASK OPERATIONS					(1) Fixed cost per storage building
Receiving	N/A	9.185	0.829	9.994	
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					(2) Dual purpose cask: Site development = \$31,000/cask; Equipment = \$3.940 M (Rev. 1)
SPENT FUEL HANDLING BUILDING					
Cost Unloading	31420	7.432	2.852	10.284	
Assembly Lag Storage	4880	3.074	0.270	3.344	
Processing	12524	9.639	7.615	17.254	
Interior Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	25.146	2.923	28.069	
RECEIVING AND HANDLING BUILDING					
Cost Unloading	85672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.305	0.855	2.160	
Processing	99733	18.441	66.719	85.160	
Volume Reduction	15237	3.952	8.522	12.474 (Rev. 2)	
Container/Container Closure	26474	7.903	21.063	29.766 (Rev. 1)	
Container/Container Lag Storage	48384	14.489	15.371	29.860	
Interior Storage Loading/Unloading	27333	8.279	15.618	23.897	
WRS/Repository Cost Handling	21709	6.386	9.936	16.322	
Building Support Facilities	421418	127.013	112.763	239.776	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	16.040	9.770	25.810 (1 & 2)	
Storage Units	N/A		See Consumables, Table 7-53		
Receiving Building	N/A	1.607	1.006	2.613	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	46.610	--	46.610	
Offsite Preparation	N/A	16.293	--	16.293	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 1)	

TABLE 7-51
CONSTRUCTION COSTS

Scenario: B
Construction Phase: Three
Storage Concept: Vault

Date: 10/10/00
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS						100					
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING						23	45	30			
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING						20	20	25	25	10	
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
HRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS											
Storage Facilities						36	37	27			
Storage Units											
Receiving Building						100					
BALANCE OF PLANT AND SUPPORT OPERATIONS						50	30	20			
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 7-52
CONSTRUCTION COST DISTRIBUTION

Scenario: 8
Construction Phase: Three
Storage Concept: Vault

Date: 1/20/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (%/Year)			Consumables	Notes (Rev. 3)
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.020 M/Year Fixed	(1) Cost per storage building
Receiving	2.0				
Cask Lag Storage					(2) PWR = \$30,500/Unit (\$29,000 + \$1500 for 3 HFBC canisters)
WASTE HANDLING OPERATIONS				\$2.126 M/Year - Operations;	BWR = \$38,900/Unit (\$29,000 + \$2000 for 4 HFBC canisters + 1/5 of HFBC-only container w/ 21 end fitting canisters)
SPENT FUEL HANDLING BUILDING				\$0.970 M/Year - Standby (Rev. 1)	
Cask Unloading	2.0				
Assembly Lag Storage	1.0				
Processing	1.5	1.8			
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed	
Building Support Facilities	1.1	1.9	12.9		(3) PWR or BWR = \$29,000/Unit
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	
Cask Unloading	0.7		3.4		(4) MLM = \$17,000/Unit
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.5	(Included in container cost)	
Canister/Container Closure	1.0		1.4	Consolidated fuel and HFBC (2)	
				Intact fuel (3)	
				MLM (4)	
Canister/Container Lag Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
MRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0 (1)	0.3 (1)	0.6 (1)	1st Year Ops. = \$0.006 M Fixed	
				Other Ops. Years = \$0.827 M/Year Fixed (1);	
				\$0.0006 M/Year/Position (Rev. 1)	
Storage Units				SF Container or MLM Canister Position	
				(30") = \$36,700/Unit; Bare, Intact SF	
				Position (30") = \$36,700/Unit	
Receiving Building	2.0				
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	33.4	37.3		
Other Support Facilities	1.6	33.9	24.0		

TABLE 7-53
ANNUAL OPERATING COSTS

Scenario: B
Construction Phase: Three
Storage Concept: Vault

Date: 11/23/88
Revision: 1

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	FTE/crew increases to 8 for first 4 years of operations
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PMR = 150(T);540(R) BNR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/A assemblies BNR = 95/B assemblies	1.5	\$53,900	Load/unload onsite transfer cask : PMR = 530; BNR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BNR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and containerize fuel/NFBC	Consolidated: PMR = 834/container; (Rev. 1) BNR = 2070/container (Rev. 1) Intact: PMR = 255/container;BNR = 510/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BNR fuel Includes BNR NFBC-only container loading (Rev. 1)
Volume-reduce/package NFBC	PMR = 165/container (Rev. 1) BNR = 303/container (Rev. 1)	1	\$53,900	
Hold/decom/test containers	190/canister	1.5 w/o HLW 1.6 w/ HLW	\$53,900	
Container handling: lag storage	90/container	3	\$53,900	
transporter loading/unloading	45/transporter load			
NRS transport cask loading	170(SF);170(NFBC);170(MLW);215(RH-LLW)			
Building support staff	N/A	158 w/o HLW 161 w/ HLW	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	230/cask	17	\$53,900	
Transporter operation (incl. loading of intact SF basket as required)	85/trip from R & H Building 95/trip from SFHB	2 3	\$53,900	Times based on 15,000 NTU onsite storage
Storage placement	85/position w/o HLW 90/position w/ HLW 80/bare, intact SF position	32 w/o HLW 21.5 w/ HLW 21.5	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 7-34
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: B
Construction Phase: Three
Storage Concept: Vault

Date: 10/18/88
Revision: 0

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	3							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
WBS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	3		20	40	40				
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Burn, intact SF vault = 12%

TABLE 7-55
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 9
Construction Phase: Single
Storage Concepts: Cast

Date: 10/21/00
Revision: 3

COST CENTER/Cost Element	Cost (Millions \$)	Percent of H & I Cost per Year Prior to Operations											
		-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	41	47	12 (Rev. 2)									
Design													
Proof-of-Principle Tests (6 Tests)	1.0	41	54	5 (Rev. 3)									
Advanced Conceptual Design	N/A												
License Application Design	38.3		41	54	5								
Licensing Support	5.2				37	60	23						
Final Procurement and Construction Design	25.6				73	27							
Title III Support	30.2						2	20	29	29	20		
Operating Contractor Support													
Design	9.9	11	30	31	14	11	3						(Rev. 1)
Construction	10.8					5	15	23	20	19	13	5	(Rev. 1)
Construction Management	56.1						2	20	29	29	20		
Preoperational Testing and Personnel Training	66.8					3	5	10	17	24	41		(Rev. 1)

TABLE 7-56
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 9
Construction Phase: Single
Storage Concept: Cask

Date: 11/23/88
Revision: 1

COST CENTER/Cost Element	Building Area	Millions in 1988 \$		
		Facility Cost	Equipment Cost	Total Cost
CASK OPERATIONS				
Receiving	N/A	3.332	--	3.332
Cask Lag Storage	N/A	2.996	--	2.996
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	N/A
Cask Unloading				
Assembly Lag Storage				
Processing				
Interim Storage Loading/Unloading				
Building Support Facilities				
RECEIVING AND HANDLING BUILDINGS				
Cask Unloading	85672	11.970	10.403	22.373
Assembly Lag Storage	4864	1.905	0.833	2.340
Processing	59733	18.441	66.719	85.160
Volume Reduction	13237	3.952	0.322	12.474 (Rev. 1)
Container/Container Closure	26474	7.903	21.863	29.766
Container/Container Lag Storage	48384	14.689	13.371	29.060
Interim Storage Loading/Unloading	27533	8.279	13.618	23.897
WRS/Repository Cask Handling	21709	4.386	9.936	16.322
Building Support Facilities	421418	127.015	107.493	234.508
INTERIM STORAGE OPERATIONS				
Storage Facilities	N/A	07500/cask	7.810	--
Storage Units	N/A		See Consumables, Table 7-59	
Receiving Building	N/A	N/A	N/A	N/A
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Onsite Preparation	N/A	34.137	--	34.137
Offsite Preparation	N/A	16.293	--	16.293
Administration	N/A	2.605	0.424	3.029
Other Support Facilities	N/A	42.130	18.915	61.045

TABLE 7-57
CONSTRUCTION COSTS

Scenario: 9
Construction Phase: Single
Storage Concept: Cask

Date: 10/21/88
Revision: 1

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS			10	90							
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING		N/A	N/A	N/A	N/A	N/A					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING		2	20	29	29	20					
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Cask/Container Closure											
Cask/Container Lag Storage											
Interim Storage Loading/Unloading											
RH/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS			17	33	33	17					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS			50	30	20 (Rev. 1)						
Suite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 7-50
CONSTRUCTION COST DISTRIBUTION

Scenario: 9
Construction Phase: Single
Storage Concept: Cask

Date: 1/20/99
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (\$/Year)			Consumables	Notes (Rev. 3)
	Annual	10 Year	20 Year		
CASK OPERATIONS				90.014 M/Year Fixed	(1) PMR = \$30,300/Unit (\$29,000 + \$1500 for 3 HFBC canisters) BMR = \$38,900/Unit (\$29,000 + \$2000 for 4 HFBC canisters + 1/5 of HFBC-only container w/ 21 end fitting canisters)
Receiving					
Cask Lag Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A		
Cask Unloading					
Assembly Lag Storage					
Processing					(2) PMR or BMR = \$29,000/Unit
Interim Storage Loading/Unloading					
Building Support Facilities					(3) HLW = \$17,000/Unit
RECEIVING AND HANDLING BUILDING				96.188 M/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.3		(Included in container cost)
Canister/Container Closure	1.0		1.4		Consolidated fuel and HFBC (1) Intact fuel (2) HLW (3)
Canister/Container Lag Storage	0.3		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
WRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0	0.8	95	90.050 M/Year Fixed	
Storage Units				Casks = 90.197 M/Unit	
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				91.350 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	55.9	24.0		

TABLE 7-59
ANNUAL OPERATING COSTS

Scenario: 9
Construction Phase: Single
Storage Concept: Cask

Date: 1/20/89
Revision: 3

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 93/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks				
Storage loading/unloading				
Building support staff				
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and containerize fuel/NFBC	Consolidated: PMR = 834/container; (Rev. 2) BMR = 2070/container (Rev. 2)	2.5	\$53,900	Requires all 4 cells to handle both PMR and BMR fuel Includes BMR NFBC-only container loading (Rev. 2)
Volume-reduce/package NFBC	Intact: PMR = 255/container; BMR = 310/container PMR = 165/container (Rev. 2) BMR = 303/container (Rev. 2)	1	\$53,900	
Weld/decom/test containers	190/container	1.5 w/o MLW 1.6 w/ MLW	\$53,900	
Container handling: lag storage	90/container	3	\$53,900	
storage cask loading/unloading	90/cask of 4 containers			
NRS transport cask loading	170(SF);170(NFBC);170(MLW);215(RH-LLW)			
Building support staff	N/A	156 w/o MLW 157 w/ MLW	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Storage cask preparation & closing/reopening	210/cask	4	\$53,900	If cask is reused, add 30 min. (Rev. 1)
Storage placement (incl. 45 min. to obtain new cask)	145/cask	6	\$53,900	If cask is reused, reduce by 45 min. (Rev. 3)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff (excl. Cask Mfg. Facility of 11)	N/A	264	\$53,900	

TABLE 7-60
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 9
Construction Phase: Single
Storage Concept: Cask

Date: 9/2/00
Revision: 0

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Lay Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	N/A								
Cask Unloading									
Assembly Lay Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Lay Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lay Storage									
Interim Storage Loading/Unloading									
HRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facility									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Bottle Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

TABLE 7-61
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 9
Construction Phase: Two
Storage Concepts: Cost

Date: 10/21/00
Revision: 4

Storage Concept Cost		Percent of M & I Cost per Year Prior to Operations										
COST CENTER/Cost Element	Cost (Millions \$)	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION												
Site Selection/Investigation	8.6	35	45 (Rev. 3)									
Design												
Proof-of-Principle Tests (6 Tests)	1.0	35	45 (Rev. 4)									
Advanced Conceptual Design	3.0	67	33 (Rev. 4)									
License Application Design	45.1	45	55 (Rev. 4)									
Licensing Support	5.2				40	40	20 (Rev. 4)					
Final Procurement and Construction Design	30.1				80	20	(Rev. 4)					
Title III Support	34.0						20	23	26	22	9	
Operating Contractor Support												
Design	9.9	11	30	31	14	11	3					
Construction	10.8					5	15	23	20	19	13	3 (Rev. 1)
Construction Management	67.4						20	23	26	22	9	(Rev. 2)
Preoperational Testing and Personnel Training	66.8					3	5	10	17	24	41	(Rev. 1)

TABLE 7-62
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: V
Construction Phase: Two
Storage Concept: Cask

Date: 11/23/00
Revision: 3

COST CENTER/Cont Element	Building Area	Millions in 1980 \$		
		Facility Cost	Equipment Cost	Total Cost
CASK OPERATIONS				
Receiving	N/A	3.352	--	3.352
Cask Log Storage	N/A	2.996	--	2.996
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Cask Unloading	31420	7.432	2.852	10.284
Assembly Log Storage	4080	3.074	0.270	3.344
Processing	12524	9.639	7.615	17.254
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121
Building Support Facilities	92916	23.146	2.923	26.069 (Rev. 1)
RECEIVING AND HANDLING BUILDING				
Cask Unloading	85672	11.970	10.403	22.373
Assembly Log Storage	4864	1.505	0.855	2.360
Processing	59733	18.441	66.719	85.160
Volume Reduction	13237	3.932	8.522	12.474 (Rev. 3)
Canister/Container Closure	26474	7.903	21.863	29.766
Canister/Container Log Storage	48384	14.489	15.371	29.860
Interim Storage Loading/Unloading	27533	8.279	15.618	23.897
RRS/Repository Cask Handling	21709	6.986	9.936	16.922
Building Support Facilities	421418	127.015	107.493	234.508
INTERIM STORAGE OPERATIONS				
Storage Facilities	N/A	\$7500/cask	7.810	--
Storage Units	N/A		See Consumables, Table 7-65	
Receiving Building	N/A	N/A	N/A	N/A
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Waste Preparation	N/A	39.895	--	39.895 (Rev. 2)
Offsite Preparation	N/A	16.293	--	16.293
Administration	N/A	2.605	0.424	3.029
Other Support Facilities	N/A	42.130	18.915	61.045

TABLE 7-63
CONSTRUCTION COSTS

Scenario: 9
Construction Phase: Two
Storage Concept: Cask

Date: 9/2/00
Revision: 0

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				10	90						
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				25	45	30					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interior Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				20	20	25	25	10			
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interior Storage Loading/Unloading											
HNF/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS				10	60	30					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				50	30	20					
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 7-40
CONSTRUCTION COST DISTRIBUTION

Scenario: 9
Construction Phase: Two
Storage Concept: Cask

Date: 1/20/89
Revision: 4

COST CENTER/Cost Element	Equipment Maintenance/Replacement (1/Year)			Consumables	Notes (Rev. 4)
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.014 M/Year Fixed	(1) PMR = \$30,000/Unit (\$29,000 + \$1500 for 3 HFBC canisters)
Receiving					PMR = \$38,900/Unit (\$29,000 + \$2000 for 4 HFBC canisters + 1/3 of HFBC-only container w/ 21 and fitting canisters)
Cask Lag Storage					
WASTE HANDLING OPERATIONS				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby (Rev. 2)	(2) PMR or PMR = \$29,000/Unit
SPENT FUEL HANDLING BUILDING				Transfer Casks = \$3.9 M Fixed	(3) MLM = \$17,000/Unit
Cask Unloading	2.0			\$6.188 M/Year Fixed	
Assembly Lag Storage	1.0				
Processing	1.5	1.8			
Interim Storage Loading/Unloading	1.2		24.0		
Building Support Facilities	1.1	1.9	12.9		
RECEIVING AND HANDLING BUILDING					
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.5		(Included in container cost)
Canister/Container Closure	1.0		1.4		Consolidated fuel and HFBC (1)
					Intact fuel (2)
					MLM (3)
Canister/Container Lag Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
WRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2		Drums = \$100/Unit
INTERIM STORAGE OPERATIONS				\$0.050 M/Year Fixed	
Storage Facilities	2.0	0.8	95		Casks = \$0.197 M/Unit
Storage Units					
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.350 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	35.9	24.0		

TABLE 7-6S
ANNUAL OPERATING COSTS

Scenario: 9
Construction Phase: Two
Storage Concept: Cask

Date: 1/20/89
Revision: 3

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask: 375/cask
Unload transport casks	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading	PMR = 510/cask (Rev. 1) BWR = 1230/cask (Rev. 3)	1.5	\$53,900	Load/unload onsite transfer cask: PMR = 530; BWR = 1070
Building support staff	N/A	51	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and containerize fuel/WFBC	Consolidated: PMR = 834/container; (Rev. 2) BWR = 2070/container (Rev. 2) Intact: PMR = 255/container; BWR = 510/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BWR fuel includes BWR WFBC-only container loading (Rev. 2)
Volume-reduce/package WFBC	PMR = 165/container (Rev. 2) BWR = 303/container (Rev. 2)	1	\$53,900	
Weld/decon/test containers	190/canister	1.5 w/d HLM 1.6 w/ HLM	\$53,900	
Container handling:		3	\$53,900	
lag storage	90/container			
storage cask loading/unloading	90/cask of 4 containers			
WRS transport cask loading	170(SF);170(WFBC);170(HLM);215(RH-LLM)			
Building support staff	N/A	156 w/d HLM 157 w/ HLM	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Storage cask preparation & closing/reopening	210/cask	4	\$53,900	If cask is reused, add 30 min. (Rev. 1)
Storage placement (incl. 45 min. to obtain new cask)	145/cask	6	\$53,900	If cask is reused, reduce by 45 min. (Rev. 3)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff (excl. Cask Mfg. Facility of 11)	N/A	264	\$53,900	

TABLE 7-66
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 9
Construction Phase: Two
Storage Concept: Cask

Date : 10/11/00
Revision : 2

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	0	+1	+2	+3	+4	
CASK OPERATIONS	5							100	(Rev.1)
Receiving									
Cask Log Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING OUTLINE	12				10	80	10		
Cask Unloading									
Assembly Log Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Log Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Log Storage									
Interim Storage Loading/Unloading									
WRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					Bare, intact SF costs = 12% (Rev. 2)
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Route Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

TABLE 7-67
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario 9
Construction Phase: Three
Storage Concepts Cost

Date: 10/21/00
Revision: 2

		Percent of M & I Cost per Year Prior to Operations											
COST CENTER/Cost Element	Cost (Millions \$)	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	18	52	30 (Rev. 1)									
Design													
Proof-of-Principle Tests (6 Tests)	1.0	18	54	28 (Rev. 2)									
Advanced Conceptual Design	3.8		100	(Rev. 2)									
License Application Design	45.1		18	55	27								
Licensing Support	5.2				20	40	40						
Final Procurement and Construction Design	30.1				40	60							
Title III Support	34.0							20	23	26	22	9	
Operating Contractor Support													
Design	9.9		11	30	31	14	11	3					
Construction	10.8						5	13	23	20	19	13	5
Construction Management	67.4							20	23	26	22	9	
Preoperational Testing and Personnel Training	66.8						3	5	10	17	24	41	

TABLE 7-68
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 9
Construction Phase: Three
Storage Concept: Cask

Date: 11/23/88
Revision: 4

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					(1) Site development:
Receiving	N/A	5.163	0.829	5.994	Storage cost = \$7500/cask
Cask Log Storage	N/A	2.996	--	2.996	Seal purpose cask = \$31,000/cask
WASTE HANDLING OPERATIONS					(2) Storage cask equipment = \$7.810 M
SPENT FUEL HANDLING BUILDING					Seal purpose cask equip. = \$3.940 M
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Log Storage	4080	3.074	0.270	3.344	
Processing	12524	9.639	7.615	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	29.146	2.923	28.069 (Rev. 2)	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	18.403	22.373	
Assembly Log Storage	4864	1.303	0.855	2.158	
Processing	59733	18.441	66.719	85.160	
Volume Reduction	13237	3.952	0.522	12.474 (Rev. 4)	
Canister/Container Closure	26474	7.903	21.863	29.766	
Canister/Container Log Storage	48384	14.489	15.371	29.860	
Interim Storage Loading/Unloading	27333	8.279	15.618	23.897	
WMS/Repository Cask Handling	21709	4.966	9.936	16.322	
Building Support Facilities	421418	127.015	107.493	234.508	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	(2)	-- (Rev. 1)	
Storage Bays	N/A		See Commales, Table 7-71		
Receiving Building	N/A	1.607	1.006	2.613	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	39.895	--	39.895 (Rev. 3)	
Offsite Preparation	N/A	16.293	--	16.293	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	42.130	18.915	61.045	

TABLE 7-69
CONSTRUCTION COSTS

Scenario: 9
Construction Phase: Three
Storage Concept: Cost

Date: 9/2/88
Revision: 0

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS						100					
Receiving											
Cask Log Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING						25	45	30			
Cask Unloading											
Assembly Log Storage											
Processing											
Interior Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING						20	20	25	25	10	
Cask Unloading											
Assembly Log Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Log Storage											
Interior Storage Loading/Unloading											
NRS/Repository Cost Handling											
Building Support Facility											
INTERIM STORAGE OPERATIONS											
Storage Facilities						100					
Storage Units											
Receiving Building						100					
BALANCE OF PLANT AND SUPPORT OPERATIONS						50	30	20			
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 7-70
CONSTRUCTION COST DISTRIBUTION

Scenario: 9
Construction Phase: Three
Storage Concept: Cask

Date: 1/20/89
Revision: 4

COST CENTER/Cost Element	Equipment Maintenance/Replacement (\$/Year)			Consumables	Notes (Rev. 4)
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.020 M/Year Fixed	(1) PWR = \$30,500/Unit (\$29,000 + \$1500 for 3 HFBC canisters)
Receiving	2.0				BWR = \$38,900/Unit (\$29,000 + \$2000 for 4 HFBC canisters + 1/5 of HFBC-only container w/ 21 end fitting canisters)
Cask Lag Storage					
WASTE HANDLING OPERATIONS				\$2.126 M/Year - Operations;	
SPENT FUEL HANDLING BUILDING				\$0.970 M/Year - Standby	
Cask Unloading	2.0			(Rev. 2)	(2) PWR or BWR = \$29,000/Unit
Assembly Lag Storage	1.0				
Processing	1.5	1.8		Transfer Casks = \$3.9 M Fixed	
Interim Storage Loading/Unloading	1.2		24.0		(3) MLN = \$17,000/Unit
Building Support Facilities	1.1	1.9	12.9		
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.5	(Included in container cost)	
Canister/Container Closure	1.0		1.4	Consolidated fuel and HFBC (1)	
				Intact fuel (2)	
				MLN (3)	
Canister/Container Lag Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
WRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0	0.8	95	1st Year Ops. = \$0.006 M Fixed;	(Rev. 1)
				Other Ops. Years = \$0.050 M/Year	
Storage Units				Casks = \$0.197 M/Unit	
Receiving Building	2.0	(Rev. 1)			
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	55.9	24.0		

TABLE 7-71
ANNUAL OPERATING COSTS

Scenario: 9
Construction Phase: Three
Storage Concept: Cask

Date: 1/20/89
Revision: 4

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; Inspect & ship transport casks	Receive = 93/cask Ship = 30/cask	4	\$53,900	FTE/crow increases to 8 for first 4 years of operations
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PWR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Storage landing/unloading	PWR = 510/cask (Rev. 2) BWR = 1230/cask (Rev. 4)	1.5	\$53,900	Load/unload onsite transfer cask : PWR = 530; BWR = 1070
Building support staff	N/A	51	\$53,900	(Rev. 1)
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PWR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and containerize fuel/NFBC	Consolidated: PWR = 834/container; (Rev. 3) BWR = 2070/container (Rev. 3) Intact: PWR = 225/container;BWR = 510/container	2.5	\$53,900	Requires all 4 cells to handle both PWR and BWR fuel Includes BWR NFBC-only container loading (Rev. 3)
Volume-reduce/package NFBC	PWR = 165/container (Rev. 3) BWR = 303/container (Rev. 3)	1	\$53,900	
Weld/decon/test containers	190/canister	1.5 w/o MLN 1.6 w/ MLN	\$53,900	
Container handling: log storage	90/container	3	\$53,900	
storage cask loading/unloading	90/cask of 4 containers			
NRS transport cask loading	170(SF);170(NFBC);170(MLN);215(RH-LLN)			
Building support staff	N/A	156 w/o MLN 157 w/ MLN	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	230/cask	17	\$53,900	
Storage cask preparation & closing/reopening	210/cask	4	\$53,900	If cask is reused, add 30 min. (Rev. 2)
Storage placement (incl. 45 min. to obtain new cask)	145/cask	6	\$53,900	If cask is reused, reduce by 45 min. (Rev. 4)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff (excl. Cask Mfg. Facility of 11)	N/A	264	\$53,900	

TABLE 7-72
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario 9
Construction Phase: Three
Storage Concept: Cask

Date: 10/11/00
Revision: 1

COST CENTER/Cost Element	X of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	0	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
WRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		60	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Waste Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Note, intact SF costs = 12% (Rev. 1)

TABLE 7-73
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 9
Construction Phase: Single
Storage Concept: Drywell

Date: 10/21/88
Revision: 2

		Percent of M & I Cost per Year Prior to Operations											
COST CENTER/Cost Element	Cost												
	(Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	41	47	12 (Rev. 1)									
Design													
Proof-of-Principle Tests (6 Tests)	1.0	41	54	5 (Rev. 2)									
Advanced Conceptual Design	N/A												
License Application Design	38.3		41	54	5								
Licensing Support	5.2				37	40	23						
Final Procurement and Construction Design	25.6				73	27							
Title III Support	30.2						2	20	29	29	20		
Operating Contractor Support													
Design	9.9	11	30	31	14	11	3						
Construction	10.8					5	15	23	20	19	13	5	
Construction Management	34.1						2	20	29	29	20		
Preoperational Testing and Personnel Training	66.8					3	5	10	17	24	41		

TABLE 7-74
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenarios 9
Construction Phases Single
Storage Concept: Drywell

Date: 11/23/88
Revision: 3

COST CENTER/Cont Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASE OPERATIONS					
Receiving	N/A	3.352	--	3.352	(1) Site development costs included in drywell unit cost. See consequences, Table 7-77
Cost Log Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	N/A	
Cost Unloading					
Assembly Log Storage					
Processing					
Interim Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING					
Cost Unloading	85472	11.979	10.403	22.373	
Assembly Log Storage	4864	1.505	0.855	2.360	
Processing	59733	18.441	66.719	85.160	
Volume Reduction	13237	3.952	8.522	12.474 (Rev. 3)	
Container/Container Closure	26474	7.903	21.063	29.766	
Container/Container Log Storage	48384	14.489	15.371	29.860	
Interim Storage Loading/Unloading	27333	8.279	15.618	23.897	
NES/Repository Cost Handling	21709	6.506	9.934	16.522	
Building Support Facilities	421418	127.015	107.493	234.508	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	3.311	--	
Storage Units	N/A		See Consequences, Table 7-77		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	28.638	--	28.638 (Rev. 1)	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 2)	

TABLE 7-75
CONSTRUCTION COSTS

Scenario: 9
Construction Phase: Single
Storage Concept: Drywell

Date: 10/21/00
Revision: 1

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS			10	90							
Receiving											
Cask Lag Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING		N/A	N/A	N/A	N/A	N/A					
Cask Unloading											
Assembly Lag Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING		2	20	29	29	20					
Cask Unloading											
Assembly Lag Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Lag Storage											
Interim Storage Loading/Unloading											
WCS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS			17	33	33	17					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS			50	30	20 (Rev. 1)						
Bottle Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 7-76
CONSTRUCTION COST DISTRIBUTION

Scenario: 9
Construction Phase: Single
Storage Concept: Drywell

Date: 1/20/89
Revision: 2

COST CENTER/Cost Element	Equipment Maintenance/Replacement (%/Year)			Consumables	Notes (Rev. 2)
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.014 M/Year Fixed	(1) PWR = \$30,500/Unit (\$29,000 + \$1500 for 3 HFBC canisters) BWR = \$38,900/Unit (\$29,000 + \$2000 for 4 HFBC canisters + 1/3 of HFBC-only container w/ 21 end fitting canisters)
Receiving					
Cask Lag Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A		(2) PWR or BWR = \$29,000/Unit
Cask Unloading					
Assembly Lag Storage					
Processing					(3) MLW = \$17,000/Unit
Interim Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.5		(Included in container cost)
Canister/Container Closure	1.0		1.4		Consolidated fuel and HFBC (1) Intact fuel (2) MLW (3)
Canister/Container Lag Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
WRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2		Drums = \$100/Unit
INTERIM STORAGE OPERATIONS					
Storage Facilities	1.6	3.0	50		\$0.050 M/Year Fixed
Storage Units					Intact SF Container Drywell (Rev. 2) (30" dia.) = \$13,000/Unit; Consol. SF Container Drywell (30" dia.) = \$14,400/Unit; HFBC and MLW Drywell (30" dia.) = \$12,200/Unit
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	35.9	24.0		

TABLE 7-77
ANNUAL OPERATING COSTS

Scenario: 9
Construction Phase: Single
Storage Concept: Drywell

Date: 11/23/00
Revision: 2

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$33,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks				
Storage loading/unloading				
Building support staff				
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$33,900	
Unload transport casks into process cells	PMR = 150(T);340(R) DWR = 230(T);1080(R)	1.8	\$33,900	
Consolidate and containerize fuel/NFBC	Consolidated: PMR = 834/container; (Rev. 2) DWR = 2070/container (Rev. 2) Intact: PMR = 235/container; DWR = 510/container	2.5	\$33,900	Requires all 4 cells to handle both PMR and DWR fuel Includes DWR NFBC-only container loading (Rev. 2)
Valuum-reduce/package NFBC	PMR = 165/container (Rev. 2) DWR = 303/container (Rev. 2)	1	\$33,900	
Build/docu/test containers	170/container	1.5 w/o HLW 1.6 w/ HLW	\$33,900	
Container handling: lag storage	90/container	3	\$33,900	
transporter loading/unloading	43/transporter load			
NRS transport cask loading	170(SF);170(NFBC);170(MLW);213(MR-LLW)			
Building support staff	N/A	156 w/o HLW 157 w/ HLW	\$33,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter operation (incl. loading of shield plug)	60/trip	1	\$33,900	If drywell is reused, reduce by 15 min. (Rev. 1)
Storage placement	30/drywell	3.5 w/o HLW 2.7 w/ HLW	\$33,900	(Rev. 1)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$33,900	

TABLE 7-7B
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario 9
Construction Phase: Single
Storage Concept: Drywell

Date : 9/6/88
Revision : 0

COST CENTER/Cost Element	%	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	0	+1	+2	+3	+4	+5
CASK OPERATIONS	3							100	
Receiving									
Cask Log Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	N/A								
Cask Unloading									
Assembly Log Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Log Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Log Storage									
Interim Storage Loading/Unloading									
WRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	9		60	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

TABLE 7-79
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 9
Construction Phase: Two
Storage Concept: Drywell

Date: 10/21/88
Revision: 3

		Percent of M & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6			55	45 (Rev. 2)									
Design														
Proof-of-Principle Tests (6 Tests)	1.0			55	45 (Rev. 3)									
Advanced Conceptual Design	3.8			67	33 (Rev. 3)									
License Application Design	45.1				45	55 (Rev. 3)								
Licensing Support	5.2						40	40	20 (Rev. 3)					
Final Procurement and Construction Design	30.1						80	20	(Rev. 3)					
Title III Support	34.0								20	23	26	22	9	
Operating Contractor Support														
Design	9.9			11	30	31	14	11	3					
Construction	10.8							9	13	23	20	19	13	5
Construction Management	67.4								20	23	26	22	9	(Rev.1)
Preoperational Testing and Personnel Training	66.0							3	9	10	17	24	41	

TABLE 7-80
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 9
Construction Phase: Two
Storage Concept: Drywell

Date: 11/23/88
Revision: 4

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	3.352	--	3.352	(1) Site development cost for drywell included in drywell unit cost. See consumables, Table 7-B3
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Lag Storage	4080	3.074	0.270	3.344	
Processing	12324	9.639	7.615	17.254	
Interior Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	29.146	2.923	28.069 (Rev. 1)	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.505	0.895	2.340	
Processing	99733	18.441	66.719	85.160	
Volume Reduction	13237	3.952	8.522	12.474 (Rev. 4)	
Canister/Container Closure	26474	7.903	21.863	29.766 (Rev. 3)	
Canister/Container Lag Storage	48384	14.689	15.371	29.060	
Interior Storage Loading/Unloading	27933	8.779	15.618	23.897	
WIS/Repository Cask Handling	21709	6.586	9.936	16.522	
Building Support Facilities	421418	127.015	107.493	234.508	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	3.311	--	
Storage Units	N/A		See Consumables, Table 7-B3		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Waste Preparation	N/A	32.390	--	32.390 (Rev. 2)	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.609	0.426	3.079	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 3)	

TABLE 7-B1
CONSTRUCTION COSTS

Scenario 9
Construction Phase: Two
Storage Concept: Drywell

Date: 9/6/88
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS			10	90					
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING			25	45	30				
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING			20	20	25	25	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
HRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS			10	60	30				
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS			30	30	20				
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

TABLE 7-82
CONSTRUCTION COST DISTRIBUTION

Scenario: 9
Construction Phases Two
Storage Concept: Drywell

Date: 1/20/89
Revision: 4

COST CENTER/Cost Element	Equipment Maintenance/Replacement (\$/Year)			Consumables	Notes (Rev. 4)
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.014 M/Year Fixed	(1) PMR = \$38,500/Unit (\$29,000 + \$1500 for 3 HFBC canisters)
Receiving					BMR = \$38,900/Unit (\$29,000 + \$2000 for 4 HFBC canisters + 1/3 of HFBC-only container w/ 21 end fitting canisters)
Cask Lag Storage					
WASTE HANDLING OPERATIONS				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby (Rev. 2)	(2) PMR or BMR = \$29,000/Unit
SPENT FUEL HANDLING BUILDING				Transfer Casks = \$3.9 M Fixed (Rev. 1)	(3) MLN = \$17,000/Unit
Cask Unloading	2.0			\$6.188 M/Year Fixed	
Assembly Lag Storage	1.0				
Processing	1.5	1.8			
Interim Storage Loading/Unloading	1.2		24.0		
Building Support Facilities	1.1	1.9	12.9		
RECEIVING AND HANDLING BUILDING					
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.5		(Included in container cost)
Canister/Container Closure	1.0		1.4		Consolidated fuel and HFBC (1) Intact fuel (2) MLN (3)
Canister/Container Lag Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
WRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS				\$0.050 M/Year Fixed	
Storage Facilities	2.0	0.8	95		Bare, Intact SF and Intact SF (Rev. 4)
Storage Units					Drywell (30" dia.) = \$13,000/Unit; Consol. SF Container Drywell (30" dia.) = \$14,400/Unit; HFBC and MLN Drywell (30" dia.) = \$12,200/Unit
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed	
Units Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	35.9	24.0		

TABLE 7-83
ANNUAL OPERATING COSTS

Scenarios 9
Construction Phase: Two
Storage Concept: Drywell

Date : 11/23/88
Revision : 2

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/4 assemblies BWR = 95/8 assemblies (Rev. 1)	1.5	\$53,900	Load/unload onsite transfer cask : PMR = 530; BWR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BWR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and containerize fuel/NFBC	Consolidated: PMR = 834/container; (Rev. 2) BWR = 2070/container (Rev. 2) Intact: PMR = 255/container; BWR = 510/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BWR fuel Includes BWR NFBC-only container loading (Rev. 2)
Volume-reduce/package NFBC	PMR = 165/container (Rev. 2) BWR = 303/container (Rev. 2)	1	\$53,900	
Meld/decon/test containers	190/container	1.5 w/o HLM 1.6 w/ HLM	\$53,900	
Container handling: lag storage	90/container	3	\$53,900	
transporter loading/unloading	45/transport load			
NRS transport cask loading	170(SF);170(NFBC);170(HLM);215(RH-LLW)			
Building support staff	N/A	156 w/o HLM 157 w/ HLM	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter Operation (incl. loading of shield plug, and intact SF basket as required)	60/trip from R & H Building 75/trip from SFHB	1	\$53,900	If drywell is reused, reduce by 15 min. (Rev. 1)
Storage placement	50/drywell	3.5 w/o HLM 2.7 w/ HLM	\$53,900	(Rev. 1)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 7-84
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 9
Construction Phase: Two
Storage Concept: Drywell

Date: 10/11/88
Revision: 1

COST CENTER/Cost Element	1 of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Log Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	00	10		
Cask Unloading									
Assembly Log Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Log Storage									
Processing									
Volume Reduction									
Container/Container Closure									
Container/Container Log Storage									
Interim Storage Loading/Unloading									
WCS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	3		60	40					
Storage Facility									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Basis Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Base, intact SF drywells = 122
(Rev. 1)

TABLE 7-03
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 9
Construction Phase: Three
Storage Concept: Drywell

Date: 10/21/88
Revision: 2

COST CENTER/Cost Element	Cost (Millions \$)	Percent of R & I Cost per Year Prior to Operations											
		-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	0.6	18	52	30 (Rev. 1)									
Design													
Proof-of-Principle Tests (6 Tests)	1.0	18	54	20 (Rev. 2)									
Advanced Conceptual Design	3.8		100	(Rev. 2)									
License Application Design	45.1		18	55	27								
Licensing Support	5.2				20	40	40						
Final Procurement and Construction Design	30.1				40	60							
Title III Support	34.0							20	23	26	22	9	
Operating Contractor Support													
Design	9.9		11	30	31	14	11	3					
Construction	10.8						9	19	23	20	19	13	5
Construction Management	67.4							20	23	26	22	9	
Preoperational Testing and Personnel Training	66.8						3	5	10	17	24	41	

TABLE 7-B6
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario 9
Construction Phase: Three
Storage Concept: Drywell

Date: 11/23/88
Revision: 3

Millions in 1988 \$					
COST CENTER/Cost Element	Building Area	Facility Cost	Equipment Cost	Total Cost	Notes
CASK OPERATIONS					(Rev. 1) (1) Site development cost included in drywell unit cost. See consumables, Table 7-89
Receiving	N/A	3.163	0.829	3.994 (Rev. 1)	
Cask Lag Storage	N/A	2.996	--	2.996 (Rev. 1)	Dual purpose cask site development cost = \$31,000/cask
WASTE HANDLING OPERATIONS					(2) Drywell equipment cost = \$3.311 M
SPENT FUEL HANDLING BUILDING					Dual purpose cask equip. = \$3.940 M
Cask Unloading	31420	7.432	2.832	10.264	
Assembly Lag Storage	4080	3.074	0.270	3.344	
Processing	12524	9.639	7.613	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	29.146	2.923	29.069 (Rev. 2)	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Lag Storage	4064	1.305	0.855	2.160	
Processing	99733	18.441	66.719	85.160	
Volume Reduction	13237	3.932	8.522	12.474 (Rev. 3)	
Canister/Container Closure	26474	7.903	21.863	29.766 (Rev. 4)	
Canister/Container Lag Storage	40384	14.409	13.371	27.780	
Interim Storage Loading/Unloading	27333	0.279	13.618 (Rev. 2)	23.897	
HRS/Repository Cask Handling	21709	6.306	9.936	16.222	
Building Support Facilities	421418	127.013	107.493	234.506	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	(1)	(2)	--	
Storage Units	N/A		See Consumables, Table 7-89		
Receiving Building	N/A	1.607	1.006	2.613	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	32.390	--	32.390 (Rev. 3)	
Offsite Preparation	N/A	16.293	--	16.293	
Administration	N/A	2.605	0.429	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 4)	

TABLE 7-87
CONSTRUCTION COSTS

Scenario: 9
Construction Phases: Three
Storage Concepts: Drywell

Date: 9/6/88
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS						100					
Receiving											
Cask Log Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING						25	45	30			
Cask Unloading											
Assembly Log Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING						20	20	25	25	10	
Cask Unloading											
Assembly Log Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Log Storage											
Interim Storage Loading/Unloading											
RRR/Repository Cost Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS											
Storage Facilities						100					
Storage Units											
Receiving Building						100					
BALANCE OF PLANT AND SUPPORT OPERATIONS						50	30	20			
Biosite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 7-88
CONSTRUCTION COST DISTRIBUTION

Scenario 9
Construction Phase: Three
Storage Concept: Drywell

Date: 1/20/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (\$/Year)			Consumables	Notes (Rev. 3)
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.020 M/Year Fixed	(1) PUR = \$30,500/Unit (\$29,000 + \$1500 for 3 HFBC canisters)
Receiving	2.0				PUR = \$38,900/Unit (\$29,000 + \$2000 for 4 HFBC canisters + 1/5 of HFBC-only container w/ 21 end fitting canisters)
Cask Lag Storage					
WASTE HANDLING OPERATIONS				\$2.126 M/Year - Operations; \$0.970 M/Year - Standby (Rev. 1)	(2) PUR or DMR = \$29,000/Unit
SPENT FUEL HANDLING BUILDING				Transfer Casks = \$3.9 M Fixed	(3) MLN = \$17,000/Unit
Cask Unloading	2.0				
Assembly Lag Storage	1.0				
Processing	1.5	1.8			
Interim Storage Loading/Unloading	1.2		24.0		
Building Support Facilities	1.1	1.9	12.9		
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.5		(Included in container cost)
Canister/Container Closure	1.0		1.4		Consolidated fuel and HFBC (1) Intact fuel (2) MLN (3)
Canister/Container Lag Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
MRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS				1st Year Ops. = \$0.006 M Fixed; Other Ops. Years = \$0.050 M/Year Bare, Intact SF and Intact SF (Rev. 3) Drywell (30" dia.) = \$13,000/Unit; Consol. SF Container Drywell (30" dia.) = \$14,400/Unit; HFBC and MLN Drywell (30" dia.) = \$12,200/Unit	
Storage Facilities	1.6	3.0	58		
Storage Units					
Receiving Building	2.0				
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.530 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	55.9	24.0		

TABLE 7-89
ANNUAL OPERATING COSTS

Scenario: V
Construction Phase: Three
Storage Concept: Drywell

Date: 11/23/88
Revision: 2

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	FTE/crew increases to 8 for first 4 years of operations
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/4 assemblies BMR = 95/8 assemblies (Rev. 1)	1.5	\$53,900	Load/unload onsite transfer cask : PMR = 530; BMR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and containerize fuel/NFBC	Consolidated: PMR = 834/container; (Rev. 2) BMR = 2070/container (Rev. 2) Intact: PMR = 255/container;BMR = 510/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BMR fuel Includes BMR NFBC-only container loading (Rev. 2)
Volume-reduce/package NFBC	PMR = 165/container (Rev. 2) BMR = 303/container (Rev. 2)	1	\$53,900	
Weld/decon/test containers	190/canister	1.5 w/o HLN 1.6 w/ HLN	\$53,900	
Container handling: lag storage	90/container	3	\$53,900	
transporter loading/unloading	45/transporter load			
NRS transport cask loading	170(SF);170(NFBC);170(HLN);215(RH-LLW)			
Building support staff	N/A	156 w/o HLN 157 w/ HLN	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	230/cask	17	\$53,900	
Transporter operation (incl. loading of shield plug, and intact SF basket as required)	60/trip from R & H Building 75/trip from SFHB	1	\$53,900	If drywell is reused, reduce by 15 min. (Rev. 1)
Storage placement	50/drywell	3.5 w/o HLN 2.7 w/ HLN	\$53,900	(Rev. 1)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 7-90
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 9
Construction Phase: Three
Storage Concept: Drywell

Date: 10/11/88
Revision: 1

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	3							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	12				10	80	10		
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	23	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
HRS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	3		60	40					
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100	
Waste Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

Bare, intact SF drywells = 12%
(Rev. 1)

TABLE 7-91
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenarios: 9
Construction Phase: Single
Storage Concept: Vault

Date: 10/18/88
Revision: 0

Storage Concept: Vault		Percent of M & I Cost per Year Prior to Operations											
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2
MANAGEMENT AND INTEGRATION													
Site Selection/Investigation	8.6	41	47	12									
Design													
Proof-of-Principle Tests (& Tests)	1.0	36	55	9									
Advanced Conceptual Design	5.5	33	67										
License Application Design	45.4		41	54	3								
Licensing Support	5.2				37	46	23						
Final Procurement and Construction Design	30.3				73	27							
Title III Support	33.9						11	26	26	24	13		
Operating Contractor Support													
Design	9.9	11	30	31	14	11	3						
Construction	10.8					5	15	23	20	19	13	5	
Construction Management	67.8						11	26	26	24	13		
Preoperational Testing and Personnel Training	66.8					3	5	10	17	24	41		

TABLE 7-92
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 9
Construction Phase: Single
Storage Concept: Vault

Date: 11/23/88
Revision: 2

COST CENTER/Cost Element	Millions in 1988 \$				Notes
	Building Area	Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					(1) Fixed cost per storage building
Receiving	N/A	3.352	--	3.352	
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	N/A	
Cask Unloading					
Assembly Lag Storage					
Processing					
Interior Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING					
Cask Unloading	83672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.365	0.855	2.360	
Processing	99733	18.441	66.719	83.160	
Volume Reduction	13237	3.952	8.522	12.474 (Rev. 2)	
Canister/Container Closure	76474	7.903	21.863	29.766	
Canister/Container Lag Storage	48384	14.489	15.371	29.860	
Interior Storage Loading/Unloading	27533	8.279	15.618	23.897	
WRS/Repository Cost Handling	21709	6.586	9.936	16.522	
Building Support Facilities	421418	127.015	107.493	234.508	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	16.040	9.770	25.810 (1)	
Storage Units	N/A		See Consumables, Table 7-93		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	42.858	--	42.858	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.685	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 1)	

TABLE 7-93
CONSTRUCTION COSTS

Scenario: V
 Construction Phase: Single
 Storage Concept: Vault

Date: 10/10/00
 Revision: 0

COST CENTER/Cost Element	Percent of Facility/Construction Cost by Year Prior to Start-up										
	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS			10	90							
Receiving											
Cask Log Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING		N/A	N/A	N/A	N/A	N/A					
Cask Unloading											
Assembly Log Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING		2	20	29	29	20					
Cask Unloading											
Assembly Log Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Log Storage											
Interim Storage Loading/Unloading											
NRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS		13	26	26	24	13					
Storage Facilities											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS			30	30	20						
Site Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 7-94
 CONSTRUCTION COST DISTRIBUTION

Scenario: 9
Construction Phase: Single
Storage Concept: Vault

Date: 1/20/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (1/Year)			Consumables	Notes (Rev. 3)
	Annual	10 Year	20 Year		
CASK OPERATIONS				90.014 M/Year Fixed	(1) Cost per storage building
Receiving					
Cask Lag Storage					
WASTE HANDLING OPERATIONS					(2) PWR = \$30,500/Unit (\$29,000 + \$1500 for 3 HFBC canisters) BWR = \$38,900/Unit (\$29,000 + \$2000 for 4 HFBC canisters + 1/5 of HFBC-only container w/ 21 end fitting canisters)
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A		
Cask Unloading					
Assembly Lag Storage					
Processing					
Interior Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	(3) PWR or BWR = \$29,000/Unit
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				(4) MLW = \$17,000/Unit
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.5		(Included in container cost)
Canister/Container Closure	1.0		1.4		Consolidated fuel and HFBC (2) Intact fuel (3) MLW (4)
Canister/Container Lag Storage	0.5		11.8		
Interior Storage Loading/Unloading	0.6		3.3		
WRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIOR STORAGE OPERATIONS					
Storage Facilities	2.0 (1)	0.3 (1)	0.6 (1)	90.827 M/Year Fixed (1); 90.0006 M/Year/Position (Rev. 1) SF Container or MLW Canister Position (30") = \$36,700/Unit	
Storage Units					
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.550 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	33.4	37.3		
Other Support Facilities	1.6	35.9	24.0		

TABLE 7-93
ANNUAL OPERATING COSTS

Scenarios: 9
Construction Phase: Single
Storage Concept: Vault

Date: 11/23/88
Revision: 1

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks				
Storage loading/unloading				
Building support staff				
RECEIVING AND HANDLING BUILDING				
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = \$15/cask Rail = \$15/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);340(R) BWR = 250(T);1000(R)	1.3	\$53,900	
Consolidate and containerize fuel/WFBC	Consolidated: PMR = 834/container; (Rev. 1) BWR = 2070/container; (Rev. 1)	2.5	\$53,900	Requires all 4 cells to handle both PMR and BWR fuel Includes BWR WFBC-only container loading (Rev. 1)
Volume-reduce/package WFBC	Intact: PMR = 255/container; BWR = 510/container PMR = 165/container (Rev. 1) BWR = 303/container (Rev. 1)	1	\$53,900	
Hold/decon/test containers	190/container	1.9 w/o MLN 1.6 w/ MLN	\$53,900	
Container handling: ing storage	90/container	3	\$53,900	
transporter loading/unloading	45/transporter load			
WRS transport cask loading	170(SF);170(WFBC);170(MLN);215(RH-LLN)			
Building support staff	N/A	156 w/o MLN 157 w/ MLN	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter operation	90/trip	2	\$53,900	Time based on 15,000 RTU onsite storage
Storage placement	85/position w/o MLN 90/position w/ MLN	32 w/o MLN 21.5 w/ MLN	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 7-96
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 9
Construction Phase: Single
Storage Concept: Vault

Date: 10/10/00
Revision: 0

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations							
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5
CASK OPERATIONS	5							100	
Receiving									
Cask Lag Storage									
WASTE HANDLING OPERATIONS									
SPENT FUEL HANDLING BUILDING	N/A								
Cask Unloading									
Assembly Lag Storage									
Processing									
Interim Storage Loading/Unloading									
Building Support Facilities									
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15
Cask Unloading									
Assembly Lag Storage									
Processing									
Volume Reduction									
Canister/Container Closure									
Canister/Container Lag Storage									
Interim Storage Loading/Unloading									
HNS/Repository Cask Handling									
Building Support Facilities									
INTERIM STORAGE OPERATIONS	5		20	40	40				
Storage Facilities									
Storage Units									
Receiving Building									
BALANCE OF PLANT AND SUPPORT OPERATIONS	1								100
Onsite Preparation									
Offsite Preparation									
Administration									
Other Support Facilities									

TABLE 7-97
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 9
Construction Phase: Two
Storage Concept: Vault

Date: 10/18/88
Revision: 0

		Percent of M & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6		14	52	34									
Design														
Proof-of-Principle Tests (6 Tests)	1.0		14	55	31									
Advanced Conceptual Design	9.3			100										
License Application Design	52.1			14	55	31								
Licensing Support	5.2					17	40	40	3					
Final Procurement and Construction Design	34.8					33	67							
Title III Support	48.7								21	24	24	24	7	
Operating Contractor Support														
Design	9.9		3	11	28	34	14	11	3					
Construction	10.8							5	15	23	20	19	13	5
Construction Management	68.2								21	24	24	24	7	
Preoperational Testing and Personnel Training	66.8							3	5	10	17	24	41	

TABLE 7-98
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 9
Construction Phases Two
Storage Concept: Vault

Date: 11/23/88
Revision: 2

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	3.352	--	3.352	(1) Fixed cost per storage building
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Lag Storage	4000	3.074	0.270	3.344	
Processing	12324	9.639	7.615	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	25.146	2.923	28.069	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.505	0.895	2.340	
Processing	59733	18.441	66.719	85.160	
Volume Reduction	13237	3.952	8.522	12.474 (Rev. 2)	
Canister/Container Closure	26474	7.903	21.863	29.766 (Rev. 1)	
Canister/Container Lag Storage	48384	14.489	15.371	29.860	
Interim Storage Loading/Unloading	27533	8.279	15.618	23.897	
WHA/Repository Cask Handling	21709	6.586	9.936	16.522	
Building Support Facilities	421418	127.015	107.493	234.508	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	16.040	9.778	25.810 (1)	
Storage Units	N/A		See Commentaries, Table 7-101		
Receiving Building	N/A	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	46.610	--	46.610	
Offsite Preparation	N/A	16.293	--	16.293	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 1)	

TABLE 7-99
CONSTRUCTION COSTS

Scenario: 9
Construction Phase: Two
Storage Concept: Vault

Date: 10/18/00
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cont Element	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5
CASK OPERATIONS				10	90						
Receiving											
Cask Log Storage											
WASTE HANDLING OPERATIONS											
SPENT FUEL HANDLING BUILDING				25	45	30					
Cask Unloading											
Assembly Log Storage											
Processing											
Interim Storage Loading/Unloading											
Building Support Facilities											
RECEIVING AND HANDLING BUILDING				20	20	25	25	10			
Cask Unloading											
Assembly Log Storage											
Processing											
Volume Reduction											
Canister/Container Closure											
Canister/Container Log Storage											
Interim Storage Loading/Unloading											
HRS/Repository Cask Handling											
Building Support Facilities											
INTERIM STORAGE OPERATIONS				33	37	30					
Storage Facility											
Storage Units											
Receiving Building											
BALANCE OF PLANT AND SUPPORT OPERATIONS				30	30	20					
Onsite Preparation											
Offsite Preparation											
Administration											
Other Support Facilities											

TABLE 7-100
CONSTRUCTION COST DISTRIBUTION

Scenario: 9
Construction Phase: Two
Storage Concept: Vault

Date: 1/20/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (1/Year)			Consumables	Notes (Rev. 3)
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.014 M/Year Fixed	(1) Cost per storage building
Receiving					
Cask Lag Storage					(2) PWR = \$30,500/Unit (\$29,000 + \$1500 for 3 HFBC canisters)
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations;	BWR = \$38,900/Unit (\$29,000 + \$2000 for 4 HFBC canisters + 1/5 of HFBC-only container w/ 21 and fitting canisters)
Cask Unloading	2.0			90.970 M/Year - Standby (Rev. 1)	
Assembly Lag Storage	1.0				
Processing	1.5	1.8			
Interim Storage Loading/Unloading	1.2		24.0	Transfer Casks = \$3.9 M Fixed	
Building Support Facilities	1.1	1.9	12.9		(3) PWR or BWR = \$29,000/Unit
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	(4) MLN = \$17,000/Unit
Cask Unloading	0.7		3.4		
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.5	(Included in container cost)	
Canister/Container Closure	1.0		1.4	Consolidated fuel and HFBC (2)	
				Intact fuel (3)	
				MLN (4)	
Canister/Container Lag Storage	0.5		11.8		
Interim Storage Loading/Unloading	0.6		3.3		
WRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Dross = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0 (1)	0.3 (1)	0.6 (1)	\$0.827 M/Year Fixed (1);	
				\$0.0006 M/Year/Position (Rev. 1)	
Storage Units				SF Container or MLN Canister Position	
				(30") = \$36,700/Unit; Bare, Intact SF	
				Position (30") = \$36,700/Unit	
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.590 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	37.3		
Other Support Facilities	1.6	35.9	24.0		

TABLE 7-101
ANNUAL OPERATING COSTS

Scenarios: 9
Construction Phase: Two
Storage Concept: Vault

Date: 11/23/88
Revision: 1

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; Inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/4 assemblies BMR = 95/8 assemblies	1.5	\$53,900	Load/unload onsite transfer cask : PMR = 530; BMR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and containerize fuel/HFBC	Consolidated: PMR = 834/container; (Rev. 1) BMR = 2070/container (Rev. 1) Intact: PMR = 255/container; BMR = 510/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BMR fuel Includes BMR HFBC-only container loading (Rev. 1)
Volume-reduce/package HFBC	PMR = 165/container (Rev. 1) BMR = 303/container (Rev. 1)	1	\$53,900	
Weld/decom/test containers	190/container	1.5 w/o MLM 1.6 w/ MLM	\$53,900	
Container handling: lag storage	90/container	3	\$53,900	
transporter loading/unloading	45/transport load			
HRS transport cask loading	170(SF);170(HFBC);170(MLM);215(RM-LLM)			
Building support staff	N/A	156 w/o MLM 157 w/ MLM	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter Operation (incl. loading of intact SF basket as required)	85/trip from R & H Building 97/trip from SFHB	2 3	\$53,900	Times based on 15,000 MTU onsite storage
Storage placement	85/position w/o MLM 90/position w/ MLM 80/bare, intact SF position	32 w/o MLM 21.5 w/ MLM 21.5	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 7-102
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 9
Construction Phase: Two
Storage Concept: Vault

Date: 10/10/88
Revision: 0

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations						
		-2	-1	0	+1	+2	+3	+4
CASK OPERATIONS	5							100
Receiving								
Cask Log Storage								
WASTE HANDLING OPERATIONS								
SPENT FUEL HANDLING BUILDING	12				10	80	10	
Cask Unloading								
Assembly Log Storage								
Processing								
Interim Storage Loading/Unloading								
Building Support Facilities								
RECEIVING AND HANDLING BUILDING	12				10	20	25	30
Cask Unloading								
Assembly Log Storage								
Processing								
Volume Reduction								
Canister/Container Closure								
Canister/Container Log Storage								
Interim Storage Loading/Unloading								
WRS/Repository Cask Handling								
Building Support Facilities								
INTERIM STORAGE OPERATIONS	5		20	40	40			
Storage Facilities								
Storage Units								
Receiving Building								
BALANCE OF PLANT AND SUPPORT OPERATIONS	1							100
Onsite Preparation								
Offsite Preparation								
Administration								
Other Support Facilities								

Note, intact SF vault = 12%

TABLE 7-103
DECOMMISSIONING COSTS AND DISTRIBUTION

Scenario: 9
Construction Phases Three
Storage Concept: Vault

Date: 10/18/88
Revision: 0

		Percent of M & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5	+6
MANAGEMENT AND INTEGRATION														
Site Selection/Investigation	8.6	18	52	30										
Design														
Proof-of-Principle Tests (6 Tests)	1.0	18	55	27										
Advanced Conceptual Design	9.3		100											
License Application Design	52.1		18	55	27									
Licensing Support	5.2				20	40	40							
Final Procurement and Construction Design	34.8				40	60								
Title III Support	48.7							30	30	23	14	3		
Operating Contractor Support														
Design	9.9		11	30	31	14	11	3						
Construction	18.8						5	13	23	20	19	13	3	
Construction Management	68.2							30	30	23	14	3		
Preoperational Testing and Personnel Training	66.8						3	5	10	17	24	41		

TABLE 7-104
MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 9
Construction Phase: Three
Storage Concept: Vault

Date: 11/23/88
Revision: 2

COST CENTER/Cost Element	Building Area	Millions in 1988 \$			Notes
		Facility Cost	Equipment Cost	Total Cost	
CASK OPERATIONS					
Receiving	N/A	5.163	0.829	5.994	(1) Fixed cost per storage building
Cask Lag Storage	N/A	2.996	--	2.996	
WASTE HANDLING OPERATIONS					(2) Dual purpose cask: Site development = \$31,000/cask; Equipment = \$3,940 M (Rev. 1)
SPENT FUEL HANDLING BUILDING					
Cask Unloading	31420	7.432	2.852	10.284	
Assembly Lag Storage	4000	3.074	0.270	3.344	
Processing	12524	9.639	7.615	17.254	
Interim Storage Loading/Unloading	17170	15.682	0.439	16.121	
Building Support Facilities	92916	25.146	2.923	28.069	
RECEIVING AND HANDLING BUILDING					
Cask Unloading	85672	11.970	10.403	22.373	
Assembly Lag Storage	4864	1.305	0.853	2.158	
Processing	59733	18.441	66.719	85.160	
Volume Reduction	13237	3.932	8.922	12.854 (Rev. 2)	
Canister/Container Closure	26474	7.903	21.863	29.766 (Rev. 1)	
Canister/Container Lag Storage	48384	14.489	15.371	29.860	
Interim Storage Loading/Unloading	27333	8.279	15.618	23.897	
WRS/Repository Cask Handling	21709	6.386	9.936	16.322	
Building Support Facilities	421418	127.015	107.493	234.508	
INTERIM STORAGE OPERATIONS					
Storage Facilities	N/A	16.040	9.770	25.810 (1 & 2) (Rev. 1)	
Storage Units	N/A		See Consumables, Table 7-107		
Receiving Building	N/A	1.607	1.006	2.613	
BALANCE OF PLANT AND SUPPORT OPERATIONS					
Onsite Preparation	N/A	46.610	--	46.610	
Offsite Preparation	N/A	16.295	--	16.295	
Administration	N/A	2.605	0.424	3.029	
Other Support Facilities	N/A	34.647	10.413	45.060 (Rev. 1)	

TABLE 7-105
CONSTRUCTION COSTS

Scenario: 9
Construction Phase: Three
Storage Concept: Vault

Date: 10/10/00
Revision: 0

Percent of Facility/Construction Cost by Year Prior to Start-up

COST CENTER/Cost Element

CASK OPERATIONS

Receiving
Cask Lag Storage

100

WASTE HANDLING OPERATIONS

SPENT FUEL HANDLING BUILDING

Cask Unloading
Assembly Lag Storage
Processing
Interim Storage Loading/Unloading
Building Support Facilities

25 45 30

RECEIVING AND HANDLING BUILDING

Cask Unloading
Assembly Lag Storage
Processing
Volume Reduction
Canister/Container Closure
Canister/Container Lag Storage
Interim Storage Loading/Unloading
WRS/Repository Cask Handling
Building Support Facilities

20 20 75 25 10

INTERIM STORAGE OPERATIONS

Storage Facilities
Storage Units
Receiving Building

34 37 27

100

BALANCE OF PLANT AND SUPPORT OPERATIONS

Waste Preparation
Offsite Preparation
Administration
Other Support Facilities

50 30 20

TABLE 7-106
CONSTRUCTION COST DISTRIBUTION

Scenario: 9
Construction Phase: Three
Storage Concept: Vault

Date: 1/20/89
Revision: 3

COST CENTER/Cost Element	Equipment Maintenance/Replacement (\$/Year)			Consumables	Notes (Rev. 3)
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.020 M/Year Fixed	(1) Cost per storage building
Receiving	2.0				
Cask Lag Storage					(2) PUR = \$30,500/Unit (\$29,000 + \$1500 for 3 NFBC canisters)
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING				\$2.126 M/Year - Operations;	PUR = \$30,900/Unit (\$29,000 + \$2000 for 4 NFBC canisters + 1/3 of NFBC-only container w/ 21 end fitting canisters)
Cask Unloading	2.0			\$0.970 M/Year - Standby (Rev. 1)	
Assembly Lag Storage	1.0				
Processing	1.3	1.8			
Interior Storage Loading/Unloading	1.2		24.0	Transfer Costs = \$3.9 M Fixed	
Building Support Facilities	1.1	1.9	12.9		(3) PUR or BUR = \$29,000/Unit
RECEIVING AND HANDLING BUILDING				\$6.188 M/Year Fixed	
Cask Unloading	0.7		3.4		(4) MLN = \$17,000/Unit
Assembly Lag Storage	1.0				
Processing	1.2	31.8	3.7		
Volume Reduction	1.2		0.3	(Included in container cost)	
Canister/Container Closure	1.0		1.4	Consolidated fuel and NFBC (2)	
				Intact fuel (3)	
				MLN (4)	
Canister/Container Lag Storage	0.3		11.8		
Interior Storage Loading/Unloading	0.6		3.3		
WRS/Repository Cask Handling	1.4		6.6		
Building Support Facilities	0.7	11.1	18.2	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	2.0 (1)	0.3 (1)	0.6 (1)	1st Year Ops. = \$0.006 M Fixed	
				Other Ops. Years = \$0.827 M/Year Fixed (1);	
				\$0.0006 M/Year/Position (Rev. 1)	
Storage Units				SF Container or MLN Canister Position	
				(30") = \$36,700/Unit; Bare, Intact SF	
				Position (30") = \$36,700/Unit	
Receiving Building	2.0				
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$1.530 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	33.4	37.3		
Other Support Facilities	1.6	33.9	24.0		

TABLE 7-107
ANNUAL OPERATING COSTS

Scenario: 9
Construction Phase: Three
Storage Concept: Vault

Date: 11/23/88
Revision: 1'

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; Inspect & ship transport casks	Receive = 95/cask Ship = 30/cask	4	\$53,900	FTE/crew increases to 8 for first 4 years of operations
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.5	\$53,900	Prepare to load/unload transfer cask : 375/cask
Unload transport casks	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Storage loading/unloading (incl. basket handling of 15 min.)	PMR = 95/4 assemblies BMR = 95/8 assemblies	1.5	\$53,900	Load/unload onsite transfer cask : PMR = 530; BMR = 1070
Building support staff	N/A	59	\$53,900	
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	Truck = 515/cask Rail = 615/cask	4.3	\$53,900	
Unload transport casks into process cells	PMR = 150(T);540(R) BMR = 230(T);1080(R)	1.5	\$53,900	
Consolidate and containerize fuel/NFBC	Consolidated: PMR = 834/container; (Rev. 1) BMR = 2070/container (Rev. 1) Intact: PMR = 255/container;BMR = 510/container	2.5	\$53,900	Requires all 4 cells to handle both PMR and BMR (fuel) Includes BMR NFBC-only container loading (Rev. 1)
Volume-reduce/package NFBC	PMR = 165/container (Rev. 1) BMR = 303/container (Rev. 1)	1	\$53,900	
Weld/decom/test containers	190/canister	1.5 w/o MLW 1.6 w/ MLW	\$53,900	
Container handling:		3	\$53,900	
Jug storage	90/container			
transporter loading/unloading	45/transporter load			
NRS transport cask loading	170(SF);170(NFBC);170(MLW);215(RW-LLW)			
Building support staff	N/A	156 w/o MLW 157 w/ MLW	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	230/cask	17	\$53,900	
Transporter operation (incl. loading of intact SF basket as required)	85/trip from R & H Building 95/trip from SFNB	2 3	\$53,900	Times based on 15,000 NTU onsite storage
Storage placement	85/position w/o MLW 90/position w/ MLW	32 w/o MLW 21.5 w/ MLW	\$53,900	
	80/bare, intact SF position	21.5		
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	264	\$53,900	

TABLE 7-108
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 9
Construction Phase: Three
Storage Concept: Vault

Date: 10/10/00
Revision: 0

COST CENTER/Cost Element	% of Total Constr. Cost	Percent of Decommissioning Cost by Year After Last Year of Operations								
		-2	-1	Last Year Operations	+1	+2	+3	+4	+5	+6
CASK OPERATIONS	5							100		
Receiving										
Cask Lag Storage										
WASTE HANDLING OPERATIONS										
SPENT FUEL HANDLING BUILDING	12				10	80	10			
Cask Unloading										
Assembly Lag Storage										
Processing										
Interior Storage Loading/Unloading										
Building Support Facilities										
RECEIVING AND HANDLING BUILDING	12				10	20	25	30	15	
Cask Unloading										
Assembly Lag Storage										
Processing										
Volume Reduction										
Canister/Container Closure										
Canister/Container Lag Storage										
Interior Storage Loading/Unloading										
HRS/Repository Cask Handling										
Building Support Facilities										
INTERIM STORAGE OPERATIONS	5		20	40	40					
Storage Facilities										
Storage Units										
Receiving Building										
BALANCE OF PLANT AND SUPPORT OPERATIONS	1								100	
Waste Preparation										
Offsite Preparation										
Administration										
Other Support Facilities										

Note, intact SF vault = 122

TABLE 7-109
DECOMMISSIONING COSTS AND DISTRIBUTION

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 7-4

Scenarios 8 & 9 Single Phase Cask or Drywell Storage

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 7-5

Scenarios 8 & 9 Two Phase Cask or Drywell Storage

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 7-6

Scenarios 8 & 9 Three Phase Cask or Drywell Storage

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 7-7

Scenarios 8 & 9 Single Phase Vault Storage

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 7-8
Scenarios 8 & 9 Two Phase Vault Storage

TOTAL PROJECT ACTIVITIES SCHEDULE

Figure 7-9

Scenarios 8 & 9 Three Phase Vault Storage

SECTION 8

SUMMARY

The passage of the Nuclear Waste Policy Amendments Act of 1987 (NWPAA) modified the basis on which the major elements of the federal waste management system were developed. The principle impacts from the NWPAA were: (1) limiting site characterization activities to only the Yucca Mountain site; (2) conditionally authorizing a Monitored Retrievable Storage (MRS) Facility as part of the waste system; and (3) establishing an MRS Review Commission to evaluate the need for the MRS. The scope of this system study was developed to provide information relating to the functions of a potential MRS in the system thus supporting the MRS commission activities.

Design, cost, and operating data developed for seven scenarios including an MRS (Sections 4 through 7) reflect the variations in MRS functions relative to the receipt, packaging, and storage of waste. Section 8.1 summarizes the results of the study data and provides a discussion of variations in the data summary. This information supplements the design, cost, and operating descriptions in previous report sections.

During the development of specific data for the system variations and the subsequent development of this report, questions and/or areas of concern were identified. The scope and schedule established for this study did not permit the evaluation and resolution of these issues. Section 8.2 presents brief discussions of various concerns which, upon evaluation, may impact the data and results of this study.

8.1 COMPARISONS

Based on the MRS Facility Conceptual Design Report (CDR) and subsequent preconceptual facility designs, baseline costs, operational and schedule data was developed for specific operational scenarios, storage options, and construction options. This section presents a comparison and the rationale for the variations in data presented in Tables 8-1 through 8-3.

8.1.1 OPERATIONS

The seven scenarios analyzed vary relative to specific functions to be performed at the MRS. In addition, each scenario varies internally with construction phasing, onsite storage method, receipt rate, and potential receipt of high level waste (HLW).

The impacts on the CDR design are presented in the following sections. For internal operating variations, one scenario is used as a reference in the discussion unless the impact changes significantly between scenarios.

STORAGE OPTION / SCENARIO	R & H BUILDING VAULT CAPACITY (NTU)	SITE AREA (in acres)	DESIGN COST (in millions)	CONSTRUCTION COST (in millions)	TRAINING/TESTING COST (in millions)	ANNUAL OPERATING COST (in millions)	DECOMMISSIONING COST (in millions)	SCHEDULE DURATION (in months)
Note Reference	(1) & (2)	(3)	(3) & (4)	(3) & (5)	---	(6) & (7)	---	(8)
CASK STORAGE OPTION								
SCENARIO 3/4	N/A	214	55.0	474.3	32.7	79.2	34.9	81
SCENARIO 5	910	240	88.6	993.1	66.8	34.4	72.6	105
SCENARIO 6	833	240	88.9	1247.3	66.8	103.8	81.0	114
SCENARIO 7	833	240	88.9	1242.1	66.8	103.4	80.4	114
SCENARIO 8	1092	240	88.6	1245.7	66.8	100.9	85.2	105
SCENARIO 9	1092	240	88.6	1240.4	66.8	100.6	84.3	105
DRYWELL STORAGE OPTION								
SCENARIO 3/4	N/A	291	55.0	342.1	32.7	78.9	29.7	81
SCENARIO 5	910	269	88.6	780.3	66.8	34.1	62.8	105
SCENARIO 6	833	269	88.9	734.8	66.8	102.0	57.2	114
SCENARIO 7	833	269	88.9	749.6	66.8	102.4	56.6	114
SCENARIO 8	1092	269	88.6	804.3	66.8	99.2	64.1	105
SCENARIO 9	1092	269	88.6	801.0	66.8	98.9	63.4	105
VAULT STORAGE OPTION								
SCENARIO 3/4	N/A	205	73.9	735.3	32.7	37.1	67.2	86
SCENARIO 5	910	217	104.4	1179.9	66.8	63.1	86.3	111
SCENARIO 6	833	217	112.1	1277.4	66.8	113.0	78.0	114
SCENARIO 7	833	217	112.1	1272.2	66.8	112.7	77.4	114
SCENARIO 8	1092	217	105.9	1242.4	66.8	108.6	83.3	111
SCENARIO 9	1092	217	105.9	1211.3	66.8	108.3	82.6	111

NOTES:

- (1) CDR = 900 NTU, with 51 intact and CDR criteria for fuel oil and for NTU/assembly
- (2) Based on 51 intact for scenario including fuel consolidation
- (3) Based on 13,000 NTU of onsite storage, including NLU as appropriate
- (4) Also includes proof-of-principle tests, siting activities, licensing support, and operating contractor support during design
- (5) Also includes Title III support, operating contractor support during construction, construction management, and storage facilities
- (6) Steady-state operation at 2700 NTU/year
- (7) Excludes cask, drywell, and vault building construction costs
- (8) From start of design to first year of operation

TABLE B-1
SINGLE P DISTRIBUTION COMPARISON

STORAGE OPTION / SCENARIO	R & H BUILDING VOLUME CAPACITY (NTU)	SITE AREA (in acres)	DESIGN COST (in millions)	CONSTRUCTION COST (in millions)	TRAINING/TESTING COST (in millions)	ANNUAL OPERATING COST (in millions)	DECOMMISSIONING COST (in millions)	SCHEDULE DURATION (in months)
Note Reference	(1) & (2)	(3)	(3) & (4)	(3) & (5)	---	(6) & (7)	---	(8)
CASK STORAGE OPTION								
SCENARIO 3/4	N/A	224	55.0	471.1	32.7	29.2	37.8	63
SCENARIO 5	910	254	103.7	1043.5	66.8	61.9	87.6	91
SCENARIO 6	835	254	104.0	1252.2	66.8	109.1	93.9	93
SCENARIO 7	835	254	104.0	1247.0	66.8	108.8	93.2	93
SCENARIO 8	1092	254	103.7	1291.5	66.8	106.1	100.8	90
SCENARIO 9	1092	254	103.7	1286.2	66.8	103.8	99.3	90
DRYWELL STORAGE OPTION								
SCENARIO 3/4	N/A	300	55.0	330.1	32.7	28.9	26.3	63
SCENARIO 5	910	302	103.7	876.2	66.8	61.5	76.5	91
SCENARIO 6	835	302	104.0	845.0	66.8	108.8	71.2	93
SCENARIO 7	835	302	104.0	849.8	66.8	107.7	70.3	93
SCENARIO 8	1092	302	103.7	919.1	66.8	104.4	78.6	90
SCENARIO 9	1092	302	103.7	913.8	66.8	104.1	77.9	90
Vault STORAGE OPTION								
SCENARIO 3/4	N/A	214	73.9	753.1	32.7	36.7	67.7	63
SCENARIO 5	910	248	119.5	1272.1	66.8	68.8	102.1	93
SCENARIO 6	835	248	127.2	1354.9	66.8	119.7	101.5	97
SCENARIO 7	835	248	127.2	1349.7	66.8	119.3	100.8	97
SCENARIO 8	1092	248	120.9	1399.5	66.8	115.3	108.2	93
SCENARIO 9	1092	248	120.9	1394.2	66.8	114.9	107.5	93

NOTES:

- (1) CDR = 900 NTU, with 5% intact and CDR criteria for fuel mix and for NTU/assembly
- (2) Based on 5% intact for scenarios including fuel consolidation
- (3) Based on 15,000 NTU of onsite storage, including M&M as appropriate
- (4) Also includes proof-of-principle tests, siting activities, licensing support, and operating contractor support during design
- (5) Also includes Title III support, operating contractor support during construction, construction management, and storage facilities
- (6) Steady-state operation at 2700 NTU/year
- (7) Excludes cask, drywell, and vault building construction costs
- (8) From start of design to first year of operation

TABLE B-2
TWO PHASE CONSTRUCTION COMPARISON

STORAGE OPTION / SCENARIO	R & R BUILDING VAULT CAPACITY (NTU)	SITE AREA (in acres)	DESIGN COST (in millions)	CONSTRUCTION COST (in millions)	TRAINING/TESTING COST (in millions)	ANNUAL OPERATIONS COST (in millions)	RECOMMISSIONING COST (in millions)	SCHEDULE DURATION (in months)
Note Reference	(1) & (2)	(3)	(3) & (4)	(3) & (5)	---	(6) & (7)	---	(8)
CASK STORAGE OPTION								
SCENARIO 3/4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SCENARIO 5	910	264	103.7	1039.9	66.0	61.9	86.4	69
SCENARIO 6	835	264	104.0	1240.7	66.0	109.1	92.6	72
SCENARIO 7	835	264	104.0	1243.5	66.0	100.8	91.9	72
SCENARIO 8	1092	264	103.7	1207.9	66.0	106.1	98.7	69
SCENARIO 9	1092	264	103.7	1202.6	66.0	105.8	98.0	69
DRYWELL STORAGE OPTION								
SCENARIO 3/4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SCENARIO 5	910	310	103.7	872.7	66.0	61.5	75.8	69
SCENARIO 6	835	310	104.0	850.8	66.0	100.0	70.9	72
SCENARIO 7	835	310	104.0	864.1	66.0	107.7	70.2	72
SCENARIO 8	1092	310	103.7	922.9	66.0	104.4	70.3	69
SCENARIO 9	1092	310	103.7	917.6	66.0	104.1	77.6	69
VAULT STORAGE OPTION								
SCENARIO 3/4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SCENARIO 5	910	256	119.5	1260.3	66.0	67.1	99.0	69
SCENARIO 6	835	256	127.2	1342.7	66.0	119.3	99.2	72
SCENARIO 7	835	256	127.2	1337.5	66.0	110.9	98.5	72
SCENARIO 8	1092	256	120.9	1307.0	66.0	110.9	105.9	68
SCENARIO 9	1092	256	120.9	1301.7	66.0	114.5	105.2	68

NOTES:

- (1) CON = 900 NTU, with 51 intact and CON criteria for fuel bin and for NTU/assembly
- (2) Based on 51 intact for scenarios including fuel consolidation
- (3) Based on 15,000 NTU of onsite storage, including NLM as appropriate
- (4) Also includes proof-of-principle tests, siting activities, licensing support, and operating contractor support during design
- (5) Also includes title III support, operating contractor support during construction, construction management, and storage facilities
- (6) Steady-state operation at 2700 NTU/year
- (7) Excludes cask, drywell, and vault building construction costs
- (8) From start of design to first year of operation

TABLE B-3
THREE P1 INSTRUCTION COMPARISON

8.1.1.1 Functional Variations

The major functional requirements of each scenario and comparable functions from the CDR are shown on Table 8-4. Since Scenarios 3 and 4 are identical for the MRS Facility, they are addressed as a single element. The following discussions relating to the impacts from operational variations are based on single-phase construction of the MRS Facility.

The changes in functions to be performed primarily impact equipment requirements and incremental operating times. This impact, in turn, affects equipment utilization and/or operating shifts, resulting in waste handling building staff variations. (Changes in equipment requirements and their associated cost and facility arrangements are discussed in Section 8.1.4). Unit operating times were determined for the functional elements of each scenario based on the highest potential spent fuel receipt rate (3000 MTU per year). These times were compared to the lower receipt rate of 2700 MTU per year to verify that staff or building arrangements were not affected by the rate reduction. The onsite support staff remains constant for all scenarios since all support functions defined in the CDR are required.

Scenarios 3 and 4 require the design and construction of the Spent Fuel Handling Building (SFHB) to perform the required bare, intact spent fuel transfer operations. This building design, operation, and associate staff is unique to this study and replaces the Receiving and Handling (R&H) Building presented in the CDR. When transferring 3,000 MTU of spent fuel to interim storage, the SFHB operates on a three-shift basis for the sealed storage cask

Table 8-4 - Functional Comparison

Scenario/Function	CDR	3 & 4	5	6	7	8	9
Consolidate SF	X		X			X	X
Canister SF	X		X				
Containerize SF	(1)			X	X	X	X
Receive HLW	X			(1)	(1)	(1)	(1)
Drum NFBC	X		X				
Containerize NFBC	(1)					X	X
Repair/replace container				X		X	
Provide in-building vault lag storage	X		X	X	X	X	X
Store bare, intact SF		X	(2)	(2)	(2)	(2)	(2)
Store dual-purpose casks	(1)	(3)	(2)	(2)	(2)	(2)	(2)

(1) Operating option

(2) Two and three phase construction option only

(3) Two phase option only

option and a four-shift basis for the drywell or open-cycle vault option. Therefore the SFHB staff varies from 131 to 136 during this phase of operation. The number of shifts required may be reduced when the repository reaches full operation and transfer to onsite storage is no longer required. During this phase, only truck casks are unloaded and rail casks from reactors are routed from the MRS to the repository without unloading. This reduction is dependent on the number of truck casks received and the fuel mix (PWR vs. BWR).

Scenario 5 requires modifications to the R&H Building operations to permit loading of consolidated or intact spent fuel into square canisters. Since the capacities of the square canisters are less than the round canisters presented in the CDR, additional operating time is required to consolidate and canister a comparable quantity of spent fuel. However, the increase in the process cell operating time can be accommodated in a three-shift operation. (This is equal to the CDR operation when the throughput is reduced to the 3,000 MTU per year rate.) In order to retain the three-shift basis throughout the R&H Building, an additional welding station and associated personnel is required for the canister closure operation. The total staff for the R&H Building in Scenario 5 is 318 for the cask storage option, 317 for the drywell option, and 320 for the open-cycle vault option.

The operations required for Scenarios 6 and 7 are identical except for the repair or replacement of defective repository emplacement containers returned from the repository in Scenario 6. The elimination of fuel consolidation unit operating time is offset by the time required to transfer and load each fuel assembly independently into a storage container. If a sufficient quantities of both PWR and BWR fuel assemblies are received to permit routine loading of the "preferred" container (3 PWR plus 4 BWR), an increase in the process cell fuel handling time is required to permit equipment changes to correspond to the fuel types. The operating times presented on the data sheets assume the use of the preferred container configuration plus the PWR-only container. With all four process cells handling both fuel types, the R&H Building must operate on a four-shift basis to containerize the 3,000 MTU of spent fuel received annually. The requirement for the fourth shift also increases the R&H Building support staff resulting in a total staff of 298, 295 and 295 for the sealed storage cask, drywell, and open-cycle vault storage options. If HLW is received and containerized, additional staff is required to perform these operations. The staff increases by 9 to containerize the HLW prior to shipment and by a maximum of 17 if onsite storage of the HLW is required (storage-option dependent). For Scenario 6, the R&H Building must also have the capability to repair or replace containers which do not meet emplacement container inspection criteria upon receipt at the repository. Since the study assumes that a maximum of 1% of the containers would be returned to the MRS, the containers would be delivered to the R&H Building remote maintenance cell for rework and will not affect the routine receiving and containerizing operations. The requirement for container repair/replacement increases the R&H Building support staff by two if no HLW is received and by four if 400 MTU per year of HLW is received.

Scenarios 8 and 9 both require the consolidation and loading of spent fuel and the loading of the volume-reduced non-fuel bearing components (NFBC) into repository emplacement containers. These scenarios differ from the CDR in two

major aspects. First, the packing efficiency (capacity) and configuration of the container as compared to the CDR canister and, second, the loading of the NFBC into emplacement containers rather than 55-gallon drums. The design of the emplacement container requires additional fuel handling operations since fuel rods must be extracted and reconfigured for each container segment independently. Each segment contains less fuel than a CDR canister although the full container has a significantly greater capacity. Similarly, the handling and loading of the NFBC required for the completion of the container loading operation adversely impacts the process cell operating times. In order to minimize the impact on the R&H Building arrangement presented in the CDR, all four process cells must receive and consolidate both PWR and BWR fuel assemblies on a four-shift basis. The R&H Building staff is 333 for the sealed storage cask option and 326 for the drywell and open-cycle vault storage options. The increased quantity of staff, compared to Scenarios 6 and 7, is required to perform the consolidation and NFBC-handling operations. The addition of HLW containerizing and of container repair/replacement (Scenario 8 only), the R&H Building staff increases by the same quantities presented for Scenarios 6 and 7.

8.1.1.2 Storage Options

Although the balance-of-plant staff and cask operations (Inspection Gatehouse) staff remain constant for the single-phase construction option, the personnel required for interim (onsite) storage varies with the storage option and scenario.

The capacity of a sealed storage cask is constrained by either thermal limitations or cask cavity size. These constraints, in conjunction with the unit operations required to prepare, load, seal, and deliver the cask to storage, establish the overall operating time for this storage option. For Scenarios 3 and 4, the storage of PWR assemblies is thermally constrained to 32 (13.8 MTU) and is size-constrained to 80 (14.4 MTU) for BWR assemblies. The major portion of the operating times is used in the loading of the individual units into the casks at each of the two loadout ports. Therefore, the use of two cask transporters per shift in conjunction with the cask capacity requires the storage operations to be performed on a two-shift basis to accommodate the 3,000 MTU per year operation. (Each shift requires a staff of six to perform cask transport and placement operations.) The cask loading of consolidated spent fuel canisters in Scenario 5 is also thermally constrained, with a corresponding cask MTU capacity of 13.8 for PWR (16 canisters) and 18 for BWR (20 canisters) fuel. Intact spent fuel canisters and NFBC drums for this scenario are size-constrained to 28 PWR, 70 BWR, or three stacks of five drums. The time to load the consolidated fuel canisters is substantially less than the intact fuel loading of Scenarios 3 and 4, allowing for a reduction in storage operations to two transporters plus an available spare on a single shift. The requirement to also handle canisters of intact spent fuel and NFBC drums results in a high utilization factor (80%) for the operating transporters on the one-shift basis. This factor is feasible because of the availability of an operational spare and the ability to remove a failed unit from service for hands-on maintenance. With Scenarios 6 and 7, the cask is constrained by the container size. The capacity of the cask (7.9 MTU, average) requires a larger quantity of casks to be used than in the previous scenarios to store an equivalent amount of spent fuel. For these two scenarios, the time

to prepare, seal, and deliver the casks to storage are the controlling factors. However a single shift of two transporters, plus a spare, can again meet the discharge and storage requirements. If 400 MTU per year of HLW is received, the storage cask operations increase to a two-shift basis. Cask capacity for Scenarios 8 and 9 is also restricted by container size, although the average MTU content per cask (9.9 MTU) is substantially greater than for Scenarios 6 and 7. For these scenarios, the interim storage operations are also performed in a single shift with two transporters and a spare. As with Scenarios 6 and 7, the receipt and storage of HLW requires the addition of a shift.

The drywell transporter has a capacity of one canister, container, or basket of bare, intact spent fuel, but its loading time is significantly shorter than the sealed storage cask. The cask and its transporter are confined to a limited waste handling building area while the cask shield plug is removed, multiple packages are loaded, the shield plug replaced, and a final closure plate installed. The drywell transporter, however, has an automated shield gate, receives only one package, and requires no "final closure". This reduced time can permit the flexibility to add transporters to a shift rather than add additional shifts of five storage field personnel to perform the final closure of the drywells, if the waste handling building does not require the additional loading time. For Scenarios 3 and 4, two transporters can be used on a single-shift basis to transfer baskets of 4 PWR or 8 BWR intact spent fuel assemblies to storage. This requires the availability of a third (spare) transporter since the transporter utilization rate exceeds 70%. As with the storage cask option, the high utilization factor is acceptable if an operating spare unit is available since the transporter is contact maintained. Scenario 5 requires a three-shift operation of two transporters. This increase from Scenario 3 and 4 is required because of the reduced MTU quantity per trip and the number of canisters and NFBC drums to be transported. If a third transporter is used, the interim storage operations could be reduced to two shifts. However this would require multiple handling of the canisters in and out of the in-building lag vault storage racks. (Note that the three-shift operation is comparable to the CDR requirements if 3,000 MTU per year is transferred to storage). For Scenarios 6 through 9, spent fuel containers can be transferred to storage using three transporters on a single shift if an operating spare is available. The addition of 400 MTU per year of HLW requires the addition of a shift. Again, an operating spare must be available.

Since the capacity of the Vault Storage Building (VSB) transporter is identical to the drywell transporter, the same number of shifts to accomplish the transfer of material to storage is required. However, the preconceptual design utilizing a fixed-rail transport system and the round trip time to the farthest VSB does not permit the flexibility to add transporters to reduce shifts. In addition, the limited accessibility for maintenance to the transporter except within VSBs and the design of the transporter does not make a utilization factor greater than 60% advisable. The staff required to operate the VSB and to perform the placement operations is significantly different than the drywell final closure staff. A staff of 17 (18 on the day shift) will be required in the VSB where placement operations are being performed, shifting to the next VSB as each building reaches its assumed design capacity. Maintenance, health physics, and monitoring personnel, required for three shifts will rotate between buildings as required. For Scenarios 3, 4, and 5, a

three-shift operation is required to support the storage operations. In Scenarios 6 through 9, the operation is on a two-shift basis unless storage of HLW is required, which adds a third storage shift.

Using the sealed storage cask option for comparison, the maximum waste handling building staff varies from 131 (Scenarios 3 and 4) to 355 (Scenario 8 with HLW). The CDR value, after adjustment to a 3,000 MTU per year throughput rate, is 315 in the R&H Building. At the average annual salary used for the study (\$53,900), the operating variations result in an annual cost change from the CDR of a \$9.91 M reduction to a \$2.16 M increase.

8.1.1.3 Phased Construction

The use of phased construction for the MRS Facility permits the receipt and onsite storage of spent fuel prior to the completion of waste handling building construction.

The receipt and storage of dual purpose (DP) casks in Scenarios 3 and 4 permits the operation of MRS to be initiated 18 months prior to the hot testing of the SFHB. However, this added operation requires the construction of the Receiving Building (RB) and increases the functions performed at the Inspection Gatehouse. Since shipments can be received at any time, the Inspection Gatehouse must be staffed 24 hours a day, all year. As casks are received, shipment data must be entered into the computer system for accountability purposes. During normal operations, this data entry is made into the system housed in the SFHB. However, since the SFHB is still in construction, a computer system was added to the Inspection Gatehouse to perform the material traceability functions for the interim period. Similarly, the security alarm monitoring system (AMS) is included at this location since the main Security Building and the Protected Area Gatehouse are not available for use. The addition of these two systems to the Inspection Gatehouse plus the need to perform all site security functions from this location increases the staff requirement by 4 for the interim period prior to SFHB operation. The operation of the RB is limited to a single shift based on the incremental operating times and on the presence of onsite lag storage capacity adjacent to the RB for off-shift temporary storage of shipments. The RB operating staff of 17 will be reassigned to other areas of the MRS when the SFHB becomes operational.

Two-phase construction for the remaining five scenarios adds the operation of a modified SFHB (no radwaste treatment) to the single-phase MRS. The SFHB permits the receipt and transfer to storage of bare, intact spent fuel 23 months prior to the hot testing and operation of the R&H Building. During the hot test period of the R&H Building, both waste handling buildings are receiving spent fuel in order to reduce the amount of material used for R&H Building hot testing to a reasonable quantity. (This is especially important for those scenarios which utilize fuel consolidation.) Limiting the quantity of material received at the R&H Building reduces the total staff requirement for that facility and allows for the relocation of SFHB personnel to the R&H Building in the following year minimizing the quantity of operators to be employed and trained. Since the SFHB is placed in hot standby until the bare, intact spent fuel in interim storage can be retrieved, a staff of 6 is assumed to be required on a single-shift basis at that facility during the standby

period. (The SFHB computer system is linked to the R&H Building computer with a data highway, eliminating the need for 24-hour control room operators). If additional personnel are required for maintenance or testing operations, the SFHB staff will be temporarily augmented by personnel from the R&H Building and/or site support buildings. When the SFHB is reactivated to permit retrieval of stored bare, intact spent fuel, the building will be operated by new personnel (staff quantity is storage-option and scenario dependent) to transfer sufficient material to the R&H Building to maintain the required shipping rate to the repository.

Three-phase construction for these scenarios adds both the SFHB and the RB to the MRS site operation, permitting the receipt of DP casks 18 months prior to the operation of the SFHB (as described for Scenarios 3 and 4) and 41 months prior to the hot testing of the R&H Building. The input of cask shipment data and the AMS is assumed to be retained at the Inspection Gatehouse until the R&H Building and the total site is operational. The operation of the SFHB is identical for the two and three phase construction options.

8.1.1.4 Receipt Rates

As stated in Section 8.1.1.1, the 3,000 MTU per year receipt rate was used to perform the unit operating time calculations and to develop the related staffing allocation data. This data was compared to the lower 2,700 MTU per year rate to verify the facility arrangement and equipment utilization rates for this lower rate. Depending on the transportation modal mix, a reduction of operating shifts may be possible. However, the information provided by others for this study indicate that the modal mix and the fuel mix varies from year to year. These variations do not make a staff reduction is feasible when only spent fuel is to be received, although the potential receipt of HLW does have a predictable impact on the facility operations as discussed in Section 8.1.1.1.

8.1.2 R&H BUILDING LAG STORAGE

The CDR design provides for a canyon cell lag storage vault capacity of 1,000 MTU of canistered, consolidated spent fuel. The criteria for this study requires canyon cell lag storage vaults to contain intact or consolidated spent fuel in canisters or containers which are of a different configuration and packing efficiency than that used in the CDR design. For those scenarios requiring consolidation (5, 8, and 9), the study requires a storage mix of 5% intact and 95% consolidated spent fuel. Therefore, to form a comparison between the CDR and the scenarios presented in this study, the CDR canyon lag storage capacity was adjusted to the study mix. This adjustment reduced the CDR canyon cell storage capacity to 900 MTU.

The canyon cell lag storage vault capacity is dependent upon the packing efficiency and size of the canister or container and the minimum spacing required for structural integrity of the floor above the storage vault. The average capacity (intact and consolidated spent fuel) of Scenario 5 canisters is approximately 0.79 MTU. The canyon cell lag storage area can accommodate 96 racks of 12 canisters each for a total of 910 MTU in storage. The average capacity (intact spent fuel) of Scenarios 6 and 7 containers is approximately 1.98 MTU. The canyon cell lag storage area can accommodate 422 storage

locations for a total of 835 MTU in storage. The average capacity (intact and consolidated spent fuel) of Scenarios 8 and 9 containers is approximately 2.59 MTU. The canyon cell lag storage area can accommodate 422 storage locations for a total of 1,092 MTU in storage.

8.1.3 SITE AREA

Since the site area housing the support services and facilities is identical for all scenarios, the total MRS site area varies with the area required for onsite storage, the "foot print" of the waste handling facility(s), and the need for a Cask Manufacturing Facility.

The site area required for drywell storage is greater than the other options due to the spacing required by the thermal limitations of the surrounding ground. The site area required for cask storage is less than the drywell but is greater than open-cycle vault storage due to the need for access roads for the cask transporter.

The site area for the waste handling operations is established by the "foot print" of the waste handling building(s) required for each scenario and construction phase option. Consequently, that required for Scenarios 3 and 4 (SFHB) is less than that required for Scenarios 5 through 9 (R&H Building). Similarly, the waste handling operations site area for Scenarios 5 through 9 two and three phase construction options (SFHB and R&H Building) is greater than that required for the single-phase construction option of the same scenario. For all cask storage options, an additional site area is required for the Cask Manufacturing Facility and related transport roadways to the waste handling building(s) from the manufacturing facility.

8.1.4 COST

The following subsections present the cost variations relating to design, construction, annual operations and decommissioning of the various scenario-specific storage and construction phase options.

8.1.4.1 Design

For the purpose of this study, design costs were assumed to include all activities required to site and license the facility and to prepare the construction documentation. Therefore, the design costs presented in Tables 8-1 through 8-3 include site selection/investigation; proof-of-principle tests; advanced conceptual, license application, and final procurement and construction designs; licensing support; and operating contractor's support during design.

The cost associated with site selection and investigation was assumed to be identical for all scenarios, storage options and construction phases. Proof-of-principle tests costs vary, depending upon the need to verify operating equipment and conditions (a function of the operating complexity of a particular scenario). Therefore, the proof-of-principle testing costs associated with Scenarios 3 and 4 are less than those incurred for all other scenarios.

The design costs are a function of the constructed value of the facilities provided to perform the functions required for each specific scenario, storage option, and construction phase. For those facilities which were not included or were modifications of those presented in the MRS CDR, costs were included for the preparation of an advanced conceptual design (ACD). Consequently, costs for an ACD were included for the SFHB (Scenarios 3 and 4 and the phased construction options of Scenarios 5 through 9); for the modified R&H Building (Scenarios 6 and 7); and for all vault storage options. In general, the design cost required for Scenarios 3 and 4 are less than that required for any of the other scenarios; design costs for the open-cycle vault storage option are greater than the other storage options.

8.1.4.2 Construction Costs

The MRS Facility consists of four major operational areas: (1) cask operations, (2) waste handling operations, (3) interim storage operations, and (4) balance of plant and support operations. The constructed value of each area is a function of the site size; the functional complexity of the scenario-specific operations; and the type, packing efficiency and amount of waste stored.

Cask Operations. The constructed value of cask operations is identical for all scenarios and like construction phases. For all single-phase and two-phase construction options (except Scenarios 3 and 4), the constructed value is \$6,348 M. For Scenarios 3 and 4 two-phase and for all three-phase construction systems, the constructed value is \$8,990 M due to the addition of the Receiving Building and the equipment required for the additional operations at the Inspection Gatehouse (see Section 8.1.1.3).

Waste Handling Operations. The constructed value of the waste handling facilities is dependent upon the functional complexity of the scenario-specific operations. The functional operations required for each scenario is shown in Table 8-4 and discussed in Section 8.1.1.1. Scenarios 3 and 4 require the least functional operations resulting in a smaller and less complex waste handling building than that required for the other scenarios. Similarly, the waste handling building for Scenarios 6 and 7, which does not require consolidation of spent fuel, is slightly smaller and is less complex than that required for Scenarios 5, 8, and 9. Note that in Scenarios 6 through 9, the handling of HLW canisters is accommodated without additional building space. However, Scenarios 6 and 8 require the capability to repair repository-specific container which increases the waste handling operation cost due to the additional equipment required for this function.

The constructed value for the waste handling buildings for the single-phase options of Scenarios 3 and 4, 5, 6, 7, 8, and 9 are: \$80.2 M, \$463.3 M, \$396.2 M, \$390.8 M, \$462.2 M, and \$456.8 M.

Interim Storage Operations. The costs associated with the onsite storage facilities varies with the type and capacity (MTU) of the particular storage unit. The types of storage units considered for this study include: (1) concrete storage casks, (2) field drywells, and (3) open-cycle vault. The capacity of the storage unit is dependent upon the type of waste (spent fuel, WFEC or HLW) stored and the waste configuration (bare, intact spent fuel;

canistered or containerized, intact or consolidated spent fuel; HLW canisters; or NFBC drums or containers). All spent fuel received at the SFHB is stored as bare, intact assemblies; that received at the R&H Building is stored as canistered or containerized, intact or consolidated assemblies. The NFBC resulting from Scenario 5 spent fuel consolidation is packaged and stored in drums; that resulting from Scenarios 8 and 9 spent fuel consolidation is packaged and stored in repository-specific containers.

The configuration and unit cost of the concrete storage cask is identical for all scenarios. However due to thermal and cask cavity size restraints, the cask capacity varies with the scenario-specific storage configuration. The number of NFBC drums (15) and the number of repository-specific containers or HLW canisters (4) is limited by the size of the cask cavity. The quantity of bare, intact spent fuel assemblies (32 PWR or 80 BWR); and consolidated spent fuel canisters (16 PWR or 20 BWR) is limited by the thermal capacity of the cask. The average cask capacity, including spent fuel and NFBC drums or containers, are: 13.96 MTU for bare, intact spent fuel; 10.2 MTU for canisters of intact and consolidated spent fuel; 7.9 MTU for containers of intact spent fuel; and 9.9 MTU for containers of intact and consolidated spent fuel. Based on the cask capacity for the particular waste configuration and the total number of casks, the resulting total cost for onsite cask storage for 15,000 MTU of spent fuel is greatest for Scenario 6 and 7 and progressively less for Scenarios 8 and 9, 5, and 3 and 4 respectively. In addition, Scenarios 6 through 9 onsite storage area costs include the casks required to store 2,400 MTU of HLW.

The drywell onsite storage cost is dependent upon its size (unit cost), capacity (MTU stored), and thermal loading (spacing or land use). For the purpose of this study, it was assumed that 30-in. diameter drywells are used for the storage of bare, intact spent fuel (4 PWR or 8 BWR); a repository-specific container of intact spent fuel (3 PWR/4 BWR or 4 PWR) or consolidated spent fuel (6 PWR or 18 BWR); NFBC drums (5) or container (1); and a HLW canister (1). For canisters of intact or consolidated spent fuel, the drywell sizes selected for this study are 30-in. for canistered intact spent fuel and 16-in. for canistered consolidated spent fuel (9-in. canisters). The labor to install drywells of the size assumed in this study are essentially the same, however the spacing for thermal loading and for transporter access clearance between drywells results in unit costs which are not proportional to size. Therefore a cost comparison cannot be based on storage unit capacity as noted for the storage casks, but must be based on an average unit cost (spent fuel and, as required, NFBC) of MTU stored. The average unit cost for storage of bare, intact spent fuel is approximately \$8,000/MTU; for canistered intact or consolidated spent fuel and associated NFBC drums approximately \$7,800/MTU; for containers of intact spent fuel, approximately \$7,300/MTU; and for containers of intact and consolidated spent fuel and associated NFBC, approximately \$5,800/MTU. Consequently, the onsite drywell storage cost is greatest for Scenarios 3 and 4 and is progressively less for Scenarios 5, 6, and 7, and 8 and 9 respectively. In addition to the drywell storage of 15,000 MTU of spent fuel (and associated NFBC, as required), Scenarios 6 through 9 onsite storage area costs include the drywells required to store 2,400 MTU of HLW.

The open-cycle vault storage cost comparison is similar to that discussed for the drywell storage option. It is dependent upon the storage tube size (unit cost); capacity (MTU stored); and the minimum spacing required for the structural integrity of the floor above the storage vault. For the purpose of this study, it is assumed that 30-in. diameter storage tubes spaced 5-ft on center are used for the storage of bare, intact spent fuel; repository-specific containers of intact or consolidated spent fuel or NFBC; and drums of NFBC. Canisters of intact or consolidated spent fuel are stored in 16-in. storage tubes spaced 2 ft-6-in. on center. Since the spacing of the storage tubes determine the tributary area of the storage module and its associated cost allocation, the storage tube unit cost is not proportional to its size. As with the drywell storage option, cost comparisons must be based on an average unit cost (spent fuel and, as required, NFBC) of MTU stored. The average unit cost for storage of bare, intact spent fuel is approximately \$22,700/MTU; for canistered intact and consolidated spent fuel and associated NFBC, approximately \$24,100/MTU; for containerized intact spent fuel, approximately \$18,500/MTU; and for containerized intact and consolidated spent fuel and associated NFBC, approximately \$14,800. Consequently, the onsite vault storage cost is greater for Scenario 5 and is progressively less for Scenarios 3 and 4, 6 and 7, and 8 and 9 respectively. In addition, a fixed cost of \$0.827 M for the vault support areas is required for each 3,000 MTU of spent fuel stored. Scenarios 6 through 9 onsite storage also includes cost for 2,400 MTU of HLW.

Balance of Plant and Support Operations. It has been assumed that all scenario-specific MRS Facilities are independent installations for which like storage options require identical support services and facilities. Variations in specific scenario and construction-option values result from (1) the land area required to site the waste handling facilities; (2) the addition of a Cask Manufacturing Facility and associated cask access roads; and (3) the allocation of storage area site development costs required for the cask storage option.

The variation in land area and its associated site development constructed value is dependent on the area required for the waste handling facilities. The SFHB of Scenarios 3 and 4 has a smaller "foot print" than the R&H Building of Scenarios 5 through 9, thereby resulting in a smaller single-phase site development cost. Similarly, the constructed values for the two and three phase construction options for Scenarios 5 through 9 are greater than their single construction phase option due to the need for two (SFHB and R&H Building) waste handling facilities. The site development constructed value for the cask storage option in all scenarios is greater than the drywell storage option due to the land area required for the Cask Manufacturing Facility and the access road required for cask transfer to the waste handling operating facility. (Note that the site development costs associated with the cask and drywell storage options are included in the Interim Storage Operations cost center). Since the VSBs are attached to the waste handling building(s) within the protected area of the site, the site development costs associated with the vault storage option are included in the site development cost element of this cost center. Therefore, the site development element constructed value for the vault storage option is greater than the cost of the cask or drywell storage option.

The type and extent of infrastructure interties and the configuration of the Administration Building and their associated constructed values were assumed to be identical for all scenarios. The constructed value of the other Support Facilities cost element is greater for the cask storage option than for the other storage options since it includes the addition of a facility for the onsite fabrication of the concrete storage casks.

Construction Cost Summary: In addition to the costs discussed above, Tables 8-1 through 8-3 also included other costs associated with the construction phases. These costs include: A/E Title III support, construction management, and operating contractor support during construction. These costs are a function of the constructed value of the facilities required for each scenario, storage, and construction phase option. Consequently, the costs allocated for these services is the least for the scenario, storage option and/or construction-phase option with the lowest constructed value.

8.1.4.3 Training and Testing

The costs for preoperational testing and personnel training is a function of the complexity of the system(s) being tested and the number of personnel requiring training. Therefore, the cost attributed to these elements is less for Scenario 3 and 4 than for all other scenarios and is greater for the open-cycle vault storage option than the other storage options.

8.1.4.4 Annual Operating Costs

The annual operating costs presented in Tables 8-1 through 8-3 are for the maximum annual throughput of 2700 MTU per year (steady-state operation) and include costs for consumables, operating staff, and equipment maintenance. The consumable cost includes the fixed cost shown on the data sheets (including utilities, HEPA filters, etc.) and the drums, canisters, or containers required for waste packaging. Equipment maintenance costs were developed using the data sheet maintenance percentages and total equipment costs. Staff costs were developed from the staffing allocations shown in the data sheets and priced at \$53,900 per man year. Once the onsite storage inventory has reached its scheduled volume, the staff required for storage operations (e.g. cask manufacturing, transport operators, etc.) is reduced. This reduction equates to a decrease for the cask and drywell options of approximately \$0.7 M and \$1.0 M (Scenarios 3, 4, and 5) or \$1.3 M (Scenarios 6 through 9) for the vault option.

The single phase fixed annual operating costs are greatest for those scenarios which require (1) a R&H Building waste handling facility, (2) canisters/containers for waste packaging, and (3) an open-cycle vault storage option. The fixed costs are greatest for Scenarios 5 through 9 and are identical for like construction phases and storage options. Staffing costs are a function of the total site personnel required for each scenario and storage option. In accordance with Section 8.1.1.1, the maximum onsite staff is required by Scenarios 8 and 9. Due to the packing efficiency and unit canister/container cost, Scenarios 6 and 7 require the maximum annual canister/container cost. Unlike the storage cask or drywell, the vault storage buildings require consumables and equipment repair and maintenance for their operations. The annual container cost required for Scenarios 6 and 7 is greater than the

difference in its staffing costs compared to that required for Scenarios 8 and 9. Since the additional costs attributed to additional operations required for the two and three phase construction option are identical for Scenarios 5 through 9, the maximum annual operating cost is required for the three phase vault storage option of Scenarios 6 and 7.

8.1.4.5 Decommissioning

The costs presented in Tables 8-1 through 8-3 for decommissioning were developed using the percentages discussed in Section 3 and total constructed values for the particular scenario, storage, and construction phase option. Except for the bare, intact spent fuel storage units, the percentages allocated for cost center are identical and are essentially proportional to the constructed value of the particular combination of options (phased construction and storage).

8.1.5 DESIGN AND CONSTRUCTION SCHEDULE

Design and construction schedules were developed for all scenarios and storage and construction options based on the data developed for the CDR or data estimated from preconceptual designs. The duration from the start of design to the receipt of waste varies from 63 months (Scenarios 3 and 4, two-phase construction) to 114 months (Scenarios 6 and 7, single-phase construction). The variations in schedules result from: (1) the need for an advanced conceptual design; (2) license application design and licensing durations; and (3) the construction duration of the applicable waste handling facility.

As stated in Section 8.1.4.1, the scenario, construction phase and storage options which require new building designs (the SFHB and VSB) or modification to the CDR R&H Building require an ACD. The ACD duration for the SFHB, the VSB, and the modified R&H Building are 9, 9, and 13 months, respectively. For scenarios which include an R&H Building, the LA design and licensing duration is estimated to be 56 months; 42 months is estimated for Scenarios 3 and 4 which include only the SFHB. The total design and licensing duration for all scenarios and storage and construction-phase options varies from 51 to 62 months.

The construction duration for the waste handling and storage facilities varies with the facility size and complexity. The construction duration for the R&H Building, SFHB, each VSB, and the RB are estimated to be 51, 28, 33 to 39, and 12 months respectively. The open-cycle vault storage complex consists of five buildings for the storage of bare, intact spent fuel (Scenarios 3 and 4), canistered spent fuel and NFBC (Scenario 5), containerized spent fuel and HLW (Scenarios 6 and 7), and containerized spent fuel, NFBC and HLW (Scenarios 8 and 9). To minimize the total MRS Facility construction duration, the schedules assume that one VSB will be constructed prior to waste receipt and the others constructed during operations. The construction duration for these buildings vary depending upon the number of storage tubes and/or modules required for the scenario or construction phase-specific waste configuration. Table 8-5 presents the VSB configuration for the various scenarios.

Table 8-5 - Open-Cycle Vault Storage Configuration

Scenario	Waste Configuration	30-in. Tubes	16-in. Tubes	No. of Modules	Const. Duration (in months)
3 and 4	Bare Intact Spent Fuel	1860	-	18	33
5	Canistered Intact and Consolidated Spent Fuel and NFBC Drums	276	3774	16	36
6 and 7	Containerized Intact Spent Fuel and Canistered HLW	2427	-	25	39
8 and 9	Containerized Intact and Consolidated Spent Fuel and NFBC and Canistered HLW	2172	-	22	39

The construction duration varies from 12 months for Scenario 3 and 4 single-phase and Scenario 5 through 9 three-phase options to 51 months for all scenario single-phase.

8.2 ISSUES

During the preparation of this study, questions or areas of uncertainty arose which could not be investigated during the time frame of the effort. This section presents additional discussions relating to operations, design, cost development, and design and construction schedules.

8.2.1 OPERATIONS

Outstanding questions or issues concerning various aspects of operations have been grouped into these major categories: waste acceptance, R&H Building process cell operations, and SFHB operations.

8.2.1.1 Waste Acceptance

Discussions relative to receipt rate variations (ramp up/ramp down), HLW receipt at the SFHB, and acceptance vs. construction schedule differences are presented in the following paragraphs.

Receipt Rate Variations. The reference waste acceptance schedules provided for the study indicate a gradual increase in receipt rates over the first three to five years, depending on the construction-phase option. In addition, the last 1-1/2 to 18 years of MRS operations is devoted only to the shipment of waste from the site. Depending on the scenario and the construction phase, this "ship-only" period may not require the routine processing or packaging of the waste materials. However the operating data presented for each of the scenarios only present steady-state operation or, in the case of the SFHB, the peak throughput (receive and store 3,000 MTU per year). Although this approach to data presentation provides the maximum flexibility in evaluating any of the 88 waste acceptance schedules utilizing an MRS Facility, it does not present an accurate picture of the MRS operations in (1) the early receipt years, (2) the retrieval and shipment years, or (3) the hot standby period for the SFHB for phased construction. For example, the SFHB requires a maximum staff of 136 prior to the full operation of the R&H Building. This quantity is reduced to 6 during hot standby, then returns to full operation as the bare, intact spent fuel is retrieved from storage and transferred to the R&H Building for packaging. A similar variation occurs relative to the cost of equipment maintenance, consumables, and utilities, yet only revised fixed costs are addressed on the data sheets for the standby period.

HLW Receipt. For 24 of the waste acceptance schedules which include phased construction and HLW receipt, HLW canisters would be received at the SFHB for a period of 6 months to a year (up to 800 canisters) prior to the operation of the R&H Building in Scenarios 6 through 9. The quantity received is predicated on the actual date of waste receipt at the R&H Building and the amount of HLW scheduled to be used in hot testing. The receiving of HLW canisters at the SFHB requires the unloading and transfer of the clean canisters through a contaminated hot cell (and use of an internally contaminated vault or drywell transporter), resulting in a high potential for surface contamination of the canisters during storage. No provision has been made in the SFHB to segregate this operation or for decontaminating the canisters. When the canisters are retrieved and transferred to the R&H Building for placement in a container prior to shipment, contamination spread is now possible in the R&H Building canyon cell (a remote operated, but typically uncontaminated area). Considering the relatively small quantity of HLW canisters to be handled at the SFHB, it may be advisable to delay the shipment of the material to the MRS until the R&H Building has been hot tested for a minimum of six months.

Waste Acceptance vs. Construction Schedules. The reference waste acceptance schedules for two-phase and three-phase construction assume a construction period of two years and one year, respectively, prior to the receipt of waste at the MRS Facility. In addition, the quantity of spent fuel shown for the first operating year implies that casks are received in the first month of the calendar year stated. The construction of the SFHB, however, requires 30 months including the system cold tests. The R&H Building requires a total of 53 months for construction, allowing for hot testing to be initiated approximately two years after the SFHB begins operation.

For single-phase and two-phase construction, the assumption can be made that waste is received starting in January of a calendar year and a total of 1,350 MTU is onsite at the end of the first year. The tables in Section 2 show that in the two-phase option only 1,000 MTU is used in the third year for R&H

Building hot testing, a more feasible quantity considering the complexity of the consolidation and/or packaging operations. In order to retain the calendar start date shown in the waste acceptance schedules for the MRS waste handling building(s) and the repository, the initiation of site operations for three-phase construction must be 18 months earlier. Although the RB and other related site operations can accommodate the 750 MTU in the six-month period, a second full year of dual purpose cask receipt is required prior to the operation of the SFHB. In addition, the third year of MRS operation has a scheduled receipt rate of 2,025 MTU. This quantity is greater than the more feasible 1,350 MTU typically identified by the schedules for the first year of SFHB operation and hot test. Therefore, an additional 675 MTU should be received in dual purpose casks resulting in a total storage inventory of 2,775 MTU (not the 1,100 MTU assumed in the study) in this storage mode.

8.2.1.2 Cell Operations

The R&H Building process cell and canyon cell configurations and related equipment are dependent upon the functions to be performed, the material quantity received and handled, and the configuration of package to be prepared. A similar relationship, excluding packaging, exists for the SFHB transfer cells. The following discusses issues relating to these cell operations.

Miscellaneous Hardware. Miscellaneous non-fuel bearing hardware such as flow channels and control spiders are used by commercial reactors. However the quantity, size, and disposal requirements of this material has not been defined nor has it been identified as a material to be received at the MRS. The CDR, and therefore the equipment and facility arrangements used as a basis for this study, does not have provisions to receive, unload, volume-reduce, and package the miscellaneous hardware. As discussed in Section 8.1.1.1, some of the scenarios evaluated require a four-shift operation in order to maintain the 3,000 MTU throughput rate. Even those cases where a three-shift operation is used may not have the remote processing time required to handle the miscellaneous material, depending on the quantity, handling requirements, and anticipated annual rate of receipt. Since the SFHB has neither the volume-reduction nor the waste packaging capability, miscellaneous hardware cannot be received unless the facility design is modified.

Repository Container Design. Assumptions were made for the study relating to the construction details of the repository emplacement container. Those details include: (1) the base, not the pintle end, is attached in the MRS welding process; (2) the internal dividers of the containers are fixed, solid units permitting the loading of fuel rods without displacement during the rotation of the container for segment loading; (3) the size of the center opening in the internal "space frame" will accept a 10-inch NFBC canister (e.g., eleven inches clear); (4) the openings in the intact BWR container will accept 6-inch canisters in all seven spaces; (5) the mixed intact fuel container (PWR and BWR fuel) has fixed internal dividers for alignment during loading; (6) the containers have a permanent marking that permits accurate remote positioning of the container in the container upender and subsequent alignment with the container loading system(s) in the process cell; and (7) the container length permits the cutting and removal of the bottom closure plate (defective weld) and subsequent rewelding without damaging the container

or the enclosed fuel. These design details are the basis for the operating times presented in the study and the interrelated facility arrangements. Changes in container detail assumption(s) will require a reevaluation of Scenarios 6 through 9.

NFBC Handling. For Scenarios 8 and 9, the end fittings and volume-reduced NFBC are placed in the center of the container containing reconfigured fuel rods. Since the containers are horizontal during the loading operation, canisters are used to receive the shredded NFBC or, for BWR fuel, the end fittings before placement into the containers. Process cell equipment arrangements in the CDR were reviewed relative to the addition of NFBC and end fitting canistering operations; however conceptual equipment designs and related cell arrangements were not prepared for the study. Canister grapples, loading table, and storage racks, plus modifications to the shredder discharge interface, require conceptual design. In addition, the cell space utilization must be confirmed if the NFBC handling methods for these scenarios is to be incorporated into the R&H Building operations.

8.2.1.3 SFHB Operations

The construction of the SFHB for a two-phase MRS Facility permits receipt and storage of spent fuel approximately two years prior to the initial operation of the R&H Building. However, a cost, and potential operating, penalty is incurred for this schedule. Although the SFHB is the only waste handling building in Scenarios 3 and 4, concerns relating to operations also arise. The following paragraphs discuss potential issues relating to the SFHB.

Damaged Fuel. The SFHB is designed to transfer bare, intact spent fuel to and from interim storage and, in Scenarios 3 and 4, to ship this fuel to the repository. Since no packaging operations are performed, damaged or failed spent fuel is also stored or shipped in the same condition as it is received. Interim storage for up to 23 years (NWPAA-constrained schedules) may be required prior to onsite transfer or offsite shipment, allowing this fuel to degrade further. In Scenarios 3 and 4, it may be possible to reduce the storage time by substituting undamaged fuel for the damaged fuel in interim storage. However, this operating flexibility is not present in the phased-construction options once the R&H Building is receiving spent fuel at its maximum scheduled receipt rate of 2,700 or 3,000 MTU per year.

Operating Life. In the phased-construction options, the SFHB receives and transfers spent fuel to storage for three years. (The third year of operation reduces the R&H Building receipt rate to a reasonable quantity for hot testing.) Once the R&H Building is fully operational, the SFHB is placed in hot standby until shipments from the reactors cease. Stored bare, intact spent fuel is then returned to the SFHB for transfer to the R&H Building where it is packaged and shipped to the repository. Because the SFHB must resume operation, only limited decontamination is anticipated before it is placed in standby and building and equipment maintenance is required during the standby period. Therefore, both capital and operating cost penalties are incurred in order to achieve the early receipt. The total operating cost during the extensive standby period could be reduced if the R&H Building receiving and processing rate were increased to the CDR throughput rate of 3,600 MTU per year. This possible operating option would be scenario-specific since some

scenario/storage option combinations already require a four-shift operation, precluding the capability to exceed 3,000 MTU per year. The option would also increase the annual operating costs (staff, consumables, etc.) for that higher-rate period, but would allow for early decommissioning of the SFHB and the early transfer of damaged or failed fuel from storage.

Alternate Uses. As discussed above, capital and operating cost penalties result from the use of the SFHB to achieve earlier operation of the MRS Facility. However, the SFHB has been designed for only receiving and transferring bare, intact spent fuel to and from interim storage. Depending on the MRS operations to be incorporated in the license application design, alternative uses for the SFHB should be considered. A decision to increase the SFHB functions, and a redefinition of the operating requirements, must be made prior to initiation of the advanced conceptual design of the building. Possible functions which could be added include:

- (1) Receive and package non-standard spent fuel (extra long, high burnup, HTGR, research, etc.)
- (2) Receive and package spent fuel assemblies identified as "failed" by the reactors.
- (3) Receive and package miscellaneous reactor hardware (see Section 8.2.1.2).
- (4) Containerize HLW (Scenarios 6 through 9).
- (5) Repair defective containers (Scenarios 6 and 8).
- (6) Maintenance and/or reconfiguration (PWR vs. BWR) of transportation casks.
- (7) Research and testing of equipment to improve facility operations.
- (8) Training and testing of hot cell operators.

Dual Purpose Casks. Scenarios 3 and 4, two-phase construction, requires the receipt and storage of dual purpose casks. This operation is identical to the three-phase construction option for the other scenarios with one major exception. Since packaging of spent fuel is not performed in the SFHB, it was assumed that the dual purpose casks would not be unloaded. The capacity of these casks is greater than the standard rail casks used for the remainder of the spent fuel shipments from the reactors. Although the transfer cell to cask interface would accommodate the dual-purpose cask, the operating time to transfer the fuel from these casks to a standard rail cask was not taken into account in the SFHB transfer cell design. The study identifies that the casks would be retrieved from storage and transferred to the SFHB where the cask would be checked before release from the site. This assumes that the NRC will permit these casks to be used for transportation after an extended storage period at the MRS. Since no dual-purpose cask has been licensed to date, the requirements for maintaining the cask Certificate of Compliance is unknown. If extensive testing and/or design verification of the cask is required,

provisions for these operations must be added to the SFHB or the SFHB design must be reevaluated to provide the operating time capability to unload the casks.

8.2.2 DESIGN

Data presented in the study is based on preconceptual designs and operating assumptions. Consequently, the subsequent detail design phases may require modifications and optimization to the preconceptual facility and equipment design and a resulting modification to the operating assumptions. The principle areas of concern are the storage units, SFHB, and NFBC equipment and packaging methods for Scenarios 8 and 9.

The interim onsite storage of bare, intact spent fuel was not considered in the MRS CDR. It is assumed that the storage configuration may require a double seal and will probably require inerting of the storage units. It is assumed that the CDR design can be modified to accomplish this requirement; however, verification will be required in the subsequent design phases. Note that the study cost data does not reflect the double seal, inerting operation, or inerting equipment for the storage options.

The SFHB has been configured to transfer bare intact spent fuel to and from storage. As noted in Section 8.2.1.3, alternative uses for the SFHB may wish to be considered. If alternatives are proposed, their inclusion may require modifications to the preconceptual facility and equipment designs presented for this study. The alternative requirements must be identified prior to initiation of the Advanced Conceptual Design to preclude redesign at a later date and a related schedule delay.

Scenarios 8 and 9 require the inclusion of NFBC in the repository-specific containers. An assumed method and the associated equipment was selected for this study. However, a conceptual design for this function and the associated equipment needs to be performed to verify the study assumptions. (Also see Section 8.2.1.2).

8.2.3 COST

Cost uncertainties are primarily a function of the design uncertainties. As noted in Section 8.2.2, the assumption for cask and drywell sealing and inerting and the NFBC packaging methods for Scenarios 8 and 9 need to be verified by a more detailed design. This verification may result in design modifications and revised costing. In addition, if alternative uses are proposed for the SFHB, the resulting facility and equipment modifications may result in revised costs for this facility.

The drywell spacings have been established using an assumed soil conductivity factor. The conductivity factor for the selected site may not be the same, requiring revised spacings which could result in revisions to the storage costs presented in this study.

8.2.4 DESIGN AND CONSTRUCTION SCHEDULES

The schedules developed for this study are based on the assumption that: (1) the facility arrangements utilized in this study form the baseline (with minimal changes) for subsequent design activities; (2) the critical milestones can be met; (3) external restraints are minimized; and (4) the activities can be initiated or sequenced to minimize the total design and construction duration.

The construction schedules were developed in accordance with Section 2.2.3 which assumes an adequate labor supply, minimum downtime due to labor disputes or weather conditions, and construction/procurement strategies. In addition, the schedule assumes that the onsite storage facilities are constructed prior to and during operations. This phased construction approach assumes that sufficient storage capacity is available at the startup of any construction phase waste handling operation. However, to assure radiation safety for the construction personnel during onsite storage operations, sufficient separation distance must be planned for and maintained between the construction area and storage placement operations.

All schedules assume the initiation of proof-of-principle tests prior to the start of design to assure timely completion of data for incorporation into the licensing design documents. Site investigation activities are scheduled to be initiated immediately upon selection of the site and that sufficient geotechnical data from the investigation is available for design input six months after initiation. In addition, the schedule assumes that no geotechnical abnormalities are encountered during the investigations which will delay or require extensive rework of the ongoing license design.

For the purpose of this study, the duration of license application review and approval has been assumed to be 24 or 30 months, depending upon the waste handling operations facilities. Since facilities of this type have not been previously licensed, the validity of this assumption is uncertain.

The input data used for schedule development is partly based on preconceptual designs. Therefore, after completion of the subsequent design phases, the schedules must be verified and optimized.

APPENDIX 1

APPENDIX 1

PRECONSOLIDATED FUEL RECEIPT

This appendix covers an MRS sensitivity study for Scenarios 5 and 8 where 100%, 50%, or 25% of reactor overspill (Table 1) is received and handled at the MRS as consolidated spent fuel in square open canisters.

1.0 GENERAL DISCUSSION

The receipt of consolidated spent fuel and related non-fuel bearing components (NFBC) in open square canisters at the MRS is a departure from the initial Scenarios 5 and 8 criteria. In the original scenarios all fuel is received in the form of intact bare spent fuel assemblies for subsequent consolidation. This study presents the assumptions, the operations involved, and the impact on facilities and cost data presented in Sections 5 (Scenario 5) and 7 (Scenario 8) as a result of receiving and handling some spent fuel from reactors in a consolidated state.

2.0 STUDY ASSUMPTIONS

Assumptions specific to this study are:

- (1) The at-reactor consolidation ratio is 2:1 and the spent fuel is placed in 8-1/2" canisters for PWR and 5-1/2" canisters for BWR.
- (2) For Scenario 5, the "open canister" received from the reactor is overpacked into a canister that can be sealed/inerted for storage and shipment using the same equipment as for the standard MRS square canister. The repository inserts the canisters into 28" diameter emplacement containers.
- (3) For Scenario 8, the open canister is inserted directly into a 26" diameter repository-specific container with a capacity of three 8-1/2" PWR canisters or six 5-1/2" BWR canisters.
- (4) The "open canister" can be handled by the process cell crane using the MRS fuel grapples.
- (5) The reactor overspill received replaces an equal amount of unconsolidated spent fuel normally received in any year.
- (6) The MRS operates at 2700 MTU/year/in accordance with Waste Acceptance Schedule No. 2.
- (7) NFBC are compacted, using the 7 to 1 compaction ratio for PWR assemblies and 3 to 1 for BWR assemblies, into canisters with the same dimensions as the at-reactor consolidated fuel canisters, and are handled in the same manner as the canisters of at-reactor consolidated fuel at MRS.

Table-1 - Annual Receipt (MTU) of Reactor Overspill

Year	PWR	BWR
2003	0	0
2004	0	0
2005	0	0
2006	1	14
2007	0	0
2008	28	0
2009	7	5
2010	13	34
2011	11	368
2012	390	71
2013	11	129
2014	394	19
2015	290	0
2016	393	57
2017	133	194
2018	57	28
2019	31	65
2020	404	252
2021	137	10
2022	90	0
2023	144	0
2024	78	0
2025	602	64
2026	0	61

(8) Spent fuel received does not increase the allowable inventory of spent fuel at the MRS.

3.0 WASTE HANDLING OPERATIONS

Waste Acceptance Schedule No. 2, (single phase, western strategy) requires the startup of the R&H Building in year 2003. Consequently, the receipt and handling of the reactor overspill of consolidated spent fuel in open canisters is accomplished in the Receiving and Handling (R & H) Building.

3.1 SCENARIO 5

The receiving, inspection, and fuel unloading operations for this sensitivity study are similar to that of Scenario 5 (Section 5). The open canisters of consolidated spent fuel are unloaded from the shipping cask into one of the four process cells in the R & H Building. The canisters are either placed in lag storage or are transferred to the upender normally used for intact spent fuel that is to be canistered without consolidation. The canister is placed on the upender in a vertical orientation, clamped in place, lowered to a horizontal position, and translated to a port in the shield wall between the

process cell and canyon cell. In the canyon cell, a clean overpack canister is introduced into the canyon cell, and placed on a canister upender. The upender is aligned with the axial centerline of the spent fuel canister in the process cell and the consolidated fuel canister is pushed into the overpack canister. The overpack canister is then positioned, by the upender, at a weld/decon/test chamber and the canister is inerted, welded, decontaminated, and tested in the same manner as described in Section 5.2.1.1. All subsequent operations for storage and shipping of the canisters are also as described for Scenario 5.

As shown in Table-1, the greatest number of consolidated fuel canisters received in any one year occurs in the year 2020 for the 404 MTU of PWR and 252 MTU of BWR spent fuel. Based on receipt of 100% of the reactor overspill MTU values, the number of consolidated fuel canisters, received at the MRS is 470 8-1/2" PWR canisters, 700 5-1/2" BWR canisters, 134 8-1/2" PWR NFBC canisters, and 467 5-1/2" NFBC canisters. The canister loading assumed is 2 PWR per 8-1/2" canister, 2 BWR per 5-1/2" canister, NFBC hardware from 7 PWR assemblies in an 8-1/2" canister, and NFBC hardware from 3 BWR assemblies in a 5-1/2" canister. On the basis of 50% of the above values, the quantity of canisters received is 235 8-1/2" PWR canisters, 350 5-1/2" BWR canisters, 67 8-1/2" PWR NFBC canisters, and 234 5-1/2" BWR NFBC canisters. On a 25% basis, the quantity of canisters received is 118 8-1/2" PWR canisters, 175 5-1/2" BWR canisters, 34 8-1/2" PWR NFBC canisters, and 117 5-1/2" BWR NFBC canisters.

3.2 SCENARIO 8

The operations in the R & H Building in this sensitivity study for Scenario 8 are similar to that described above for Scenario 5. The difference, however, is that the open canisters are pushed by the process cell intact spent fuel upender directly into a 26" diameter intact assembly repository-specific container positioned on an upender located in a canyon cell. The container is then inerted, welded, decontaminated, and tested in the same manner as described for Scenario 8 (Section 7.2.1.1). All subsequent operations for storage and shipment of the containers are also as described for Scenario 8.

The quantities of consolidated spent fuel canisters received in the year 2020 for Scenario 8 are the same as noted above for Scenario 5 for the 100%, 50%, and 25% reactor overspill receipt rates. The number of containers required, based on 3 PWR or 6 BWR consolidated fuel canisters per container at the 100% receipt rate is 157 PWR containers, 117 BWR containers, 45 PWR NFBC containers, and 67 BWR NFBC containers. On the basis of 50% of the reactor overspill, the quantity of containers is 79 PWR containers, 59 BWR containers, 23 PWR NFBC containers, and 34 BWR NFBC containers. On a 25% basis, the quantity of containers is 39 PWR containers, 29 BWR containers, 11 PWR NFBC containers, and 17 BWR NFBC canisters.

4.0 STORAGE OPERATIONS

The spent fuel waste receipt schedule assumed for this sensitivity study provides for a MRS steady-state receipt/shipping operation in year 2007. Consequently, the maximum reactor overspill to be stored onsite is 15 MTU. The handling and storage of these canisters has a negligible effect on the storage operations and cost.

5.0 COST DATA

These operations do not affect either the equipment design or the R & H Building arrangement presented for Scenarios 5 and 8. Therefore, the inclusion of handling reactor overspill does not impact the capital costs presented in Section 5.4.2 and Section 7.4.2.

The receipt of preconsolidated spent fuel reduces the yearly throughput of intact assemblies requiring consolidation thereby reducing the process cell total operating time. However this reduction is partially offset by the additional process cell total operational time required to handle and package the open canisters. The canister closure total operating time is increased due to the increased number of canisters or containers (spent fuel and NFBC) required. In total, these variations do not affect the crew/shift allocations presented in Section 5 (Scenario 5) or Section 7 (Scenario 8).

For Scenario 5, the total number of overpack canisters required for the maximum receipt (MTU) of open canisters is 1771 compared to 830 canisters plus 318 NFBC drums required for the same receipt (MTU) of intact assemblies to be consolidated and canistered. The difference in canisters and/or drums results in an increase of \$1.2 million for canistering 100% of the reactor overspill.

The total number of containers required for the maximum receipt (MTU) of open canisters is 386 compared to 266 containers required for the same receipt (MTU) of intact assemblies to be consolidated and containerized for Scenario 8. The difference in spent fuel and NFBC containers results in an increase cost of \$1.8 million for MRS containerization of 100% reactor overspill.

6.0 DESIGN AND CONSTRUCTION SCHEDULES

As previously stated, the receipt and handling of preconsolidated spent fuel and the related NFBC does not affect the equipment or facility designs described in Sections 5 and 7. Therefore, neither the design nor construction schedules are affected by this sensitivity study.

7.0 SUMMARY

The receipt of reactor-consolidated spent fuel does not require additional capital cost, R & H Building and storage facility operational staffing, or storage costs for either Scenario 5 or Scenario 8. Additional consumable costs for additional canisters and containers will be required, however these costs are minimal when compared to those required for the yearly throughput of the scenarios.

APPENDIX 2

NUTECH/NUHOMS CANISTER

This sensitivity study for Scenarios 3, 4, and 5 involves the receiving and handling of 100%, 50%, or 25% of reactor overspill (Table-1) as intact spent fuel in NUTECH/NUHOMS canisters.

1.0 GENERAL DISCUSSION

The initial Scenarios 3, 4, and 5 criteria are based on the receipt and handling, at the MRS, of intact bare spent fuel assemblies. This sensitivity study introduces a requirement to receive and handle spent fuel assemblies encased in NUTECH/NUHOMS canisters that have the following characteristics:

Length - 4.6 m (186.5 in.)
Diameter - 1.71 m (67.24 in.)
Wall thickness - 16 mm (0.625 in.)
Material - stainless steel
Capacity - 24 PWR (intact) or 52 BWR (intact)
Weight - 36,290 kg (80,000 lb)

The assumptions and operations involved, and the impact on MRS facilities and cost data resulting from this additional criterion are presented in this appendix.

2.0 STUDY ASSUMPTIONS

Specific assumptions established for this study are:

- (1) MRS operates at 2700 MTU/year in accordance with Waste Acceptance Schedule No. 2 (single-phase, western strategy, no HLW).
- (2) Spent fuel received in NUHOMS canisters replaces an equal amount of spent fuel normally received in any year.
- (3) NUHOMS canister shipping cask size is not greater than the MRS-to-repository cask.
- (4) NUHOMS canister shipping cask (empty) equals weight of a "dual-purpose" cask (250,000 lb loaded weight minus 34,800 lb fuel weight = 211,600 lb). Therefore, the loaded cask weight plus the NUHOMS canister of 80,000 lb is less than the MRS-to-repository cask.
- (5) NUHOMS canister is to be volume-reduced and handled as remote handled low level waste (RH-LLW).

Table-1 - Annual Receipt (MTU) of Reactor Overspill

Year	PWR	BWR
2003	0	0
2004	0	0
2005	0	0
2006	1	14
2007	0	0
2008	28	0
2009	7	5
2010	13	34
2011	11	368
2012	390	71
2013	11	129
2014	394	19
2015	290	0
2016	393	57
2017	133	194
2018	57	28
2019	31	65
2020	404	252
2021	137	10
2022	90	0
2023	144	0
2024	78	0
2025	602	64
2026	0	61

- (6) Fuel from the NUHOMS canister is to be consolidated except for 5% which will remain intact.
- (7) In-process lag storage in the Receiving and Handling (R & H) Building or the Spent Fuel Handling Building (SFHB) can be reduced by up to 50% to provide space for NUHOMS canister handling.
- (8) NUHOMS canister pintle is at same end as fuel assembly top end fitting; the fitting is intact and functional and can support the loaded canister during a lift while in the vertical orientation.
- (9) Lead shield plug at each end of the NUHOMS canister is 4-inches thick.
- (10) Casks containing NUHOMS canisters can remain in onsite cask lag storage until the canisters can be scheduled for processing (i.e. casks are not constrained by a "turn-around" requirement).

3.0 WASTE HANDLING OPERATIONS

Receipt and handling of the NUHOMS canister is in the SFHB for Scenarios 3 and 4 and in the R & H Building for Scenario 5.

3.1 SCENARIOS 3 AND 4

The operations involving the receipt and inspection of the shipping cask, the positioning of the cask, mating of the cask to a transfer cell, and removing the port plug in the SFHB are identical to the operations described for Scenarios 3 and 4 (Section 4.2.1.1). The operations involved with unloading of the canister from the shipping cask, opening of the canister, and handling of the canister are described in the following paragraphs.

To handle the canister, only one transfer cell is used. With the in-cell crane and appropriate grapple, the canister is lifted from the shipping cask and vertically placed in a special 12-ft deep pit with the upper end of the canister protruding above the pit. The grapple is then changed and the transfer cell port plug is set in place before other cell operations begin. The canister top is cut around its circumference, below the top lead shield plug, using two plasma arc torches mounted opposite each other on a rotating mechanism. The canister top and lead shield plug is lifted by the cell crane and set on a transfer cart. The cart is translated to the adjoining transfer cell. The operations for unloading of the spent fuel assemblies and loading into either lag storage or into a shipping cask, a storage cask, or other transfer system to onsite storage is the same as that described for the normal operations in Scenarios 3 and 4.

Simultaneous with the fuel unloading, the canister top and lead shield plug in the adjacent cell is lifted by that cell's crane and lowered into the remote handled equipment maintenance cell through the equipment maintenance hatch. The hatch is opened by its own lifting/ transfer mechanism and closed after the top and plug has been lowered onto a transfer cart in the equipment maintenance cell. In the equipment maintenance cell, the top and plug are lifted by the maintenance cell crane and placed on a cutting table. The top is cut into segments by a plasma arc cutting machine, and the shield plug is cut into segments by a saw. This cutting operation is performed as time permits and is not coupled to the transfer cell operations above.

After the canister is unloaded, the canister is lifted from the pit and placed on the transfer cart, lowered to a horizontal position, translated into the adjoining cell, lifted to a vertical position by the cell crane, and lowered through the maintenance hatch to the remote equipment maintenance cell below. The canister, having been lowered vertically onto a transfer cart in the maintenance cell, is moved to a position under the maintenance cell crane where it is lifted and lowered to a horizontal position onto a plasma arc cutting machine. The machine consists of a frame with rollers on which the canister can be rotated. The plasma arc cutter is mounted on a frame on rails that can translate horizontally along the length of the canister.

Each canister is cut into 10 radial segments and 6 axial segments yielding 60 segments, each weighing approximately 113 lb. Using a robot that travels along the same track as the cutter, the segments are placed in drums. The canister

internal basket is also cut incrementally and is placed in drums. The total number of drums per canister and the internal basket is 20 drums plus 12 drums for the lead shield plug segments. The drum capacities are limited by allowable weight and/or the configuration of the canister material. The exterior of these waste drums are decontaminated and shipped to a waste disposal site.

The maximum number of spent fuel assemblies in NUHOMS canisters received at the SFHB is in the year 2020. For 100% of the overspill, the number of PWR assemblies is 940 and 1400 for BWR. Based on 50% of the maximum overspill, the number of assemblies for PWR is 470 and 700 for BWR. On a 25% basis, the numbers are 234 PWR and 350 BWR.

3.2 SCENARIO 5

The operations, involving the receipt, inspection, and unloading of the shipping cask and the handling and disposal of the NUHOMS canister for Scenario 5 is the same as that described above for Scenarios 3 and 4. The receipt of the canister in this case is in one of the four process cells in the R & H Building, modified to receive the canister. The canister volume reduction is accomplished in the remote handled maintenance cell below the process cells in the same manner and with the same type of equipment as described for Scenarios 3 and 4.

4.0 STORAGE OPERATIONS

The spent fuel received in NUHOMS canisters replaces an equal quantity of fuel to be received and handled at the MRS. In addition, RH-LLW is not stored onsite but is shipped to a disposal site as soon as possible. Therefore the receipt of NUHOMS canisters does not affect the MRS interim storage operations.

5.0 COST DATA

The handling of NUHOMS canisters at the MRS revises the previous data relating to management and integration, construction cost, annual operating cost, and staff allocation.

5.1 MANAGEMENT AND INTEGRATION

Tables 1 and 5 present revised costs for preoperational testing and personnel training for Scenarios 3 and 4 and for Scenario 5, respectively. The cost increases relate to the development of procedures and the personnel training required for the canister opening and volume-reduction activities.

The relative cost of the related design and construction changes do not affect the design and construction management cost elements shown in Sections 4 and 5.

5.2 CONSTRUCTION

The design of the SFHB for Scenarios 3 and 4 and the R & H Building for Scenario 5 requires modification to accommodate the handling of the NUHOMS

canister introduced by this sensitivity study. Drawings APP 2-1 thru APP 2-9 show the SFHB and R&H Building arrangements incorporating the NUHOMS canister handling requirements.

The design changes to the SFHB and the R & H Building base designs involve: (1) the addition of a 6'-6" diameter x 12'-0" deep pit in one cell to receive the canister; (2) the addition of the canister cutting equipment in the cell; (3) the increase of the cell crane capacity from 20 tons to 40 tons; (4) a four foot increase to the height of the cells to accommodate the increased crane capacity; (5) an increase to the size of the remote handled maintenance room in each building to accommodate additional canister cutting and handling equipment to effect volume reduction; and (6) the lowering of the remote maintenance cell floor in order to gain the necessary height resulting from the increased crane capacity and the increased crane span.

The addition of the NUHOMS canister pit in the SFHB transfer cell and the R & H Building process cell reduces the in-process lag storage capacity of one cell by approximately one third; however, this has no appreciable effect on operations and is a more reasonable approach than increasing the cell size.

Changes to the construction cost information presented in Section 4 of this report for Scenarios 3 and 4 are presented in Table 2. The data for Scenario 5 appears in Table 6 and present modifications to the tables in Section 5.

5.3 ANNUAL OPERATING COSTS

The addition of canister cutting equipment is reflected in the Table 3 equipment maintenance percentiles for Scenarios 3 and 4. Since the cost and complexity of the new equipment is negligible in comparison to other equipment required for Scenario 5, no modifications to the tables in Section 5 are required.

Another impact from handling the NUHOMS canisters is the addition of 32 drums of waste for each canister received. This increases the consumables (drums) for the SFHB and the R & H Building. For the year 2020, the operating cost increase is \$0.2 million if 100% of the reactor overspill is received in NUHOMS canisters.

5.4 STAFFING ALLOCATION

In Scenarios 3 and 4 the receipt of reactor overspill in the NUHOMS canister at the SFHB affects both the overall operating time for the transfer cell and operations of the remote handled maintenance cell. The simultaneous receipt of NUHOMS canisters and a large fleet of truck casks requires the SFHB, except for the maintenance cell, to operate on a four-shift basis. Although the largest quantity of spent fuel in NUHOMS canisters could be received in year 2025, the waste acceptance schedule assumed for this analysis reflects only 226 MTU to be received. Therefore calculations for the study were based on year 2020 with the MRS receiving 100%, 50%, or 25% of the reactor overspill in that year. In all cases, the four-shift operation is required. "Normal" operation, without NUHOMS canisters and assuming no additional material to storage from the unloaded truck casks, requires the use of three shifts.

The SFHB remote handled maintenance cell must also increase by one shift to provide the necessary time to volume-reduce and package the empty NUHOMS canisters. During normal operations, this cell was scheduled to operate only two shifts to support the maintenance requirements of the transfer cells. (Although underutilized during this period, this cell must assure the on-line capability of the transfer cells to maintain the required throughput.) The addition of the volume reduction activities, and the added functions in the one transfer cell, increases the utilization of the cell and the number of operations shifts to three. The net increase in staff is 41 for the SFHB.

The quantity of spent fuel received in NUHOMS canisters and the approach used to calculate the related impacts to Scenario 5 are as presented for Scenarios 3 and 4. During the reference maximum throughput year, only NUHOMS canisters are received, opened, and unloaded in the modified process cell. The remaining quantity of spent fuel received (2044 MTU) is handled in the other three cells. At the assumed throughput rate of 2700 MTU per year, no increase in staff is required relative to the operation of the process cells. The increase in operations of the remote maintenance cell to perform volume-reduction of the NUHOMS canisters requires the addition of two operating technicians to each of the three shifts, a net change in the building support staff of six.

The incremental operating times for handling the NUHOMS canister at the SFHB and at the R & H Building are presented in Tables 4 and 7, respectively. Also shown are the changes to building support staff reflecting the increase in operating shifts and/or remote maintenance cell activities.

6.0 DESIGN AND CONSTRUCTION SCHEDULES

Although the design and construction of the waste handling buildings are affected by this sensitivity study, the changes do not impact the schedules presented in Sections 4 and 5.

7.0 SUMMARY

The receipt of NUHOMS canisters in Scenarios 3, 4, and 5 requires the addition of remotely operated equipment and of operating personnel to the waste handling buildings. In addition, the cost of consumables (drums) and the requirement to ship additional waste from the MRS are a direct result of NUHOMS canister volume-reduction activities.

The cost increase in management and integration is \$0.5 million for both scenarios and in construction cost is \$5.048 million (Scenarios 3 and 4) and \$2,192 million (Scenario 5). For the year 2020, the annual operating costs increase by approximately \$2.5 million for Scenarios 3 and 4 and by approximately \$0.5 million for Scenario 5.

Scenario: 3/4
 Construction Phase: Single
 Storage Concept: All

Date : 11/23/88
 Revision : 0

COST CENTER/Cost Element	Cost (Millions \$)	Percent of M & I Cost per Year Prior to Operations												
		-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION		NO CHANGES REQUIRED EXCEPT AS NOTED												
Site Selection/Investigation														
Design														
Proof-of-Principle Tests (3 Tests)														
Advanced Conceptual Design														
License Application Design														
Licensing Support														
Final Procurement and Construction Design														
Title III Support														
Operating Contractor Support														
Design														
Construction														
Construction Management														
Preoperational Testing and Personnel Training		33.2												

Scenario: 3/4
Construction Phase: Single
Storage Concept: All

Date : 11/23/88
Revision : 0

COST CENTER/Cost Element	Millions in 1988 \$			
	Building Area	Facility Cost	Equipment Cost	Total Cost
CASK OPERATIONS		NO CHANGES REQUIRED		
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS		NO CHANGES REQUIRED EXCEPT AS NOTED		
SPENT FUEL HANDLING BUILDING				
Cask Unloading		2.656		2.926
Assembly Lag Storage	3200			
Processing	11424	9.482	8.576	18.058
Interim Storage Loading/Unloading	18360	16.249		16.688
Building Support Facilities	116326	31.061	6.189	37.250
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	N/A
Cask Unloading				
Assembly Lag Storage				
Processing				
Volume Reduction				
Canister/Container Closure				
Canister/Container Lag Storage				
Interim Storage Loading/Unloading				
WRS/Repository Cask Handling				
Building Support Facilities				
INTERIM STORAGE OPERATIONS		NO CHANGES REQUIRED		
Storage Facilities				
Storage Units				
Receiving Building				
BALANCE OF PLANT AND SUPPORT OPERATIONS		NO CHANGES REQUIRED		
Onsite Preparation				
Offsite Preparation				
Administration				
Other Support Facilities				

Scenario: 3/4
 Construction Phase: Single
 Storage Concept: All

Date : 11/23/88
 Revision : 0

COST CENTER/Cost Element	Equipment Maintenance/Replacement (%/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS	NO CHANGES REQUIRED			
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	NO CHANGES REQUIRED EXCEPT AS NOTED			
Cask Unloading				
Assembly Lag Storage				
Processing		2.0		
Interim Storage Loading/Unloading				
Building Support Facilities		7.0		
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	
Cask Unloading				
Assembly Lag Storage				
Processing				
Volume Reduction				
Canister/Container Closure				
Canister/Container Lag Storage				
Interim Storage Loading/Unloading				
WRS/Repository Cask Handling				
Building Support Facilities				
INTERIM STORAGE OPERATIONS	NO CHANGES REQUIRED			
Storage Facilities				
Storage Units				
Receiving Building				
BALANCE OF PLANT AND SUPPORT OPERATIONS	NO CHANGES REQUIRED			
Onsite Preparation				
Offsite Preparation				
Administration				
Other Support Facilities				

Scenario: 3/4
Construction Phase: Single
Storage Concept: All

Date: 12/9/88
Revision: 1

COST CENTER/Functional Activity by Crew -----	Processing Time/Unit Processed (in minutes) -----	FTE/Crew -----	Annual \$/FTE -----	Notes -----
CASK OPERATIONS	NO CHANGES REQUIRED			
Receive & inspect transport casks; inspect & ship transport casks				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	NO CHANGES REQUIRED EXCEPT AS NOTED			
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks				NUMOMS cask unloading = 140/cask
Storage loading/unloading				
Building support staff	N/A	(Rev. 1) 64	\$53,900	Canister volume reduction & packaging = 240/canister
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks into process cells				
Consolidate and canister fuel				
Volume-reduce/package NFDC				
Weld/decom/test canisters				
Canister handling:				
log storage				
storage loading/unloading				
NRS transport cask loading				
Building support staff				
INTERIM STORAGE OPERATIONS	NO CHANGES REQUIRED			
Receiving Building staff				
Storage transport operations				
Storage placement				
BALANCE OF PLANT AND SUPPORT OPERATIONS	NO CHANGES REQUIRED			
Site support staff				

APPENDIX 2
TABLE 5
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 5
 Construction Phase: Single
 Storage Concept: All

Date : 11/23/88
 Revision : 0

COST CENTER/Cost Element	Cost (Millions \$)	Percent of M & I Cost per Year Prior to Operations											
		-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2
MANAGEMENT AND INTEGRATION		NO CHANGES REQUIRED EXCEPT AS NOTED											
Site Selection/Investigation													
Design													
Proof-of-Principle Tests (6 Tests)													
Advanced Conceptual Design													
License Application Design													
Licensing Support													
Final Procurement and Construction Design													
Title III Support													
Operating Contractor Support													
Design													
Construction													
Construction Management													
Preoperational Testing and Personnel Training		67.3											

Scenario: 5
 Construction Phase: Single
 Storage Concept: All

Date : 11/23/88
 Revision : 0

Millions in 1988 \$				
COST CENTER/Cost Element	Building Area	Facility Cost	Equipment Cost	Total Cost
CASK OPERATIONS			NO CHANGES REQUIRED	
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	N/A
Cask Unloading				
Assembly Lag Storage				
Processing				
Interim Storage Loading/Unloading				
Building Support Facilities				
RECEIVING AND HANDLING BUILDING			NO CHANGES REQUIRED EXCEPT AS NOTED	
Cask Unloading				
Assembly Lag Storage				
Processing			67.697	86.138
Volume Reduction				
Canister/Container Closure				
Canister/Container Lag Storage				
Interim Storage Loading/Unloading				
HRS/Repository Cask Handling				
Building Support Facilities			108.707	235.722
INTERIM STORAGE OPERATIONS			NO CHANGES REQUIRED	
Storage Facilities				
Storage Units				
Receiving Building				
BALANCE OF PLANT AND SUPPORT OPERATIONS			NO CHANGES REQUIRED	
Onsite Preparation				
Offsite Preparation				
Administration				
Other Support Facilities				

Scenario: S
Construction Phase: Single
Storage Concept: All

Date : 12/9/88
Revision : 1

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS	NO CHANGES REQUIRED			
Receive & inspect transport casks; Inspect & ship transport casks				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks				
Storage loading/unloading				
Building support staff				
RECEIVING AND HANDLING BUILDING	NO CHANGES REQUIRED EXCEPT AS NOTED			
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks into process cells				NURDWS cask unloading = 140/cask
Consolidate and canister fuel				
Volume-reduce/package WFC				
Build/decon/test canisters				
Canister handling:				
lag storage				
storage loading/unloading				
WRS transport cask loading				
Building support staff	N/A	(Rev. 1) 152	\$53,900	Canister volume reduction & packaging = 240/canister
INTERIM STORAGE OPERATIONS	NO CHANGES REQUIRED			
Receiving Building staff				
Storage transport operations				
Storage placement				
BALANCE OF PLANT AND SUPPORT OPERATIONS	NO CHANGES REQUIRED			
Site support staff

TRANSFER/DISCHARGE ARRANGEMENT
FOR VAULT STORAGE OPTION

						SPCS APPS		MRS FACILITY	
						EXPRESS		CENTRAL MAIL ROOM	
						SCALE 1/8"=1'-0"		FIRST FLOOR PLAN	
						REVISIONS		NOT RECD	
						LAST REV		APR 27 1968	
						DRAWING STATUS		NONE

[illegible]

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99		JGPR
U.S. DEPARTMENT OF ENERGY RICHMOND OPERATIONS OFFICE PACIFIC NORTHWEST LABORATORY OPERATED BY BATTTELLE MEMORIAL INSTITUTE THE RALPH M. PARSONS COMPANY OF DELAWARE		U.S. DEPARTMENT OF ENERGY RICHMOND OPERATIONS OFFICE PACIFIC NORTHWEST LABORATORY OPERATED BY BATTTELLE MEMORIAL INSTITUTE THE RALPH M. PARSONS COMPANY OF DELAWARE
MRS FACILITY SPENT FUEL HANDLING BLDG BUILDING SECTIONS		MRS FACILITY SPENT FUEL HANDLING BLDG BUILDING SECTIONS
3/64" - 0"		3/64" - 0"
NONE		NONE

U. S. Department of Energy Richland Operations Office PACIFIC NORTHWEST LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
PROJECT: JQP-#	
DRAWN BY: [blank]	
CHECKED BY: [blank]	
DATE: [blank]	
SCALE: [blank]	
NOT RECD	
CLASSIFICATION: NONE

PARTIAL FLOOR PLAN ABOVE

U. S. Department Of Energy Richland Operations Office	
PACIFIC NORTHWEST LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
THE FLOWMETER COMPANY AT RICHLAND	
MFC FACILITY RELL VINE AND HAYDEN BUILDING	
TOWN OF RICHLAND, WA	
NOT RECD	DATE
CLASSIFICATION	
NONE	
APPROVED

SECTION B

3 16 36 48 64 80 FT JQP #P	
APPROVED FOR RELEASE BY THE DIRECTOR OF FBI/DOJ DATE 12-1-81	U.S. Department of Energy Nuclear Operations Office PACIFIC NORTHWEST LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE THE ANTIMONY RESEARCH COMPANY OF DELAWARE MRS FACILITY RECEIVING AND HANDLING BLDG BUILDING SECTIONS
NAME SEX AKA DATE BORN AGENCY ADDRESS SOCIAL SECURITY NO. TELEPHONE NO. EMPLOYER OCCUPATION EDUCATION MARITAL STATUS RELIGION RACE HEIGHT WEIGHT HAIR EYES SKIN TATTOOS SCARS OTHER	NAME ADDRESS CITY STATE ZIP PHONE NO. TELETYPE NO. FAX NO. E-MAIL WWW

APPENDIX 3

VARIATIONS IN HLW RECEIPT RATE

This sensitivity study involves packaging functions for Scenarios 6,7,8, and 9 where receipt of canistered high level waste (HLW) at the MRS is reduced by 200 and 400 MTU/year, and the packaging function for these amounts shifts to the repository.

1.0 GENERAL DISCUSSION

The criteria for the initial Scenarios 6 through 9 include the receipt of 400 MTU of HLW/year at the MRS. Since the impact of HLW receipt is essentially the same for all Scenarios, discussions in this appendix are applicable to all scenarios except as noted. The assumptions made and effects on operating time, facilities, and equipment are presented in the following sections.

2.0 STUDY ASSUMPTIONS

For the purpose of this sensitivity study, HLW is assumed to be received and handled in the Receiving and Handling (R&H) Building for the single-phase construction option only.

3.0 WASTE HANDLING OPERATIONS

HLW canisters are received, handled, and packaged in repository-specific containers as described in Section 6.2.1.1. These operations require the use of a dedicated weld/decon/test station in the discharge area of one canyon cell. Related equipment, such as container upenders, clean container handling mechanisms, etc., are also required to support the handling of HLW.

4.0 STORAGE OPERATIONS

In the initial study, the storage operations and related costs are based on an onsite inventory of 2400 MTU. The activities associated with the interim storage are as described in Section 6 and 7. A decrease in, or the elimination of, HLW receipt at the MRS affects both operating and construction costs relating to onsite storage requirements.

5.0 COST DATA

The inclusion of HLW canister handling and packaging requires a dedicated weld/decon station. This station is required for both the 400 and 200 MTU/year receipt. Consequently, the deletion of the HLW receipt will delete the need for the weld/decon station and reduce the R&H Building capital cost by approximately \$7.3 million.

The staffing allocations for a 400 MTU/year HLW throughput are noted on the applicable data sheets included in Sections 6 and 7. The deletion of HLW receipt (400 MTU/year) reduces the R&H Building operating staff by 15

personnel or a reduction in the operating cost of approximately \$0.08 million/year. A reduction to 200 MTU/year throughput rate reduces the operating staff required to handle the HLW canisters, but retains the staff required for container closure. The net effect is a R&H Building operating staff reduction of 5 personnel or approximately \$0.3 million/year. In addition, Scenarios 6 and 8 require a container repair function. The staff allocated to this function is 2 personnel or approximately \$0.1 million/year for either the 200 MTU/year or the 400 MTU/year throughput option. Consequently, the deletion of HLW throughput (400 MTU/year) reduces the R&H Building staffing costs by approximately \$0.1 million/year.

If the HLW is not stored onsite, the following incremental cost reductions can be applied to the total storage costs. The staffing allocations relating to storage for 400 MTU/year of HLW are 10, 6, and 12 personnel for the cask, drywell, and vault storage options respectively. The same staff allocations are required for a 200 MTU/year throughput. Therefore, the deletion of HLW receipt (400 MTU/year) results in a storage staff cost reduction of approximately \$0.5 million, \$0.3 million, and \$0.6 million per year for the cask, drywell, and vault storage options respectively.

The number of containers required for the packaging of 400 MTU of HLW is 800 with an additional 8 containers required for Scenarios 6 and 8 for the repackaging of the HLW removed from the defective containers returned to the MRS. Due to the variation in container unit costs (\$23K or \$19K) the consumable cost associated with 400 MTU throughput is \$18.6 million/year, \$18.4 million/year, \$15.4 million/year, and \$15.2 million/year for Scenarios 6, 7, 8, and 9 respectively. Therefore, the deletion of HLW throughput (400 MTU/year) reduces the consumable cost by the quantities stated above, and a reduction of 200 MTU/year results in a cost reduction of one-half of these values.

In addition, the deletion of the HLW receipt reduces the number and associated storage unit costs. The number of casks required for 400 MTU of HLW storage is 200. The cost reduction resulting from deleting HLW receipt is approximately \$39.4 million. The cost reduction for 400 MTU of drywell storage is \$9.8 million and \$29.4 million for vault storage. The reduction of HLW receipt to 200 MTU/year results in storage values equal to one-half of that noted for the 400 MTU storage option.

6.0 DESIGN AND CONSTRUCTION SCHEDULES

The facility arrangements used for the initial study show a weld/decon/test station and related equipment for the containerizing of HLW. The deletion of the HLW requirement at the MRS, and therefore the elimination of this equipment does not affect the single-phase construction schedules presented in Sections 6 and 7.

7.0 SUMMARY

The deletion of 400 MTU/year HLW throughput results in a cask handling operations cost reduction of \$19.5 million, \$19.2 million, \$16.3 million, and \$16.0 million per year for Scenarios 6, 7, 8, and 9 respectively. The reduction in HLW throughput to 200 MTU/year results in a cost reduction of

\$9.7 million, \$9.5 million, \$8.1 million, and \$7.9 million per year for Scenarios 6, 7, 8, and 9 respectively. If the HLW received is transferred to storage, additional cost reduction can be realized. These cost reductions are \$39.9 million, \$10.1 million, and \$30.0 million for 400 MTU cask, dry well, and vault storage respectively. The costs for 200 MTU cask, dry well, and vault storage are \$19.7 million, \$4.9 million, and \$14.7 million respectively.

Scenario: 6
Construction Phase: All
Storage Concept: All

Date: 11/23/00
Revision: 0

		Millions in 1988 \$		
COST CENTER/Cost Element	Building Area	Facility Cost	Equipment Cost	Total Cost
<hr/>				
CASK OPERATIONS		NO CHANGES REQUIRED		
Receiving				
Cost Log Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING		NO CHANGES REQUIRED		
Cost Unloading				
Assembly Log Storage				
Processing				
Interior Storage Loading/Unloading				
Building Support Facilities				
RECEIVING AND HANDLING BUILDING		NO CHANGES REQUIRED EXCEPT AS NOTED		
Cost Unloading				
Assembly Log Storage				
Processing				
Volume Reduction				
Canister/Container Closure			14.375	22.780
Canister/Container Log Storage				
Interior Storage Loading/Unloading				
WRS/Repository Cost Handling				
Building Support Facilities				
INTERIOR STORAGE OPERATIONS		NO CHANGES REQUIRED		
Storage Facilities				
Storage Units				
Receiving Building				
BALANCE OF PLANT AND SUPPORT OPERATIONS		NO CHANGES REQUIRED		
Onsite Preparation				
Offsite Preparation				
Administration				
Other Support Facilities				

Scenario: 7
Construction Phase: All
Storage Concept: All

Date : 11/23/88
Revision : 0

COST CENTER/Cost Element	Building Area	Millions in 1988 \$		
		Facility Cost	Equipment Cost	Total Cost
CASK OPERATIONS		NO CHANGES REQUIRED		
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS		NO CHANGES REQUIRED		
SPENT FUEL HANDLING BUILDING		NO CHANGES REQUIRED		
Cask Unloading				
Assembly Lag Storage				
Processing				
Interio Storage Loading/Unloading				
Building Support Facilities				
RECEIVING AND HANDLING BUILDING		NO CHANGES REQUIRED EXCEPT AS NOTED		
Cask Unloading				
Assembly Lag Storage				
Processing				
Volume Reduction				
Canister/Container Closure			14.575	22.780
Canister/Container Lag Storage				
Interio Storage Loading/Unloading				
NRS/Repository Cask Handling				
Building Support Facilities				
INTERIM STORAGE OPERATIONS		NO CHANGES REQUIRED		
Storage Facilities				
Storage Units				
Receiving Building				
BALANCE OF PLANT AND SUPPORT OPERATIONS		NO CHANGES REQUIRED		
Waste Preparation				
Offsite Preparation				
Administration				
Other Support Facilities				

Scenario: B
Construction Phase: All
Storage Concept: All

Date : 11/23/88
Revision : 0

		Millions in 1988 \$		
COST CENTER/Cost Element	Building Area	Facility Cost	Equipment Cost	Total Cost
<hr/>				
CASK OPERATIONS		NO CHANGES REQUIRED		
Receiving				
Cask Lag Storage				
 WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING		NO CHANGES REQUIRED		
Cask Unloading				
Assembly Lag Storage				
Processing				
Interim Storage Loading/Unloading				
Building Support Facilities				
 RECEIVING AND HANDLING BUILDING				
		NO CHANGES REQUIRED EXCEPT AS NOTED		
Cask Unloading				
Assembly Lag Storage				
Processing				
Volume Reduction				
Canister/Container Closure			14.575	22.478
Canister/Container Lag Storage				
Interim Storage Loading/Unloading				
RRG/Repository Cask Handling				
Building Support Facilities				
 INTERIM STORAGE OPERATIONS				
		NO CHANGES REQUIRED		
Storage Facilities				
Storage Units				
Receiving Building				
 BALANCE OF PLANT AND SUPPORT OPERATIONS				
		NO CHANGES REQUIRED		
Onsite Preparation				
Offsite Preparation				
Administration				
Other Support Facilities				

Scenario: 9
 Construction Phase: All
 Storage Concept: All

Date : 11/23/88
 Revision : 0

COST CENTER/Cost Element	Building Area	Millions in 1988 \$		
		Facility Cost	Equipment Cost	Total Cost
CASK OPERATIONS		NO CHANGES REQUIRED		
Receiving				
Cask Log Storage				
WASTE HANDLING OPERATIONS		NO CHANGES REQUIRED		
SPENT FUEL HANDLING BUILDING		NO CHANGES REQUIRED		
Cask Unloading				
Assembly Log Storage				
Processing				
Interim Storage Loading/Unloading				
Building Support Facilities				
RECEIVING AND HANDLING BUILDING		NO CHANGES REQUIRED EXCEPT AS NOTED		
Cask Unloading				
Assembly Log Storage				
Processing				
Value Reduction				
Canister/Container Closure			14.575	22.470
Canister/Container Log Storage				
Interim Storage Loading/Unloading				
RRS/Repository Cask Handling				
Building Support Facilities				
INTERIM STORAGE OPERATIONS		NO CHANGES REQUIRED		
Storage Facilities				
Storage Units				
Receiving Building				
BALANCE OF PLANT AND SUPPORT OPERATIONS		NO CHANGES REQUIRED		
Onsite Preparation				
Offsite Preparation				
Administration				
Other Support Facilities				

APPENDIX 4

MRS SERVES SECOND REPOSITORY

This sensitivity study relates to Scenarios 3, 4, and 8 where the MRS serves as a packaging facility for a second repository in accordance with Waste Acceptance Schedule No. 26.

1.0 GENERAL DISCUSSION

In the initial Scenarios 3, 4, and 8 criteria, the MRS serves only one repository and is decommissioned after all stored spent fuel has been shipped to that repository. This sensitivity study introduces the additional criterion that requires the MRS to serve a second repository after the first repository has received and emplaced the scheduled waste quantity. The assumptions established and the effect on operations are presented the following sections.

2.0 STUDY ASSUMPTIONS

Assumptions made specific to the sensitivity study are:

- (1) The Receiving and Handling (R & H) Building or Spent Fuel Handling Building (SFHB) are placed on hot standby during the interim period between the first repository and second repository operation.
- (2) Onsite staff can be reduced to the minimum feasible while assuring plant and public safety.
- (3) Procedures used for the original (first repository) startup are still valid or have been revised during the previous operational period to reflect the current equipment and practices.
- (4) Minimal preoperational testing is required for Scenarios 3 and 4 since the equipment is assumed to have functioned properly when the previous operational period ended and preventative maintenance will be performed on the equipment during the hot standby period. (Slightly more testing is required for Scenario 8 since the equipment is more complex.)
- (5) The MRS does not store spent fuel during operation for the second repository, but only receives, packages (Scenario 8 only), and ships to the repository.
- (6) For Scenario 8, second repository container configurations and costs are the same as those used for the first repository.
- (7) Decommissioning is postponed for the total site until the completion of operations with second repository.

3.0 WASTE HANDLING OPERATIONS

The elapsed time, from the time the MRS has shipped all stored spent fuel to the first repository and the start of receipt and shipments to the second repository, is 5-1/2 years. For this period, the SFHB for Scenarios 3 and 4 or the R & H Building for Scenario 8 is placed on hot standby and requires only a caretaker crew. All support facilities not required to support the caretaker crew and all equipment not required to assure plant and public safety are shut down.

4.0 STORAGE OPERATIONS

No costs for interim storage operations are incurred since the spent fuel received is forwarded to the repository without an interim storage operation.

5.0 COST DATA

During the standby period, there is a reduction in personnel and annual operating costs. Personnel training costs, however, are incurred in the two years prior to the operation of the second repository.

SFHB design modifications are not required for this sensitivity study. Scenarios 3 and 4 receive and ship bare intact spent fuel only. Based on the assumptions stated in Section 4 for these scenarios, only truck casks are unloaded if the quantity of material received equals the quantity shipped. Rail casks from the reactors are received at the MRS and added to the MRS rail cask shipments to the repository. Similarly, modifications to the R&H Building for Scenario 8 are not required since it was assumed that the container size, configuration loading, and cost are as presented in Section 7.

The data reflecting the standby mode for Scenarios 3 and 4 are shown in Tables 1 through 5. For Scenario 8, Tables 1, and 6 through 10 apply. The staff and costs presented for the standby period are required to support security, fire protection, maintenance, radiation protection, and site administration operations. The personnel and operating cost data tables for the MRS operating years serving the first repository are still valid for the maximum throughput operating years serving the second repository. As stated in Section 8.2.1.1, no data has been developed in this study relative to the initial (lower rate) receipt years or the ship-only operating years.

6.0 DESIGN AND CONSTRUCTION SCHEDULES

Since no additional functions are added to the MRS to support the operations of the second repository, design and construction schedules presented in Section 4 (Scenarios 3 and 4) and Section 7 (Scenario 8) remain unchanged.

7.0 SUMMARY

The addition of the second repository packaging functions to the MRS does not affect the design or construction costs of the facility. However the delay period prior to the operation of the second repository adds life cycle costs to the MRS. These cost increases relate to: (1) preoperational testing after the standby period, (2) training of new operators prior to and in the first

two years of renewed operation, (3) maintenance and equipment replacement during standby and preoperational testing, and (4) consumables, utilities, and personnel costs during the standby period. The annual operating cost during this period is as follows:

Scenarios 3 and 4

Cask/Drywell	\$ 9,067 M
Vault	\$10,618 M

Scenario 8

Cask/Drywell	\$12,123 M
Vault	\$13,674 M

This sensitivity study increases the total life of the MRS, including 5-1/2 years of hot standby, by approximately 18 years. During the 12-1/2 years of operation for the second repository, only six years are at the original design rate of 3000 MTU/year. The last 4-1/2 years are at a reduced rate of 700 MTU/year (less than one-fourth of the design rate) implying that the MRS operations would require only one operating shift in Scenario 8. Since the transportation data (modal mix) was not provided for the second repository, the number of shifts required for Scenarios 3 and 4 cannot be determined.

Scenario: 3/4
 Construction Phase: Single
 Storage Concept: All

Date : 11/23/88
 Revision : 0

		Percent of M & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION		NO CHANGES REQUIRED EXCEPT AS NOTED												
Site Selection/Investigation														
Design														
Proof-of-Principle Tests (3 Tests)														
Advanced Conceptual Design														
License Application Design														
Licensing Support														
Final Procurement and Construction Design														
Title III Support														
Operating Contractor Support														
Design														
Construction														
Construction Management														
Preoperational Testing and Personnel Training (1st Repository Only)	32.7													
Preoperational Testing and Personnel Training & (2nd Repository Only)	19.6									20	00			

‡ Prior to first year of operations of second repository

Scenarios 3/4
Construction Phase: Single
Storage Concept: Cask/Drywell

Date : 11/23/88
Revision : 0

COST CENTER/Cost Element	Equipment Maintenance/Replacement (\$/Year)			Consumption
	Annual	10 Year	20 Year	
CASK OPERATIONS				90.014 M/Year Fixed
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS				90.970 M/Year Fixed
SPENT FUEL HANDLING BUILDING				
Cask Unloading	N/A			
Assembly Lag Storage	N/A			
Processing	N/A	N/A		
Interim Storage Loading/Unloading	N/A		N/A	
Building Support Facilities	0.1	N/A	N/A	Brack = \$100/Unit
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	
Cask Unloading				
Assembly Lag Storage				
Processing				
Volume Reduction				
Canister/Container Closure				
Canister/Container Lag Storage				
Interim Storage Loading/Unloading				
WIS/Repository Cask Handling				
Building Support Facilities				
INTERIM STORAGE OPERATIONS				90.014 M/Year Fixed
Storage Facilities	N/A	N/A	N/A	
Storage Units				
Receiving Building	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS				90.609 M/Year Fixed
Waste Preparation				
Offsite Preparation				
Administration	3.1	N/A	N/A	
Other Support Facilities	0.2	N/A	N/A	

APPENDIX 4
TABLE 2
ANNUAL OPERATIONS COSTS

Scenario: 3/4
 Construction Phases: Single
 Storage Concept: Cask/Drywell

Date : 11/23/00
 Revision : 0

COST CENTER/Functional Activity by Crew -----	Processing Time/Unit Processed (in minutes) -----	FTE/Crew -----	Annual \$/FTE -----	Notes -----
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	N/A	1	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	N/A	N/A		
Unload transport casks	N/A	N/A		
Storage loading/unloading	N/A	N/A		
Building support staff	N/A	10	\$53,900	
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks into process cells				
Consolidate and canister fuel				
Volume-reduce/package WFC				
Weld/decon/test canisters				
Canister handling:				
log storage				
storage loading/unloading				
NRS transport cask loading				
Building support staff				
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Storage transport operations	N/A	N/A		
Storage placement	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	123	\$53,900	

APPENDIX 4
 TABLE 3
 STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 3/4
Construction Phase: Single
Storage Concept: Vault

Date: 11/23/00
Revision: 0

COST CENTER/Cost Element	Equipment Maintenance/Replacement (1/Year)			Consumables	Notes
	Annual	10 Year	20 Year		
COCK OPERATIONS				60.014 M/Year Fixed	(1) Cost per storage building (2 required)
Receiving					
Cock Log Storage					
WASTE HANDLING OPERATIONS				90.970 M/Year Fixed	
SPENT FUEL HANDLING BUILDING					
Cock Unloading	N/A				
Assembly Log Storage	N/A				
Processing	N/A	N/A			
Interim Storage Loading/Unloading	N/A		N/A		
Building Support Facilities	0.1	N/A	N/A	Drums = \$100/Unit	
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A		
Cock Unloading					
Assembly Log Storage					
Processing					
Volume Reduction					
Canister/Container Closure					
Canister/Container Log Storage					
Interim Storage Loading/Unloading					
WRS/Repository Cock Handling					
Building Support Facilities					
INTERIM STORAGE OPERATIONS				90.603 M/Year Fixed (1)	
Storage Facilities	0.3 (1)	N/A	N/A		
Storage Units					
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				90.609 M/Year Fixed	
Waste Preparation					
Offsite Preparation					
Administration	3.1	N/A	N/A		
Other Support Facilities	0.2	N/A	N/A		

APPENDIX 4
TABLE 4
ANNUAL OPERATING COSTS

Scenario: 3/4
 Construction Phases: Single
 Storage Concept: Vault

Date: 11/23/00
 Revision: 0

COST CENTER/Functional Activity by Crew -----	Processing Time/Unit Processed (in minutes) -----	FTE/Crew -----	Annual \$/FTE -----	Notes -----
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	N/A	1	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	N/A	N/A		
Unload transport casks	N/A	N/A		
Storage loading/unloading (incl. basket handling of 15 min.)	N/A	N/A		
Building support staff	N/A	10	\$53,900	
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks into process cells				
Consolidate and canister fuel				
Volume-reduce/package HFBC				
Weld/docum/test canisters				
Canister handling:				
lag storage				
transporter loading/unloading				
NRS transport cask loading				
Building support staff				
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter operation (incl. loading of intact SF basket)	N/A	N/A		
Storage placement	N/A	6	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	123	\$53,900	

APPENDIX 4
 TABLE 3
 STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: B
 Construction Phase: Single
 Storage Concept: A11

Date: 11/23/00
 Revision: 0

Storage Concept: 11													
COST CENTER/Cost Element	Cost (Millions \$)	Percent of H & I Cost per Year Prior to Operations											
		-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2
-----		----	----	----	----	----	----	----	----	----	----	----	----
MANAGEMENT AND INTEGRATION		NO CHANGES REQUIRED EXCEPT AS NOTED											
Site Selection/Investigation													
Design													
Proof-of-Principle Tests (6 Tests)													
Advanced Conceptual Design													
License Application Design													
Licensing Support													
Final Procurement and Construction Design													
Title III Support													
Operating Contractor Support													
Design													
Construction													
Construction Management													
Preoperational Testing and Personnel Training (1st Repository Only)	66.0												
Preoperational Testing and Personnel Training \$ (2nd Repository Only)	44.2	40 60											

\$ Prior to first year of operations of second repository

APPENDIX 4
 TABLE 6
 MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 8
Construction Phases: Single
Storage Concept: Cask/Drywell

Date: 11/23/88
Revision: 0

COST CENTER/Cont Element	Equipment Maintenance/Replacement (1/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.014 M/Year Fixed
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Cask Unloading				
Assembly Lag Storage				
Processing				
Interim Storage Loading/Unloading				
Building Support Facilities				
RECEIVING AND HANDLING BUILDING				\$2.811 M/Year Fixed
Cask Unloading	N/A		N/A	
Assembly Lag Storage	N/A			
Processing	N/A	N/A	N/A	
Volume Reduction	N/A		N/A	
Comister/Container Closure	N/A		N/A	
Comister/Container Lag Storage	N/A		N/A	
Interim Storage Loading/Unloading	N/A		N/A	
WRS/Repository Cask Handling	N/A		N/A	
Building Support Facilities	0.5	N/A	N/A	Dries = \$100/Unit
INTERIM STORAGE OPERATIONS				
Storage Facilities	N/A	N/A	N/A	\$0.014 M/Year Fixed
Storage Units				
Receiving Building	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$0.609 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	N/A	N/A	
Other Support Facilities	0.2	N/A	N/A	

APPENDIX 4
TABLE 7
ANNUAL OPERATING COSTS

Scenario: 8
Construction Phase: Single
Storage Concept: Cask/Wrywell

Date: 11/23/00
Revision: 0

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS				
Receive & inspect transport casks; inspect 6 ship transport casks	N/A	1	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	N/A	N/A	N/A	
Unload transport casks				
Storage loading/unloading				
Building support staff				
RECEIVING AND HANDLING BUILDING				
Prepare reactor/NRS transport casks for unloading/shipment (incl. 75 min. for washdown)	N/A	N/A		
Unload transport casks into process cells	N/A	N/A		
Consolidate and containerize fuel/HFBC	N/A	N/A		
Volume-reduce/package HFBC	N/A	N/A		
Hold/dump/test containers	N/A	N/A		
Container handling: log storage	N/A	N/A		
storage loading/unloading				
NRS transport cask loading				
Building support staff	N/A	21	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Storage transport operations	N/A	N/A		
Storage placement	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	123	\$53,900	

APPENDIX 4
TABLE 8
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: B
Construction Phase: Single
Storage Concept: Vault

Date: 11/23/88
Revision: 0

COST CENTER/Cost Element	Equipment Maintenance/Replacement (\$/Year)			Consumables	Notes
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.014 M/Year Fixed	(1) Cost per storage building (2 required)
Receiving					
Cost Log Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A		
Cost Unloading					
Assembly Log Storage					
Processing					
Interim Storage Loading/Unloading					
Building Support Facilities					
RECEIVING AND HANDLING BUILDING				\$2.811 M/Year Fixed	
Cost Unloading	N/A		N/A		
Assembly Log Storage	N/A				
Processing	N/A	N/A	N/A		
Volume Reduction	N/A		N/A		
Canister/Container Closure	N/A		N/A		
Canister/Container Log Storage	N/A		N/A		
Interim Storage Loading/Unloading	N/A		N/A		
MRS/Repository Cost Handling	N/A		N/A		
Building Support Facilities	0.5	N/A	N/A	Drums = \$100/Unit	
INTERIM STORAGE OPERATIONS					
Storage Facilities	0.3 (1)	N/A	N/A	\$0.603 M/Year Fixed (1)	
Storage Units					
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$0.609 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	N/A	N/A		
Other Support Facilities	0.2	N/A	N/A		

APPENDIX 4
TABLE 9
ANNUAL OPERATING COSTS

Scenario: B
Construction Phase: Single
Storage Concept: Vault

Date: 11/23/88
Revision: 0

COST CENTER/Functional Activity by Crew -----	Processing Time/Unit Processed (in minutes) -----	FTE/Crew -----	Annual \$/FTE -----	Notes -----
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	N/A	1	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks				
Storage loading/unloading				
Building support staff				
RECEIVING AND HANDLING BUILDING				
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for washdown)	N/A	N/A		
Unload transport casks into process cells	N/A	N/A		
Consolidate and containerize fuel/HFBC	N/A	N/A		
Volume-reduce/package HFBC	N/A	N/A		
Weld/decon/test containers	N/A	N/A		
Container handling: lag storage	N/A	N/A		
transporter loading/unloading				
HRS transport cask loading				
Building support staff	N/A	21	\$53,900	
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A	N/A	
Transporter operation	N/A	N/A		
Storage placement	N/A	6	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	123	\$53,900	

APPENDIX 4
TABLE 10
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

APPENDIX 5

MRS IN CARETAKER MODE

For Scenarios 3 and 4, this sensitivity study evaluates the impact if the MRS is placed into a caretaker mode when the repository is fully operational and subsequent spent fuel shipments from the reactors go directly to the repository.

1.0 GENERAL DISCUSSION

The criteria for the initial Scenarios 3 and 4 establishes a requirement for the MRS to receive, store, and ship bare, intact spent fuel assemblies to the repository throughout a period of up to 28 years. In this sensitivity study, the MRS is required to perform these functions until the repository becomes fully operational at which time the MRS is placed in a standby mode. The assumptions made and the effects on the MRS resulting from this criterion are presented in this study.

2.0 STUDY ASSUMPTIONS

The assumptions made specific to this study are:

- (1) Maximum onsite inventory remains at the MRS during the caretaker phase.
- (2) No extensive decontamination of SFHB is performed prior to the caretaker phase.
- (3) During the more extensive caretaker periods shown on the single-phase construction waste acceptance schedules, the NRC will revise its regulatory requirements necessitating a significant revision to the operational procedures.
- (4) Even though preventative maintenance will be performed on equipment during the caretaker period, age deterioration will require extensive startup testing and possibly replacement of some components.

3.0 WASTE HANDLING OPERATIONS

Based on the various single-phase waste acceptance schedules, the MRS is in a caretaker mode for up to 17 years until the onsite inventory can be shipped to the repository. The SFHB is on hot standby during this period, with only a minimal crew. All support facilities not required to support the caretaker crew, or equipment not required to assure plant and public safety, are shut down.

4.0 STORAGE OPERATIONS

Although during the standby period no spent fuel is added to or routinely retrieved from storage, interim storage personnel are required to perform scheduled monitoring of the stored material. However no heavy equipment (mobile crane, transporters, etc.) operators are included in the staff allocation. If material must be retrieved based on monitor readings, temporary personnel will be required to perform the retrieval activities. Since routine testing of the hot cell equipment will be performed during the standby period, operators are available on a single-shift basis to unload spent fuel from storage if required. As noted in Section 8.2.1.3, the SFHB does not have the capability to package damaged or failed fuel retrieved from storage.

5.0 COST DATA

This sensitivity study does not require any modification of the SFHB design to accommodate the hot standby period. However, personnel training costs are incurred two years prior to shipment of stored waste to the repository. During the caretaker period, there is a reduction in the number of personnel required and a reduction in annual operating costs of the MRS.

Data reflecting the caretaker years is presented in Tables 1 through 7 and apply to the single-phase construction option. The operating costs and personnel quantities shown support security, fire protection, maintenance, radiation protection, storage monitoring, and site administration operations. The personnel and operating cost data tables prepared for the original Scenarios 3 and 4 (Section 4) are still valid for the operating years starting with the resumption of shipments until all stored spent fuel is delivered to the repository.

When the SFHB is reactivated to perform retrieval and repository shipping operations, a "hot test" period should be scheduled for the first year of resumed operation. This hot test of approximately 1500 MTU will allow time for the training of additional personnel, the implementation of new or revised operating procedures, and the testing of equipment prior to full operation at 2700 MTU or 3000 MTU in subsequent years.

6.0 DESIGN AND CONSTRUCTION SCHEDULES

Since no additional functions are added to the MRS for this sensitivity study, the schedules for single-phase construction presented in Section 4 are still valid.

7.0 SUMMARY

Placing the MRS in a caretaker mode reduces the annual operating costs during the standby period. However since spent fuel is still onsite, storage operations personnel are required to perform routine monitoring of the stored spent fuel. The SFHB is in hot standby, resulting in a reduction of consumables during this period. The annual caretaker phase operating cost is \$ 9,538, \$9,524 and \$12,854 million for the cask, drywell, and vault storage options, respectively.

Scenario: 3/4
 Construction Phase: Single
 Storage Concept: All

Date : 11/23/88
 Revision : 0

Storage Concept: AEC		Percent of M & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION		NO CHANGES REQUIRED EXCEPT AS NOTED												
Site Selection/Investigation														
Design														
Proof-of-Principle Tests (3 Tests)														
Advanced Conceptual Design														
License Application Design														
Licensing Support														
Final Procurement and Construction Design														
Title III Support														
Operating Contractor Support														
Design														
Construction														
Construction Management														
Preoperational Testing and Personnel Training (Prior to Initial Operations)	32.7													
Preoperational Testing and Personnel Training (Prior to Restart of Operations)	28.6	4 38 38												

APPENDIX 5
 TABLE 1
 MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 3/4
Construction Phase: Single
Storage Concept: Cask

Date : 11/23/88
Revision : 0

COST CENTER/Cost Element	Equipment Maintenance/Replacement (2/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.014 M/Year Fixed
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS				\$0.970 M/Year Fixed
SPENT FUEL HANDLING BUILDING				
Cask Unloading	N/A			
Assembly Lag Storage	N/A			
Processing	N/A	N/A		
Interim Storage Loading/Unloading	N/A		N/A	
Building Support Facilities	0.1	1.5	N/A	Drums = \$100/Unit
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	
Cask Unloading				
Assembly Lag Storage				
Processing				
Volume Reduction				
Canister/Container Closure				
Canister/Container Lag Storage				
Interim Storage Loading/Unloading				
RRS/Repository Cask Handling				
Building Support Facilities				
INTERIM STORAGE OPERATIONS				\$0.014 M/Year Fixed
Storage Facilities	0.6	N/A	N/A	
Storage Units				
Receiving Building	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$0.609 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	35.4	N/A	
Other Support Facilities	0.2	0.1	N/A	

APPENDIX 5
TABLE 2
ANNUAL OPERATING COSTS

Scenario: 3/4
Construction Phase: Single
Storage Concept: Cask

Date: 1/20/89
Revision: 1

COST CENTER/Functional Activity by Crew -----	Processing Time/Unit Processed (in minutes) -----	FTE/Crew -----	Annual \$/FTE -----	Notes -----
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	N/A	1	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for washdown)	N/A	N/A		
Unload transport casks	N/A	N/A		
Storage loading/unloading	N/A	N/A		
Building support staff	N/A	10	\$53,900	
RECEIVING AND HANDLING BUILDING	N/A	N/A		
Prepare reactor/WRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks into process cells				
Consolidate and canister fuel				
Volume-reduce/package WFC				
Weld/decon/test canisters				
Canister handling:				
log storage				
storage cask loading/unloading				
WRS transport cask loading				
Building support staff				
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A		
Storage cask preparation & closing/reopening	N/A	N/A		
Storage placement (incl. 45 min. to obtain new cask)	N/A	8	\$53,900	(Rev. 1)
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	123	\$53,900	

APPENDIX 5
TABLE 3
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 3/4
Construction Phase: Single
Storage Concept: Drywell

Date: 11/23/88
Revision: 0

COST CENTER/Cost Element	Equipment Maintenance/Replacement (1/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS				\$0.014 M/Year Fixed
Receiving				
Cask Log Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				\$0.970 M/Year Fixed
Cask Unloading	N/A			
Assembly Log Storage	N/A			
Processing	N/A	N/A		
Interim Storage Loading/Unloading	N/A		N/A	
Building Support Facilities	0.1	1.5	N/A	Drums = \$100/Unit
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	
Cask Unloading				
Assembly Log Storage				
Processing				
Volume Reduction				
Canister/Container Closure				
Canister/Container Log Storage				
Interim Storage Loading/Unloading				
WRS/Repository Cask Handling				
Building Support Facilities				
INTERIM STORAGE OPERATIONS				
Storage Facilities	1.0	N/A	N/A	\$0.014 M/Year Fixed
Storage Units				
Receiving Building	N/A	N/A	N/A	
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$0.609 M/Year Fixed
Onsite Preparation				
Offsite Preparation				
Administration	3.1	35.4	N/A	
Other Support Facilities	0.2	0.1	N/A	

APPENDIX 5
TABLE 4
ANNUAL OPERATING COSTS

Scenario: S/A
Construction Phase: Single
Storage Concept: Drywell

Date : 11/23/88
Revision : 0

COST CENTER/Functional Activity by Crew -----	Processing Time/Unit Processed (in minutes) -----	FTE/Crew -----	Annual \$/FTE -----	Notes -----
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	N/A	1	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/MRS transport casks for unloading/shipment (incl. 75 min. for washdown)	N/A	N/A		
Unload transport casks	N/A	N/A		
Storage loading/unloading (incl. basket handling of 15 min.)	N/A	N/A		
Building support staff	N/A	10	\$53,900	
RECEIVING AND HANDLING BUILDING	N/A	N/A		
Prepare reactor/MRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks into process cells				
Consolidate and canister fuel				
Volume-reduce/package WFC				
Weld/decon/test canisters				
Canister handling:				
lay storage				
storage loading/unloading				
MRS transport cask loading				
Building support staff				
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A		
Transporter Operation (incl. loading of shield plug and intact SF basket)	N/A	N/A		
Storage placement	N/A	8	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	123	\$53,900	

APPENDIX 5
TABLE 5
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

Scenario: 3/4
Construction Phase: Single
Storage Concept: Vault

Date : 11/23/88
Revision : 0

COST CENTER/Cost Element	Equipment Maintenance/Replacement (1/Year)			Consumables	Notes
	Annual	10 Year	20 Year		
CASK OPERATIONS				\$0.014 M/Year Fixed	(1) Cost per storage building (5 required)
Receiving					
Cask Lag Storage					
WASTE HANDLING OPERATIONS					
SPENT FUEL HANDLING BUILDING				\$0.970 M/Year Fixed	
Cask Unloading	N/A				
Assembly Lag Storage	N/A				
Processing	N/A	N/A			
Interim Storage Loading/Unloading	N/A		N/A		
Building Support Facilities	0.1	1.5	N/A	Drums = \$100/Unit	
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A		
Cask Unloading					
Assembly Lag Storage					
Processing					
Volume Reduction					
Canister/Container Closure					
Canister/Container Lag Storage					
Interim Storage Loading/Unloading					
WRS/Repository Cost Handling					
Building Support Facilities					
INTERIM STORAGE OPERATIONS					
Storage Facilities	0.3 (1)	0.3 (1)	N/A	\$0.603 M/Year Fixed (1)	
Storage Units					
Receiving Building	N/A	N/A	N/A		
BALANCE OF PLANT AND SUPPORT OPERATIONS				\$0.609 M/Year Fixed	
Onsite Preparation					
Offsite Preparation					
Administration	3.1	35.4	N/A		
Other Support Facilities	0.2	0.1	N/A		

APPENDIX 5
TABLE 6
ANNUAL OPERATING COSTS

Scenario: 3/4
Construction Phase: Single
Storage Concept: Vault

Date: 11/23/88
Revision: 0

COST CENTER/Functional Activity by Crew -----	Processing Time/Unit Processed (in minutes) -----	FTE/Crew -----	Annual \$/FTE -----	Notes -----
CASK OPERATIONS				
Receive & inspect transport casks; inspect & ship transport casks	N/A	1	\$53,900	
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING				
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for washdown)	N/A	N/A		
Unload transport casks	N/A	N/A		
Storage loading/unloading (incl. basket handling of 15 min.)	N/A	N/A		
Building support staff	N/A	10	\$53,900	
RECEIVING AND HANDLING BUILDING	N/A	N/A		
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for washdown)				
Unload transport casks into process cells				
Consolidate and canister fuel				
Volume-reduce/package HFBC				
Weld/decom/test canisters				
Canister handling:				
lag storage				
storage loading/unloading				
HRS transport cask loading				
Building support staff				
INTERIM STORAGE OPERATIONS				
Receiving Building staff	N/A	N/A		
Transporter operation (incl. loading of intact SF basket)	N/A	N/A		
Storage placement	N/A	11	\$53,900	
BALANCE OF PLANT AND SUPPORT OPERATIONS				
Site support staff	N/A	123	\$53,900	

APPENDIX 5
TABLE 7
STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

APPENDIX 6

HIGH CAPACITY RAIL CASK

This study evaluates the impact on Scenarios 3 and 4 where all incoming casks from the reactors are unloaded and the spent fuel placed into a rail cask, with a capacity of 34 PWR or 80 BWR fuel assemblies, for shipment to the repository.

1.0 GENERAL DISCUSSION

The initial Scenarios 3 and 4 used a rail cask to ship spent fuel to the repository with a capacity of 21 PWR or 48 BWR bare spent fuel assemblies. The criterion for this study substitutes a higher capacity cask and requires that all MRS-to-repository shipments use this cask. This study establishes the assumptions and presents the effects on the operations and facilities caused by the cask substitution.

2.0 STUDY ASSUMPTIONS

Specific assumptions made in the analyses for this sensitivity study are:

- (1) New rail cask size and weight does not exceed previous MRS-to-repository cask size and weight
- (2) MRS operates at 3000 MTU/year in accordance with Waste Acceptance Schedule No. 26
- (3) Steady-state operation places no additional material in onsite storage (e.g., all fuel is transferred to shipping casks upon receipt when repository becomes fully operational)

3.0 WASTE HANDLING OPERATIONS

The operations in the SFHB are affected by (1) the introduction of the larger capacity MRS-to-repository shipping cask, and (2) the requirement to perform a direct transfer of spent fuel from the incoming rail cask to a MRS-to-repository shipping cask in lieu of a direct shipment to the repository of the incoming rail casks as presented for the original Scenarios 3 and 4.

The operations for the receipt, inspection, and unloading of the reactor-to-MRS shipping cask are the same as for the initial Scenarios 3 and 4 operations. The incoming shipping cask is received in the receiving/inspection area of the SFHB, placed on a cart, translated to an unloading/decon cell cask handling, preparation, and decon room, and mated to a transfer cell unloading port. In a parallel sequence of operations, an MRS-to-repository empty shipping cask received in the receiving/inspection area is placed on a rail cart by the receiving/inspection area crane. The cart and shipping cask are then translated to a turntable outside a cask loadout/decon room, the

turntable turned 90 degrees, and the cart/shipping cask translated into the loadout/decon room. The cask is mated to the transfer cell loadout port in a similar sequence of operations as the reactor-to-MRS shipping cask is mated to the transfer cell unloading port. Once the two casks are mated to their respective ports, the spent fuel assemblies are unloaded from the reactor-to-MRS shipping cask and, if required, from lag storage, and loaded into the MRS-to-repository shipping cask. It is necessary to unload more than one reactor-to-MRS shipping cask to fill one MRS-to-repository cask because of the difference in cask capacities. At the conclusion of the loading process, the MRS-to-repository shipping cask is demated from the port, and the cart and shipping cask are returned to the receiving/inspection area for shipment to the repository. The operations are repeated for each rail cask unloading and loading sequence until all reactor-to-MRS spent fuel has been received. Subsequent shipments to the repository will be from the MRS storage field as described in Section 4.

4.0 STORAGE OPERATIONS

The inclusion of the loadout of the higher capacity MRS-to-repository shipping cask has no effect on the storage operations as presented in Section 4.

5.0 COST DATA

The inclusion of the MRS-to-repository higher capacity shipping cask operations affects the design of the SFHB and equipment requirements. To accommodate this operation, the SFHB arrangement is modified to include two additional transfer corridors, loadout/decon rooms, and transfer cell loadout ports and port shield plugs. (Modified SFHB arrangements to accommodate the requirements of this study are shown on drawings APP 6-1 through 6-4.) Two transfer corridors and loadout/decon rooms are each provided with a rail system from the SFHB receiving/inspection area, a motorized rail cart to transfer the shipping cask to the loadout/decon room, and a turntable to effect entry of the shipping cask into the loadout/decon room for cask loading port interfacing. The inclusion of this additional handling equipment required the addition of ground floor level space for the loadout/decon rooms, transfer corridors, and turntable areas. In addition, the transfer cell located on the second floor is lengthened to accommodate the additional loadout ports. The added SFHB design and construction costs resulting from this sensitivity study are \$11.8 million as shown on Tables 1 and 2.

The data reflecting the personnel and annual operating costs for this study appear in Tables 3 and 4. In order to perform the spent fuel transfer required by this study at a rate of 3000 MTU per year, the SFHB will be operated on a four-shift basis. This is comparable to the initial years of storage operations for the drywell and vault concept, but adds a shift to the cask storage option operations. During steady-state (reference year 2009) operations when no additional material is placed in interim storage and only truck casks are unloaded, the SFHB is scheduled to operate on a four-shift basis. Therefore, for the steady-state operation of this study no additional staff is required. The data sheets provided for the Scenarios 3 and 4 in

Section 4 reflect the transfer of 3000 MTU to interim storage. The revised staffing allocation for this study (Table 4) adds the unit operating times to load the new rail cask and presents the building support personnel required for the four-shift operation.

6.0 DESIGN AND CONSTRUCTIONS SCHEDULES

Although design changes are required to accommodate the requirements of this sensitivity study, the schedule durations presented in Section 4 remain unchanged.

7.0 SUMMARY

The inclusion of the MRS-to-repository higher capacity shipping casks results in an additional cost of \$11.8 million for design and construction impacts. Changes in annual operating costs, including staff requirements, are negligible.

Scenario: 3/4
 Construction Phase: Single
 Storage Concept: All

Date : 11/23/88
 Revision : 0

		Percent of M & I Cost per Year Prior to Operations												
COST CENTER/Cost Element	Cost (Millions \$)	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	+1	+2	+3
MANAGEMENT AND INTEGRATION		NO CHANGES REQUIRED EXCEPT AS NOTED												
Site Selection/Investigation														
Design														
Proof-of-Principle Tests (3 Tests)														
Advanced Conceptual Design	5.8													
License Application Design	20.1													
Licensing Support														
Final Procurement and Construction Design	13.4													
Title III Support	11.2													
Operating Contractor Support														
Design														
Construction														
Construction Management	33.5													
Preoperational Testing and Personnel Training														

APPENDIX 6
 TABLE 1
 MANAGEMENT AND INTEGRATION COST DISTRIBUTION

Scenario: 3/4
 Construction Phase: Single
 Storage Concept: All

Date : 11/23/88
 Revision : 0

COST CENTER/Cost Element	Building Area	Millions in 1988 \$		
		Facility Cost	Equipment Cost	Total Cost
CASK OPERATIONS		NO CHANGES REQUIRED		
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS		NO CHANGES REQUIRED EXCEPT AS NOTED		
SPENT FUEL HANDLING BUILDING				
Cask Unloading				
Assembly Lag Storage	2736	1.757		2.027
Processing	21300	13.731	9.002	22.733
Interim Storage Loading/Unloading	10804	13.070		13.509
Building Support Facilities	115006	33.211		40.201
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	N/A
Cask Unloading				
Assembly Lag Storage				
Processing				
Volume Reduction				
Canister/Container Closure				
Canister/Container Lag Storage				
Interim Storage Loading/Unloading				
WRS/Repository Cask Handling				
Building Support Facilities				
INTERIM STORAGE OPERATIONS		NO CHANGES REQUIRED		
Storage Facilities				
Storage Units				
Receiving Building				
BALANCE OF PLANT AND SUPPORT OPERATIONS		NO CHANGES REQUIRED		
Onsite Preparation				
Offsite Preparation				
Administration				
Other Support Facilities				

Scenario: 3/4
 Construction Phase: Single
 Storage Concept: All

Date : 11/23/88
 Revision : 0

COST CENTER/Cost Element	Equipment Maintenance/Replacement (1/Year)			Consumables
	Annual	10 Year	20 Year	
CASK OPERATIONS		NO CHANGES REQUIRED		
Receiving				
Cask Lag Storage				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING		NO CHANGES REQUIRED EXCEPT AS NOTED		
Cask Unloading				
Assembly Lag Storage				
Processing	1.4			
Interim Storage Loading/Unloading				
Building Support Facilities				
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	
Cask Unloading				
Assembly Lag Storage				
Processing				
Volume Reduction				
Canister/Container Closure				
Canister/Container Lag Storage				
Interim Storage Loading/Unloading				
WRS/Repository Cask Handling				
Building Support Facilities				
INTERIM STORAGE OPERATIONS		NO CHANGES REQUIRED		
Storage Facilities				
Storage Units				
Receiving Building				
BALANCE OF PLANT AND SUPPORT OPERATIONS		NO CHANGES REQUIRED		
Onsite Preparation				
Offsite Preparation				
Administration				
Other Support Facilities				

APPENDIX 6
 TABLE 3
 ANNUAL OPERATING COSTS

Scenario: 3/4
 Construction Phase: Single
 Storage Concept: All

Date : 12/9/88
 Revision : 1

COST CENTER/Functional Activity by Crew	Processing Time/Unit Processed (in minutes)	FTE/Crew	Annual \$/FTE	Notes
CASK OPERATIONS	NO CHANGES REQUIRED			
Receive & inspect transport casks; inspect & ship transport casks				
WASTE HANDLING OPERATIONS				
SPENT FUEL HANDLING BUILDING	NO CHANGES REQUIRED EXCEPT AS NOTED			Transport cask loading : PMR = 650/cask; DMR = 1340/cask
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for washdown) Unload transport casks				
Storage loading/unloading				
Building support staff		59	\$53,900	(Rev. 1)
RECEIVING AND HANDLING BUILDING	N/A	N/A	N/A	
Prepare reactor/HRS transport casks for unloading/shipment (incl. 75 min. for washdown) Unload transport casks into process cells				
Consolidate and canister fuel				
Volume-reduce/package HFBC				
Weld/decon/test canisters				
Canister handling:				
log storage				
storage loading/unloading				
HRS transport cask loading				
Building support staff				
INTERIM STORAGE OPERATIONS	NO CHANGES REQUIRED			
Receiving Building staff				
Storage transport operations				
Storage placement				
BALANCE OF PLANT AND SUPPORT OPERATIONS	NO CHANGES REQUIRED			
Site support staff				

APPENDIX 6
 TABLE 4
 STAFFING ALLOCATIONS BY FUNCTIONAL ACTIVITIES

										SPR APPS		MRS FACILITY	
										CHANGED		AGENT FLE/HANDLING BULL	
										STATUS		FIRST FLOOR PLAN	
										SCALE 3/64"=1'-0"			
										CUTTING		NOT REQD	
										DATE 10		DATE 10	
REFERENCE DRAWINGS										DRAWING STATUS		DRAWING NO	
NEXT USED ON										DRAWING STATUS		DRAWING NO	
DRAWING STATUS										DRAWING NO		DRAWING NO

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DRAWINGS

NOTE:
1. THE STORAGE AREA SHOWN IS FOR
A CAPACITY OF 15,000 MTU.

DE 11011101 PL 111400 001MRS JA 004

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NEXT USED ON

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DATE CHECK PREP DRAW NO
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MRS FACILITY CASK STORAGE SCENARIO #3 - SINGLE PHASE	
C-301

NOTE:
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OF DELAWARE
MRS FACILITY
DRYWELL STORAGE
SCENARIO #3 - SINGLE PHASE

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DATE: [Date]
SCALE: 1" = 200'
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NOTE:
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THE RALPH M. PARSONS COMPANY
OF DELAWARE
MRS FACILITY
DRYWELL STORAGE
SCENARIO #3 - 2 PHASE

C-322

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NOT RECD
CLASSIFICATION
NONE

NOTE:
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A CAPACITY OF 15,000 MTU.

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THE RALPH M. PARSONS COMPANY OF DELAWARE	
MRS FACILITY VAULT STORAGE	
SCENARIO #3 - SINGLE PHASE	
SCALE 1" = 200'	DATE 11-1-77
CLASSIFIED BY NOT RECD	CLASSIFICATION NONE
SHEET NO. C-331	SHEET NO. OF SET 1 OF 1

REV.	DATE	BY	CHKD.	APP.	DESCRIPTION
1	11-1-77	JOP			ISSUED FOR CONSTRUCTION
2	11-1-77	JOP			ISSUED FOR CONSTRUCTION
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12	11-1-77	JOP			ISSUED FOR CONSTRUCTION
13	11-1-77	JOP			ISSUED FOR CONSTRUCTION

REFERENCE DRAWINGS
NEXT USED ON

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NOTE:
1. THE STORAGE AREA SHOWN IS FOR
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SCALE 1" = 200'	DATE 11/1/2007
CLASSIFIED BY NOT REQD	CLASSIFIED BY NONE
REVISIONS DATE DESCRIPTION	REVISIONS DATE DESCRIPTION
REFERENCE DRAWINGS DATE DESCRIPTION	REFERENCE DRAWINGS DATE DESCRIPTION
APPROVED FOR CONSTRUCTION DATE BY	APPROVED FOR CONSTRUCTION DATE BY
APPROVED FOR OPERATION DATE BY	APPROVED FOR OPERATION DATE BY
APPROVED FOR MAINTENANCE DATE BY	APPROVED FOR MAINTENANCE DATE BY
APPROVED FOR DECOMMISSIONING DATE BY	APPROVED FOR DECOMMISSIONING DATE BY

NOTE:
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DESIGN FILE: 2F11 (140, 100)MRS-34.DGN

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P. FOR S.A. APP. DATE		MRS FACILITY CASK STORAGE SCENARIO #5 - 3 PHASE	
SCALE 1" = 200'		C-503	
CLASSIFICATION NOT RECD CLASSIFICATION NONE		DATE BY	
DRAWING STATUS NEXT USED ON		REVISIONS DATE CHECKED BY SCALE NO.	
REFERENCE DRAWINGS		COMMENTARY SHEET NO.

NOTE:
1. THE STORAGE AREA SHOWN IS FOR
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JOP CLASSIFIED BY NOT RECD CLASSIFICATION NONE	SHEET NO. 1 OF 1 C-521

NOTE:
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A CAPACITY OF 15,000 MTU.

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REVISIONS NO. 1 DATE DESCRIPTION	REVISIONS NO. 2 DATE DESCRIPTION	REVISIONS NO. 3 DATE DESCRIPTION	REVISIONS NO. 4 DATE DESCRIPTION

NOTE:
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A CAPACITY OF 15,000 MTU.

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NOTE:

1. THE STORAGE AREA SHOWN IS FOR A CAPACITY OF 13,000 MTU.

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D	Richland Operations Office
S	PACIFIC NORTHWEST LABORATORY
APP	OPERATED BY BATTELLE MEMORIAL INSTITUTE
ENG	THE RALPH W. PARSONS COMPANY
DESIGN NO.	OF DELAWARE
CHECKED	MHS FACILITY
SCALE	Vault Storage
DATE	SCENARIO #5 - 2 PHASE
REV	NO. 10
CLASSIFIED BY	NO. 11
NOT RECD	NO. 12
TO BE MAILED	NO. 13
NOTE	C-532

FIRST FLOOR PLAN

FIRST MEZZANINE PLAN

10 20 40 60 80 FT

JQP:R

U. S. Department Of Energy Richland Operations Office	
PACIFIC NORTHWEST LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
THE RALPH W. PARSONS COMPANY OF DELAWARE	
MRS FACILITY VAULT STORAGE BUILDING FIRST FLOOR PLAN AND FIRST MEZZANINE PLAN	
SCALE: 3/4"=1'-0"	NOT RECD
A-101	

REV	DATE	BY	CHKD	DESCRIPTION
1	10/1/78	JQP	JQP	ISSUED FOR CONSTRUCTION
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FLOOR PLAN

SECTION A

APPROVED FOR SUBMITTANCE BY: _____ DATE: _____ TITLE: _____		U.S. Department Of Energy Richland Operations Office PACIFIC NORTHWEST LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE THE HAZARD W. PARSONS COMPANY P.O. BOX 147 RICHLAND, WASH. 99354 MRS. FACILITY RECEIVING BUILDING FLOOR PLAN AND SECTION		JQP# _____
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SECTION A

SECTION B

JQP#

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PROJECT: 100-1000000	REVISION: 1
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CLASSIFICATION: NOT RECD	STATUS: NONE

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U. S. Department Of Energy Richland Operations Office PACIFIC NORTHWEST LABORATORY OPERATED BY BATTTELLE MEMORIAL INSTITUTE	
MRS FACILITY SPENT FUEL HANDLING BLDG. HVAC COMPOSITE FLOW DIAGRAM	
APPROVED FOR CONSTRUCTION BY: [] DATE: []	SCALE: NONE
DESIGNED BY: [] DATE: []	NOT RECD
CHECKED BY: [] DATE: []	DATE: []
APPROVED BY: [] DATE: []	DATE: []
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MAINTENANCE/RECHARGE ARRANGEMENT
FOR VEHICLE STORAGE DETENT

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PROJECT NO.	MP-PA-100
REVISION NO.	1
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SECTION 5

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 DATE 10/1/80
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RECEIVING AND HANDLING BUILDING
 F-201 FLOOR PLAN
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PNE AND HANDLING BLDG	
SECOND FLOOR PLAN	
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SECTION A

SECTION B

SECTION C

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MRS FACILITY RECEIVING AND HANDLING BUILDING BUILDING SECTIONS	
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