1984 Federal Interim Storage Fee Study: A Technical and Economic Analysis

July 1984

**Prepared by E.R. Johnson Associates, Inc.
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1984 FEDERAL INTERIM STORAGE FEE STUDY:
A TECHNICAL AND ECONOMIC ANALYSIS

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1984 FEDERAL INTERIM STORAGE FEE STUDY:
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1.0 INTRODUCTION

The Nuclear Waste Policy Act of 1982 enacted on January 7, 1983 (Pub. L. 97-425, 96 Stat. 2201, 42 U.S.C. 10101 et seq., referred to herein as "the Act") established, among other things, a Federal Interim Storage (FIS) Program for spent nuclear fuel from domestic civilian power reactors. This program is intended to ensure the continued orderly operation of such reactors where at-reactor storage cannot reasonably be provided soon enough, as determined by the Nuclear Regulatory Commission (NRC), to prevent a disruption of operations. Sec. 136(a)(2) of the Act provides that the Secretary of Energy (the Secretary) undertake a study to establish payment charges for FIS of spent fuel and report the results to Congress not later than 180 days after the date of enactment of the Act.

In accordance with this requirement, the Department of Energy (the Department) prepared and submitted a report to Congress entitled Payment Charges for Federal Interim Storage of Spent Nuclear Fuel from Civilian Nuclear Power Plants in the United States, DOE/S-0022, dated July 1983. The report was supplemented by a more detailed technical, contractual, and economic study and analysis which was contained in a report entitled Federal Interim Storage Fee Study for Civilian Spent Nuclear Fuel: A Technical and Economic Analysis, DOE/S-0023, dated July 1983. These reports formed the basis for the payment charges for Federal Interim Storage (FIS) services which were published in the Federal Register on December 2, 1983 and became effective on January 1, 1984 (F.R. 48:54391). Under the provisions of the Act, the Department may revise these payment charges no more frequently than annually to reflect changing conditions. In preparation for the possibility of a revision to the payment charges for FIS services for 1985, E. R. Johnson Associates, Inc. (JAI) was asked to review and analyze DOE/S-0022 and DOE/S-0023 and to carefully examine the:

- o bases for establishing the storage fee,
- o status of available storage technology,
- o estimates of the cost of storage under the prospective scenarios of FIS facility operation,
- o estimates of the cost of transportation of spent fuel from the reactor to the FIS facilities,
- o structure of the storage fee, and
- o criteria for acceptance of spent fuel for FIS purposes.

As a result of this examination, JAI has updated the content of the previous report on the matter (DOE/S-0023) to provide a basis for the Department to establish the payment charges^{1/} for FIS services in the Federal Register for the year commencing January 1, 1985.

This report sets forth the details of this update and examines the sensitivity of the unit cost for FIS services to changing conditions of cost, schedule, mix of spent fuel types, discount rate, and applicability of NRC regulations.

^{1/} The terms "payment charges", "charges", "fee" and "unit cost" have been used interchangeably throughout this report and, therefore, have identical meanings.

2.0

SUMMARY AND CONCLUSIONS

JAI examined alternative methods for structuring charges for FIS services and concluded that the combined interests of the Department and the users would be best served, and costs most appropriately recovered, by a two-part fee involving an Initial Payment upon execution of a contract for FIS services followed by a Final Payment upon delivery of the spent fuel to the Department.

The Initial Payment would be an advance payment covering the pro rata share of preoperational costs, including (i) the capital costs of the required transfer facilities and storage area, (ii) development costs, (iii) government administrative costs including storage fund management, and (iv) impact aid payments made in accordance with section 136(e) of the Act.

The Final Payment would be made at the time of delivery of the spent fuel to the Department and would be calculated to cover the sum of the following:

- (i) any under-or over-estimation in the costs used to calculate the Initial Payment of the fee (including savings due to rod consolidation),
- (ii) module costs (i.e., storage casks, drywells, or silos), and
- (iii) the total estimated cost of operation and decommissioning of the FIS facilities (including government administrative costs, storage fund management and impact aid).

Charges for the transport of spent fuel from the reactor site to FIS facilities would be separately assessed at cost since these will be specific to each reactor site and destination.

The Initial Payments received from all users would provide the funds necessary to design, license (as applicable) and construct the FIS facilities and to repay any funds borrowed from the U.S. Treasury that may have been needed earlier. The cost of storage modules would be incurred at about the same time as the Final Payment is made and would be included therein; thus, the actual cost of storage modules would be quantified by the time and then-applicable Final Payment is established. The Final Payments received would also include an adjustment for differences between the actual preoperational costs and those used to calculate the Initial Payment, and the estimated future costs of facility operation.

JAI estimated the charges that would have to be made for the FIS of commercial spent fuel by each of three different methods of dry storage. These estimates were made for facilities having storage capacities ranging from 50-1900 MTU^{2/} at each of two different types of government sites, one of which has an existing hot cell for the transfer of spent fuel from shipping casks to the storage modules, and one which does not. The determination of this range of charges was necessary inasmuch as the method of FIS has not yet been selected, the selection of a specific location(s) for FIS facilities has not been initiated, and the quantity of spent fuel which is eligible to be stored in FIS facilities has not yet been determined. The total estimated charges developed by JAI are set forth in Table 2-1; the corresponding Initial Payments and Final Payments are set forth in Tables 2-2 and 2-3.

TABLE 2-1
ESTIMATE OF THE TOTAL UNIT CHARGES FOR FIS SERVICES AT THE
INDICATED FIS CAPACITY LEVELS FOR EACH OF THE
ALTERNATIVE MODES OF STORAGE AND FACILITY LOCATION^{a,b}
 (1985 Dollars)

Capacity Of FIS Facility (MTU)	Total FIS Fees (\$/kgU)					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$1,131	\$1,247	\$1,179	\$ 624	\$ 832	\$ 763
100	643	690	662	389	482	455
300	301	305	304	217	236	234
800	193	185	195	161	158	167
1500	164	151	161	144	133	144
1900	157	142	152	139	128	138

^aExcludes cost for transport of spent fuel since this will be specific to each reactor site and destination

^bBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

^{2/}MTU stands for metric tons of uranium contained in the fuel assemblies at first introduction into the reactor. kgU represents kilograms of uranium contained in the fuel assemblies at first introduction into the reactor.
 1 MTU = 1000 kgU

TABLE 2-2
ESTIMATED INITIAL PAYMENT FOR FIS SERVICES
AT THE INDICATED INITIAL FIS CAPACITY LEVELS FOR EACH OF THE
ALTERNATIVE MODES OF STORAGE^{a,b}
(1985 Dollars)

Capacity Of FIS Facility (MTU)	Initial Payment (\$/kgU)					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 498	\$ 601	\$ 542	\$ 160	\$ 331	\$ 273
100	255	307	278	86	172	144
300	90	108	99	34	63	54
800	38	46	43	17	29	26
1500	23	28	27	11	18	17
1900	20	23	23	10	16	15

^aExcludes cost for transport of spent fuel since this will be specific to each reactor site and destination

^bBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

TABLE 2-3
ESTIMATED FINAL PAYMENT FOR FIS SERVICES
AT THE INDICATED INITIAL FIS CAPACITY LEVELS FOR EACH OF THE
ALTERNATIVE MODES OF STORAGE^{a,b}
(1985 Dollars)

Capacity Of FIS Facility (MTU)	Final Payment (\$/kgU)					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 633	\$ 646	\$ 637	\$ 464	\$ 501	\$ 490
100	388	383	384	303	310	311
300	211	197	205	183	173	180
800	155	139	152	144	129	141
1500	141	123	134	133	115	127
1900	137	119	129	129	112	123

^aExcludes cost for transport of spent fuel since this will be specific to each reactor site and destination

^bBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

The magnitude of the payments listed in the preceding tables were higher than those set forth in the 1983 report inasmuch as they included the effects of escalation over the two year period 1983-1985. Most all of the cost elements involved were reestimated and the cost of some of the facilities were reduced somewhat as a result of the use of improved designs, however, these changes did not significantly impact the payments required. The cost increases ranged from about 5% to 12% for cases involving the use of existing transfer facilities, and from about 9% to 12% for cases involving the use of new transfer facilities, depending on the capacity level involved.

JAI also estimated the costs of transporting spent fuel between each of twenty-two reactor sites which are prospective candidates for FIS services and two sample locations for FIS facilities, one in the Eastern U.S. and one in the Western U.S. It was found that costs for shipments made under NRC and DOT regulations averaged from \$9/kgU to \$36/kgU for a FIS facility located in the Eastern U.S., and averaged from \$34/kgU to \$78/kgU for a FIS facility located in the Western U.S., depending on the mode of shipment involved. These estimates are subject to change because of uncertainties in shipping cask design, licensing and fabrication costs, and the possible impact of carrier deregulation.

In view of the limited amount of spent fuel that is expected to be received for FIS compared to the total amount of spent fuel stored at reactor locations, and the requirements of the Act that the Department recover the costs associated with the FIS program, it is recommended that the Department (i) establish fees for FIS and the method of collection thereof in the manner described in Section 6.D of this report, (ii) accept only non-defective spent fuel assemblies and canistered consolidated fuel rods meeting specific acceptance criteria, (iii) require specific measurements and calculations to be made on the fuel and loaded casks delivered to the Department to support certifications with respect to the condition thereof, and (iv) obtain reimbursement for additional costs incurred as a result of its receiving defective fuel or shipping casks that are not delivered in full accordance with specific certifications required by the Department, in addition to the published charges for FIS services.

3.0 BASES FOR THE STUDY

The overall bases for DOE/S-0023 (which is subsequently referred to herein as the 1983 report) were reviewed and evaluated with respect to applicability for establishing charges for FIS services for the calendar year 1985. The following sections summarize the bases used for establishing the 1985 charges.

3.1 STORAGE METHODS CONSIDERED

For the purposes of this study, JAI used the same basic assumptions with respect to the methods of storage to be considered for FIS purposes that the Department did in the 1983 report:

- (1) that the FIS of spent fuel would be accomplished using dry, modular methods of storage inasmuch as these methods offer the greatest flexibility in meeting changing requirements for storage capacity, and
- (2) since the Department has yet to select the specific method of storage, this study considered storage by one design each of three classes of dry, modular methods including metal storage casks, drywells (or caissons below-grade), and concrete storage silos (or caissons above-grade).

The Department does not expect to make the selection of a specific method for use in FIS until the first contract(s) for FIS services is executed.

The Department has continued to consider the possibility of using existing water basin storage facilities which may be available at government sites for FIS purposes. However, neither the feasibility nor economics of the use of such facilities for FIS has been established. As a result of the foregoing, the use of such facilities has not been considered in this study as a basis for establishing payment charges for FIS services for calendar year 1985.

The Department is examining the possibility of using decommissioned TITAN II missile silos for the storage of spent nuclear fuel and high level waste. Since this work is in a very preliminary stage, the feasibility of the use of the modified silos for FIS has not yet been established. Moreover, decommissioning of these silos is currently underway and the option for their use for FIS purposes will not be available for long. In view of the foregoing uncertainties, JAI does not believe that FIS of spent fuel in converted missile silos can be considered as a basis for establishing firm charges for FIS services at the present time.

3.2 QUANTITIES OF SPENT FUEL TO BE STORED

The Department has updated its estimate of the prospective needs of utility companies for spent fuel storage and has determined that such requirements could amount to about 270 MTU in 1988 increasing to as much as 1400 MTU in 1991, as described in the following Table 3-1.^{3,4/}

TABLE 3-1
PROSPECTIVE SOURCES OF SPENT FUEL FOR FIS

Reactor	Cumulative Quantities (MTU)					
	1988	1989	1990	1991	1992	1993
Millstone 1	23	59	59	94	94	129
Millstone 2	87	87	119	151	180	180
Turkey Point 3	35	59	59	90	114	114
Palisades	34	34	60	87	87	113
Oconee 3	6	37	69	69	100	100
Turkey Point 4	44	44	73	102	102	132
St. Lucie 1	8	39	67	67	99	127
Surry 1	3	44	72	72	99	127
Surry 2	27	55	55	83	110	110
Prairie Island 1		2	18	34	50	66
Prairie Island 2			16	32	48	64
Robinson 2			18	41	63	86
Brunswick 2			33	33	67	101
LaSalle 1			20	62	62	103
LaSalle 2			40	82	82	123
LaCrosse			1	4	4	4
Oconee 2			30	30	61	93
Monticello			1	19	37	37
Peach Bottom 2			38	84	84	131
Peach Bottom 3			36	82	82	129
Ginna			9	19	29	38
Oconee 1				30	30	59
Pilgrim 1				6	6	40
Fitzpatrick				24	60	60
Brunswick 1				33	67	67
Calvert Cliffs 1					18	18
Calvert Cliffs 2						28
Oyster Creek					24	24
Indian Point 2						10
Cooper						15
Sequoyah 2						30
Davis Besse 1						15
Total	<u>267</u>	<u>460</u>	<u>893</u>	<u>1,430</u>	<u>1,859</u>	<u>2473</u>

^{3/}Department of Energy, Spent Fuel Storage Requirements, DOE/RL-84-1, May 1984

^{4/}If a requirement for FIS services occurs before 1988, this requirement would be met by temporary storage at existing Department facilities.

However, it may be possible for many, if not all, of the utility companies which have the expected shortfall in spent fuel storage capacity to meet all or part of their additional storage needs through transshipments, rod consolidation^{5/}, installation of additional capacity at reactor sites, or combinations thereof. Moreover, the NRC may, during the determination of eligibility, find that much of the spent fuel currently forecast to exceed available on-site storage capacity will not qualify for FIS.

In view of the uncertainties associated with predicting the amount of spent fuel to be received for FIS, this study considered storage in facilities having the following nominal capacities for each of the storage methods considered up to the limitation of 1900 MTU as established by the Act:

(1) 50 MTU	(4) 800 MTU
(2) 100 MTU	(5) 1500 MTU
(3) 300 MTU	(6) 1900 MTU

3.3 LOCATION AND EXISTING CAPABILITIES OF FIS SITE

As in the 1983 study, this study continued to consider the use of two generic types of government sites -- one assumed to have existing facilities for transferring spent fuel from shipping casks to storage modules, and a second without such facilities. It was assumed that NRC licensing would apply to all FIS activities except the modification and operation of an existing transfer facility. JAI also estimated the costs involved in shipping spent fuel to sites in both the Eastern and the Western U.S. A site for FIS of spent fuel probably will not be specified until there are clear indications that FIS services will be required.

JAI reviewed the prospect of locating FIS facilities at reactors, as permitted by Sec. 135(a)(1)(B) and (C) of the Act, but concluded that the Department probably could not develop storage capability at such locations sooner than utility companies acting on their own. For these and the other reasons set forth in the 1983 report, the possibility of locating FIS facilities at reactors was not considered further in this study.

^{5/}Rod consolidation consists of removing fuel rods from the fuel assembly structure and placing them in a safe, close-packed array (in canisters) that occupies less space than the original fuel assembly.

3.4 SCHEDULE OF CONSTRUCTION AND OPERATION

For the purposes of factoring the time value of money into the fee calculations of this study, JAI assumed the following concerning the schedule of constructing and operating FIS facilities in developing the revenue/expenditure schedules:

- (1) Design, licensing (as applicable) and construction of FIS facilities would commence in 1985 and be completed so that storage operations could commence in mid-1988.
- (2) The FIS facility would receive spent fuel during the three-year period between mid-1988 and mid-1991. It would ship spent fuel to a Monitored Retrievable Storage (MRS) facility or waste repository during the three-year period commencing at the beginning of 1998 and terminating at the end of 2000. One third of the storage capacity of the FIS facility would be received each year during the receiving period, and one-third would be shipped each year during the shipping period.
- (3) Decontamination and decommissioning of FIS facilities would be conducted in the year 2001.

This schedule represents a one-year compression of the FIS program over that used in the 1983 report inasmuch as the program has been assumed to start one year later, but end at the same time as was assumed before.

3.5 DEVELOPMENT OF THE FEE FOR FIS

The same basic assumptions concerning the development of charges for FIS of spent fuel were used by JAI in this study as were used in the development of the 1983 report, as follows:

- (1) The charges for FIS would include the cost of
 - (a) design, licensing and construction of FIS facilities,
 - (b) storage modules,
 - (c) research and development solely related to the development of FIS facilities,
 - (d) operating costs which are incremental to the operation of the government site(s) at which the FIS facilities are located,

- (e) government administration associated with FIS of spent fuel, including storage fund management,
 - (f) impact aid, and
 - (g) decontamination and decommissioning of the FIS facilities at the end of their useful life.
- (2) The charges for transport of spent fuel from the reactor locations to the FIS facilities would be separately included inasmuch as they would be specific to each point of origin and destination, and would be charged directly to the utility.
 - (3) The fee developed for FIS of spent fuel would cover all costs of the FIS system for storage as aforementioned through the year 2000 and for the decommissioning period.

3.6 CONSOLIDATED SPENT FUEL

For this study JAI assumed that canistered consolidated spent fuel rods would be acceptable for storage at the FIS facilities, but that consolidation would not be a criterion for acceptance, nor would the disassembly and consolidation of spent fuel be included in the capabilities of the FIS facilities. It would be expected that the Department would collect the same fee for storage of canistered consolidated spent fuel rods as for intact fuel assemblies until the cost effects of storing consolidated fuel become known. However, the cost of transporting consolidated spent fuel rods from the reactors to FIS facilities is expected to be about half of that involved in transporting intact fuel assemblies and, therefore, would result in a significant reduction in costs for utilities sending consolidated spent fuel to FIS.

4.0 COSTS FOR FIS OF SPENT FUEL

4.1 REVIEW OF AND REVISIONS IN FIS FACILITY DESIGNS

The preliminary designs for FIS facilities which were developed in the 1983 report were reviewed and analyzed. As a result of this review and analysis, the following conclusions were drawn:

- (1) The design of the new transfer facility and of the modifications to an existing transfer facility should remain unchanged from those designs set forth in the 1983 report. Several new designs for transfer facilities were considered which would result in lower prospective capital costs. However, it was concluded that these prospective cost reductions would be accompanied by a decrease in operational flexibility and a greater uncertainty in the licensability of the resulting facility.

Consideration was also given to the prospective use of new designs for transfer facilities which had been developed by others, including the (i) igloo concept, (ii) metal cask loading turntable, (iii) shuttle mechanism, and (iv) trench concept. While these concepts all appear to be less expensive than the design used in the 1983 report, they do not have all the necessary support facilities likely to be required (radwaste handling, lag storage, maintenance capability, etc.). The inclusion of these additional required facilities would make the costs of such new concepts more comparable to those of the design concept used in the 1983 report.

- (2) The design of the modifications required for an existing hot-cell type facility in order to convert it to a workable transfer facility for FIS purposes should remain unchanged from those designs set forth in the 1983 report.
- (3) The designs of canisters and storage modules (cask, drywell, and silo) should remain unchanged from those designs set forth in the 1983 report. It was recognized that the design of the drywell and silo were conservative in order that they might be suitable for use in a variety of locations and be clearly acceptable for NRC licensing, but it was believed that this was desirable to cover the costs that might be incurred.
- (4) The designs of the storage areas should be modified slightly to reduce construction costs.
 - (a) Concrete stands were used to replace the concrete pad which was used in the 1983 report for metal storage casks. The thickness of concrete stands for the silos was reduced from 2 ft. to 16-inches. These changes

significantly reduced the amount of concrete required for the storage area and is not expected to impact operational efficiency of FIS activities at the contemplated rates of emplacement and removal of casks from the storage area.

- (b) The drywell storage area layout was redesigned to provide a 60 kW/acre heat loading, which resulted in a reduction of the distance between drywells to about 19 ft. from the 25 ft. spacing used in the 1983 report. This change significantly reduces the size of the storage area and yet represents a conservative spacing. A heat loading of 60 kW/acre has been used in connection with the design of salt repositories, and higher heat loadings have been used in other geologic media. Since drywells will not be in salt and will be at the surface where they can be expected to experience surface cooling, a 60 kW/acre heat loading should represent a conservative situation.

4.2 REVIEW OF AND REVISIONS IN 1983 FIS COST ESTIMATES

Revised estimates of the capital costs for transfer facilities and storage areas were made in terms of early 1984 dollars and escalated to 1985 dollars using applicable cost indexes. The estimates of the cost of canisters and storage modules as set forth in the 1983 report were reviewed and found to be suitable for use without change after escalation to 1985 dollars using applicable cost indexes. The estimates of operating costs as set forth in the 1983 report were modified to change the insurance allowance and to otherwise escalate them to 1985 dollars using applicable cost indexes. The estimates of government administration costs as set forth in the 1983 report were reviewed and found to be suitable for use without change after escalation to 1985 dollar using applicable cost indexes. The estimates of FIS development costs as set forth in the 1983 report were reviewed and it was concluded that the same estimates would be applicable for use herein.

A description of the alternative facility designs, details of the associated cost estimates, and FIS system spending schedules are set forth in Exhibit A of this report.

Table 4-1 sets forth the total capital costs for the cases studied. The capital costs include (i) the cost of the transfer/encapsulation facilities, or modifications to existing hot cell facilities which can be used for transfer/encapsulation, (ii) the cost of the storage area, and (iii) the cost of the storage modules.

TABLE 4-1
SUMMARY OF ESTIMATED CAPITAL COSTS FOR FIS FACILITIES
HAVING DIFFERENT TOTAL STORAGE CAPACITIES^a
(\$-millions, 1985)

Capacity Of FIS Facility (MTU)	Total Capital Cost					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 26.5	\$ 30.6	\$ 28.2	\$ 8.9	\$16.6	\$ 14.3
100	30.9	33.8	32.0	13.3	19.8	18.1
300	47.5	46.4	47.4	29.9	32.5	33.5
800	88.5	77.9	85.7	70.9	64.0	71.8
1500	147.0	121.9	139.4	129.4	107.9	125.5
1900	180.1	147.0	170.1	162.5	133.0	156.2

^aBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

From the capital cost data shown in Table 4-1, it can be seen that for the lower capacities the capital cost of storage cask facilities is the lowest while the drywell facilities are the highest. However, at the higher capacities the capital cost of drywell facilities is the lowest while the storage cask facilities are the highest. This is due to the following:

- (1) the cost of the transfer facilities is lower in the case of storage casks than for the other two cases
- (2) the cost of the storage area is lowest for the cask and highest for the drywell because of the larger size of the latter
- (3) the cost of modules is lowest for the drywell and highest for the cask

- (4) at higher capacities, the cost advantages described in (1) and (2), above, are more than offset by the higher module cost of the storage casks.

The capital costs for all cases are obviously less where an existing facility exists which can be modified for transfer/encapsulation purposes. However, cask storage requires considerably less modification to an existing facility (hot cell) than the other modes of storage since no encapsulation facilities are required.

Table 4-2 sets forth the total operating costs for the cases studied.

TABLE 4-2
SUMMARY OF ESTIMATED TOTAL OPERATING COSTS FOR FIS FACILITIES
HAVING DIFFERENT TOTAL STORAGE CAPACITIES^a
(\$-millions, 1985)

Capacity Of FIS Facility (MTU)	Total Operating Cost					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 28.4	\$ 30.6	\$ 29.3	\$ 18.6	\$22.2	\$ 20.8
100	29.8	32.1	30.9	20.0	23.7	22.4
300	35.3	38.3	36.6	25.6	29.8	28.1
800	50.4	54.2	54.6	39.9	45.7	44.5
1500	73.1	79.8	76.5	60.9	69.0	65.4
1900	85.9	94.5	88.9	72.8	82.3	77.3

^aBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

From the operating costs shown in Table 4-2, it can be seen that for all cases, the operating costs associated with storage casks are the lowest while those associated with the drywells are the highest. Operating costs at the

site with an existing transfer facility are lower than those at a site where a complete transfer facility has to be built, inasmuch as in the latter case it was assumed that a small caretaker operation would be required for the new facility, whereas in the former case it was assumed that the existing facility would either find other use during the storage only period or otherwise would have incurred caretaker expense in the absence of the FIS facility locating at the site.

Table 4-3 sets forth the total costs of special charges which are applicable to each of the cases studied. These include (i) research and development costs associated with the development of the FIS facilities, (ii) government administration costs for the FIS program including storage fund management, and (iii) impact aid.

TABLE 4-3
SUMMARY OF ESTIMATED SPECIAL COSTS FOR FIS FACILITIES
HAVING DIFFERENT TOTAL STORAGE CAPACITIES^a
(\$-millions, 1985)

Capacity Of FIS Facility (MTU)	Total Special Cost					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 5.9	\$ 5.9	\$ 5.9	\$ 5.9	\$ 5.9	\$ 5.9
100	8.1	8.1	8.1	8.1	8.1	8.1
300	13.1	13.1	13.1	13.1	13.1	13.1
800	23.8	23.8	23.8	23.8	23.8	23.8
1500	37.9	36.4	37.9	34.9	33.4	34.9
1900	45.6	41.8	43.7	39.9	39.9	39.9

^aBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

From Table 4-3 it can be seen that special costs remain the same at a given capacity for all modes of storage through the 800 MTU capacity level. This is due to the fact that the FIS development costs are the same for all cases, the government administration costs are the same at each capacity level, and the impact aid is fixed at \$15/kg U. The Act establishes a maximum for impact aid amounting to \$15/kg U or 10% of all costs, whichever is smaller. In the capacity cases through 800 MTU, 10% of the costs is higher than \$15/kg U, thus \$15/kg U was used in these cases. However, in the cases above the 800 MTU capacity level, 10% of the costs is lower than \$15/kg U and was used, thus producing a variation among the cases considered at these capacity levels.

Table 4-4 sets forth the total discounted costs of construction and operation of the FIS storage system for each of the cases studied. These costs include the sum of all capital costs, operating costs and special costs (except impact aid) -- discounted to 1985 at 2 percent/year (based on an average annual escalation rate of 7.93 percent/year and a cost of money to the government of 10.06 percent/year, as derived in Section 9.0 of Exhibit A).

TABLE 4-4
SUMMARY OF TOTAL DISCOUNTED COSTS FOR CONSTRUCTION AND OPERATIONS
OF FIS FACILITIES HAVING DIFFERENT TOTAL STORAGE CAPACITIES^a
(\$-millions, 1985)

Capacity Of FIS Facility (MTU)	Total Discounted Costs (Discounted @ 2%/yr to 1985)					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 53.2	\$ 58.9	\$ 55.6	\$ 28.5	\$38.8	\$ 35.4
100	59.5	64.3	61.6	34.9	44.2	41.4
300	80.6	82.4	81.8	56.0	62.2	61.6
800	132.7	126.7	134.0	107.5	106.5	112.5
1500	206.9	190.5	203.3	180.3	168.4	181.0
1900	248.8	226.7	242.6	221.3	203.5	219.9

^aBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.1B3 MTU loading.

From the total discounted costs shown in Table 4-4, it can be seen that for the lower capacities the cost of storage in storage casks is less than the other two cases, with the cost of storage in drywells being the highest. However, for the higher capacities, the cost of storage in drywells is less than the other two cases, with the cost of storage in storage casks being the highest. The cost of storage is approximately the same for all modes of storage at the 300 MTU capacity level. The aforementioned relationships apply to both cases where transfer facilities exist at the FIS site and where they do not so exist, however, the total costs for storage by all storage methods are lower in the former case than they are in the latter.

5.0 COSTS FOR SPENT FUEL TRANSPORT

Estimates were made of the cost of transporting spent fuel from each of the prospective reactor locations identified in Table 3-1 of this report and FIS facility sites in the Eastern U.S. and the Western U.S. Estimated costs were developed for both truck transport and for rail transport, however, rail shipments should be used to the maximum extent feasible inasmuch as the larger payload of the rail casks significantly reduces the number of shipments and the amount of cask handling at both the reactor site and the FIS facilities.

Table 5-1 sets forth the estimated total cost of a single shipment of spent fuel between the various points of origin and destination considered in this study.

TABLE 5-1
SUMMARY OF ESTIMATED COSTS FOR A SINGLE CASK SHIPMENT OF SPENT
FUEL FROM SPECIFIC REACTOR LOCATIONS TO FIS FACILITIES
 (1985 Dollars)

<u>Reactor to Destination</u>	<u>Total Cost for Shipment</u>	
	<u>Truck Shipments^a</u>	<u>Rail Shipments^b</u>
<u>From Surry to</u>		
Eastern U.S. Site	\$ 8,529	\$ 80,992
Western U.S. Site	24,422	199,014
<u>From Palisades to</u>		
Eastern U.S. Site	9,341	70,128
Western U.S. Site	19,123	146,709
<u>From St. Lucie to</u>		
Eastern U.S. Site	11,200	90,112
Western U.S. Site	29,030	198,592
<u>From Robinson to</u>		
Eastern U.S. Site	7,011	64,991
Western U.S. Site	28,941	186,492
<u>From Fitzpatrick to</u>		
Eastern U.S. Site	12,164	80,680
Western U.S. Site	24,582	184,180
<u>From Brunswick to</u>		
Eastern U.S. Site	8,619	67,134
Western U.S. Site	28,346	187,924
<u>From LaSalle to</u>		
Eastern U.S. Site	8,657	74,093
Western U.S. Site	16,887	143,485
<u>From Oconee to</u>		
Eastern U.S. Site	6,025	73,000
Western U.S. Site	25,311	193,050
<u>From Turkey Point to</u>		
Eastern U.S. Site	12,439	73,082
Western U.S. Site	30,414	198,696
<u>From Monticello to</u>		
Eastern U.S. Site	13,152	98,379
Western U.S. Site	14,806	131,399
<u>From Peach Bottom to</u>		
Eastern U.S. Site	10,459	84,003
Western U.S. Site	25,097	184,658
<u>From Pilgrim to</u>		
Eastern U.S. Site	11,936	109,111
Western U.S. Site	27,360	209,955

TABLE 5-1 (Continued)
SUMMARY OF ESTIMATED COSTS FOR A SINGLE CASK SHIPMENT OF SPENT
FUEL FROM SPECIFIC REACTOR LOCATIONS TO FIS FACILITIES
 (1985 Dollars)

<u>Reactor to Destination</u>	<u>Total Cost for Shipment</u>	
	<u>Truck Shipments^a</u>	<u>Rail Shipments^b</u>
<u>From Ginna to</u>		
Eastern U.S. Site	\$11,140	\$ 96,458
Western U.S. Site	23,426	190,758
<u>From Indian Point to</u>		
Eastern U.S. Site	13,423	97,454
Western U.S. Site	26,499	196,986
<u>From Millstone to</u>		
Eastern U.S. Site	11,497	99,311
Western U.S. Site	26,848	197,919
<u>From Prairie Island to</u>		
Eastern U.S. Site	12,972	83,677
Western U.S. Site	17,219	130,872
<u>From LaCrosse to</u>		
Eastern U.S. Site	11,524	81,836
Western U.S. Site	15,882	130,958
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	9,105	82,252
Western U.S. Site	25,074	197,422
<u>From Oyster Creek to</u>		
Eastern U.S. Site	10,621	90,800
Western U.S. Site	26,178	197,126
<u>From Cooper to</u>		
Eastern U.S. Site	12,103	83,127
Western U.S. Site	13,836	125,155
<u>From Sequoyah to</u>		
Eastern U.S. Site	4,257	46,562
Western U.S. Site	22,940	176,927
<u>From Davis Besse to</u>		
Eastern U.S. Site	9,324	65,780
Western U.S. Site	20,076	110,902

^aBased on use of NLI 1/2 truck cask with capacity for either one PWR or two BWR fuel assemblies.

^bBased on use of IF-300 rail cask with capacity for either 7 PWR or 18 BWR fuel assemblies.

6.0 FEE METHODOLOGY AND FEE COMPUTATION

6.1 METHOD OF FEE COLLECTION

JAI has reviewed the proposed method of fee collection set forth in the 1983 report and the alternative methods that were considered therein, and has concluded that the combined interests of the Department and the FIS users would still be best served by a two-part fee involving an Initial Payment upon execution of a contract for FIS services, followed by a Final Payment upon delivery of the spent fuel to the Department.

The Initial Payment represents an advance payment to cover the pro rata share of preoperational costs, including:

- o the capital costs of the required transfer facilities and storage area
- o development costs
- o government administrative costs including storage fund management
- o impact aid payments made in accordance with section 136(e) of the Act, and
- o interest on any Treasury funds advanced to the FIS program.

The Final Payment would cover the sum of the following:

- o any under- or over-estimation in the costs used to calculate the Initial Payment of the fee (including savings due to rod consolidation)
- o transportation costs (including cask lease, freight, handling and security)
- o module costs (i.e., storage casks, drywells, or silos), and
- o the total estimated cost of operation and decommissioning of the FIS facilities (including government administrative costs, storage fund management and impact aid)

The Initial Payment received for all users would be calculated to provide the funds necessary to design, license (where applicable) and construct the FIS facilities and to repay any funds borrowed from the U.S. Treasury that may have been needed earlier. The costs of storage modules and

transportation would be incurred at about the same time as the Final Payment is made and would be included therein; thus, the actual costs of storage modules and transportation would be quantified by the time the then-applicable Final Payment is established. The Final Payments received would also include an adjustment for differences between the actual preoperational costs and those used to calculate the Initial Payment, and the estimated future costs of facility operation.

6.2 METHOD OF COMPUTATION OF FEE

The same method for computation of the fees for FIS services as was described in the 1983 report was used in this study. This method is summarized below:

- (1) In order to effect the recovery of costs incurred by the Department in providing FIS services, the fees for such services must be established such that the sum of the discounted costs of providing the services is equal to the sum of the discounted revenues received by the Department for such services, as follows:

$$\text{Discounted Costs} = \text{Discounted Revenues}$$

$$\text{Discounted Revenues} = \text{Discounted (Unit Fee} \times \text{Units of Storage)}$$

$$\text{Discounted (Unit Fee} \times \text{Units of Storage)} = \\ \text{Unit Fee} \times \text{Discounted Units of Storage}$$

- (2) Since the fee is an unknown in the above equations, but the units of storage (MTU or numbers of modules) and estimated costs are known, the fee can be calculated by the following:

$$\text{Unit Fee} = \frac{\text{Discounted Costs}}{\text{Discounted Units of Storage}}$$

- (3) Since it has been determined that a two-part fee for FIS services is desirable, and since a two-part fee would provide all required funds for the FIS of spent fuel either in advance of or at the same time that the corresponding component of cost of storage would be incurred, it is necessary to employ a discount rate equal to the "real" value of money, i.e., the value of money to the government net of escalation. The discount factor established by JAI for this purpose is 1.02 (or a 2%/year discount rate); this resulted from the ratio of (i) a value of money factor of 1.1006 which is derived from the average interest rates over the period 1977-1983 (inclusive) on U. S. Treasury notes and

bonds with maturities^{6/} of 10 years and over and (ii) an escalation factor of 1.0793^{7/}, as follows:

$$\frac{1.1006}{1.0793} = 1.020$$

Using the costs developed in Exhibit A, Section 9.0, the Initial Payments, Final Payments and total payments estimated to be required in 1985 dollars for the FIS of spent fuel are set forth in Tables 6-1, 6-2 and 6-3, respectively -- for each of the three methods of storage, at the six different levels of capacity, and the two different types of locations considered in this study. The costs of transport of the spent fuel from the various prospective reactor locations to two typical FIS facility locations have been excluded from the unit costs set forth in these tables but have been shown separately in Table 6-4.

TABLE 6-1
ESTIMATED INITIAL PAYMENT FOR FIS SERVICES
AT THE INDICATED INITIAL FIS CAPACITY LEVELS FOR EACH OF THE
ALTERNATIVE MODES OF STORAGE^{a,b}

(1985 Dollars)

Capacity Of FIS Facility (MTU)	Initial Payment (\$/kgU)					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 498	\$ 601	\$ 542	\$ 160	\$ 331	\$ 273
100	255	307	278	86	172	144
300	90	108	99	34	63	54
800	38	46	43	17	29	26
1500	23	28	27	11	18	17
1900	20	23	23	10	16	15

^aExcludes cost for transport of spent fuel since this will be specific to each reactor site and destination

^bBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

^{6/}Federal Reserve Board, Federal Reserve Bulletin, various issues 1978-1984

^{7/}Average of several applicable price indexes over the period 1976-1983

TABLE 6-2
ESTIMATED FINAL PAYMENT FOR FIS SERVICES
AT THE INDICATED INITIAL FIS CAPACITY LEVELS FOR EACH OF THE
ALTERNATIVE MODES OF STORAGE^{a,b}
(1985 Dollars)

Capacity Of FIS Facility (MTU)	Final Payment (\$/kgU)					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 633	\$ 646	\$ 637	\$ 464	\$ 501	\$ 490
100	388	383	384	303	310	311
300	211	197	205	183	173	180
800	155	139	152	144	129	141
1500	141	123	134	133	115	127
1900	137	119	129	129	112	123

^aExcludes cost for transport of spent fuel since this will be specific to each reactor site and destination

^bBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

TABLE 6-3
ESTIMATED TOTAL UNIT COST FOR FIS SERVICES
AT THE INDICATED INITIAL FIS CAPACITY LEVELS FOR EACH OF THE
ALTERNATIVE MODES OF STORAGE^{a,b}
(1985 Dollars)

Capacity Of FIS Facility (MTU)	Total FIS Fees (\$/kgU)					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$1,131	\$1,247	\$1,179	\$ 624	\$ 832	\$ 763
100	643	690	662	389	482	455
300	301	305	304	217	236	234
800	193	185	195	161	158	167
1500	164	151	161	144	133	144
1900	157	142	152	139	128	138

^aExcludes cost for transport of spent fuel since this will be specific to each reactor site and destination

^bBased on two-thirds of the weight of uranium being contained in PWR assemblies with a 0.461 MTU loading and one-third of the weight of uranium being contained in BWR assemblies with a 0.183 MTU loading.

TABLE 6-4
SUMMARY OF ESTIMATED UNIT COSTS FOR TRANSPORTING SPENT FUEL FROM
SPECIFIC REACTOR LOCATIONS TO FIS FACILITIES^a
 (1985 Dollars)

<u>Reactor to Destination</u>	<u>Total Cost for Shipment (\$/kgU)</u>	
	<u>By Truck^b</u>	<u>By Rail^c</u>
<u>From Surry to</u>		
Eastern U.S. Site	\$18.50	\$25.10
Western U.S. Site	52.98	61.67
<u>From Palisades to</u>		
Eastern U.S. Site	20.26	21.73
Western U.S. Site	41.48	45.46
<u>From St. Lucie to</u>		
Eastern U.S. Site	24.30	27.92
Western U.S. Site	62.97	61.54
<u>From Robinson to</u>		
Eastern U.S. Site	15.21	20.14
Western U.S. Site	62.78	57.79
<u>From Fitzpatrick to</u>		
Eastern U.S. Site	33.24	24.49
Western U.S. Site	67.16	56.11
<u>From Brunswick to</u>		
Eastern U.S. Site	23.55	20.38
Western U.S. Site	77.45	57.05
<u>From LaSalle to</u>		
Eastern U.S. Site	23.65	22.49
Western U.S. Site	46.14	43.56
<u>From Oconee to</u>		
Eastern U.S. Site	13.07	22.62
Western U.S. Site	54.91	59.82
<u>From Turkey Point to</u>		
Eastern U.S. Site	26.98	22.65
Western U.S. Site	65.98	61.57
<u>From Monticello to</u>		
Eastern U.S. Site	35.93	29.87
Western U.S. Site	40.45	39.89
<u>From Peach Bottom to</u>		
Eastern U.S. Site	28.58	25.50
Western U.S. Site	68.57	56.06
<u>From Pilgrim to</u>		
Eastern U.S. Site	32.61	33.12
Western U.S. Site	74.75	63.74
<u>From Ginna to</u>		
Eastern U.S. Site	24.16	29.89
Western U.S. Site	50.82	59.11

TABLE 6-4 (Continued)
SUMMARY OF ESTIMATED UNIT COSTS FOR TRANSPORTING SPENT FUEL FROM
SPECIFIC REACTOR LOCATIONS TO FIS FACILITIES^a
 (1985 Dollars)

<u>Reactor to Destination</u>	<u>Total Cost for Shipment (\$/kgU)</u>	
	<u>By Truck^b</u>	<u>By Rail^c</u>
<u>From Indian Point to</u>		
Eastern U.S. Site	\$29.12	\$30.20
Western U.S. Site	57.48	61.04
<u>From Millstone to</u>		
Eastern U.S. Site	24.94	30.78
Western U.S. Site	58.24	61.33
<u>From Prairie Island to</u>		
Eastern U.S. Site	28.14	25.93
Western U.S. Site	37.35	40.56
<u>From La Crosse to</u>		
Eastern U.S. Site	31.49	24.84
Western U.S. Site	43.39	39.76
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	19.75	25.49
Western U.S. Site	54.39	61.18
<u>From Oyster Creek to</u>		
Eastern U.S. Site	29.02	27.57
Western U.S. Site	71.53	59.84
<u>From Cooper to</u>		
Eastern U.S. Site	33.07	25.24
Western U.S. Site	37.80	38.00
<u>From Sequoyah to</u>		
Eastern U.S. Site	9.23	14.43
Western U.S. Site	49.76	54.83
<u>From Davis Besse to</u>		
Eastern U.S. Site	20.23	20.38
Western U.S. Site	43.55	34.37

^aBased on 0.461 MTU/PWR assembly and 0.183 MTU/BWR assembly, as introduced into the reactor. Unit cost will increase or decrease proportionately to corresponding decreases or increases in the uranium content of the fuel assemblies.

^bBased on use of NLI 1/2 truck cask with capacity for either one PWR or two BWR fuel assemblies.

^cBased on use of IF-300 rail cask with capacity for either 7 PWR or 18 BWR fuel assemblies.

6.3 SENSITIVITY OF FEES TO CHANGES IN CONDITIONS

The sensitivity of the total fees^{8/} for FIS to changing conditions of cost, schedule, mix of spent fuel types, and discount rate, and to whether or not the facility was subject to NRC licensing, was determined for the drywell cases at storage capacity levels of 100 MTU and 1900 MTU (see Section 10.0 of Exhibit A). The results of these fee sensitivity studies are summarized below:

- (1) A change of \$1-million in the capital cost of transfer facilities at the FIS site causes a corresponding change in the total fees for FIS of about \$12/kgU at the 100 MTU capacity level, decreasing to about \$1/kgU at the 1900 MTU capacity level.
- (2) A change of \$1,000 in the cost of canisters or drywells causes a corresponding change in the total fees for FIS of about \$3/kgU at all capacity levels.
- (3) For each year the term of the FIS program is extended (due to delay in repository startup), there is an increase in the total fees for FIS at the 100 MTU capacity level of about \$15/kgU for instances where a new transfer facility is built, and about \$9/kgU for instances where an existing transfer facility can be utilized for FIS. These increases amount to about \$1.40/kgU and \$0.80/kgU, respectively, at the 1900 MTU capacity level.
- (4) For each year the time over which spent fuel is received for storage increases, there is a increase in the total fees for FIS at the 100 MTU capacity level of about \$3/kgU for instances where a new transfer facility is built, and about \$9/kgU for instances where an existing transfer facility can be utilized for FIS. There is little impact of the receipt schedule on total fees at the 1900 MTU capacity level.
- (5) For each year the time for design, licensing, and construction of the initial FIS facilities decreases (and, therefore, increasing the amount of time spent fuel is stored by a corresponding amount), there is an increase in the total fees for FIS at the 100 MTU capacity level of about \$18/kgU for instances where a new transfer facility is built, and about \$9/kgU for instances where an existing transfer facility can be utilized. These increases amount to about \$1/kgU and \$0.50/kgU, respectively, at the 1900 MTU capacity level.

^{8/} The term "total fees" used in this section refers to the sum of the Initial and Final Payments.

- (6) A one kilogram decrease in the average amount of uranium contained in the spent fuel in a drywell from the 429 kgU loading assumed for this study causes an increase in the total fees for FIS by about \$0.20/kgU, in the range of 366 kg U to 461 kg U. Conversely, a one kilogram increase in the average amount of uranium contained in a drywell causes a decrease of \$0.20/kgU in the total fees for FIS.
- (7) An increase in the discount rate by one percentage point causes a decrease in the total fees for FIS at the 100 MTU capacity level of about \$20/kgU for instances where a new transfer facility is built, and about \$13/kgU for instances where an existing transfer facility can be utilized for FIS. These decreases amount to about \$3.3/kgU and \$2.5/kgU, respectively, at the 1900 MTU capacity level.
- (8) Not having to follow the procedural (not safety) requirements involved in NRC licensing activities nor conform the FIS systems to NRC security requirements causes a decrease in the total fees for FIS by about \$100/kgU at the 100 MTU capacity level decreasing to about \$7/kgU at the 1900 MTU capacity level.

6.4 ESTABLISHMENT OF FEES FOR FIS SERVICES

JAI recommends that the Department establish its fee for FIS services in the same basic manner as it did in the 1983 report, and which is described below:

- (1) The fee should be published in two parts -- an Initial Payment and a Final Payment. The Final Payment should be subdivided into two components: one should include all cost components except transportation of spent fuel, and the other should include spent fuel transportation and associated costs between reactor locations and FIS facilities.
- (2) Upon publication, the Initial Payment, and the Final Payment for all cost components except transportation, should be firm until revised by a subsequent publication. The Department should plan to invoice the individual user for the actual cost the Department incurs in the transportation of the user's spent fuel to the FIS facilities.
- (3) Until the Department has received commitments for FIS services, it should publish a fee schedule for a range of capacities from 100 MTU to the 1900 MTU limit established by the Act.

- (4) Until the Department determines the location or locations for FIS facilities and the method or methods of storage to be used, the fee that represents the highest cost(s) for the combination of types of location(s) and storage method(s) under consideration should apply.
- (5) Upon execution of the first contract(s) the Department should commence the design of the FIS facilities on the basis of the contractual commitments that then exist for FIS services. These facilities should have the capacity for storage of only that amount of spent fuel which is committed to storage under the then-existing contracts.
- (6) These first contract(s) should determine the fee for FIS services from the schedule of fees published in the Federal Register. The Initial Payment should be the unit price in effect for the total storage capacity required by such contract(s) or for 100 MTU, whichever is larger. This same Initial Payment should then be charged to all subsequent users of FIS services until the Initial Payment is next revised.
- (7) The Department should revise its fee (both the Initial and Final Payment) annually to reflect (among other things) the economies of a larger FIS operation which results from additional commitments for FIS services.
- (8) Upon completion of the preoperational activities (i.e., design, safety reviews, construction, and associated activities), the Department should determine the total costs incurred -- and should credit or debit the Final Payment of each user with the difference between the amounts paid as Initial Payments and its pro rata share of the total preoperational costs (net of its pro rata share of interest earned on advance payments made).
- (9) After decommissioning of the FIS system, or December 31, 2001, whichever is later, the Department should determine the total costs incurred in design, construction, operation and decommissioning of the FIS system through December 31, 2001 -- and should make final adjustments to the extent that there is a difference between the amounts paid by each user in Initial and Final Payments and the user's pro rata share of the aforementioned costs (net of its pro rata share of interest earned on advance payments made).

The Department should plan to sign contracts for FIS services with users within 60 days after the user's need has been certified by NRC. This is necessary in order for the Department to be able to provide the required storage facilities on a timely basis.

7.0 SPENT FUEL ACCEPTANCE CRITERIA FOR FIS

In developing revised spent fuel acceptance criteria, JAI was mindful of the facts that FIS was intended for use only in special situations and that only a limited amount of spent fuel would be eligible for FIS. This is in marked contrast to the repository program, which can be expected to receive all spent fuel for disposal purposes, absent any reprocessing in the U.S. Therefore, in order to simplify the FIS program and minimize the costs attendant therewith, it was concluded that the interests of the prospective users of FIS services were best served by the Department accepting only non-defective fuel assemblies and canistered consolidated fuel rods meeting specific and clearly defined acceptance criteria.

JAI has reviewed the spent fuel acceptance criteria which was included in the 1983 report and has considered the comments received thereon from prospective users of FIS services. As a result of this review and consideration, minor revisions have been made to the acceptance criteria. The revised criteria are included in Exhibit C to this report.

EXHIBIT A

DESIGN DESCRIPTION AND ESTIMATED COSTS FOR THE DRY STORAGE
OF SPENT NUCLEAR FUEL IN FEDERAL INTERIM STORAGE FACILITIES

EXHIBIT A
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EXHIBIT A
DESIGN DESCRIPTION AND ESTIMATED COSTS FOR THE DRY STORAGE
OF SPENT NUCLEAR FUEL IN FEDERAL INTERIM STORAGE FACILITIES

This Exhibit describes the design of the components of the alternative FIS systems considered, including (i) canisters, (ii) required new facilities for the transfer of spent fuel from shipping casks to either transfer casks or storage modules and for performing the encapsulation of spent fuel in cases where such is considered necessary, (iii) modifications to existing facilities at government sites which are necessary to perform the same operations as described in (ii) above, (iv) storage modules, and (v) storage facilities. The results of estimates of the capital cost of the components of the alternative FIS systems are presented as are the cost of operation thereof, and the special costs stipulated by the Act to be included in the development of charges for FIS services. A summary of the total and discounted costs of operation of the FIS system, and the unit costs resulting therefrom, is presented for each combination of storage method, capacity, and facility location which was considered (as described in Section 3.0 of the report).

In addition to the foregoing, sensitivity analyses were performed to determine the effects of changing conditions of cost, schedule, mix of fuel type, discount rate, and licensing-related activities on the unit cost for FIS.

1.0 SPENT FUEL CANISTERS

JAI considered both the need for canistering spent reactor fuel assemblies and the type of canister that should be employed. It was concluded that spent fuel assemblies that were destined for storage in sealed drywells or silos should be encapsulated to provide a double containment for the fuel assemblies. Since the metal storage casks are designed with a double containment lid, no canistering of the fuel assemblies was considered necessary for this mode of storage. It was also concluded that a carbon steel canister with convex ends would perform satisfactorily in the dry storage environment.

1.1 DESCRIPTION

The canister designed to contain one PWR or two BWR fuel assemblies has a 13-in. inside diameter and a 1/2-in. wall thickness. Canisters are prefabricated from 1/2-in. thick steel plate with a convex bottom and lid. The guide cages used to position the fuel within the canister are fabricated from 1/8-in. steel plate with 1/4-in. steel plate cage guides. A 1/2-in. steel plate is located at the bottom of the canister to support the cage and fuel. The mating surfaces of the lid and wall are machined for welding. Guides are welded inside the lid to assure positive alignment and to facilitate guiding the lid into place. A grapple pintle on the top of the lid is used to lift the lid and place it on the canister; it is also used to apply pressure during welding to assure positive contact, and to lift the loaded canisters. A vent hole through the pintle and lid is provided to relieve any pressure build-up during girth-welding, and to permit pressure and leak testing of the loaded canister; it is seal welded upon completion of such testing. It can also be used to add an inert atmosphere to the canister if desired for heat transfer or for additional corrosion protection. A TIG or MIG weld of the girth and the pintle seal welds is used to eliminate the need for a flux and subsequent chipping of slag, and the attendant generation of scrap.

Empty canisters and lids are moved from storage into the hot cell and lifted using a magnetic grapple. The empty canisters are stored in special racks and the lids are placed on a conveyor that feeds the welding machine. The loaded and tested canisters are placed in interim storage in a small vault in new hot cell facilities or are stored in a shielded storage cask in existing hot cell facilities. The canisters are subsequently loaded into a transfer cask for transfer to drywell storage or are loaded directly into a concrete silo.

1.2 ESTIMATED COST

The cost of canisters for PWR and BWR fuel assemblies to be stored in drywells or silos was estimated to average \$4,930 (1985 dollars).

2.0

RECEIVING AND HANDLING FACILITIES

Three types of receiving and handling facilities were considered for the FIS facilities. At government facilities which have no hot cell facilities which can be used for the transfer of spent fuel from shipping casks into storage casks, such will have to be provided. In the case of drywell or silo storage, these transfer facilities will also have to be equipped for encapsulation of the fuel assemblies. (Encapsulation is not necessary for cask storage because the cask provides the desired double containment of the spent fuel.) Both the transfer-only and transfer/encapsulation facilities should be equipped with a limited amount of lag storage space.

At government facilities which have hot cell facilities which could be used for the above described purposes, some modifications and equipment additions are assumed to be necessary in order to perform the described activities.

This section describes the conceptual designs of the new transfer and transfer/encapsulation facilities, and the required additions and modifications to an existing one -- and provides an estimate of the capital costs associated with such facilities.

2.1

FACILITIES FOR RECEIVING AND TRANSFER

A basic design for a transfer facility was developed and is shown in Figures A2-1, A2-2 and A2-3. This facility is a simple hot-cell facility equipped with standard hot cell equipment, and is designed to accomplish the following operations:

- (1) receive, inspect and washdown and/or decontaminate the shipping casks and storage casks
- (2) remove the cask heads from the casks and temporarily store them
- (3) remove the spent fuel from the shipping cask and place it in the storage cask
- (4) place the cask head on the storage cask when loaded, seal, and transfer the cask to the storage area
- (5) place the cask head on the empty shipping cask and prepare cask for return shipment

FIGURE A2-1
PLAN VIEW OF TRANSFER FACILITY
 Section View AA

- 1 CANISTER WELD
- 2 NDT WELD
- 3 RAD SURVEY
- 4 DECONTAMINATION STATION

FIGURE A2-2
SIDE VIEW OF TRANSFER FACILITY
Section View BB

FIGURE A2-3
END VIEW OF TRANSFER FACILITY
 Section View CC

- (6) provide a small amount of lag storage in the hot cell to minimize shipping cask turnaround time, and for general operational convenience.

It is recognized that there have been a number of unique conceptual designs developed for accomplishing these types of transfer operations at low estimated capital cost. However, the development of these designs has not proceeded to the point that the Department should risk the use of them from either a cost or licensing standpoint, in the establishing of charges for FIS services at the present time.

Spent fuel shipping casks are received at the FIS facility on special rail cars for the IF-300 cask and on tractor-trailer trucks for the NLI 1/2 cask. The rail transport vehicle is spotted on a rail siding, extending into the concrete pad in front of the FIS transfer facility; the trucks are also spotted on this same pad. The mobile transporter straddles the rail car or truck and engages the trunions of the cask after the personnel barriers, tie-downs and impact limiters are removed. The casks are lifted horizontally to clear the carrier vehicle and moved to a clear space on the concrete pad. The casks are then rotated to a vertical position using a small hoist. They are then positioned over the dolly and lowered onto it. Tie-downs to attach the cask to the dolly are secured and the trunions disengaged. The mobile transporter is moved into the clear to be available for other work including transport of storage casks, transfer casks or silos to the storage area. The dolly and cask is moved into the washdown/decontamination area for final inspection, removal of the outer head and inner head bolts, attachment of the inner head lifting sling and installation of the expandable seal ring, gasket protection, and contamination bib. The dolly and cask are then ready to be moved into the air lock (cask unloading) area.

The transfer facility described in Figures A2-1, A2-2 and A2-3 is a reinforced concrete structure having overall dimensions of 48 ft. x 76 ft. by 61 ft. high. The interior of the hot cell is 22 ft. wide, 45 ft. long and 25 ft. high and contains a 40-ton bridge crane with a 10-ton auxiliary hoist on the same trolley. A clearance of 18 ft. under the crane hooks is provided for handling grapples and fuel assemblies. The crane is equipped with an inching motor for precise movement as well as an emergency drive to move the crane into the 22 ft. x 13 ft. shielded maintenance cell at one end of the hot cell.

All shielding walls are constructed of 5-ft. thick nuclear grade concrete and are lined with stainless steel plate for ease of decontamination. A 5-ft. thick concrete door can be used to shield the crane maintenance cell from the hot cell in the event spent fuel is exposed in the hot cell and a crane breakdown occurs. Cell viewing is provided through two 4-ft. square, lead-glass windows and CCTV cameras on the crane and in the cell. A master slave, heavy duty manipulator at each view-window is available for special purposes.

Lag storage is available in two small vaults below the floor level of the hot cell, each with space for 35-40 baskets in safe geometry spacing. Each vault has a 5-ft. thick concrete cover to be used in the event the hot cell needs to be entered when spent fuel is in lag storage. Each such vault is 7 ft. wide, 10 ft. long and 31 ft. deep (see Figure A2-2). Cooling is provided by drawing cell ventilation air through the fuel assemblies into a plenum in the lower part of each vault. The air is filtered and cooled in the HVAC area.

The cask loading/unloading area is an air-lock 22 ft. wide and 21 ft. long where both the shipping casks and storage casks are brought in on dollies and raised to mate with the underside of the hot cell access port for unloading and loading. An expandable seal between the top of the cask and the access port prevents cell atmosphere leakage into the air-lock area.

The two cell plugs which fill the access port between the air-lock and the hot cell are each constructed with a ring and a center plug such that they can be removed either together or individually. Only the center plug is removed when a truck cask is to be unloaded while both the plug and ring are removed for rail casks and storage casks. Special storage holes are provided in the floor of the hot cell for the cell plugs when they are removed in order to permit top surfaces of the plugs to be flush with the hot-cell floor, eliminating the need for additional head room in the cell (see Figure A2-2).

The auxiliary area is a multi-storied building with the HVAC and electrical switch gear equipment located on the top floor (see Figures A2-1 and A2-3). The second floor is used as an operating aisle and a manipulator repair shop. The bottom floor is utilized for low-level liquid and solid waste handling and processing, including catch tanks for the hot cell and decontamination areas, liquid filter and ion exchange systems, liquid waste solidification equipment and solid waste compaction equipment.

The other floors of the auxiliary area are utilized for change room facilities, health physics analytical laboratory, general plant maintenance shop, and administrative and engineering offices.

2.2 FACILITIES FOR RECEIVING, CANNING AND TRANSFER

The same basic facilities that were described for the transfer of spent fuel from shipping casks to storage casks in Section 2.1 can be used for the receipt, canning and transfer of the canned spent fuel assemblies to either silos or a transfer cask (in the case of drywell storage). However, in the latter cases, the facilities are equipped to perform the following additional activities:

- (1) load spent fuel assemblies into canisters
- (2) weld lid onto canister
- (3) backfill canister and seal
- (4) test/inspect weld integrity, and
- (5) decontaminate loaded canisters.

In these cases one of the two 7 ft. by 10 ft. by 31 ft. deep vaults shown in Figure A2-1 is utilized for new canister storage, loaded canister storage and the welding and test equipment. A special welding jig accurately positions the canisters against guide and drive rollers. New canisters and lids are moved into the cell through the air-lock to the cell port and to the weld jig or lag storage by means of an electromagnetic grapple. After the fuel assemblies are loaded into the canister, a handling tool picks up a lid from a conveyor and places it on the canister, holding it in place during welding. The TIG welder is positioned using a roller-follower to maintain weld gap distance. The canister is rotated and the welding sequence carried out. A canister grapple lifts the canister to the test jigs for weld and leak tests and radiation survey test.

Also for these cases, a part of the first floor of the auxiliary area is used as a warehouse to store the new canisters. Part of the second floor is eliminated to provide a high-bay warehouse so the canisters can be stored vertically. A small jib crane in this area with a magnetic grapple is

used to transfer the canisters to a handling cart for movement to the air-lock and into the cell. An 18 ft. high, double door provides access to this warehouse area.

2.3 MODIFICATION OF EXISTING FACILITIES

For the purposes of determining the likely cost of dry storage of spent fuel in FIS facilities at a government site which has an existing hot cell it was assumed that all of the activities described in Sections 2.1 and 2.2 could be performed in the hot cell with certain additions and modifications. It was also assumed that other existing facilities were available to washdown incoming casks to remove road dirt prior to unloading in the hot cell.

The hot cell was assumed to be 50 ft. wide, 160 ft. long and 55 ft. high. It is equipped with a 150/15-ton crane (15-ton auxiliary hoist on same trolley) with a hook height of 50 ft. It has a bridge mounted, overhead heavy duty manipulator with an elbow capacity of 5000 pounds, a manipulator capacity of 600 pounds, and a hook height of 28 ft. In addition the cell is equipped with two wall-mounted manipulators with a 28 ft. reach and a 27 ft. hook height. The cell is shielded with 7-ft. thick, reinforced concrete and has lead-glass viewing windows at two operating elevations on both sides of the cell length. The manipulators could be used in the welding operation but the hook height is insufficient for lifting spent fuel or loaded canisters to or from casks. The hot cell is supported by HVAC equipment, radiation alarms, laboratories for checking activity levels of smear samples, and radwaste processing facilities to handle decontamination solutions.

Any existing special test equipment in the hot cell would need to be removed or stored out of the way and the hot cell totally dedicated to the receiving, canning, and/or transfer of spent reactor fuel during the period that fuel is received for storage, and when it is being removed from storage. The modifications assumed to be required include the following:

- (1) installation of CCTV on the cranes, overhead manipulators and in the cell to provide close-up viewing of operations
- (2) construction of cask support structures in the cell to prevent the casks from falling from the vertical position during operations

- (3) procurement and installation of a modified metal storage cask for lag storage of loaded canisters prior to their placement in drywells or silos, and of two standard storage casks for lag storage of spent fuel unloaded from shipping casks (since radioactive material contained in the cell will need to be enclosed in shielded containers prior to introducing or removing items from the cell)
- (4) construction of racks for all cask heads including those from storage casks that will need to be used for lag storage
- (5) installation of welding and testing equipment described in Section 2.2 for the canistering of spent fuel assemblies
- (6) installation of a conveyor for canister lids and a rack for new canisters.

It was assumed the cell cranes and manipulators are usable without modification.

The handling procedure at the existing hot cell was assumed to differ from a new FIS transfer facility. The vehicles (trucks) bringing the casks to the existing hot cell are assumed to move directly into and out of the cell through shielded, air-lock doors. The cask tie-downs, personnel barriers, and impact limiters are removed. The trunnions are engaged with a yoke using the 150-ton bridge crane. The cask is lifted clear of the vehicle and rotated to a vertical position. It is then moved to a special cask holder where it is locked in place to prevent tipping during unloading or from any seismic activity. This holder also serves as a scaffold for worker access to the top of the cask to remove head bolts and attach head lifting slings. The outer head is removed and stored and the inner head bolts removed. REA storage casks are placed in similar cask holders with their inner heads in place to shield any fuel assemblies transferred previously. The operators vacate the cell and the cell door is closed so that remote unloading can be conducted. The inner heads of the transport and storage casks are removed and the fuel is transferred from the shipping cask to the storage cask. Where fuel is to be sealed in canisters, three REA casks are used for surge storage; one for PWR fuel, one for BWR fuel and one for canistered assemblies. When canisters are to be moved to silos or drywells, a mobile transporter is used to bring the silo or transfer cask into the cell for loading.

It was also assumed for the purposes of this study that a separate storage area would be provided for the storage of modules at a government site having existing transfer facilities.

2.4 ESTIMATED COSTS

Estimates were made of the capital costs of new transfer and encapsulation facilities required for the FIS of spent fuel at a government site having no such facilities. A summary of these estimated costs is set forth in Table A2-1 for each of the three methods of dry storage considered.

TABLE A2-1
ESTIMATED CAPITAL COSTS OF NEW TRANSFER AND ENCAPSULATION FACILITIES
(\$000, 1985)

	<u>Capital Costs</u>		
	<u>Storage Cask</u>	<u>Drywell</u>	<u>Silo</u>
Site Preparation	\$ 12	\$ 12	\$ 12
Structures	7,269	7,269	7,269
Equipment	3,763	4,556	4,562
Equipment Installation (35% of equipment cost)	<u>1,317</u>	<u>1,595</u>	<u>1,597</u>
	12,361	13,432	13,440
Engineering (15%)	1,854	2,015	2,016
Licensing	<u>852</u>	<u>852</u>	<u>852</u>
	15,067	16,299	16,308
Contingency (35%)	<u>5,274</u>	<u>5,705</u>	<u>5,708</u>
Total	<u>\$20,341</u>	<u>\$22,004</u>	<u>\$22,016</u>

Estimates were also made of the cost of additions and modifications to the existing hot cell which are required to transfer and encapsulate spent fuel. A summary of these estimated costs is set forth in Table A2-2 for each of the three methods of dry storage considered.

TABLE A2-2
ESTIMATED COSTS OF ADDITIONS AND MODIFICATIONS TO AN EXISTING
HOT CELL FOR TRANSFER AND ENCAPSULATION OF SPENT FUEL
(\$000, 1985)

	<u>Capital Costs</u>		
	<u>Storage Cask</u>	<u>Drywell</u>	<u>Silo</u>
Equipment	\$ 960	\$ 4,212	\$ 4,223
Equipment Installation (35% of equipment cost)	336	503 ^a	506 ^a
	1,296	4,715	4,729
Engineering (15%)	194	707	709
Safety Review	389	389	389
	1,879	5,811	5,827
Contingency (35%)	658	2,034	2,040
Total	<u>\$ 2,537</u>	<u>\$ 7,845</u>	<u>\$ 7,867</u>

^a assumes no installation cost for metal storage casks used for lag storage

3.0 STORAGE CASKS

3.1 DESCRIPTION

The use of storage casks, which may or may not be licensed for transportation over the road, for the storage of spent fuel offer an attractive option in common with the drywell and silo modes, in that it permits the addition of storage capacity in small increments as increased capacity is required. The casks offer an additional advantage of providing capability for on-site transportation of spent fuel with the possible future prospect of serving as off-site shipping containers.

Three different casks were considered for use in the FIS system: a cask designed and built by Ridihalgh, Eggers and Associates, Inc. (the REA 2023 cask), a cask based on modification of existing casks designed and built by the Transnuclear group (TN-24 cask) and a cask designed and built by GNS, a German company (CASTOR-V). The REA cask has a steel structure and lead shielding, the Transnuclear cask is constructed of forged steel, and the GNS cask is fabricated from nodular cast iron. One REA-2023 cask has been built for the Department and is undergoing hot testing. The first TN-24 cask has not yet been built but the topical report therefor was submitted to NRC in early 1984. Two Castor-V casks have been built; one for use in Russia and one for testing to establish that it meets NRC licensing requirements. The latter tests are expected to be conducted in 1984, and GNS expects NRC approval of the use of this cask by the end of 1984. In view of the fact that licensing and testing activities are in a somewhat further advance state than for the other two casks, the REA-2023 was selected as the storage cask for use in developing the charges for FIS in storage casks.

A diagram of the REA-2023 cask for BWR fuel is shown in Figure A3-1. It will store 52 BWR assemblies that have been cooled at least 5 years after removal from the reactor. This cask weighs 95 tons, is 87.5 in. in diameter and 192.6 in. long. According to design data, the cask will limit the fuel clad temperature to 250°C , at a decay heat of 0.4 kW/assembly, and will produce a surface radiation dose rate of 20 mRem/hr based on a gamma source of 9.0×10^{16} photons/sec-cask and a neutron source of 3.9×10^9 neutrons/sec-cask.

FIGURE A3-1
REA-2023 CASK FOR SPENT FUEL STORAGE (BWR)

A similar REA-2023 cask for PWR fuel will store 24 PWR assemblies (5-year cooled). The PWR cask is 93 in. in diameter, 182 in. long and weighs 97 tons. It is also designed to limit the fuel clad temperature to 250°C at a decay heat of 1 kW/assembly, and permit a surface radiation dose rate of 20 mRem/hr based on a gamma source of 9.5×10^{16} photons/sec-cask and a neutron source of 3.3×10^9 neutrons/sec-cask.

The REA casks are designed and constructed for double-containment with a final welded closure. The various components include a smooth stainless steel clad lead gamma shield, water/glycol neutron shield, and a basket with BORAL neutron absorbing plates. The primary containment vessel is stainless steel, designed in accordance with the ASME Boiler and Pressure Vessel Code.

Each cask is procured with a mounting skid that can be moved with the cask onto a storage area pad, eliminating the need for special cradles.

3.2 ESTIMATED COST

Based upon previous manufacturer's quotes which were made on a f.o.b. Canton, Ohio basis, the 1985 cost of the REA cask was estimated to be \$816,450, and the storage skid \$19,050. Freight costs to both the Eastern U.S. site and the Western U.S. site have been estimated to amount to \$14,000 and \$32,700, respectively. Therefore, the total costs of the REA cask when used at an Eastern U.S. site is about \$850,000 and is about \$868,000 when used at a Western U.S. site.

4.0 DRYWELLS

4.1 DESCRIPTION

Storage of spent fuel in drywells just below grade is an alternative method of interim storage. The drywells are placed on a grid within a fenced storage area. Each drywell, when loaded and the liner welded closed, provides a sealed, secondary containment for canistered spent fuel assemblies.

A schematic drawing of the drywell design used in this study is set forth in Figure A4-1. The drywell liner consists of a schedule 40 steel pipe which is 16 ft., 6 in. long and has an outside diameter of 16 in. A 1/2-in. thick plate is welded into the base of the pipe to form the bottom of the liner. A 1/2-in. thick transition ring is welded to the top of the 16 in. liner. The base of a concentric 5 ft. long, schedule 40 steel pipe, with a 20-in. outside diameter is then welded to the transition ring. The top of the 20-in. diameter pipe is machined to permit a seal plate of 1/2-in. thick steel to be inserted in a recess for welding. The transition ring provides a ledge to support the 48-in. long concrete shield plug. The liner is surrounded by 3 in. of grout on the sides and an 8-in. grout plug underneath. A 5-ft. diameter concrete collar, 20 in. thick surrounds the top of the liner and is tapered to 2 in. above grade level at the drywell liner to assure positive drainage of any surface water. A 1/2-in. thick steel cover is welded to the top of the liner after a canister of fuel is loaded therein and the concrete plug is in place. Each drywell will contain one canister of spent fuel. The top of the active fuel rods is 8-10 ft. below grade level with the canister in place. The surrounding earth serves as a radiation barrier as well as conductor of heat from the drywell.

4.2 ESTIMATED COST

The cost of the drywells described in Section 4.1 was estimated to be \$20,990 (1985 dollars). Therefore, the total cost of the drywell assembly, including the canisters described in Section 1.0, is estimated to be \$25,920.

FIGURE A4-1
SCHEMATIC DIAGRAM OF DRYWELL

5.0 CONCRETE SILOS

5.1 DESCRIPTION

Another alternative is the storage of spent fuel in concrete silos above ground. The silos are placed in rows on concrete stands within a fenced storage area. Each silo, when loaded and the liner welded closed, provides a sealed secondary containment for canistered spent fuel assemblies.

A schematic drawing of the silo design developed in this study is shown in Figure A5-1. A silo is a reinforced concrete structure 10 ft. in diameter and 23 ft. high. It has an inside cavity which is 45 in. in diameter and is lined with 1/4-in. steel that also serves as an inside form for pouring the structure. A 2-ft. high pedestal is located in the center of the cavity to support a secondary containment liner. This liner is 36 in. in diameter (outside) and has a 1/2-in. wall thickness. The bottom segment of the liner is 17 ft. long; at the top it is welded to the upper segment which is 39-in. diameter (inside) and 3 ft. long. The upper segment of the liner passes through the upper cavity of the silo structure and receives a 4-ft. long concrete plug to effect the closure of the liner cavity. After loading of the silo with canisters of spent fuel and insertion of the plug in the upper segment of the liner, a steel lid is welded on the top of the upper liner cavity to effect the double containment of the fuel. A cruciform spacer is provided for the lower liner cavity to position the canisters of spent fuel contained within. Each silo is capable of storing 4 canisters of spent fuel (4 PWR assemblies or 8 BWR assemblies). The loaded silo weighs about 125 tons.

5.2 ESTIMATED COST

The cost of the silos described in Section 5.1 was estimated to be \$105,679 (1985 dollars). Therefore, the total cost of the silo assembly, including four of the canisters described in Section 1.0, is estimated to be \$125,399.

FIGURE A5-1
 CONCRETE STORAGE SILO

6.0 STORAGE FACILITY COSTS

6.1 CASK STORAGE FACILITIES

The storage of spent fuel in storage casks requires a storage area with concrete stands to support the casks and a transporter to move the loaded cask to the storage area. Storage stands are added as required.

The storage cask area is a graded area with concrete stands 10 ft. wide and 18 ft. long made of 18-in. thick reinforced concrete and includes a 300 ft. long and 30 ft. wide paved road between the transfer facility and the storage area. Casks are brought to the storage area by a transporter. The casks, on their skids, are placed end-to-end in two parallel rows on the concrete stands which are separated 10 ft. apart. On each side of each pair of rows is a 30 ft. access driveway to permit easy access to each cask in its storage location. A 50 ft. buffer zone is provided around the perimeter of the concrete pad and is surrounded by an 8 ft. high chain link security fence topped with 3 strands of barbed wire. The bottom of the fence is anchored in concrete. A microwave security system is used to monitor the perimeter of the storage area, and the area is lighted. A security gate permits access of the transporter and inspection personnel to the storage area.

The transporter used to move the storage casks from the transfer facility to the storage area consists of a commercially available straddle crane having a 150-ton lift capacity, which is modified by the addition of a strongback and yoke. The cask is first lifted from the receiving carrier in a horizontal position and rotated to the vertical. After loading the cask with spent fuel and sealing the heads, it is lifted by the transporter, rotated to horizontal, and placed on its skid. After securing the cask to its skid, the cask/skid unit is lifted and moved to the storage area. When fully loaded, the speed of the transporter is limited to 60-100 ft. per minute. The straddle crane is mounted on dual rubber tires on all four corners and is driven by a diesel engine. It can operate on both gravel and paved roads, and can negotiate grades up to 6%. It has the capability of making a 90° turn. The wheel base, tread width and clear height are easily modified from standard equipment sizes by removing or adding structural sections to customize the unit to handle the storage casks.

6.2 DRYWELL STORAGE FACILITIES

The storage of canistered spent fuel in drywells requires a storage area, drywells, and handling equipment to transfer canisters to the drywells. This equipment includes a top loading/bottom discharge transfer cask, a plug cask, a shielded seal valve, transport vehicles, a portable welder for sealing each drywell, and a 1/2-ton hydraulic hoist to lift and move the drywell cover. Drywells are added as required.

The drywell storage area is a graded area with 6 in. of compacted gravel between the drywells which are constructed on approximately 19 ft. centers. The storage area is connected to the transfer facility by a 300 ft. long and 30 ft. wide paved road. A 50 ft. buffer zone is provided around the perimeter of the storage area and is surrounded by an 8 ft. high chain link security fence topped by 3 strands of barbed wire. The bottom of the fence is anchored in concrete. A microwave security system is used to monitor the perimeter of the storage area, and the area is lighted. A security gate permits access of the transporters and inspection personnel to the storage area.

The canisters of spent fuel are moved to the storage area in a transfer cask. This cask is a modified NFS-4 type cask with the length extended to accommodate the 188-in. long canisters and equipped with a shielded, manually operated valve on the bottom end with a mating surface to fit into the shield valve at the drywell. The top of the cask has an easily removable head with an integral electrically operated winch to raise and lower the canisters. The transfer cask head is brought into the hot cell, positioned over the canister storage rack, and a canister is grappled and lifted by the winch up to the head. The canister and head are lowered by the cell crane into the cask until the cask head mates with the cask. The head is clamped or bolted in place and the transfer cask is picked up vertically by the transporter, moved to a designated drywell, and mated with the shield valve.

Both the valve in the bottom of the transfer cask and the shield valve are opened and the spent fuel canister is lowered into the drywell. After the retraction of the cable, both of the valves are closed and the transfer cask is returned to the transfer facility. A smaller cask containing the drywell plug is then positioned over the shield valve and mated. Both the

valve in the bottom of the plug cask and the shield valve are then opened and the plug is lowered into the top of the drywell cavity. After retraction of the cable, the plug cask and the shield valve are lifted together and moved to the next empty drywell position. The cable from the plug cask is lowered to engage the pintle on the plug and the plug is withdrawn into the plug cask. Both the valve on the bottom of the plug cask and the shield valve are then closed and the plug cask is removed. The above process is then repeated.

After loading of each drywell, a steel cover is placed on the top of the drywell and is welded to the top of the drywell liner.

Two transporters are used to move the storage casks and the plug cask/shield valve. Both consist of commercially available straddle cranes having a 60-ton lift, and which are modified with a special strongback. The speed of these transporters is limited to 130 ft. per minute. The straddle crane is mounted on single rubber tires on all four corners and is driven by a gasoline engine. It can operate on both gravel and paved roads and can negotiate grades up to 6%. It has the capability of making a 90° turn.

In the case of a drywell storage facility having a 1500 MTU or greater storage capacity, two sets of transfer casks, plug casks, shield valves and their respective transporters are required.

6.3 SILO STORAGE FACILITIES

The storage of canistered spent fuel in concrete silos requires a storage area with concrete stands to support the silos and a transporter to move the loaded silo from the transfer facility to a storage pad. Storage stands are added as required.

The silo storage area is a graded area with 6 in. of compacted gravel between the reinforced concrete silo storage stands. Each storage stand is a 16-in. thick, reinforced concrete slab 16 ft. wide by 32 ft. long which provides storage space for 2 silos. The stands are spaced 10 ft. apart in rows with a 25 ft. spacing (roadway) between each row of stands. The storage area is connected to the transfer facility by a 300 ft. long and 30 ft. wide paved road. A 50 ft. buffer zone is provided around the perimeter of the storage area and is surrounded by a 8 ft. high chain link security fence topped with 3 strands of barbed wire. The bottom of the fence is anchored in concrete. A microwave security system is used to monitor the perimeter of the

storage area and the area is lighted. A security gate permits access of the transporter and inspection personnel to the storage area. A transporter similar to that described for cask storage is used to transport the loaded silos from the transfer facility to the concrete stands in the storage area.

6.4 ESTIMATED COSTS

Estimates were made of the capital cost of the storage area facilities required for the six levels of capacity considered for each dry storage method addressed in this study. A listing of these costs is set forth in Table A6-1 for government facilities which have existing transfer facilities and for those without such facilities.

TABLE A6-1
ESTIMATED INITIAL CAPITAL COSTS FOR STORAGE AREA FACILITIES^a
(\$000, 1985)

Capacity	Storage Method					
	Storage Cask		Drywell		Silo	
	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities
50 MTU	\$2,016	\$1,811	\$5,707	\$5,503	\$2,634	\$2,431
100 MTU	2,050	1,846	5,843	5,639	2,808	2,604
300 MTU	2,161	1,957	6,284	6,081	3,431	3,228
800 MTU	2,392	2,188	7,233	7,029	4,856	4,653
1500 MTU	2,694	2,492	8,454	8,252	6,777	6,573
1900 MTU	2,862	2,660	9,129	8,926	7,853	7,650

^aStorage area facilities at a site with existing transfer facilities include a security guard house; in the case of a new transfer facility the guard house was included in the cost of the transfer facility.

7.0 OPERATING COSTS FOR FIS SYSTEM

7.1 LOADING, STORAGE AND REMOVAL

Estimates were made of the cost of operation of the FIS system for spent fuel storage at the six capacity levels considered for each dry storage method addressed in this study, and for both government sites which have no existing transfer facilities and those which do.

A listing of the total annual operating costs of FIS facilities during the years in which spent fuel is being loaded into or removed therefrom is set forth in Table A7-1 for each of the cases studied. A listing of the total annual operating costs during the years in which storage-only takes place is set forth in Table A7-2 for each of the cases studied.

TABLE A7-1
ESTIMATED ANNUAL OPERATING COSTS FOR TRANSFER FACILITIES AND STORAGE FACILITIES
DURING LOADING AND REMOVAL OPERATIONS
(\$D00, 1985)

Capacity	Storage Method					
	Storage Cask		Drywell		Silo	
	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities
50 MTU	\$1,784	\$1,875	\$1,953	\$2,025	\$1,865	\$1,937
100 MTU	1,850	1,941	2,080	2,153	1,977	2,049
300 MTU	2,109	2,201	2,596	2,668	2,326	2,399
800 MTU	2,884	2,975	3,999	4,071	3,563	3,635
1500 MTU	4,071	4,162	6,115	6,187	4,928	5,000
1900 MTU	4,746	4,837	7,326	7,398	5,705	5,778

TABLE A7-2
ESTIMATED ANNUAL OPERATING COSTS FOR STORAGE FACILITIES
AT GOVERNMENT SITE DURING STORAGE ONLY PERIOD
(\$000, 1985)

Capacity	Storage Method					
	Storage Cask		Drywell		Silo	
	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities
50 MTU	\$ 944	\$1,824	\$1,098	\$1,899	\$1,037	\$1,854
100 MTU	968	1,850	1,118	1,919	1,058	1,873
300 MTU	1,065	1,942	1,188	1,995	1,143	1,957
800 MTU	1,301	2,286	1,365	2,185	1,355	2,409
1500 MTU	1,635	2,877	1,649	2,822	1,651	2,858
1900 MTU	1,824	3,213	1,812	3,187	1,822	3,114

7.2 DECONTAMINATION AND DECOMMISSIONING

In addition to the operating costs listed in Tables A7-1 and A7-2 for the various methods of storage considered, the cost of decontamination and decommissioning of the storage facilities at the end of their useful life was estimated. These costs were assumed to amount to 20 percent of the capital cost of transfer facilities, storage area facilities and storage modules. In the case of storage at a government site which has existing transfer facilities, only the capital cost of additions and modifications to the facilities were included in the calculation inasmuch as it was reasoned that the existing facilities would otherwise have had to be decommissioned by the government in the absence of the FIS system.

8.0 OTHER ASSOCIATED STORAGE COSTS

8.1 GOVERNMENT ADMINSTRATIVE COSTS

An estimated allowance for government administrative costs associated with the FIS program was developed which assumed that the Department's administration of the program would be handled by a Program Manager assisted to the extent necessary by another program person, an accountant, and a clerical person. The following Table A8-1 sets forth the total estimated annual costs for this administrative activity including storage fund management.

TABLE A8-1
ESTIMATED ANNUAL COSTS FOR GOVERNMENT ADMINISTRATION ASSOCIATED
WITH FEDERAL INTERIM STORAGE
(\$D00, 1985)

	<u>Total Capacity of FIS Facilities</u>					
	<u>50</u> <u>MTU</u>	<u>100</u> <u>MTU</u>	<u>300</u> <u>MTU</u>	<u>800</u> <u>MTU</u>	<u>1,500</u> <u>MTU</u>	<u>1,900</u> <u>MTU</u>
Annual Total	\$125	\$212	\$327	\$519	\$727	\$828

8.2 FIS DEVELOPMENT COSTS

The Act provides that the Department may establish a research and development program for the dry storage of up to 300 MTU of spent fuel at facilities owned by the government (Sec. 218(c)), that the total contributions from Federal funds shall not exceed 25 percent of the program costs (Sec. 218(d)), and that the remaining costs of such program shall be paid for by the utilities involved or shall be provided from the interim storage fund (Sec. 218(d)). For the purposes of this study, it has been assumed that all of the costs in excess of the contribution of 25 percent of the program costs from Federal funds will be borne by the utility involved in the research and development program and, therefore, none of the costs associated with the program will be included in the fee for FIS.

However, the Act provides that funds required for the development of FIS facilities may be obtained from the storage fund (Sec. 136(d)(1)) and, therefore, will have to be included in the calculation of the fee for FIS in order to allow the Department to realize recovery of costs incurred in connection with FIS activities, as provided in Sec. 136(f)(6) of the Act. It is estimated that the costs associated with the development of the FIS program will amount to about \$3-million and will be incurred in accordance with the following estimated schedule of expenditures:

<u>Year</u>	<u>Amount</u> <u>(\$000, 1985)</u>
1985	\$ 500
1986	1,000
1987	1,000
1988	<u>500</u> (half year)
Total	<u>\$3,000</u>

8.3 IMPACT AID

The cost of impact aid was estimated on the following basis:

- (1) Impact aid will commence at the beginning of CY-1985 and will be terminated at the end of CY-2001.
- (2) The total impact aid will amount to the lesser of the following alternatives:
 - (a) 10% of the total cost of establishing and operating the FIS system -- including all capital, operating and decommissioning costs of the storage facilities involved, plus a pro rata share of research and development, government administration and trust fund management, but will exclude the cost of shipping.
 - (b) \$15/kgU contained in the spent fuel stored.

- (3) A significant level of impact aid will be needed by the recipients during the period 1985 to mid-1988 due to construction and the need of local jurisdictions to become familiar with the storage activity. Therefore, one-third of the total aid has been included in the Initial Payment.
- (4) The final two-thirds of the impact aid has been included in the final payment.

9.0 TOTAL COST OF FIS STORAGE

The total cost associated with FIS storage was computed for each combination of storage method, capacity and location which was studied using the applicable elements of cost developed in Sections 1.0 through 8.0 of this Exhibit A, and an estimated annual spending schedule (in 1985 dollars) was developed for each such case. The annual costs which were estimated to be incurred prior to the startup of the FIS system (the component to be included in the Initial Payment) and the annual costs which were estimated to be incurred after startup through decommissioning (the component to be included in the Final Payment) were separately discounted to 1985 at a discount rate of 2%/year. This discount rate represented the net discount rate resulting from a value of money to the government of 10.06%/year (the average interest rate over the 7-year period 1977-1983, inclusive, of U.S. Treasury notes and bonds having maturities of 10-years and over), and an escalation rate of 7.93%/year (which is the average annual increase for the period 1976-1983 of the weighted average the ENR Construction Index (50%), the Average Hourly Earnings of Production Workers and Manufacturing Payrolls (25%), and the Wholesale Price Index for Industrial Commodities (25%)).

The Initial Payments were calculated by equating the total discounted costs estimated to be incurred prior to startup of the FIS system and the discounted revenues (which are equal to the discounted quantities times a uniform unit cost) and solving the equality for the unknown value, i.e., the unit cost. Since the Initial Payment is assumed to be made in 1985 for all spent fuel to be stored, the revenues would be as follows:

<u>Capacity of FIS Storage (MTU)</u>	<u>Revenues</u>
50	\$ 50 P_1
100	100 P_1
300	300 P_1
800	800 P_1
1500	1,500 P_1
1900	1,900 P_1

where P_1 is the unit cost (or Initial Payment)

The Final Payments were similarly calculated using the discounted total costs estimated to be incurred after startup of the FIS system and the discounted revenues set forth in Table A9-1.

TABLE A9-1
ANNUAL AND DISCOUNTED REVENUES RECEIVED FROM FINAL PAYMENTS FOR FIS SERVICES^a

Year	Capacity											
	50 MTU		100 MTU		300 MTU		800 MTU		1500 MTU		1900 MTU	
	Rev.	Disc. To 1985 @ 2% / Yr	Rev.	Disc. To 1985 @ 2% / Yr	Rev.	Disc. To 1985 @ 2% / Yr	Rev.	Disc. To 1985 @ 2% / Yr	Rev.	Disc. To 1985 @ 2% / Yr	Rev.	Disc. To 1985 @ 2% / Yr
1988	\$ 8 P ₂	\$ 7.5 P ₂	\$ 17 P ₂	\$ 16.0 P ₂	\$ 50 P ₂	\$ 47.1 P ₂	\$ 133 P ₂	\$ 125.3 P ₂	\$ 250 P ₂	\$ 235.6 P ₂	\$ 317 P ₂	\$ 298.7 P ₂
1989	\$ 17 P ₂	15.7 P ₂	33 P ₂	30.5 P ₂	100 P ₂	92.4 P ₂	267 P ₂	246.7 P ₂	500 P ₂	461.9 P ₂	633 P ₂	584.8 P ₂
1990	17 P ₂	15.4 P ₂	33 P ₂	29.9 P ₂	100 P ₂	90.6 P ₂	267 P ₂	241.8 P ₂	500 P ₂	452.9 P ₂	633 P ₂	573.3 P ₂
1991	8 P ₂	7.1 P ₂	17 P ₂	15.1 P ₂	50 P ₂	44.4 P ₂	133 P ₂	118.1 P ₂	250 P ₂	222.0 P ₂	317 P ₂	281.5 P ₂
Total	\$50 P ₂	\$45.7 P ₂	\$100 P ₂	\$91.5 P ₂	\$300 P ₂	\$274.5 P ₂	\$800 P ₂	\$731.9 P ₂	\$1500 P ₂	\$1372.4 P ₂	\$1900 P ₂	\$1738.3 P ₂

^a Assumes revenues received in first three years after startup on a uniform basis
P₂ = Final Payment

The estimated spending schedules, discounted annual costs and the calculation of the Initial and Final Payments for FIS of spent fuel for each of the cases studied are set forth in Tables A9-2 through A9-37.

TABLE 2

ESTIMATED SPENDING SCHEDULE FOR TREATMENT PLANT (50 MTU)
AT GOVERNMENT SITE, LITTLE ROCK, AR
(1985-2001)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODUL COSTS	OPERAT COSTS	DEVEL COSTS	ADJ COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3308	993					4926	4926
1986	230	133					1488	1459
1987	8459	376					9960	9573
1988	8344	309	703				10939	10308
1989			1447				3447	3184
1990			1447				3447	3122
1991			202				2598	2396
1992							1949	1697
1993							1949	1663
1994							1949	1631
1995							1949	1599
1996							1949	1568
1997							1949	1537
1998							2000	1546
1999							2000	1516
2000							2000	1486
2001							5423	3950
TOTAL	20341	1811	4340				60022	53161

* - Decommissioning cost

Initial Payment = \$1,000,000 (50 KgU impact aid)

Final Payment = \$5,423,000 (50 KgU impact aid)

TABLE 3

ESTIMATED SPENDING SCHEDULE FOR TREATMENT PLANT (100 MTU)
AT GOVERNMENT SITE, LITTLE ROCK, AR
(1985-2001)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODUL COSTS	OPERAT COSTS	DEVEL COSTS	ADJ COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3308	993					5018	5018
1986	230	133					1575	1544
1987	8459	351					10062	9671
1988	8344	276					11798	11118
1989			1147				5046	4662
1990			1147				5046	4570
1991			202				3555	3157
1992							2062	1795
1993							2062	1760
1994							2062	1725
1995							2062	1692
1996							2062	1658
1997							2062	1626
1998							2153	1664
1999							2153	1632
2000							2153	1600
2001							6385	4651
TOTAL	20341	1846	5090				67316	59543

* - Decommissioning cost

Initial Payment = \$1,000,000 (100 KgU impact aid)

Final Payment = \$6,385,000 (100 KgU impact aid)

TABLE A9-4

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 29 CASKS (300 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3308	1012			500	327	5147	5147
1986	230	133			1000	327	1690	1657
1987	8459	439			1000	327	10225	9828
1988	8344	373	4195	1101	500	327	14840	13984
1989			8391	2201		327	10919	10087
1990			8391	2201		327	10919	9890
1991			4195	2072		327	6594	5855
1992				1942		327	2269	1975
1993				1942		327	2269	1937
1994				1942		327	2269	1899
1995				1942		327	2269	1861
1996				1942		327	2269	1825
1997				1942		327	2269	1789
1998				2201		327	2528	1954
1999				2201		327	2528	1916
2000				2201		327	2528	1878
2001				9494*		327	9821	7154
TOTAL	20341	1957	25172	35324	3000	5559	91353	80636

* - Decommissioning cost

Initial Payment = 90 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 211 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-5

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 76 CASKS (800 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3308	1042			500	519	5369	5369
1986	230	133			1000	519	1882	1845
1987	8459	540			1000	519	10518	10110
1988	8344	473	10995	1488	500	519	22319	21032
1989			21989	2975		519	25483	23542
1990			21989	2975		519	25483	23081
1991			10995	2631		519	14145	12560
1992				2286		519	2805	2442
1993				2286		519	2805	2394
1994				2286		519	2805	2347
1995				2286		519	2805	2301
1996				2286		519	2805	2256
1997				2286		519	2805	2212
1998				2975		519	3494	2701
1999				2975		519	3494	2648
2000				2975		519	3494	2596
2001				17699*		519	18218	13271
TOTAL	20341	2188	65968	50409	3000	8823	150729	132707

* - Decommissioning cost

Initial Payment = 38 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 155 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-6

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 143 CASKS (1500 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3308	1082			500	727	5617	5617
1986	230	133			1000	727	2090	2049
1987	8459	672			1000	727	10858	10436
1988	8344	605	20687	2081	500	727	32944	31044
1989			41375	4162		727	46264	42741
1990			41375	4162		727	46264	41903
1991			20687	3520		727	24934	22141
1992				2877		727	3604	3137
1993				2877		727	3604	3076
1994				2877		727	3604	3016
1995				2877		727	3604	2957
1996				2877		727	3604	2899
1997				2877		727	3604	2842
1998				4162		727	4889	3779
1999				4162		727	4889	3705
2000				4162		727	4889	3633
2001				29391*		727	30118	21939
TOTAL	20341	2492	124124	73064	3000	12359	235380	206914

* - Decommissioning cost

Initial Payment = 23 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 141 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-7

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 181 CASKS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3308	1104			500	828	5740	5740
1986	230	133			1000	828	2191	2148
1987	8459	745			1000	828	11032	10604
1988	8344	678	26185	2419	500	828	38954	36707
1989			52369	4837		828	58034	53614
1990			52369	4837		828	58034	52563
1991			26185	4025		828	31038	27561
1992				3213		828	4041	3518
1993				3213		828	4041	3449
1994				3213		828	4041	3381
1995				3213		828	4041	3315
1996				3213		828	4041	3250
1997				3213		828	4041	3186
1998				4837		828	5665	4379
1999				4837		828	5665	4293
2000				4837		828	5665	4209
2001				36022*		828	36850	26843
TOTAL	20341	2660	157108	85929	3000	14076	283114	248760

* - Decommissioning cost

Initial Payment = 20 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 137 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-8

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 118 DRYWELLS (50 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	1675			500	125	5825	5825
1986	230	143			1000	125	1498	1469
1987	9182	1878			1000	125	12185	11712
1988	9067	1807	510	1013	500	125	13022	12271
1989			1020	2025		125	3170	2929
1990			1020	2025		125	3170	2871
1991			510	1962		125	2597	2306
1992				1899		125	2024	1762
1993				1899		125	2024	1727
1994				1899		125	2024	1694
1995				1899		125	2024	1660
1996				1899		125	2024	1628
1997				1899		125	2024	1596
1998				2025		125	2150	1662
1999				2025		125	2150	1629
2000				2025		125	2150	1597
2001				6113*		125	6238	4544
TOTAL	22004	5503	3060	30607	3000	2125	66299	58882

* - Decommissioning cost

Initial Payment = 601 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 646 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-9

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	1693			500	212	5930	5930
1986	230	143			1000	212	1585	1554
1987	9182	1937			1000	212	12331	11852
1988	9067	1866	1020	1077	500	212	13742	12949
1989			2039	2153		212	4404	4069
1990			2039	2153		212	4404	3989
1991			1020	2036		212	3268	2902
1992				1919		212	2131	1855
1993				1919		212	2131	1819
1994				1919		212	2131	1783
1995				1919		212	2131	1748
1996				1919		212	2131	1714
1997				1919		212	2131	1680
1998				2153		212	2365	1828
1999				2153		212	2365	1792
2000				2153		212	2365	1757
2001				6752*		212	6964	5073
TOTAL	22004	5639	6118	32144	3000	3604	72509	64294

* - Decommissioning cost

Initial Payment = 307 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 383 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-10

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 707 DRYWELLS (300 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	1751			500	327	6103	6103
1986	230	143			1000	327	1700	1667
1987	9182	2129			1000	327	12638	12147
1988	9067	2058	3054	1334	500	327	16340	15398
1989			6108	2668		327	9103	8410
1990			6108	2668		327	9103	8245
1991			3054	2332		327	5713	5073
1992				1995		327	2322	2021
1993				1995		327	2322	1982
1994				1995		327	2322	1943
1995				1995		327	2322	1905
1996				1995		327	2322	1867
1997				1995		327	2322	1831
1998				2668		327	2995	2315
1999				2668		327	2995	2270
2000				2668		327	2995	2225
2001				9282*		327	9609	7000
TOTAL	22004	6081	18324	38258	3000	5559	93226	82402

* - Decommissioning cost

Initial Payment = 108 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 197 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-11

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 1886 DRYWELLS (800 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	1874			500	519	6418	6418
1986	230	143			1000	519	1892	1855
1987	9182	2542			1000	519	13243	12729
1988	9067	2470	8148	2036	500	519	22740	21428
1989			16295	4071		519	20885	19295
1990			16295	4071		519	20885	18916
1991			8148	3128		519	11795	10474
1992				2185		519	2704	2354
1993				2185		519	2704	2308
1994				2185		519	2704	2263
1995				2185		519	2704	2218
1996				2185		519	2704	2175
1997				2185		519	2704	2132
1998				4071		519	4590	3548
1999				4071		519	4590	3479
2000				4071		519	4590	3410
2001				15584*		519	16103	11730
TOTAL	22004	7029	48886	54213	3000	8823	143955	126732

* - Decommissioning cost

Initial Payment = 46 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 139 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-12

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 3535 DRYWELLS (1500 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	2034			500	727	6786	6786
1986	230	143			1000	727	2100	2059
1987	9182	3073			1000	727	13982	13439
1988	9067	3002	15271	3094	500	727	31661	29835
1989			30542	6187		727	37456	34604
1990			30542	6187		727	37456	33925
1991			15271	4505		727	20503	18206
1992				2822		727	3549	3090
1993				2822		727	3549	3029
1994				2822		727	3549	2970
1995				2822		727	3549	2911
1996				2822		727	3549	2854
1997				2822		727	3549	2798
1998				6187		727	6914	5345
1999				6187		727	6914	5240
2000				6187		727	6914	5137
2001				24376*		727	25103	18286
TOTAL	22004	8252	91626	79842	3000	12359	217083	190514

* - Decommissioning cost

Initial Payment = 28 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 123 \$/KgU (Includes \$9/KgU impact aid)

TABLE A9-13

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	2122			500	828	6975	6975
1986	230	143			1000	828	2201	2158
1987	9182	3366			1000	828	14376	13818
1988	9067	3295	19345	3699	500	828	36734	34615
1989			38690	7398		828	46916	43343
1990			38690	7398		828	46916	42493
1991			19345	5293		828	25466	22613
1992				3187		828	4015	3495
1993				3187		828	4015	3427
1994				3187		828	4015	3360
1995				3187		828	4015	3294
1996				3187		828	4015	3229
1997				3187		828	4015	3166
1998				7398		828	8226	6359
1999				7398		828	8226	6234
2000				7398		828	8226	6112
2001				29400*		828	30228	22019
TOTAL	22004	8926	116070	94504	3000	14076	258580	226710

* - Decommissioning cost

Initial Payment = 23 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 119 \$/KgU (Includes \$9/KgU impact aid)

TABLE A9-14

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 30 SILOS (50 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3527	1420			500	125	5572	5572
1986	230	143			1000	125	1498	1469
1987	9187	470			1000	125	10782	10363
1988	9072	398	625	969	500	125	11689	11015
1989			1251	1937		125	3313	3061
1990			1251	1937		125	3313	3001
1991			625	1896		125	2646	2350
1992				1854		125	1979	1723
1993				1854		125	1979	1689
1994				1854		125	1979	1656
1995				1854		125	1979	1623
1996				1854		125	1979	1592
1997				1854		125	1979	1560
1998				1937		125	2062	1594
1999				1937		125	2062	1563
2000				1937		125	2062	1532
2001				5640*		125	5765	4199
TOTAL	22016	2431	3752	29314	3000	2125	62638	55562

* - Decommissioning cost

Initial Payment = 542 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 637 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-15

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 59 SILOS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3527	1442			500	212	5681	5681
1986	230	143			1000	212	1585	1554
1987	9187	545			1000	212	10944	10519
1988	9072	474	1233	1025	500	212	12516	11794
1989			2466	2049		212	4727	4367
1990			2466	2049		212	4727	4281
1991			1233	1961		212	3406	3024
1992				1873		212	2085	1815
1993				1873		212	2085	1780
1994				1873		212	2085	1745
1995				1873		212	2085	1710
1996				1873		212	2085	1677
1997				1873		212	2085	1644
1998				2049		212	2261	1748
1999				2049		212	2261	1714
2000				2049		212	2261	1680
2001				6404*		212	6616	4819
TOTAL	22016	2604	7398	30873	3000	3604	69495	61552

* - Decommissioning cost

Initial Payment = 278 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 384 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-16

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 177 SILOS (300 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3527	1524			500	327	5878	5878
1986	230	143			1000	327	1700	1667
1987	9187	816			1000	327	11330	10890
1988	9072	745	3698	1200	500	327	15542	14646
1989			7397	2399		327	10123	9352
1990			7397	2399		327	10123	9169
1991			3698	2178		327	6203	5508
1992				1957		327	2284	1988
1993				1957		327	2284	1949
1994				1957		327	2284	1911
1995				1957		327	2284	1874
1996				1957		327	2284	1837
1997				1957		327	2284	1801
1998				2399		327	2726	2107
1999				2399		327	2726	2066
2000				2399		327	2726	2025
2001				9487*		327	9814	7149
TOTAL	22016	3228	22190	36602	3000	5559	92595	81817

* - Decommissioning cost

Initial Payment = 99 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 205 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-17

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 471 SILOS (800 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3527	1710			500	519	6256	6256
1986	230	143			1000	519	1892	1855
1987	9187	1436			1000	519	12142	11671
1988	9072	1364	9845	1818	500	519	23118	21785
1989			19691	3635		519	23845	22029
1990			19691	3635		519	23845	21597
1991			9845	3022		519	13386	11886
1992				2409		519	2928	2549
1993				2409		519	2928	2499
1994				2409		519	2928	2450
1995				2409		519	2928	2402
1996				2409		519	2928	2355
1997				2409		519	2928	2309
1998				3635		519	4154	3211
1999				3635		519	4154	3148
2000				3635		519	4154	3086
2001				17148*		519	17667	12869
TOTAL	22016	4653	59072	54617	3000	8823	152181	133957

* - Decommissioning cost

Initial Payment = 43 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 152 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-18

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 884 SILOS (1500 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3527	1960			500	727	6714	6714
1986	230	143			1000	727	2100	2059
1987	9187	2271			1000	727	13185	12673
1988	9072	2199	18475	2500	500	727	33473	31542
1989			36949	5000		727	42676	39426
1990			36949	5000		727	42676	38653
1991			18475	3929		727	23131	20540
1992				2858		727	3585	3121
1993				2858		727	3585	3060
1994				2858		727	3585	3000
1995				2858		727	3585	2941
1996				2858		727	3585	2883
1997				2858		727	3585	2827
1998				5000		727	5727	4427
1999				5000		727	5727	4340
2000				5000		727	5727	4255
2001				27887*		727	28614	20844
TOTAL	22016	6573	110848	76464	3000	12359	231260	203305

* - Decommissioning cost

Initial Payment = 27 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 134 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-19

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 1120 SILOS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3527	2101			500	828	6956	6956
1986	230	143			1000	828	2201	2158
1987	9187	2739			1000	828	13754	13220
1988	9072	2667	23406	2889	500	828	39362	37092
1989			46812	5778		828	53418	49350
1990			46812	5778		828	53418	48382
1991			23406	4446		828	28680	25467
1992				3114		828	3942	3432
1993				3114		828	3942	3364
1994				3114		828	3942	3298
1995				3114		828	3942	3234
1996				3114		828	3942	3170
1997				3114		828	3942	3108
1998				5778		828	6606	5107
1999				5778		828	6606	5007
2000				5778		828	6606	4908
2001				34020*		828	34848	25385
TOTAL	22016	7650	140436	88929	3000	14076	276107	242638

* - Decommissioning cost

Initial Payment = 23 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 129 \$/KgU (Includes \$9/KgU impact aid)

TABLE A9-20

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 5 CASKS (50 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	630	1020			500	125	2275	2275
1986	105	133			1000	125	1363	1336
1987	927	465			1000	125	2517	2419
1988	875	398	723	892	500	125	3513	3310
1989			1447	1784		125	3356	3100
1990			1447	1784		125	3356	3040
1991			723	1364		125	2212	1964
1992				944		125	1069	931
1993				944		125	1069	912
1994				944		125	1069	894
1995				944		125	1069	877
1996				944		125	1069	860
1997				944		125	1069	843
1998				1784		125	1909	1476
1999				1784		125	1909	1447
2000				1784		125	1909	1418
2001				1779*		125	1904	1387
TOTAL	2537	2016	4340	18619	3000	2125	32637	28489

* - Decommissioning cost

Initial Payment = 160 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 464 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-21

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 10 CASKS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	630	1024			500	212	2366	2366
1986	105	133			1000	212	1450	1422
1987	927	480			1000	212	2619	2517
1988	875	413	1447	925	500	212	4372	4120
1989			2893	1850		212	4955	4578
1990			2893	1850		212	4955	4488
1991			1447	1409		212	3068	2724
1992				968		212	1180	1027
1993				968		212	1180	1007
1994				968		212	1180	987
1995				968		212	1180	968
1996				968		212	1180	949
1997				968		212	1180	930
1998				1850		212	2062	1594
1999				1850		212	2062	1563
2000				1850		212	2062	1532
2001				2653*		212	2865	2087
TOTAL	2537	2050	8680	20045	3000	3604	39916	34859

* - Decommissioning cost

Initial Payment = 86 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 303 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-22

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 29 CASKS (300 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	630	1039			500	327	2496	2496
1986	105	133			1000	327	1565	1534
1987	927	528			1000	327	2782	2674
1988	875	461	4195	1055	500	327	7413	6985
1989			8391	2109		327	10827	10002
1990			8391	2109		327	10827	9806
1991			4195	1587		327	6109	5425
1992				1065		327	1392	1212
1993				1065		327	1392	1188
1994				1065		327	1392	1165
1995				1065		327	1392	1142
1996				1065		327	1392	1120
1997				1065		327	1392	1098
1998				2109		327	2436	1883
1999				2109		327	2436	1846
2000				2109		327	2436	1810
2001				5974*		327	6301	4590
TOTAL	2537	2161	25172	25551	3000	5559	63980	55976

* - Decommissioning cost

Initial Payment = 34 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 183 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-23

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 76 CASKS (800 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	630	1069			500	519	2718	2718
1986	105	133			1000	519	1757	1723
1987	927	628			1000	519	3074	2955
1988	875	562	10995	1442	500	519	14893	14034
1989			21989	2884		519	25392	23458
1990			21989	2884		519	25392	22998
1991			10995	2093		519	13607	12083
1992				1301		519	1820	1584
1993				1301		519	1820	1553
1994				1301		519	1820	1523
1995				1301		519	1820	1493
1996				1301		519	1820	1464
1997				1301		519	1820	1435
1998				2884		519	3403	2631
1999				2884		519	3403	2579
2000				2884		519	3403	2528
2001				14179*		519	14698	10707
TOTAL	2537	2392	65968	39940	3000	8823	122660	107466

* - Decommissioning cost

Initial Payment = 17 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 144 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-24

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 143 CASKS (1500 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	630	1108			500	727	2965	2965
1986	105	133			1000	727	1965	1926
1987	927	760			1000	727	3414	3281
1988	875	693	20687	2036	500	727	25518	24046
1989			41375	4071		727	46173	42657
1990			41375	4071		727	46173	41820
1991			20687	2853		727	24267	21548
1992				1635		727	2362	2056
1993				1635		727	2362	2016
1994				1635		727	2362	1976
1995				1635		727	2362	1938
1996				1635		727	2362	1900
1997				1635		727	2362	1862
1998				4071		727	4798	3709
1999				4071		727	4798	3636
2000				4071		727	4798	3565
2001				25871*		727	26598	19375
TOTAL	2537	2694	124124	60925	3000	12359	205639	180276

* - Decommissioning cost

Initial Payment = 11 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 133 \$/KgU (Includes \$9/KgU impact aid)

TABLE A9-25

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 181 CASKS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	630	1130			500	828	3088	3088
1986	105	133			1000	828	2066	2025
1987	927	833			1000	828	3588	3449
1988	875	766	26185	2373	500	828	31527	29709
1989			52369	4746		828	57943	53530
1990			52369	4746		828	57943	52481
1991			26185	3285		828	30298	26904
1992				1824		828	2652	2309
1993				1824		828	2652	2263
1994				1824		828	2652	2219
1995				1824		828	2652	2176
1996				1824		828	2652	2133
1997				1824		828	2652	2091
1998				4746		828	5574	4309
1999				4746		828	5574	4224
2000				4746		828	5574	4142
2001				32501*		828	33329	24278
TOTAL	2537	2862	157108	72833	3000	14076	252416	221330

* - Decommissioning cost

Initial Payment = 10 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 129 \$/KgU (Includes \$8/KgU impact aid)

TABLE A9-26

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 118 DRYWELLS (50 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	1702			500	125	3649	3649
1986	105	143			1000	125	1373	1346
1987	3235	1967			1000	125	6327	6081
1988	3183	1895	510	977	500	125	7190	6775
1989			1020	1953		125	3098	2862
1990			1020	1953		125	3098	2806
1991			510	1526		125	2161	1919
1992				1098		125	1223	1065
1993				1098		125	1223	1044
1994				1098		125	1223	1023
1995				1098		125	1223	1003
1996				1098		125	1223	984
1997				1098		125	1223	964
1998				1953		125	2078	1606
1999				1953		125	2078	1575
2000				1953		125	2078	1544
2001				3322*		125	3447	2511
TOTAL	7845	5707	3060	22178	3000	2125	43915	38757

* - Decommissioning cost

Initial Payment = 331 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 501 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-27

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	1720			500	212	3754	3754
1986	105	143			1000	212	1460	1431
1987	3235	2026			1000	212	6473	6222
1988	3183	1954	1020	1040	500	212	7909	7453
1989			2039	2080		212	4331	4001
1990			2039	2080		212	4331	3923
1991			1020	1599		212	2831	2514
1992				1118		212	1330	1158
1993				1118		212	1330	1135
1994				1118		212	1330	1113
1995				1118		212	1330	1091
1996				1118		212	1330	1070
1997				1118		212	1330	1049
1998				2080		212	2292	1772
1999				2080		212	2292	1737
2000				2080		212	2292	1703
2001				3961*		212	4173	3040
TOTAL	7845	5843	6118	23708	3000	3604	50118	44166

* - Decommissioning cost

Initial Payment = 172 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 310 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-28

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 707 DRYWELLS (300 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	1777			500	327	3926	3926
1986	105	143			1000	327	1575	1544
1987	3235	2218			1000	327	6780	6517
1988	3183	2146	3054	1298	500	327	10508	9902
1989			6108	2596		327	9031	8343
1990			6108	2596		327	9031	8180
1991			3054	1892		327	5273	4682
1992				1188		327	1515	1319
1993				1188		327	1515	1293
1994				1188		327	1515	1268
1995				1188		327	1515	1243
1996				1188		327	1515	1218
1997				1188		327	1515	1195
1998				2596		327	2923	2260
1999				2596		327	2923	2215
2000				2596		327	2923	2172
2001				6491*		327	6818	4967
TOTAL	7845	6284	18324	29789	3000	5559	70801	62244

* - Decommissioning cost

Initial Payment = 63 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 173 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-29

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 1886 DRYWELLS (800 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	1901			500	519	4242	4242
1986	105	143			1000	519	1767	1732
1987	3235	2630			1000	519	7384	7097
1988	3183	2559	8148	2000	500	519	16709	15934
1989			16295	3999		519	20813	19228
1990			16295	3999		519	20813	18851
1991			8148	2682		519	11349	10078
1992				1365		519	1884	1640
1993				1365		519	1884	1608
1994				1365		519	1884	1576
1995				1365		519	1884	1546
1996				1365		519	1884	1515
1997				1365		519	1884	1486
1998				3999		519	4518	3493
1999				3999		519	4518	3424
2000				3999		519	4518	3357
2001				12793*		519	13312	9697
TOTAL	7845	7233	48886	45660	3000	8823	121447	106504

* - Decommissioning cost

Initial Payment = 29 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 129 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-30

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 3535 DRYWELLS (1500 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	2060			500	727	4609	4609
1986	105	143			1000	727	1975	1936
1987	3235	3161			1000	727	8123	7808
1988	3183	3090	15271	3058	500	727	25829	24339
1989			30542	6115		727	37384	34537
1990			30542	6115		727	37384	33860
1991			15271	3882		727	19880	17653
1992				1649		727	2376	2068
1993				1649		727	2376	2028
1994				1649		727	2376	1988
1995				1649		727	2376	1949
1996				1649		727	2376	1911
1997				1649		727	2376	1873
1998				6115		727	6842	5289
1999				6115		727	6842	5185
2000				6115		727	6842	5084
2001				21585*		727	22312	16253
TOTAL	7845	8454	91626	68994	3000	12359	192278	168370

* - Decommissioning cost

Initial Payment = 18 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 115 \$/KgU (Includes \$8/KgU impact aid)

TABLE A9-31

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	2148			500	828	4798	4798
1986	105	143			1000	828	2076	2035
1987	3235	3455			1000	828	8518	8187
1988	3183	3383	19345	3663	500	828	30902	29120
1989			38690	7326		828	46844	43277
1990			38690	7326		828	46844	42428
1991			19345	4569		828	24742	21970
1992				1812		828	2640	2298
1993				1812		828	2640	2253
1994				1812		828	2640	2209
1995				1812		828	2640	2166
1996				1812		828	2640	2123
1997				1812		828	2640	2082
1998				7326		828	8154	6303
1999				7326		828	8154	6180
2000				7326		828	8154	6059
2001				26609*		828	27437	19986
TOTAL	7845	9129	116070	82343	3000	14076	232463	203474

* - Decommissioning cost

Initial Payment = 16 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 112 \$/KgU (Includes \$8/KgU impact aid)

TABLE A9-32

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 30 SILOS (50 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1325	1446			500	125	3396	3396
1986	105	143			1000	125	1373	1346
1987	3245	558			1000	125	4928	4737
1988	3192	487	625	933	500	125	5862	5524
1989			1251	1865		125	3241	2994
1990			1251	1865		125	3241	2935
1991			625	1451		125	2201	1954
1992				1037		125	1162	1012
1993				1037		125	1162	992
1994				1037		125	1162	972
1995				1037		125	1162	953
1996				1037		125	1162	935
1997				1037		125	1162	916
1998				1865		125	1990	1538
1999				1865		125	1990	1508
2000				1865		125	1990	1479
2001				2851*		125	2976	2168
TOTAL	7867	2634	3752	20782	3000	2125	40160	35359

* - Decommissioning cost

Initial Payment = 273 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 490 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-33

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 59 SILOS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1325	1469			500	212	3506	3506
1986	105	143			1000	212	1460	1431
1987	3245	634			1000	212	5091	4893
1988	3192	562	1233	989	500	212	6688	6302
1989			2466	1977		212	4655	4301
1990			2466	1977		212	4655	4216
1991			1233	1518		212	2963	2631
1992				1058		212	1270	1106
1993				1058		212	1270	1084
1994				1058		212	1270	1063
1995				1058		212	1270	1042
1996				1058		212	1270	1021
1997				1058		212	1270	1001
1998				1977		212	2189	1692
1999				1977		212	2189	1659
2000				1977		212	2189	1626
2001				3615*		212	3827	2788
TOTAL	7867	2808	7398	22355	3000	3604	47032	41362

* - Decommissioning cost

Initial Payment = 144 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 311 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-34

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 177 SILOS (300 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1325	1550			500	327	3702	3702
1986	105	143			1000	327	1575	1544
1987	3245	905			1000	327	5477	5264
1988	3192	833	3698	1163	500	327	9713	9153
1989			7397	2326		327	10050	9285
1990			7397	2326		327	10050	9103
1991			3698	1735		327	5760	5115
1992				1143		327	1470	1280
1993				1143		327	1470	1255
1994				1143		327	1470	1230
1995				1143		327	1470	1206
1996				1143		327	1470	1182
1997				1143		327	1470	1159
1998				2326		327	2653	2051
1999				2326		327	2653	2011
2000				2326		327	2653	1971
2001				6698*		327	7025	5117
TOTAL	7867	3431	22190	28084	3000	5559	70131	61628

* - Decommissioning cost

Initial Payment = 54 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 180 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-35

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 471 SILOS (800 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1325	1736			500	519	4080	4080
1986	105	143			1000	519	1767	1732
1987	3245	1524			1000	519	6288	6044
1988	3192	1453	9845	1782	500	519	17291	16294
1989			19691	3563		519	23773	21963
1990			19691	3563		519	23773	21532
1991			9845	2459		519	12823	11386
1992				1355		519	1874	1631
1993				1355		519	1874	1599
1994				1355		519	1874	1568
1995				1355		519	1874	1537
1996				1355		519	1874	1507
1997				1355		519	1874	1478
1998				3563		519	4082	3156
1999				3563		519	4082	3094
2000				3563		519	4082	3033
2001				14359*		519	14878	10838
TOTAL	7867	4856	59072	44545	3000	8823	128163	112472

* - Decommissioning cost

Initial Payment = 26 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 141 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-36

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 884 SILOS (1500 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1325	1987			500	727	4539	4539
1986	105	143			1000	727	1975	1936
1987	3245	2359			1000	727	7331	7046
1988	3192	2288	18475	2464	500	727	27646	26051
1989			36949	4928		727	42604	39360
1990			36949	4928		727	42604	38588
1991			18475	3290		727	22492	19972
1992				1651		727	2378	2070
1993				1651		727	2378	2030
1994				1651		727	2378	1990
1995				1651		727	2378	1951
1996				1651		727	2378	1913
1997				1651		727	2378	1875
1998				4928		727	5655	4371
1999				4928		727	5655	4286
2000				4928		727	5655	4202
2001				25098*		727	25825	18812
TOTAL	7867	6777	110848	65398	3000	12359	206249	180992

* - Decommissioning cost

Initial Payment = 17 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 127 \$/KgU (Includes \$9/KgU impact aid)

TABLE A9-37

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 1120 SILOS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1325	2127			500	828	4780	4780
1986	105	143			1000	828	2076	2035
1987	3245	2827			1000	828	7900	7593
1988	3192	2756	23406	2853	500	828	33535	31601
1989			46812	5705		828	53345	49283
1990			46812	5705		828	53345	48316
1991			23406	3764		828	27998	24861
1992				1822		828	2650	2307
1993				1822		828	2650	2262
1994				1822		828	2650	2217
1995				1822		828	2650	2174
1996				1822		828	2650	2131
1997				1822		828	2650	2090
1998				5705		828	6533	5050
1999				5705		828	6533	4951
2000				5705		828	6533	4854
2001				31231*		828	32059	23353
TOTAL	7867	7853	140436	77305	3000	14076	250537	219858

* - Decommissioning cost

Initial Payment = 15 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 123 \$/KgU (Includes \$8/KgU impact aid)

10.0 SENSITIVITY OF COSTS TO CHANGES IN CONDITIONS

The sensitivity of costs for FIS to changing conditions of cost, schedule, mix of spent fuel types, and discount rate, and to whether or not the facility was subject to NRC licensing, was determined for the drywell at storage capacity levels of 100 MTU and 1900 MTU. The following sections describe the conditions considered and the impact of each on the total discounted cost of FIS system construction and operation and the total unit cost.

10.1 IMPACT OF COST CHANGES

The impact of design improvements which result in a reduction in capital cost of a new transfer facility to \$15-million and \$10-million, and a reduction in the capital cost of modifying an existing transfer facility to 6.8 million on FIS costs is shown in Table A10-1.

TABLE A10-1
IMPACT OF REDUCTIONS IN CAPITAL COSTS OF TRANSFER FACILITIES
ON FIS SYSTEM COSTS

<u>Capital Cost</u> <u>(\$-Millions)</u>	<u>100 MTU</u>		<u>1900 MTU</u>	
	<u>Total</u> <u>Discounted</u> <u>Cost (\$000)</u>	<u>Total</u> <u>Unit</u> <u>Cost (\$/kgU)</u>	<u>Total</u> <u>Discounted</u> <u>Cost (\$000)</u>	<u>Total</u> <u>Unit</u> <u>Cost (\$/kgU)</u>
<u>New Facility Cases</u>				
\$22 (Base Case)	\$64,294	\$690	\$226,710	\$142
15.5	56,747	613	219,173	136
10	50,413	548	212,830	134
Change per \$-million	1,262	12	1,262	1
<u>Existing Facility Cases</u>				
7.8 (Base Case)	\$44,166	\$482	\$203,474	\$128
6.8	43,004	471	202,325	127
Change per \$-million	1,162	11	1,149	1

The estimated spending schedules, discounted annual costs, and the calculation of the Initial and Final Payments for FIS of spent fuel for each of the cases considered in Table A10-1 are set forth in Tables A10-2 through A10-7.

TABLE A10-2

COST SENSITIVITY CASE -- \$15.5-MILLION TRANSFER FACILITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	2676	1693			500	212	5081	5081
1986	230	143			1000	212	1585	1554
1987	6350	1937			1000	212	9499	9130
1988	6235	1866	1020	1059	500	212	10892	10264
1989			2039	2118		212	4369	4036
1990			2039	2118		212	4369	3957
1991			1020	2002		212	3234	2872
1992				1885		212	2097	1826
1993				1885		212	2097	1790
1994				1885		212	2097	1755
1995				1885		212	2097	1720
1996				1885		212	2097	1687
1997				1885		212	2097	1653
1998				2118		212	2330	1801
1999				2118		212	2330	1766
2000				2118		212	2330	1731
2001				5450*		212	5662	4124
TOTAL	15491	5639	6118	30411	3000	3604	64263	56747

* - Decommissioning cost

Initial Payment = 245 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 368 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-3

COST SENSITIVITY CASE -- \$10-MILLION TRANSFER FACILITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1761	1693			500	212	4366	4366
1986	230	143			1000	212	1585	1554
1987	3969	1937			1000	212	7118	6842
1988	3854	1866	1020	1046	500	212	8498	8008
1989			2039	2091		212	4342	4011
1990			2039	2091		212	4342	3933
1991			1020	1974		212	3206	2847
1992				1857		212	2069	1801
1993				1857		212	2069	1766
1994				1857		212	2069	1731
1995				1857		212	2069	1697
1996				1857		212	2069	1664
1997				1857		212	2069	1631
1998				2091		212	2303	1780
1999				2091		212	2303	1745
2000				2091		212	2303	1711
2001				4354*		212	4566	3326
TOTAL	10014	5639	6118	28971	3000	3604	57346	50413

* - Decommissioning cost

Initial Payment = 192 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 356 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-4

COST SENSITIVITY CASE -- \$15.5-MILLION TRANSFER FACILITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	2676	2122			500	828	6126	6126
1986	230	143			1000	828	2201	2158
1987	6350	3366			1000	828	11544	11096
1988	6235	3295	19345	3683	500	828	33886	31932
1989			38690	7365		828	46883	43313
1990			38690	7365		828	46883	42463
1991			19345	5259		828	25432	22583
1992				3153		828	3981	3466
1993				3153		828	3981	3398
1994				3153		828	3981	3331
1995				3153		828	3981	3266
1996				3153		828	3981	3202
1997				3153		828	3981	3139
1998				7365		828	8193	6333
1999				7365		828	8193	6209
2000				7365		828	8193	6088
2001				28097*		828	28925	21070
TOTAL	15491	8926	116070	92782	3000	14076	250345	219173

* - Decommissioning cost

Initial Payment = 19 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 117 \$/KgU (Includes \$8/KgU impact aid)

TABLE A10-5

COST SENSITIVITY CASE - \$10-MILLION TRANSFER FACILITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1961	2122			500	828	5411	5411
1986	230	143			1000	828	2201	2158
1987	3969	3366			1000	828	9163	8807
1988	3854	3295	19345	3668	500	828	31490	29674
1989			38690	7336		828	46854	43286
1990			38690	7336		828	46854	42437
1991			19345	5231		828	25404	22558
1992				3125		828	3953	3441
1993				3125		828	3953	3374
1994				3125		828	3953	3308
1995				3125		828	3953	3243
1996				3125		828	3953	3179
1997				3125		828	3953	3117
1998				7336		828	8164	6311
1999				7336		828	8164	6187
2000				7336		828	8164	6066
2001				27002*		828	27830	20273
TOTAL	10014	8926	116070	91331	3000	14076	243417	212830

* - Decommissioning cost

Initial Payment = 17 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 117 \$/KgU (Includes \$8/KgU impact aid)

TABLE A10-6

COST SENSITIVITY CASE -- \$6.8-MILLION TRANSFER FACILITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	FRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1192	1720			500	212	3624	3624
1986	105	143			1000	212	1460	1431
1987	2800	2026			1000	212	6038	5804
1988	2748	1954	1020	1038	500	212	7472	7041
1989			2039	2075		212	4326	3997
1990			2039	2075		212	4326	3918
1991			1020	1594		212	2826	2509
1992				1112		212	1324	1153
1993				1112		212	1324	1130
1994				1112		212	1324	1108
1995				1112		212	1324	1086
1996				1112		212	1324	1065
1997				1112		212	1324	1044
1998				2075		212	2287	1768
1999				2075		212	2287	1733
2000				2075		212	2287	1699
2001				3761*		212	3973	2894
TOTAL	6845	5843	6118	23440	3000	3604	48850	43004

* - Decommissioning cost

Initial Payment = 164 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 307 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-7

COST SENSITIVITY CASE -- \$6.8-MILLION TRANSFER FACILITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1192	2148			500	828	4668	4668
1986	105	143			1000	828	2076	2035
1987	2800	3455			1000	828	8083	7769
1988	2748	3383	19345	3661	500	828	30465	28708
1989			38690	7321		828	46839	43272
1990			38690	7321		828	46839	42424
1991			19345	4565		828	24738	21967
1992				1808		828	2636	2295
1993				1808		828	2636	2250
1994				1808		828	2636	2206
1995				1808		828	2636	2162
1996				1808		828	2636	2120
1997				1808		828	2636	2078
1998				7321		828	8149	6299
1999				7321		828	8149	6176
2000				7321		828	8149	6055
2001				26409*		828	27237	19841
TOTAL	6845	9129	116070	82088	3000	14076	231208	202325

* - Decommissioning cost

Initial Payment = 15 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 112 \$/KgU (Includes \$8/KgU impact aid)

The impact of reductions in the cost of individual modules (drywells) to \$15,000 and \$10,000 on FIS costs is shown in Table A10-8.

TABLE A10-8
IMPACT OF REDUCTIONS IN COST OF DRYWELLS AND CANISTERS
ON FIS SYSTEM COSTS

<u>Item Cost (\$)</u>	<u>100 MTU</u>		<u>1900 MTU</u>	
	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kgU)</u>	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kgU)</u>
<u>Drywells</u>				
\$20,990	\$64,294	\$690	\$226,710	\$142
15,000	62,710	672	196,811	124
10,000	61,402	658	171,867	107
Change per \$-thousand	263	2.91	4,986	3.18
<u>Canisters</u>				
\$ 4,930	\$64,294	\$690	\$226,710	\$142
3,500	63,935	686	219,920	137
2,000	63,560	682	212,794	133
Change per \$-thousand	251	2.73	4,749	3.07

The estimated spending schedules, discounted annual costs, and the calculation of the Initial and Final Payments for FIS of spent fuel for each of the cases considered in Table A10-8 are set forth in Tables A10-9 through A10-16.

TABLE A10-9

COST SENSITIVITY CASE -- \$15,000 DRYWELL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	1693			500	212	5930	5930
1986	230	143			1000	212	1585	1554
1987	9182	1937			1000	212	12331	11852
1988	9067	1866	784	1073	500	212	13502	12723
1989			1568	2145		212	3925	3626
1990			1568	2145		212	3925	3555
1991			784	2028		212	3024	2685
1992				1911		212	2123	1848
1993				1911		212	2123	1812
1994				1911		212	2123	1776
1995				1911		212	2123	1742
1996				1911		212	2123	1707
1997				1911		212	2123	1674
1998				2145		212	2357	1822
1999				2145		212	2357	1786
2000				2145		212	2357	1751
2001				6469*		212	6681	4867
TOTAL	22004	5639	4704	31761	3000	3604	70712	62710

* - Decommissioning cost

Initial Payment = 307 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 365 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-10

COST SENSITIVITY CASE -- \$10,000 DRYWELL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	1693			500	212	5930	5930
1986	230	143			1000	212	1585	1554
1987	9182	1937			1000	212	12331	11852
1988	9067	1866	587	1070	500	212	13302	12535
1989			1174	2139		212	3525	3257
1990			1174	2139		212	3525	3193
1991			587	2023		212	2822	2506
1992				1906		212	2118	1844
1993				1906		212	2118	1808
1994				1906		212	2118	1772
1995				1906		212	2118	1737
1996				1906		212	2118	1703
1997				1906		212	2118	1670
1998				2139		212	2351	1817
1999				2139		212	2351	1782
2000				2139		212	2351	1747
2001				6233*		212	6445	4695
TOTAL	22004	5639	3522	31457	3000	3604	69226	61402

* - Decommissioning cost

Initial Payment = 307 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 351 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-11

COST SENSITIVITY CASE -- \$15,000 DRYWELL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	2122			500	828	6975	6975
1986	230	143			1000	828	2201	2158
1987	9182	3366			1000	828	14376	13818
1988	9067	3295	14874	3630	500	828	32194	30337
1989			29749	7259		828	37836	34955
1990			29749	7259		828	37836	34269
1991			14874	5154		828	20856	18520
1992				3048		828	3876	3374
1993				3048		828	3876	3308
1994				3048		828	3876	3243
1995				3048		828	3876	3180
1996				3048		828	3876	3117
1997				3048		828	3876	3056
1998				7259		828	8087	6252
1999				7259		828	8087	6129
2000				7259		828	8087	6009
2001				24035*		828	24863	18111
TOTAL	22004	8926	89246	87402	3000	14076	224654	196811

* - Decommissioning cost

Initial Payment = 23 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 101 \$/KgU (Includes \$8/KgU impact aid)

TABLE A10-12

COST SENSITIVITY CASE -- \$10,000 DRYWELL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	2122			500	828	6975	6975
1986	230	143			1000	828	2201	2158
1987	9182	3366			1000	828	14376	13818
1988	9067	3295	11143	3572	500	828	28405	26767
1989			22286	7144		828	30258	27954
1990			22286	7144		828	30258	27406
1991			11143	5039		828	17010	15104
1992				2933		828	3761	3274
1993				2933		828	3761	3210
1994				2933		828	3761	3147
1995				2933		828	3761	3085
1996				2933		828	3761	3025
1997				2933		828	3761	2966
1998				7144		828	7972	6163
1999				7144		828	7972	6042
2000				7144		828	7972	5923
2001				19558*		828	20386	14850
TOTAL	22004	8926	66858	81487	3000	14076	196351	171867

* - Decommissioning cost

Initial Payment = 22 \$/KgU (Includes \$3/KgU impact aid)

Final Payment = 85 \$/KgU (Includes \$7/KgU impact aid)

TABLE A10-13
COST SENSITIVITY CASE - \$3,500 CANISTER

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	1693			500	212	5930	5930
1986	230	143			1000	212	1585	1554
1987	9182	1937			1000	212	12331	11852
1988	9067	1866	963	1077	500	212	13685	12896
1989			1927	2153		212	4292	3965
1990			1927	2153		212	4292	3887
1991			963	2036		212	3211	2851
1992				1919		212	2131	1855
1993				1919		212	2131	1819
1994				1919		212	2131	1783
1995				1919		212	2131	1748
1996				1919		212	2131	1714
1997				1919		212	2131	1680
1998				2153		212	2365	1828
1999				2153		212	2365	1792
2000				2153		212	2365	1757
2001				6685*		212	6897	5024
TOTAL	22004	5639	5780	32077	3000	3604	72104	63935

* - Decommissioning cost

Initial Payment = 307 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 379 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-14
COST SENSITIVITY CASE -- \$2,000 CANISTER

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	1693			500	212	5930	5930
1986	230	143			1000	212	1585	1554
1987	9182	1937			1000	212	12331	11852
1988	9067	1866	904	1077	500	212	13626	12840
1989			1809	2153		212	4174	3856
1990			1809	2153		212	4174	3781
1991			904	2036		212	3152	2799
1992				1919		212	2131	1855
1993				1919		212	2131	1819
1994				1919		212	2131	1783
1995				1919		212	2131	1748
1996				1919		212	2131	1714
1997				1919		212	2131	1680
1998				2153		212	2365	1828
1999				2153		212	2365	1792
2000				2153		212	2365	1757
2001				6614*		212	6826	4972
TOTAL	22004	5639	5426	32006	3000	3604	71679	63560

* - Decommissioning cost

Initial Payment = 307 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 375 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-15
COST SENSITIVITY CASE -- \$3,500 CANISTER

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	2122			500	828	6975	6975
1986	230	143			1000	828	2201	2158
1987	9182	3366			1000	828	14376	13818
1988	9067	3295	18278	3699	500	828	35667	33610
1989			36555	7398		828	44781	41371
1990			36555	7398		828	44781	40560
1991			18278	5293		828	24399	21666
1992				3187		828	4015	3495
1993				3187		828	4015	3427
1994				3187		828	4015	3360
1995				3187		828	4015	3294
1996				3187		828	4015	3229
1997				3187		828	4015	3166
1998				7398		828	8226	6359
1999				7398		828	8226	6234
2000				7398		828	8226	6112
2001				28119*		828	28947	21086
TOTAL	22004	8926	109666	93223	3000	14076	250895	219920

* - Decommissioning cost

Initial Payment = 23 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 114 \$/KgU (Includes \$8/KgU impact aid)

TABLE A10-16
COST SENSITIVITY CASE -- \$2,000 CANISTER

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	2122			500	828	6975	6975
1986	230	143			1000	828	2201	2158
1987	9182	3366			1000	828	14376	13818
1988	9067	3295	17158	3699	500	828	34547	32554
1989			34316	7398		828	42542	39302
1990			34316	7398		828	42542	38532
1991			17158	5293		828	23279	20671
1992				3187		828	4015	3495
1993				3187		828	4015	3427
1994				3187		828	4015	3360
1995				3187		828	4015	3294
1996				3187		828	4015	3229
1997				3187		828	4015	3166
1998				7398		828	8226	6359
1999				7398		828	8226	6234
2000				7398		828	8226	6112
2001				26776*		828	27604	20108
TOTAL	22004	8926	102948	91880	3000	14076	242834	212794

* - Decommissioning cost

Initial Payment = 23 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 110 \$/KgU (Includes \$8/KgU impact aid)

10.2 IMPACT OF SCHEDULE CHANGES

The impact on FIS costs of extending the FIS program by 2 years and by 5 years as a result of a delay in repository startup are shown in Table A10-17.

TABLE A10-17
IMPACT OF EXTENDING THE TERM OF THE FIS PROGRAM
ON FIS SYSTEM COSTS

Year of Completion of FIS Activities	100 MTU		1900 MTU	
	Total Discounted Cost (\$000)	Total Unit Cost (\$/kgU)	Total Discounted Cost (\$000)	Total Unit Cost (\$/kgU)
New Transfer Facility Cases				
2000 (Base Case)	\$64,294	\$690	\$226,710	\$142
2002	67,151	721	231,276	145
2005	71,229	765	237,795	149
Increase-per yr. of delay	1,387	15	2,217	1.40
Existing Transfer Facility Cases				
2000 (Base Case)	\$44,166	\$482	\$203,474	\$128
2002	45,882	501	206,020	130
2005	48,330	528	209,653	132
Increase-per yr. of delay	833	9.2	1,236	0.80

The estimated spending schedules, discounted annual costs, and the calculation of the Initial and Final Payments for FIS of spent fuel for each of the cases considered in Table A10-17 are set forth in Tables A10-18 through A10-25.

TABLE A10-18

COST SENSITIVITY CASE -- 2 YEAR EXTENSION OF FIS PROGRAM

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	1693			500	212	5930	5930
1986	230	143			1000	212	1585	1554
1987	9182	1937			1000	212	12331	11852
1988	9067	1866	1020	1077	500	212	13742	12949
1989			2039	2153		212	4404	4069
1990			2039	2153		212	4404	3989
1991			1020	2036		212	3268	2902
1992				1919		212	2131	1855
1993				1919		212	2131	1819
1994				1919		212	2131	1783
1995				1919		212	2131	1748
1996				1919		212	2131	1714
1997				1919		212	2131	1680
1998				1919		212	2131	1647
1999				1919		212	2131	1615
2000				2153		212	2365	1757
2001				2153		212	2365	1723
2002				2153		212	2365	1689
2003				6752*		212	6964	4876
TOTAL	22004	5639	6118	35982	3000	4028	76771	67151

* - Decommissioning cost

Initial Payment = 307 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 414 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-19

COST SENSITIVITY CASE -- 5 YEAR EXTENSION OF FIS PROGRAM

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	1693			500	212	5930	5930
1986	230	143			1000	212	1585	1554
1987	9182	1937			1000	212	12331	11852
1988	9067	1866	1020	1077	500	212	13742	12949
1989			2039	2153		212	4404	4069
1990			2039	2153		212	4404	3989
1991			1020	2036		212	3268	2902
1992				1919		212	2131	1855
1993				1919		212	2131	1819
1994				1919		212	2131	1783
1995				1919		212	2131	1748
1996				1919		212	2131	1714
1997				1919		212	2131	1680
1998				1919		212	2131	1647
1999				1919		212	2131	1615
2000				1919		212	2131	1583
2001				1919		212	2131	1552
2002				1919		212	2131	1522
2003				2153		212	2365	1656
2004				2153		212	2365	1623
2005				2153		212	2365	1592
2006				6752*		212	6964	4595
TOTAL	22004	5639	6118	41739	3000	4664	83164	71229

* - Decommissioning cost

Initial Payment = 307 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 458 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-20
COST SENSITIVITY CASE -- 2 YEAR EXTENSION OF FIS PROGRAM

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
 AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
 (\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	2122			500	828	6975	6975
1986	230	143			1000	828	2201	2158
1987	9182	3366			1000	828	14376	13818
1988	9067	3295	19345	3699	500	828	36734	34615
1989			38690	7398		828	46916	43343
1990			38690	7398		828	46916	42493
1991			19345	5293		828	25466	22613
1992				3187		828	4015	3495
1993				3187		828	4015	3427
1994				3187		828	4015	3360
1995				3187		828	4015	3294
1996				3187		828	4015	3229
1997				3187		828	4015	3166
1998				3187		828	4015	3104
1999				3187		828	4015	3043
2000				7398		828	8226	6112
2001				7398		828	8226	5992
2002				7398		828	8226	5875
2003				29400*		828	30228	21164
TOTAL	22004	8926	116070	100878	3000	15732	266610	231276

* - Decommissioning cost

Initial Payment = 23 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 122 \$/KgU (Includes \$9/KgU impact aid)

TABLE A10-21
COST SENSITIVITY CASE -- 5 YEAR EXTENSION OF FIS PROGRAM

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
 AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
 (\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	2122			500	828	6975	6975
1986	230	143			1000	828	2201	2158
1987	9182	3366			1000	828	14376	13818
1988	9067	3295	19345	3699	500	828	36734	34615
1989			38690	7398		828	46916	43343
1990			38690	7398		828	46916	42493
1991			19345	5293		828	25466	22613
1992				3187		828	4015	3495
1993				3187		828	4015	3427
1994				3187		828	4015	3360
1995				3187		828	4015	3294
1996				3187		828	4015	3229
1997				3187		828	4015	3166
1998				3187		828	4015	3104
1999				3187		828	4015	3043
2000				3187		828	4015	2983
2001				3187		828	4015	2925
2002				3187		828	4015	2867
2003				7398		828	8226	5760
2004				7398		828	8226	5647
2005				7398		828	8226	5536
2006				29400*		828	30228	19944
TOTAL	22004	8926	116070	110439	3000	18216	278655	237795

* - Decommissioning cost

Initial Payment = 24 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 125 \$/KgU (Includes \$9/KgU impact aid)

TABLE A10-22

COST SENSITIVITY CASE -- 2 YEAR EXTENSION OF FIS PROGRAM

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	1720			500	212	3754	3754
1986	105	143			1000	212	1460	1431
1987	3235	2026			1000	212	6473	6222
1988	3183	1954	1020	1040	500	212	7909	7453
1989			2039	2080		212	4331	4001
1990			2039	2080		212	4331	3923
1991			1020	1599		212	2831	2514
1992				1118		212	1330	1158
1993				1118		212	1330	1135
1994				1118		212	1330	1113
1995				1118		212	1330	1091
1996				1118		212	1330	1070
1997				1118		212	1330	1049
1998				1118		212	1330	1028
1999				1118		212	1330	1008
2000				2080		212	2292	1703
2001				2080		212	2292	1670
2002				2080		212	2292	1637
2003				3961*		212	4173	2922
TOTAL	7845	5843	6118	25944	3000	4028	52778	45882

* - Decommissioning cost

Initial Payment = 172 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 329 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-23

COST SENSITIVITY CASE -- 5 YEAR EXTENSION OF FIS PROGRAM

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	1720			500	212	3754	3754
1986	105	143			1000	212	1460	1431
1987	3235	2026			1000	212	6473	6222
1988	3183	1954	1020	1040	500	212	7909	7453
1989			2039	2080		212	4331	4001
1990			2039	2080		212	4331	3923
1991			1020	1599		212	2831	2514
1992				1118		212	1330	1158
1993				1118		212	1330	1135
1994				1118		212	1330	1113
1995				1118		212	1330	1091
1996				1118		212	1330	1070
1997				1118		212	1330	1049
1998				1118		212	1330	1028
1999				1118		212	1330	1008
2000				1118		212	1330	988
2001				1118		212	1330	969
2002				1118		212	1330	950
2003				2080		212	2292	1605
2004				2080		212	2292	1573
2005				2080		212	2292	1542
2006				3961*		212	4173	2753
TOTAL	7845	5843	6118	29298	3000	4664	56768	48330

* - Decommissioning cost

Initial Payment = 172 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 356 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-24

COST SENSITIVITY CASE -- 2 YEAR EXTENSION OF FIS PROGRAM

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	2148			500	828	4798	4798
1986	105	143			1000	828	2076	2076
1987	3235	3455			1000	828	8518	8187
1988	3183	3383	19345	3663	500	828	30902	29120
1989			38690	7326		828	46844	43277
1990			38690	7326		828	46844	42428
1991			19345	4569		828	24742	21970
1992				1812		828	2640	2298
1993				1812		828	2640	2253
1994				1812		828	2640	2209
1995				1812		828	2640	2166
1996				1812		828	2640	2123
1997				1812		828	2640	2082
1998				1812		828	2640	2041
1999				1812		828	2640	2001
2000				7326		828	8154	6059
2001				7326		828	8154	5940
2002				7326		828	8154	5823
2003				26609*		828	27437	19210
TOTAL	7845	9129	116070	85967	3000	15732	237743	206020

* - Decommissioning cost

Initial Payment = 16 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 114 \$/KgU (Includes \$8/KgU impact aid)

TABLE A10-25

COST SENSITIVITY CASE -- 5 YEAR EXTENSION OF FIS PROGRAM

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	2148			500	828	4798	4798
1986	105	143			1000	828	2076	2076
1987	3235	3455			1000	828	8518	8187
1988	3183	3383	19345	3663	500	828	30902	29120
1989			38690	7326		828	46844	43277
1990			38690	7326		828	46844	42428
1991			19345	4569		828	24742	21970
1992				1812		828	2640	2298
1993				1812		828	2640	2253
1994				1812		828	2640	2209
1995				1812		828	2640	2166
1996				1812		828	2640	2123
1997				1812		828	2640	2082
1998				1812		828	2640	2041
1999				1812		828	2640	2001
2000				1812		828	2640	1962
2001				1812		828	2640	1923
2002				1812		828	2640	1885
2003				7326		828	8154	5709
2004				7326		828	8154	5597
2005				7326		828	8154	5487
2006				26609*		828	27437	18102
TOTAL	7845	9129	116070	91403	3000	18216	245663	209653

* - Decommissioning cost

Initial Payment = 16 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 116 \$/KgU (Includes \$8/KgU impact aid)

The impact on FIS costs of spreading the time for receipt of spent fuel at the FIS facility from the 3-year period set forth in Section 3.4 to a total of 4 years and 5 years, respectively, is shown in Table A10-26.

TABLE A10-26
IMPACT OF SPREADING THE TIME FOR RECEIPTS OF SPENT FUEL
AT FIS FACILITIES ON FIS SYSTEM COSTS

<u>Number of Years Spent Fuel Received</u>	<u>100 MTU</u>		<u>1900 MTU</u>	
	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kgU)</u>	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kgU)</u>
New Transfer Facility Cases				
3 yrs. (Base Case)	\$64,294	\$690	\$226,710	\$142
4 yrs.	64,238	693	224,625	142
5 yrs.	64,183	696	222,573	142
Change per yr. of receipt time	56	3	2,069	-
Existing Transfer Facility Cases				
3 yrs. (Base Case)	\$44,166	\$482	\$203,474	\$128
4 yrs.	44,752	491	202,529	129
5 yrs.	45,327	501	201,604	129
Change per yr. of receipt time	581	9.5	935	0.5

The estimated spending schedules, discounted annual costs, and the calculation of the Initial and Final Payments for FIS of spent fuel for each of the cases considered in Table A10-26 are set forth in Tables A10-27 through A10-34.

TABLE A10-27

COST SENSITIVITY CASE -- 4 YEAR RECEIPT OF SPENT FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	1693			500	212	5930	5930
1986	230	143			1000	212	1589	1554
1987	9182	1937			1000	212	12331	11852
1988	9067	1866	765	1048	500	212	13458	12682
1989			1529	2096		212	3837	3545
1990			1529	2096		212	3837	3475
1991			1529	2096		212	3837	3407
1992			765	2008		212	2985	2599
1993				1919		212	2131	1819
1994				1919		212	2131	1783
1995				1919		212	2131	1748
1996				1919		212	2131	1714
1997				1919		212	2131	1680
1998				2153		212	2365	1828
1999				2153		212	2365	1792
2000				2153		212	2365	1757
2001				6752*		212	6964	5073
TOTAL	22004	5639	6117	32150	3000	3604	72514	64238

* - Decommissioning cost

Initial Payment = 307 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 386 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-28

COST SENSITIVITY CASE -- 5 YEAR RECEIPT OF SPENT FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	1693			500	212	5930	5930
1986	230	143			1000	212	1585	1554
1987	9182	1937			1000	212	12331	11852
1988	9067	1866	612	1031	500	212	13288	12522
1989			1223	2062		212	3497	3231
1990			1223	2062		212	3497	3167
1991			1223	2062		212	3497	3105
1992			1223	2062		212	3497	3044
1993			612	1991		212	2815	2403
1994				1919		212	2131	1783
1995				1919		212	2131	1748
1996				1919		212	2131	1714
1997				1919		212	2131	1680
1998				2153		212	2365	1828
1999				2153		212	2365	1792
2000				2153		212	2365	1757
2001				6752*		212	6964	5073
TOTAL	22004	5639	6116	32157	3000	3604	72520	64183

* - Decommissioning cost

Initial Payment = 307 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 389 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-29

COST SENSITIVITY CASE -- 4 YEAR RECEIPT OF SPENT FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 447B DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	2122			500	828	6975	6975
1986	230	143			1000	828	2201	2158
1987	9182	3366			1000	828	14376	13818
1988	9067	3295	14509	3043	500	828	31242	29440
1989			29017	6086		828	35931	33195
1990			29017	6086		828	35931	32544
1991			29017	6086		828	35931	31906
1992			14509	4637		828	19974	17389
1993				3187		828	4015	3427
1994				3187		828	4015	3360
1995				3187		828	4015	3294
1996				3187		828	4015	3229
1997				3187		828	4015	3166
1998				7398		828	8226	6359
1999				7398		828	8226	6234
2000				7398		828	8226	6112
2001				29400*		828	30228	22019
TOTAL	22004	8926	116069	93467	3000	14076	257542	224625

* - Decommissioning cost

Initial Payment = 23 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 119 \$/KgU (Includes \$9/KgU impact aid)

TABLE A10-30

COST SENSITIVITY CASE -- 5 YEAR RECEIPT OF SPENT FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 447B DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	2122			500	828	6975	6975
1986	230	143			1000	828	2201	2158
1987	9182	3366			1000	828	14376	13818
1988	9067	3295	11607	2650	500	828	27947	26335
1989			23214	5299		828	29341	27107
1990			23214	5299		828	29341	26575
1991			23214	5299		828	29341	26054
1992			23214	5299		828	29341	25543
1993			11607	4243		828	16678	14235
1994				3187		828	4015	3360
1995				3187		828	4015	3294
1996				3187		828	4015	3229
1997				3187		828	4015	3166
1998				7398		828	8226	6359
1999				7398		828	8226	6234
2000				7398		828	8226	6112
2001				29400*		828	30228	22019
TOTAL	22004	8926	116070	92431	3000	14076	256507	222573

* - Decommissioning cost

Initial Payment = 23 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 119 \$/KgU (Includes \$9/KgU impact aid)

TABLE A10-31

COST SENSITIVITY CASE -- 4 YEAR RECEIPT OF SPENT FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	1720			500	212	3754	3754
1986	105	143			1000	212	1460	1431
1987	3235	2026			1000	212	6473	6222
1988	3183	1954	765	1012	500	212	7626	7186
1989			1529	2024		212	3765	3478
1990			1529	2024		212	3765	3410
1991			1529	2024		212	3765	3343
1992			765	1571		212	2548	2218
1993				1118		212	1330	1135
1994				1118		212	1330	1113
1995				1118		212	1330	1091
1996				1118		212	1330	1070
1997				1118		212	1330	1049
1998				2080		212	2292	1772
1999				2080		212	2292	1737
2000				2080		212	2292	1703
2001				3961*		212	4173	3040
TOTAL	7845	5843	6117	24446	3000	3604	50855	44752

* - Decommissioning cost

Initial Payment = 172 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 319 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-32

COST SENSITIVITY CASE -- 5 YEAR RECEIPT OF SPENT FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	1720			500	212	3754	3754
1986	105	143			1000	212	1460	1431
1987	3235	2026			1000	212	6473	6222
1988	3183	1954	612	995	500	212	7456	7026
1989			1223	1990		212	3425	3164
1990			1223	1990		212	3425	3102
1991			1223	1990		212	3425	3041
1992			1223	1990		212	3425	2982
1993			612	1554		212	2378	2030
1994				1118		212	1330	1113
1995				1118		212	1330	1091
1996				1118		212	1330	1070
1997				1118		212	1330	1049
1998				2080		212	2292	1772
1999				2080		212	2292	1737
2000				2080		212	2292	1703
2001				3961*		212	4173	3040
TOTAL	7845	5843	6116	25182	3000	3604	51590	45327

* - Decommissioning cost

Initial Payment = 172 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 329 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-33

COST SENSITIVITY CASE -- 4 YEAR RECEIPT OF SPENT FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	2148			500	828	4798	4798
1986	105	143			1000	828	2076	2035
1987	3235	3455			1000	828	8518	8187
1988	3183	3383	14509	3007	500	828	25410	23944
1989			29017	6013		828	35858	33127
1990			29017	6013		828	35858	32478
1991			29017	6013		828	35858	31841
1992			14509	3913		828	19250	16758
1993				1812		828	2640	2253
1994				1812		828	2640	2209
1995				1812		828	2640	2166
1996				1812		828	2640	2123
1997				1812		828	2640	2082
1998				7326		828	8154	6303
1999				7326		828	8154	6180
2000				7326		828	8154	6059
2001				26609*		828	27437	19986
TOTAL	7845	9129	116069	82606	3000	14076	232725	202529

* - Decommissioning cost

Initial Payment = 16 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 113 \$/KgU (Includes \$8/KgU impact aid)

TABLE A10-34

COST SENSITIVITY CASE -- 5 YEAR RECEIPT OF SPENT FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	2148			500	828	4798	4798
1986	105	143			1000	828	2076	2035
1987	3235	3455			1000	828	8518	8187
1988	3183	3383	11607	2614	500	828	22115	20839
1989			23214	5227		828	29269	27040
1990			23214	5227		828	29269	26510
1991			23214	5227		828	29269	25990
1992			23214	5227		828	29269	25480
1993			11607	3520		828	15955	13617
1994				1812		828	2640	2209
1995				1812		828	2640	2166
1996				1812		828	2640	2123
1997				1812		828	2640	2082
1998				7326		828	8154	6303
1999				7326		828	8154	6180
2000				7326		828	8154	6059
2001				26609*		828	27437	19986
TOTAL	7845	9129	116070	82877	3000	14076	232997	201604

* - Decommissioning cost

Initial Payment = 16 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 113 \$/KgU (Includes \$8/KgU impact aid)

The impact on FIS costs of compressing the construction schedule for FIS facilities to a total of two years, compared with the base case of four years (implies no NRC licensing activities required), is shown in Table A10-35.

TABLE A10-35
IMPACT OF SHORTENING OF CONSTRUCTION TIME FOR FIS FACILITIES
ON FIS SYSTEM COSTS

FIS Facility Construction Time (yr)	100 MTU		1900 MTU	
	Total Discounted Cost (\$000)	Total Unit Cost (\$/kgU)	Total Discounted Cost (\$000)	Total Unit Cost (\$/kgU)
New Transfer Facility Cases				
4 yr. (Base Case)	\$64,294	\$690	\$226,710	\$142
2 yr.	69,137	726	238,607	144
Increase per yr. of schedule shortening	2,422	18	5,949	1.0
Existing Transfer Facility Cases				
4 yr. (Base Case)	\$44,166	\$482	\$203,474	\$128
2 yr.	47,097	501	212,419	129
Increase per yr. of schedule shortening	1,466	9.5	4,473	0.5

The estimated spending schedules, discounted annual costs, and the calculation of the Initial and Final Payments for FIS of spent fuel for each of the cases considered in Table A10-35 are set forth in Tables A10-36 through A10-39.

TABLE A10-36
COST SENSITIVITY CASE -- 2-YEAR CONSTRUCTION SCHEDULE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	12362	3773			1500	212	17847	17847
1986	9642	1866	1020	1077	1500	212	15317	15017
1987			2039	2153		212	4404	4233
1988			2039	2153		212	4404	4150
1989			1020	2036		212	3268	3019
1990				1919		212	2131	1930
1991				1919		212	2131	1892
1992				1919		212	2131	1855
1993				1919		212	2131	1819
1994				1919		212	2131	1783
1995				1919		212	2131	1748
1996				1919		212	2131	1714
1997				1919		212	2131	1680
1998				2153		212	2365	1828
1999				2153		212	2365	1792
2000				2153		212	2365	1757
2001				6752*		212	6964	5073
TOTAL	22004	5639	6118	35982	3000	3604	76347	69137

* - Decommissioning cost

Initial Payment = 312 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 414 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-37
COST SENSITIVITY CASE - 2-YEAR CONSTRUCTION SCHEDULE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 447B DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	12362	5631			1500	828	20321	20321
1986	9642	3295	19345	3699	1500	828	38309	37558
1987			38690	7398		828	46916	45094
1988			38690	7398		828	46916	44210
1989			19345	5293		828	25466	23527
1990				3187		828	4015	3637
1991				3187		828	4015	3565
1992				3187		828	4015	3495
1993				3187		828	4015	3427
1994				3187		828	4015	3360
1995				3187		828	4015	3294
1996				3187		828	4015	3229
1997				3187		828	4015	3166
1998				7398		828	8226	6359
1999				7398		828	8226	6234
2000				7398		828	8226	6112
2001				29400*		828	30228	22019
TOTAL	22004	8926	116070	100878	3000	14076	264954	238607

* - Decommissioning cost

Initial Payment = 22 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 122 \$/KgU (Includes \$9/KgU impact aid)

TABLE A10-38

COST SENSITIVITY CASE -- 2-YEAR CONSTRUCTION SCHEDULE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	4400	3531			1500	212	9643	9643
1986	3445	2311	1020	1040	1500	212	9528	9341
1987			2039	2080		212	4331	4163
1988			2039	2080		212	4331	4081
1989			1020	1599		212	2831	2615
1990				1118		212	1330	1205
1991				1118		212	1330	1181
1992				1118		212	1330	1158
1993				1118		212	1330	1135
1994				1118		212	1330	1113
1995				1118		212	1330	1091
1996				1118		212	1330	1070
1997				1118		212	1330	1049
1998				2080		212	2292	1772
1999				2080		212	2292	1737
2000				2080		212	2292	1703
2001				3961*		212	4173	3040
TOTAL	7845	5842	6118	25944	3000	3604	52353	47097

* - Decommissioning cost

Initial Payment = 172 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 329 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-39

COST SENSITIVITY CASE -- 2-YEAR CONSTRUCTION SCHEDULE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	4400	5389			1500	828	12117	12117
1986	3445	3740	19345	3663	1500	828	32521	31883
1987			38690	7326		828	46844	45025
1988			38690	7326		828	46844	44142
1989			19345	4569		828	24742	22858
1990				1812		828	2640	2391
1991				1812		828	2640	2344
1992				1812		828	2640	2298
1993				1812		828	2640	2253
1994				1812		828	2640	2209
1995				1812		828	2640	2166
1996				1812		828	2640	2123
1997				1812		828	2640	2082
1998				7326		828	8154	6303
1999				7326		828	8154	6180
2000				7326		828	8154	6059
2001				26609*		828	27437	19986
TOTAL	7845	9129	116070	85967	3000	14076	236087	212419

* - Decommissioning cost

Initial Payment = 15 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 114 \$/KgU (Includes \$8/KgU impact aid)

10.3 IMPACT OF MIX OF SPENT FUEL TYPES

In developing the costs for FIS storage described in Section 9.0 of this Exhibit A, it was assumed that a mix of spent fuel would be received such that an average loading of a drywell would be 0.429 MTU (two-thirds of the fuel received would be PWR fuel containing 0.461 MTU/assembly, and one third of the fuel received would be BWR fuel containing 0.183 MTU/assembly -- with one PWR or two BWR assemblies being contained in a single drywell). The impact of receiving 100% PWR and 100% BWR fuel on FIS costs is shown in Table A10-40.

TABLE A10-40
IMPACT OF AMOUNT OF URANIUM CONTAINED IN A DRYWELL ON FIS SYSTEM COSTS

	<u>100 MTU</u>		<u>1900 MTU</u>	
	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kgU)</u>	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kgU)</u>
New Transfer Facility Cases				
67% PWR Fuel (Base Case)	\$64,294	\$690	\$226,710	\$142
100% PWR Fuel	63,755	684	216,538	135
100% BWR Fuel	65,332	701	247,028	155
Change per kg U difference in average content of drywell	17	0.18	321	0.21
Existing Transfer Facility Cases				
67% PWR Fuel (Base Case)	\$44,166	\$482	\$203,474	\$128
100% PWR Fuel	43,623	476	193,302	122
100% BWR Fuel	45,201	494	223,793	141
Change per kg U difference in average content of drywell	17	0.19	321	0.20

The estimated spending schedules, discounted annual costs, and the calculation of the Initial and Final Payments for FIS of spent fuel for each of the cases considered in Table A10-40 are set forth in Tables A10-41 through A10-48.

TABLE A10-41

COST SENSITIVITY CASE -- 100% PWR FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 217 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	1694			500	212	5931	5931
1986	230	143			1000	212	1585	1554
1987	9182	1939			1000	212	12333	11854
1988	9067	1868	937	1076	500	212	13660	12872
1989			1875	2151		212	4238	3915
1990			1875	2151		212	4238	3838
1991			937	2034		212	3183	2826
1992				1917		212	2129	1853
1993				1917		212	2129	1817
1994				1917		212	2129	1781
1995				1917		212	2129	1747
1996				1917		212	2129	1712
1997				1917		212	2129	1679
1998				2151		212	2363	1827
1999				2151		212	2363	1791
2000				2151		212	2363	1756
2001				6654*		212	6866	5002
TOTAL	22004	5644	5624	32021	3000	3604	71897	63755

* - Decommissioning cost

Initial Payment = 307 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 377 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-42

COST SENSITIVITY CASE -- 100% BWR FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 273 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	1691			500	212	5928	5928
1986	230	143			1000	212	1585	1554
1987	9182	1931			1000	212	12325	11846
1988	9067	1860	1179	1078	500	212	13896	13095
1989			2359	2156		212	4727	4367
1990			2359	2156		212	4727	4281
1991			1179	2040		212	3431	3047
1992				1923		212	2135	1859
1993				1923		212	2135	1822
1994				1923		212	2135	1786
1995				1923		212	2135	1751
1996				1923		212	2135	1717
1997				1923		212	2135	1683
1998				2156		212	2368	1831
1999				2156		212	2368	1795
2000				2156		212	2368	1759
2001				6941*		212	7153	5211
TOTAL	22004	5625	7076	32377	3000	3604	73686	65332

* - Decommissioning cost

Initial Payment = 307 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 394 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-43

COST SENSITIVITY CASE -- 100% PWR FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4121 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	2126			500	828	6979	6979
1986	230	143			1000	828	2201	2158
1987	9182	3382			1000	828	14392	13833
1988	9067	3310	17803	3680	500	828	35188	33158
1989			35605	7360		828	43793	40458
1990			35605	7360		828	43793	39665
1991			17803	5255		828	23886	21210
1992				3149		828	3977	3462
1993				3149		828	3977	3394
1994				3149		828	3977	3328
1995				3149		828	3977	3263
1996				3149		828	3977	3199
1997				3149		828	3977	3136
1998				7360		828	8188	6330
1999				7360		828	8188	6205
2000				7360		828	8188	6084
2001				27556*		828	28384	20676
TOTAL	22004	8961	106816	92185	3000	14076	247042	216538

* - Decommissioning cost

Initial Payment = 23 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 112 \$/KgU (Includes \$8/KgU impact aid)

TABLE A10-44

COST SENSITIVITY CASE -- 100% BWR FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 5191 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	2112			500	828	6965	6965
1986	230	143			1000	828	2201	2158
1987	9182	3333			1000	828	14343	13786
1988	9067	3261	22425	3738	500	828	39819	37522
1989			44850	7475		828	53153	49105
1990			44850	7475		828	53153	48142
1991			22425	5370		828	28623	25416
1992				3264		828	4092	3562
1993				3264		828	4092	3492
1994				3264		828	4092	3424
1995				3264		828	4092	3357
1996				3264		828	4092	3291
1997				3264		828	4092	3227
1998				7475		828	8303	6418
1999				7475		828	8303	6293
2000				7475		828	8303	6169
2001				33081*		828	33909	24701
TOTAL	22004	8849	134550	99148	3000	14076	281627	247028

* - Decommissioning cost

Initial Payment = 24 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 131 \$/KgU (Includes \$9/KgU impact aid)

TABLE A10-45

COST SENSITIVITY CASE -- 100% PWR FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 217 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	1720			500	212	3754	3754
1986	105	143			1000	212	1460	1431
1987	3235	2028			1000	212	6475	6224
1988	3183	1956	937	1039	500	212	7827	7376
1989			1875	2078		212	4165	3848
1990			1875	2078		212	4165	3772
1991			937	1597		212	2746	2438
1992				1116		212	1328	1156
1993				1116		212	1328	1133
1994				1116		212	1328	1111
1995				1116		212	1328	1089
1996				1116		212	1328	1068
1997				1116		212	1328	1047
1998				2078		212	2290	1770
1999				2078		212	2290	1736
2000				2078		212	2290	1702
2001				3863*		212	4075	2968
TOTAL	7845	5847	5624	23585	3000	3604	49505	43623

* - Decommissioning cost

Initial Payment = 172 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 304 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-46

COST SENSITIVITY CASE -- 100% BWR FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 273 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	1718			500	212	3752	3752
1986	105	143			1000	212	1460	1431
1987	3235	2019			1000	212	6466	6215
1988	3183	1948	1179	1042	500	212	8064	7599
1989			2359	2084		212	4655	4301
1990			2359	2084		212	4655	4216
1991			1179	1603		212	2994	2659
1992				1121		212	1333	1160
1993				1121		212	1333	1138
1994				1121		212	1333	1115
1995				1121		212	1333	1094
1996				1121		212	1333	1072
1997				1121		212	1333	1051
1998				2084		212	2296	1775
1999				2084		212	2296	1740
2000				2084		212	2296	1706
2001				4150*		212	4362	3177
TOTAL	7845	5828	7076	23941	3000	3604	51294	45201

* - Decommissioning cost

Initial Payment = 172 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 322 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-47
COST SENSITIVITY CASE -- 100% PWR FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4121 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	2153			500	828	4803	4803
1986	105	143			1000	828	2076	2035
1987	3235	3470			1000	828	8533	8202
1988	3183	3399	17803	3644	500	828	29357	27664
1989			35605	7288		828	43721	40391
1990			35605	7288		828	43721	39599
1991			17803	4531		828	23162	20567
1992				1774		828	2602	2265
1993				1774		828	2602	2221
1994				1774		828	2602	2177
1995				1774		828	2602	2135
1996				1774		828	2602	2093
1997				1774		828	2602	2052
1998				7288		828	8116	6274
1999				7288		828	8116	6151
2000				7288		828	8116	6030
2001				24765*		828	25593	18643
TOTAL	7845	9165	106816	80024	3000	14076	220926	193302

* - Decommissioning cost

Initial Payment = 16 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 106 \$/KgU (Includes \$7/KgU impact aid)

TABLE A10-48
COST SENSITIVITY CASE -- 100% BWR FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 5191 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	2138			500	828	4788	4788
1986	105	143			1000	828	2076	2035
1987	3235	3421			1000	828	8484	8155
1988	3183	3350	22425	3702	500	828	33988	32028
1989			44850	7403		828	53081	49039
1990			44850	7403		828	53081	48077
1991			22425	4646		828	27899	24774
1992				1889		828	2717	2365
1993				1889		828	2717	2319
1994				1889		828	2717	2273
1995				1889		828	2717	2229
1996				1889		828	2717	2185
1997				1889		828	2717	2142
1998				7403		828	8231	6363
1999				7403		828	8231	6238
2000				7403		828	8231	6116
2001				30289*		828	31117	22667
TOTAL	7845	9052	134550	86986	3000	14076	255509	223793

* - Decommissioning cost

Initial Payment = 16 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 125 \$/KgU (Includes \$9/KgU impact aid)

10.4 IMPACT OF DISCOUNT RATE

The impact of changes to the discount rate used to calculate FIS service charges on FIS costs is shown in Table A10-49.

TABLE A10-49
IMPACT OF DISCOUNT RATE ON FIS SYSTEM COSTS

<u>Discount Rate</u>	<u>100 MTU</u>		<u>1900 MTU</u>	
	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kgU)</u>	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kgU)</u>
New Transfer Facility Cases				
2% (Base Case)	\$64,294	\$690	\$226,710	\$142
4%	57,685	647	200,861	135
6%	52,291	610	179,605	129
Decrease per percent increase in discount rate	3,001	20	11,776	3.3
Existing Transfer Facility Cases				
2% (Base Case)	\$44,166	\$482	\$203,474	\$128
4%	39,386	454	179,959	123
6%	35,495	429	160,619	118
Decrease per percent increase in discount rate	2,168	13	10,714	2.5

The estimated spending schedules, discounted annual costs, and the calculation of the Initial and Final Payments for FIS of spent fuel for each of the cases considered in Table A10-49 are set forth in Tables A10-50 through A10-57.

TABLE A10-50

COST SENSITIVITY CASE - 4% DISCOUNT RATE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	1693			500	212	5930	5930
1986	230	143			1000	212	1585	1524
1987	9182	1937			1000	212	12331	11401
1988	9067	1866	1020	1077	500	212	13742	12217
1989			2039	2153		212	4404	3765
1990			2039	2153		212	4404	3620
1991			1020	2036		212	3268	2583
1992				1919		212	2131	1619
1993				1919		212	2131	1557
1994				1919		212	2131	1497
1995				1919		212	2131	1440
1996				1919		212	2131	1384
1997				1919		212	2131	1331
1998				2153		212	2365	1420
1999				2153		212	2365	1366
2000				2153		212	2365	1313
2001				6752*		212	6964	3718
TOTAL	22004	5639	6118	32144	3000	3604	72509	57685

* - Decommissioning cost

Initial Payment = 296 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 351 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-51

COST SENSITIVITY CASE -- 6% DISCOUNT RATE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	1693			500	212	5930	5930
1986	230	143			1000	212	1585	1495
1987	9182	1937			1000	212	12331	10975
1988	9067	1866	1020	1077	500	212	13742	11538
1989			2039	2153		212	4404	3488
1990			2039	2153		212	4404	3291
1991			1020	2036		212	3268	2304
1992				1919		212	2131	1417
1993				1919		212	2131	1337
1994				1919		212	2131	1261
1995				1919		212	2131	1190
1996				1919		212	2131	1123
1997				1919		212	2131	1059
1998				2153		212	2365	1109
1999				2153		212	2365	1046
2000				2153		212	2365	987
2001				6752*		212	6964	2741
TOTAL	22004	5639	6118	32144	3000	3604	72509	52291

* - Decommissioning cost

Initial Payment = 286 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 324 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-52
COST SENSITIVITY CASE -- 4% DISCOUNT RATE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 447B DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	2122			500	828	6975	6975
1986	230	143			1000	828	2201	2116
1987	9182	3366			1000	828	14376	13291
1988	9067	3295	19345	3699	500	828	36734	32656
1989			38690	7398		828	46916	40104
1990			38690	7398		828	46916	38562
1991			19345	5293		828	25466	20126
1992				3187		828	4015	3051
1993				3187		828	4015	2934
1994				3187		828	4015	2821
1995				3187		828	4015	2712
1996				3187		828	4015	2608
1997				3187		828	4015	2508
1998				7398		828	8226	4940
1999				7398		828	8226	4750
2000				7398		828	8226	4568
2001				29400*		828	30228	16139
TOTAL	22004	8926	116070	94504	3000	14076	258580	200861

* - Decommissioning cost

Initial Payment = 22 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 113 \$/KgU (Includes \$8/KgU impact aid)

TABLE A10-53
COST SENSITIVITY CASE -- 6% DISCOUNT RATE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 447B DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	2122			500	828	6975	6975
1986	230	143			1000	828	2201	2076
1987	9182	3366			1000	828	14376	12795
1988	9067	3295	19345	3699	500	828	36734	30843
1989			38690	7398		828	46916	37162
1990			38690	7398		828	46916	35058
1991			19345	5293		828	25466	17953
1992				3187		828	4015	2670
1993				3187		828	4015	2519
1994				3187		828	4015	2376
1995				3187		828	4015	2242
1996				3187		828	4015	2115
1997				3187		828	4015	1995
1998				7398		828	8226	3857
1999				7398		828	8226	3638
2000				7398		828	8226	3432
2001				29400*		828	30228	11899
TOTAL	22004	8926	116070	94504	3000	14076	258580	179605

* - Decommissioning cost

Initial Payment = 21 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 108 \$/KgU (Includes \$8/KgU impact aid)

TABLE A10-54
COST SENSITIVITY CASE -- 4% DISCOUNT RATE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	1720			500	212	3754	3754
1986	105	143			1000	212	1460	1404
1987	3235	2026			1000	212	6473	5985
1988	3183	1954	1020	1040	500	212	7909	7031
1989			2039	2080		212	4331	3702
1990			2039	2080		212	4331	3560
1991			1020	1599		212	2831	2237
1992				1118		212	1330	1011
1993				1118		212	1330	972
1994				1118		212	1330	934
1995				1118		212	1330	899
1996				1118		212	1330	864
1997				1118		212	1330	831
1998				2080		212	2292	1377
1999				2080		212	2292	1324
2000				2080		212	2292	1273
2001				3961*		212	4173	2228
TOTAL	7845	5843	6118	23708	3000	3604	50118	39386

* -- Decommissioning cost

Initial Payment = 166 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 288 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-55
COST SENSITIVITY CASE -- 6% DISCOUNT RATE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	1720			500	212	3754	3754
1986	105	143			1000	212	1460	1377
1987	3235	2026			1000	212	6473	5761
1988	3183	1954	1020	1040	500	212	7909	6641
1989			2039	2080		212	4331	3431
1990			2039	2080		212	4331	3236
1991			1020	1599		212	2831	1996
1992				1118		212	1330	885
1993				1118		212	1330	834
1994				1118		212	1330	787
1995				1118		212	1330	743
1996				1118		212	1330	701
1997				1118		212	1330	661
1998				2080		212	2292	1075
1999				2080		212	2292	1014
2000				2080		212	2292	956
2001				3961*		212	4173	1643
TOTAL	7845	5843	6118	23708	3000	3604	50118	35495

* - Decommissioning cost

Initial Payment = 159 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 270 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-56

COST SENSITIVITY CASE -- 4% DISCOUNT RATE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	2148			500	828	4798	4798
1986	105	143			1000	828	2076	1996
1987	3235	3455			1000	828	8518	7875
1988	3183	3383	19345	3663	500	828	30902	27472
1989			38690	7326		828	46844	40042
1990			38690	7326		828	46844	38502
1991			19345	4569		828	24742	19554
1992				1812		828	2640	2006
1993				1812		828	2640	1929
1994				1812		828	2640	1855
1995				1812		828	2640	1783
1996				1812		828	2640	1715
1997				1812		828	2640	1649
1998				7326		828	8154	4897
1999				7326		828	8154	4709
2000				7326		828	8154	4528
2001				26609*		828	27437	14649
TOTAL	7845	9129	116070	82343	3000	14076	232463	179959

* - Decommissioning cost

Initial Payment = 15 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 108 \$/KgU (Includes \$8/KgU impact aid)

TABLE A10-57

COST SENSITIVITY CASE -- 6% DISCOUNT RATE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	2148			500	828	4798	4798
1986	105	143			1000	828	2076	1958
1987	3235	3455			1000	828	8518	7581
1988	3183	3383	19345	3663	500	828	30902	25946
1989			38690	7326		828	46844	37105
1990			38690	7326		828	46844	35005
1991			19345	4569		828	24742	17442
1992				1812		828	2640	1756
1993				1812		828	2640	1656
1994				1812		828	2640	1563
1995				1812		828	2640	1474
1996				1812		828	2640	1391
1997				1812		828	2640	1312
1998				7326		828	8154	3823
1999				7326		828	8154	3607
2000				7326		828	8154	3402
2001				26609*		828	27437	10800
TOTAL	7845	9129	116070	82343	3000	14076	232463	160619

* - Decommissioning cost

Initial Payment = 15 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 103 \$/KgU (Includes \$7/KgU impact aid)

10.5 IMPACT OF NRC LICENSING STATUS

The impact on FIS costs of not having to license a FIS facility through the NRC is shown in Table A10-58. In this table the cost impact is shown separately for (i) not having to go through the formal NRC review of a safety analysis report, and hearings on construction and operation, but rather having internal DOE reviews only, (ii) not having to implement NRC security regulations but rather using the security protection afforded the existing site, and (iii) a combination of (i) and (ii).

TABLE A10-58
IMPACT ON FIS SYSTEM COSTS OF NOT HAVING TO LICENSE FIS FACILITIES

	100 MTU		1900 MTU	
	Total Discounted Cost (\$000)	Total Unit Cost (\$/kgU)	Total Discounted Cost (\$000)	Total Unit Cost (\$/kgU)
New Transfer Facility Cases				
Full NRC Licensing (Base Case)	\$64,294	\$690	\$226,710	\$142
No NRC Licensing Activities	62,552	672	224,978	141
Savings	1,742	18	1,732	1
No NRC Security	55,548	594	217,957	136
Savings	8,746	96	8,753	6
No NRC Licensing or Security	53,801	577	216,228	135
Savings	10,493	113	10,482	7
Existing Transfer Facility Cases				
Full NRC Licensing (Base Case)	\$44,166	\$482	\$203,474	\$128
No NRC Licensing Activities	43,169	472	202,491	127
Savings	997	10	983	1
No NRC Security	35,414	386	194,724	122
Savings	8,752	96	8,750	6
No NRC Licensing or Security	34,418	377	193,742	121
Savings	9,748	105	9,732	7

The estimated spending schedules, discounted annual costs, and the calculation of the Initial and Final Payments for FIS of spent fuel for each of the cases considered in Table A10-58 are set forth in Tables A10-59 through A10-70.

TABLE A10-59
COST SENSITIVITY CASE -- NO NRC LICENSING

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
 AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
 (\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3088	982			500	212	4782	4782
1986	105	63			1000	212	1380	1353
1987	9119	1898			1000	212	12229	11754
1988	9067	1866	1020	1073	500	212	13738	12946
1989			2039	2145		212	4396	4061
1990			2039	2145		212	4396	3982
1991			1020	2028		212	3260	2895
1992				1911		212	2123	1848
1993				1911		212	2123	1812
1994				1911		212	2123	1776
1995				1911		212	2123	1742
1996				1911		212	2123	1707
1997				1911		212	2123	1674
1998				2145		212	2357	1822
1999				2145		212	2357	1786
2000				2145		212	2357	1751
2001				6461*		212	6673	4861
TOTAL	21379	4809	6118	31753	3000	3604	70663	62552

* - Decommissioning cost

Initial Payment = 293 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 379 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-60
COST SENSITIVITY CASE -- NO NRC SECURITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
 AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
 (\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	1693			500	212	5930	5930
1986	230	143			1000	212	1585	1554
1987	9182	1937			1000	212	12331	11852
1988	9067	1866	1020	657	500	212	13322	12554
1989			2039	1314		212	3565	3294
1990			2039	1314		212	3565	3229
1991			1020	1198		212	2430	2158
1992				1081		212	1293	1126
1993				1081		212	1293	1104
1994				1081		212	1293	1082
1995				1081		212	1293	1061
1996				1081		212	1293	1040
1997				1081		212	1293	1020
1998				1314		212	1526	1180
1999				1314		212	1526	1157
2000				1314		212	1526	1134
2001				6752*		212	6964	5073
TOTAL	22004	5639	6118	21663	3000	3604	62028	55548

* - Decommissioning cost

Initial Payment = 307 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 287 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-61

COST SENSITIVITY CASE -- NO NRC LICENSING OR SECURITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3088	982			500	212	4782	4782
1986	105	63			1000	212	1380	1353
1987	9119	1898			1000	212	12229	11754
1988	9067	1866	1020	653	500	212	13318	12550
1989			2039	1306		212	3557	3286
1990			2039	1306		212	3557	3222
1991			1020	1190		212	2422	2151
1992				1073		212	1285	1119
1993				1073		212	1285	1097
1994				1073		212	1285	1075
1995				1073		212	1285	1054
1996				1073		212	1285	1033
1997				1073		212	1285	1013
1998				1306		212	1518	1173
1999				1306		212	1518	1150
2000				1306		212	1518	1128
2001				6461*		212	6673	4861
TOTAL	21379	4809	6118	21272	3000	3604	60182	53801

* - Decommissioning cost

Initial Payment = 293 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 284 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-62

COST SENSITIVITY CASE -- NO NRC LICENSING

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3088	1411			500	828	5827	5827
1986	105	63			1000	828	1996	1957
1987	9119	3326			1000	828	14273	13719
1988	9067	3295	19345	3696	500	828	36731	34612
1989			38690	7391		828	46909	43337
1990			38690	7391		828	46909	42487
1991			19345	5286		828	25459	22607
1992				3180		828	4008	3489
1993				3180		828	4008	3421
1994				3180		828	4008	3354
1995				3180		828	4008	3288
1996				3180		828	4008	3223
1997				3180		828	4008	3160
1998				7391		828	8219	6354
1999				7391		828	8219	6229
2000				7391		828	8219	6107
2001				29109*		828	29937	21807
TOTAL	21379	8095	116070	94126	3000	14076	256746	224978

* - Decommissioning cost

Initial Payment = 22 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 119 \$/KgU (Includes \$9/KgU impact aid)

TABLE A10-63

COST SENSITIVITY CASE -- NO NRC SECURITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3525	2122			500	828	6975	6975
1986	230	143			1000	828	2201	2158
1987	9182	3366			1000	828	14376	13818
1988	9067	3295	19345	3280	500	828	36315	34220
1989			38690	6560		828	46078	42569
1990			38690	6560		828	46078	41734
1991			19345	4454		828	24627	21868
1992				2348		828	3176	2765
1993				2348		828	3176	2711
1994				2348		828	3176	2658
1995				2348		828	3176	2605
1996				2348		828	3176	2554
1997				2348		828	3176	2504
1998				6560		828	7388	5711
1999				6560		828	7388	5599
2000				6560		828	7388	5489
2001				29400*		828	30228	22019
TOTAL	22004	8926	116070	84022	3000	14076	248098	217957

* - Decommissioning cost

Initial Payment = 23 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 113 \$/KgU (Includes \$8/KgU impact aid)

TABLE A10-64

COST SENSITIVITY CASE -- NO NRC LICENSING OR SECURITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	3088	1411			500	828	5827	5827
1986	105	63			1000	828	1996	1957
1987	9119	3326			1000	828	14273	13719
1988	9067	3295	19345	3277	500	828	36312	34218
1989			38690	6553		828	46071	42562
1990			38690	6553		828	46071	41728
1991			19345	4447		828	24620	21862
1992				2341		828	3169	2759
1993				2341		828	3169	2705
1994				2341		828	3169	2652
1995				2341		828	3169	2600
1996				2341		828	3169	2549
1997				2341		828	3169	2499
1998				6553		828	7381	5706
1999				6553		828	7381	5594
2000				6553		828	7381	5484
2001				29109*		828	29937	21807
TOTAL	21379	8095	116070	83644	3000	14076	246264	216228

* - Decommissioning cost

Initial Payment = 22 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 113 \$/KgU (Includes \$8/KgU impact aid)

TABLE A10-65
COST SENSITIVITY CASE -- NO NRC LICENSING

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	1009			500	212	3043	3043
1986	105	63			1000	212	1380	1353
1987	3235	1986			1000	212	6433	6183
1988	3183	1954	1020	1038	500	212	7907	7451
1989			2039	2076		212	4327	3997
1990			2039	2076		212	4327	3919
1991			1020	1595		212	2827	2510
1992				1113		212	1325	1153
1993				1113		212	1325	1131
1994				1113		212	1325	1109
1995				1113		212	1325	1087
1996				1113		212	1325	1066
1997				1113		212	1325	1045
1998				2076		212	2288	1769
1999				2076		212	2288	1734
2000				2076		212	2288	1700
2001				3795*		212	4007	2919
TOTAL	7845	5012	6118	23486	3000	3604	49065	43169

* - Decommissioning cost

Initial Payment = 164 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 308 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-66
COST SENSITIVITY CASE -- NO NRC SECURITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	1720			500	212	3754	3754
1986	105	143			1000	212	1460	1431
1987	3235	2026			1000	212	6473	6222
1988	3183	1954	1020	621	500	212	7490	7058
1989			2039	1242		212	3493	3227
1990			2039	1242		212	3493	3164
1991			1020	761		212	1993	1770
1992				279		212	491	427
1993				279		212	491	419
1994				279		212	491	411
1995				279		212	491	403
1996				279		212	491	395
1997				279		212	491	387
1998				1242		212	1454	1124
1999				1242		212	1454	1102
2000				1242		212	1454	1080
2001				3961*		212	4173	3040
TOTAL	7845	5843	6118	13227	3000	3604	39637	35414

* - Decommissioning cost

Initial Payment = 172 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 214 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-67

COST SENSITIVITY CASE -- NO NRC LICENSING OR SECURITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	1009			500	212	3043	3043
1986	105	63			1000	212	1380	1353
1987	3235	1986			1000	212	6433	6183
1988	3183	1954	1020	619	500	212	7488	7056
1989			2039	1237		212	3488	3222
1990			2039	1237		212	3488	3159
1991			1020	756		212	1988	1765
1992				275		212	487	424
1993				275		212	487	416
1994				275		212	487	407
1995				275		212	487	400
1996				275		212	487	392
1997				275		212	487	384
1998				1237		212	1449	1120
1999				1237		212	1449	1098
2000				1237		212	1449	1077
2001				3795*		212	4007	2919
TOTAL	7845	5012	6118	13005	3000	3604	38584	34418

* - Decommissioning cost

Initial Payment = 164 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 213 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-68

COST SENSITIVITY CASE -- NO NRC LICENSING

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	1437			500	828	4087	4087
1986	105	63			1000	828	1996	1957
1987	3235	3415			1000	828	8478	8149
1988	3183	3383	19345	3661	500	828	30900	29118
1989			38690	7322		828	46840	43273
1990			38690	7322		828	46840	42424
1991			19345	4566		828	24739	21968
1992				1809		828	2637	2296
1993				1809		828	2637	2251
1994				1809		828	2637	2207
1995				1809		828	2637	2163
1996				1809		828	2637	2121
1997				1809		828	2637	2079
1998				7322		828	8150	6300
1999				7322		828	8150	6177
2000				7322		828	8150	6056
2001				26443*		828	27271	19865
TOTAL	7845	8298	116070	82134	3000	14076	231423	202491

* - Decommissioning cost

Initial Payment = 15 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 112 \$/KgU (Includes \$8/KgU impact aid)

TABLE A10-69

COST SENSITIVITY CASE -- NO NRC SECURITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	2148			500	828	4798	4798
1986	105	143			1000	828	2076	2035
1987	3235	3455			1000	828	8518	8187
1988	3183	3383	19345	3244	500	828	30483	28725
1989			38690	6487		828	46005	42502
1990			38690	6487		828	46005	41668
1991			19345	3731		828	23904	21226
1992				974		828	1802	1569
1993				974		828	1802	1538
1994				974		828	1802	1508
1995				974		828	1802	1478
1996				974		828	1802	1449
1997				974		828	1802	1421
1998				6487		828	7315	5655
1999				6487		828	7315	5544
2000				6487		828	7315	5435
2001				26609*		828	27437	19986
TOTAL	7845	9129	116070	71863	3000	14076	221983	194724

* - Decommissioning cost

Initial Payment = 16 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 106 \$/KgU (Includes \$7/KgU impact aid)

TABLE A10-70

COST SENSITIVITY CASE -- NO NRC LICENSING OR SECURITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1985)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1985	1322	1437			500	828	4087	4087
1986	105	63			1000	828	1996	1957
1987	3235	3415			1000	828	8478	8149
1988	3183	3383	19345	3242	500	828	30481	28723
1989			38690	6484		828	46002	42499
1990			38690	6484		828	46002	41665
1991			19345	3728		828	23901	21223
1992				971		828	1799	1566
1993				971		828	1799	1535
1994				971		828	1799	1505
1995				971		828	1799	1476
1996				971		828	1799	1447
1997				971		828	1799	1418
1998				6484		828	7312	5652
1999				6484		828	7312	5542
2000				6484		828	7312	5433
2001				26443*		828	27271	19865
TOTAL	7845	8298	116070	71659	3000	14076	220948	193742

* - Decommissioning cost

Initial Payment = 15 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 106 \$/KgU (Includes \$7/KgU impact aid)

EXHIBIT B

ESTIMATED COSTS FOR TRANSPORT OF SPENT FUEL FROM VARIOUS
REACTOR SITES TO FEDERAL INTERIM STORAGE FACILITIES

EXHIBIT B
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EXHIBIT B
ESTIMATED COSTS FOR TRANSPORT OF SPENT FUEL FROM VARIOUS
REACTOR SITES TO FEDERAL INTERIM STORAGE FACILITIES

This Exhibit describes the development of the estimated costs of transporting spent fuel between each of twenty-two (22) specific reactor sites that are most likely to require FIS services, and two example locations of FIS facilities, one in the Eastern U.S. and one in the Western U.S. Costs have been developed for both truck transport and for rail transport, although the Department should use rail shipments wherever possible in order to minimize cask handling at FIS facilities -- especially in cases where the FIS storage capacity is above 300 MTU. A summary of the total costs is presented for transport by both truck and rail shipment between each point of origin and destination.

1.0 CASKS USED IN STUDY

A review was made of the availability and capability of various shipping casks in the United States and it was concluded therefrom that a determination of the estimated costs associated with transport of spent fuel from reactor sites to the FIS facilities would be made assuming that the NLI 1/2 or IF-300 casks would be used. The bases for this conclusion are set forth below:

- (1) Only two types of legal weight truck casks are currently authorized for use in the U.S., the NAC-1/NFS-4 and the NLI 1/2 casks. While there have been NRC licensing problems associated with the NAC-1/NFS-4 casks, no such problems have occurred with the NLI 1/2. Nuclear Assurance Corporation (NAC) has control of all NLI 1/2 casks and NAC-1/NFS-4 casks and has stated that the leasing charges would be about the same for either cask system.
- (2) At the present time there is only one rail cask which is both licensed and in current use in the United States. This is the IF-300 cask fabricated by General Electric. One other rail cask, the NLI 10/24, is licensed in the U.S. but is not currently in a usable condition. The others (TN 12 and NAC-3) are in some state of design, construction or are not approved by the NRC. Since the IF-300 now operates in the U.S. and can, therefore, provide current lease charges, it should provide costs which are representative of rail cask transport.

2.0 ESTIMATED COSTS OF CASK USE AND SERVICE

Estimates of the cask use charge for the NLI 1/2 cask were based on the 1984 rate schedule developed by NAC for this cask, as follows:

<u>No. Days of Use</u>	<u>Charge</u>
1 - 10 days	\$35,000(minimum charge)
11 - 30 days	1,700/day
31 - 90 days	1,300/day
91 - 180 days	1,000/day
181 - 365 days	900/day

Utilizing this rate schedule and assuming that a cask would be used 300 days/year, a cask use charge of \$1,150/day results. In order to approximate mid-1985 charges, the 1984 daily rate was escalated by 4% to produce the daily rate of \$1,200 which was used in this study. This escalation factor was obtained by determining the average monthly increase in NAC charges between February 1983 and December 1984 (NAC advised that the current prices would prevail until that time), and assuming that this average monthly increase would continue into mid-1985.

General Electric provided a quotation for the use of the IF-300 rail cask which amounted to \$4,000/day when the cask was loaded with spent fuel and \$2,000/day when the cask was empty. This results in an average cask use charge of about \$3,000/day (early 1984 dollars), assuming the lessee is making maximum productive use of the cask. This was escalated to \$3,120/day (1985 dollars) by applying the average monthly increase in the Wholesale Price Index, Industrial Commodities, Machinery and Equipment between January 1982 and January 1984 to the \$3,000/day charge to mid-1985.

3.0 FREIGHT COSTS

Freight charges for truck shipments between the various reactors and destinations, excluding escort charges, were determined using published tariffs. Freight charges for rail shipments were calculated using tariff information supplied by the Rockwell Hanford Operations Traffic Department.

3.1 TRUCK TARIFFS

The cost of shipment of spent fuel by truck consists of several separate charges:

- (1) a basic mileage commodity rate for both the loaded and empty cask,
- (2) a security charge, and
- (3) a vehicle detention charge.

The reference tariff is ICC TRSM 4007-A, dated April 12, 1982. Although originally issued in 1982, all items in this tariff which are applicable to this study represent current 1984 prices. Tri-State Motor Transit Co. (TSMT) recommends, however, increasing the existing rates by 6% to reflect proposed increases in 1985. Therefore, all rates used in this study which were taken from this tariff have been increased from their present value by 6% in order to provide a reasonable estimation of 1985 rates. The Mileage Commodity Rates are described in Item No. 2000 of the tariff. The rates are based on a cents per 100 pound basis and use a weight of 48,000 lbs for the empty cask and 49,000 lbs. for the loaded truck cask. Table B3-1 sets forth the Mileage Commodity Rates for the distances pertinent to this study.

A security surveillance charge of \$0.98 per loaded mile is applicable to the shipment under Item 810-2 of the tariff. This provides for a guard or second driver to be present in the transport vehicle. A charge of \$0.16 per mile for the return of personnel is applicable to the return of the empty cask. A charge of \$0.21/per loaded mile for arming each driver-guard would apply only to shipments through the state of Virginia.

TABLE B3-1
RATES FOR TRANSPORT OF NLI 1/2 TRUCK CASK^a
 (1985 Dollars)

<u>Reactor to Destination</u>	<u>Rates in Dollars per 100 Pounds</u>	
	<u>Loaded</u>	<u>Empty</u>
<u>From Surry to</u>		
Eastern U.S. Site	\$ 3.65	\$ 2.25
Western U.S. Site	12.08	8.82
<u>From Palisades to</u>		
Eastern U.S. Site	4.07	2.65
Western U.S. Site	9.78	7.20
<u>From St. Lucie to</u>		
Eastern U.S. Site	4.71	3.30
Western U.S. Site	14.89	11.01
<u>From Robinson to</u>		
Eastern U.S. Site	3.00	1.70
Western U.S. Site	14.89	11.01
<u>From Fitzpatrick to</u>		
Eastern U.S. Site	5.41	3.93
Western U.S. Site	12.83	9.35
<u>From Brunswick to</u>		
Eastern U.S. Site	3.82	2.43
Western U.S. Site	14.66	10.82
<u>From LaSalle to</u>		
Eastern U.S. Site	3.72	2.33
Western U.S. Site	8.46	6.17
<u>From Oconee to</u>		
Eastern U.S. Site	2.36	1.31
Western U.S. Site	12.83	9.35
<u>From Turkey Point to</u>		
Eastern U.S. Site	5.23	3.85
Western U.S. Site	15.68	11.66
<u>From Monticello to</u>		
Eastern U.S. Site	5.79	4.25
Western U.S. Site	6.96	5.05
<u>From Peach Bottom to</u>		
Eastern U.S. Site	4.71	3.30
Western U.S. Site	13.09	9.58
<u>From Pilgrim to</u>		
Eastern U.S. Site	5.41	3.93
Western U.S. Site	14.38	10.60

TABLE B3-1 (Continued)
RATES FOR TRANSPORT OF NLI 1/2 TRUCK CASK^a
(1985 Dollars)

<u>Reactor to Destination</u>	<u>Rates in Dollars per 100 Pounds</u>	
	<u>Loaded</u>	<u>Empty</u>
<u>From Ginna to</u>		
Eastern U.S. Site	\$ 4.96	\$ 3.50
Western U.S. Site	12.08	8.95
<u>From Indian Point to</u>		
Eastern U.S. Site	6.15	4.53
Western U.S. Site	13.88	10.20
<u>From Millstone to</u>		
Eastern U.S. Site	5.13	3.71
Western U.S. Site	14.14	10.42
<u>From Prairie Island to</u>		
Eastern U.S. Site	5.67	4.12
Western U.S. Site	8.37	6.10
<u>From La Crosse to</u>		
Eastern U.S. Site	5.05	3.50
Western U.S. Site	7.82	5.86
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	3.89	2.53
Western U.S. Site	13.09	9.78
<u>From Oyster Creek to</u>		
Eastern U.S. Site	4.41	3.06
Western U.S. Site	13.62	9.99
<u>From Cooper to</u>		
Eastern U.S. Site	5.23	3.85
Western U.S. Site	6.43	4.75
<u>From Sequoyah to</u>		
Eastern U.S. Site	1.70	1.04
Western U.S. Site	11.58	8.53
<u>From Davis Besse to</u>		
Eastern U.S. Site	4.17	2.78
Western U.S. Site	10.26	7.54

^aRates based upon Tariff ICC 4007-A, Item 2000, dated April 12, 1982 and escalated by 6% to approximate mid-1985 charges.

In addition to the charges detailed above, demurrage (detention) charges are applicable to each shipment and are covered in Item 500 of the tariff. The following rate schedule provides charges for the time required for loading at origination point and unloading at destination.

<u>Hours</u>	<u>Rate Per Hour Per Vehicle Used</u>
First 3	No Charge
4 - 8	\$18.55
9 - 16	\$23.85
17 - 24	\$29.15
All Over 24	\$34.45

The total turnaround time assumed for the NLI 1/2 truck cask, for this study, is 36 hours; 24 hours for loading and 12 hours for unloading. Therefore, the total detention charge, based on the above rate schedule, is \$516.75 for loading and \$188.15 for unloading for a total charge of \$704.90/round trip.

3.1.1 Escort Charges for NLI 1/2 Truck Cask

Escorts must be provided for each truck shipment as stipulated in 10 CFR Part 73.37. This regulation requires that the transport vehicle, using a pre-determined route, be escorted through each locality designated by the NRC as being a heavily populated urban area. In accordance with this regulation, the escort for a truck shipment is sufficient if the transport vehicle within a heavily populated area is:

- (a) Occupied by two individuals, one of whom serves as guard and escorted by an armed member of the local law enforcement agency in a mobile unit of such agency; or
- (b) Led by a separate vehicle occupied by a least one armed escort and trailed by a third vehicle occupied by at least one armed escort.

At the present time this escort service is provided by local law enforcement agencies in the manner described in (a), above, and is done free of charge. It is believed that as these shipments become routine some remuneration will be required by these local law enforcement agencies.

Therefore, for the purposes of this study, the following assumptions and estimates for determination of escort costs have been used:

- (1) Each major locality through which the shipment passes will require an escort.
- (2) Escorts in each of these localities will be provided by off-duty, local police at a charge of \$23.20/hr per person, including provision of a vehicle.
- (3) A minimum of 4 hours will be required for transit from 5 miles outside the locality, through locality, to 5 miles on the other side of the locality.
- (4) The time to make the necessary escort arrangements in each locality will amount to 1 person-hour. The cost of this time is estimated to amount to \$28.25.
- (5) The cost of communicating with each locality involved in a shipment (i.e., telephone, mail, telex) was estimated at \$40.

Taking into consideration the above assumptions and estimated costs, it was estimated that there would be a total cost of \$185 for escorting a shipment through each locality. This figure includes a 15% contingency to allow for such possibilities as the need for guards during equipment malfunction or compliance with state laws.

3.2 RAIL TARIFFS

Rail freight rates which were effective May 1, 1984 for Class 40 (loaded) and Class 37½ (empty) rail casks were provided by the Rockwell Hanford Operations Traffic Manager's Office. These rates were increased by 4% to obtain the 1985 values set forth in Table B3-2.

TABLE B3-2
RAIL FREIGHT RATES
(1985 Dollars)

<u>Reactor to Destination</u>	<u>Rates in Dollars per 100 Pounds</u>	
	<u>Class 40</u> <u>Loaded</u>	<u>Class 37½</u> <u>Empty</u>
<u>From Surry to</u>		
Eastern U.S. Site	\$ 6.51	\$ 6.11
Western U.S. Site	17.95	16.83
<u>From Palisades to</u>		
Eastern U.S. Site	6.76	6.35
Western U.S. Site	14.12	13.24
<u>From St. Lucie to</u>		
Eastern U.S. Site	7.95	7.45
Western U.S. Site	18.51	17.36
<u>From Robinson to</u>		
Eastern U.S. Site	5.46	5.12
Western U.S. Site	17.71	16.60
<u>From Fitzpatrick to</u>		
Eastern U.S. Site	8.22	7.70
Western U.S. Site	17.05	15.99
<u>From Brunswick to</u>		
Eastern U.S. Site	6.14	5.76
Western U.S. Site	18.20	17.07
<u>From LaSalle to</u>		
Eastern U.S. Site	6.11	5.72
Western U.S. Site	13.32	12.49
<u>From Oconee to</u>		
Eastern U.S. Site	4.78	4.48
Western U.S. Site	16.65	15.61
<u>From Turkey Point to</u>		
Eastern U.S. Site	8.87	8.32
Western U.S. Site	18.51	17.36
<u>From Monticello to</u>		
Eastern U.S. Site	9.16	8.59
Western U.S. Site	12.85	12.05
<u>From Peach Bottom to</u>		
Eastern U.S. Site	6.90	6.46
Western U.S. Site	17.27	16.18
<u>From Pilgrim to</u>		
Eastern U.S. Site	9.16	8.59
Western U.S. Site	18.44	17.29

TABLE B3-2 (Continued)

RAIL FREIGHT RATES
(1985 Dollars)

<u>Reactor to Destination</u>	<u>Rates in Dollars per 100 Pounds</u>	
	<u>Class 40 Loaded</u>	<u>Class 37½ Empty</u>
<u>From Ginna to</u>		
Eastern U.S. Site	\$ 7.70	\$ 7.22
Western U.S. Site	16.39	15.36
<u>From Indian Point to</u>		
Eastern U.S. Site	8.22	7.70
Western U.S. Site	18.08	16.95
<u>From Millstone to</u>		
Eastern U.S. Site	8.74	8.20
Western U.S. Site	18.44	17.29
<u>From Prairie Island to</u>		
Eastern U.S. Site	9.01	8.45
Western U.S. Site	12.67	11.87
<u>From La Crosse to</u>		
Eastern U.S. Site	8.46	7.93
Western U.S. Site	12.85	12.05
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	6.66	6.24
Western U.S. Site	17.44	16.36
<u>From Oyster Creek to</u>		
Eastern U.S. Site	7.70	7.22
Western U.S. Site	17.95	16.83
<u>From Cooper to</u>		
Eastern U.S. Site	9.01	8.45
Western U.S. Site	11.01	10.32
<u>From Sequoyah to</u>		
Eastern U.S. Site	3.25	3.05
Western U.S. Site	15.51	14.54
<u>From Davis Besse to</u>		
Eastern U.S. Site	5.86	5.49
Western U.S. Site	14.87	13.95

3.2.1 Heavy Haul Charges

Heavy haul charges are applicable to this study in the case of ten reactor sites which do not have direct rail access. Also, these charges are assumed to apply in all 22 cases in which the destination is the Western U.S. facility which is assumed to be without direct rail access. The Eastern U. S. site is assumed to have direct rail access.

Heavy haul charges for the ten reactor sites without rail access comprise the following components:

- (1) Transport vehicle rental (including manpower)
- (2) Transfer equipment rental (including manpower)
- (3) Overweight permits (if necessary)

A summary of the heavy haul charges between the reactor sites that do not have direct rail access and the corresponding railhead, and between the railhead and the Western U.S. facility, is set forth in Table B3-3.

TABLE B3-3
ESTIMATED HEAVY HAUL & TRANSFER CHARGES PER ROUND TRIP SHIPMENT
OF AN IF-300 RAIL CASK
(1985 Dollars)

<u>Reactor</u>	<u>Reactor to Railhead</u>			<u>Overweight Permit Cost^c</u>	<u>Total Cost</u>
	<u>One-Way Mileage</u>	<u>Heavy Haul Cost^a</u>	<u>Rigger Cost^b</u>		
Surry	35	\$3,899	\$5,644	\$ 78	\$ 9,621
Turkey Point	10	2,989	5,644	127	8,760
St. Lucie	10	2,989	5,644	127	8,760
Pilgrim	25	3,535	5,644	64	9,243
Oconee	10	2,989	5,644	85	8,718
Ginna	5	2,806	6,544	123	8,573
Indian Point	5	2,806	5,644	123	8,573
Millstone	5	2,806	5,644	72	8,522
Oyster Creek	25	3,535	5,644	848	10,027
Calvert Cliffs	50	4,446	5,644	310	10,400
Western U.S. FIS	27	3,609	5,644	-	9,253

^aHeavy haul cost for round trip of cask is determined as follows:

2x(4 hrs deadhead time plus 4 hrs loading time plus 4 hrs unloading time, plus transit time @ 6mph) @ \$109.35/hr.

^bRigger cost for round trip of cask is determined as follows:

2x(4 hrs deadhead time plus 4 hrs loading/unloading time) @ \$148.61/hr, plus a crane charge @ \$1,633 per day, 2 days per round trip.

^cPermits required for cask and for crane for each transfer, Ref. Item 675, ICC Tariff TRSM-4007-A.

3.2.2 Escort Charges

In accordance with 10 CFR Part 73.37, each rail shipment of spent fuel must provide (in addition to other provisions) that:

- "(1) A shipment car within a heavily populated area is accompanied by two armed escorts (who may be members of a local law enforcement agency), at least one of whom is stationed at a location on the train that will permit observation of the shipment car while in motion.
- (2) A shipment car not within any heavily populated area is accompanied by at least one escort stationed at a location on the train that will permit observation of the shipment car while in motion."

Since at this point in time NRC-approved routes cannot be determined (and consequently neither can the number of heavily populated areas), the cost of escort services was estimated on the basis of using two guards for the entire trip. In calculating the escort charge, the cost of equipment, rail fare, subsistence and return airfare was included.

4.0 TIME REQUIRED TO EFFECT A SPENT FUEL SHIPMENT

Many of the components of the cost of transport of spent fuel are dependent on the time required to effect a round trip shipment, therefore, a determination was made of the time required to effect a round trip shipment between each of the points of origin and destination being considered in this study.

An estimate was made of the one-way road miles between each reactor and each FIS site considered utilizing the most direct and major routes. The routes selected approximate the shortest distances from the reactors to the FIS sites and represent the route an empty cask would take; a 10% contingency was added to this distance for a loaded cask to avoid the center of urban areas. The applicable freight charges in each case were determined using the one-way distances estimated in this manner.

An average travel speed of 35 mph for a truck shipment was assumed for the calculation of the transport time involved. The turnaround time of 36 hours (12 hours for unloading and 24 hours for loading the cask) was added to the actual transit time to obtain the total time involved for a round trip shipment. The cask use and service charge and vehicle detention charges were calculated using these time estimates.

Table B4-1 presents the estimated shipping distances involved for truck shipments of spent fuel between the various shipping and receiving locations considered and the estimated time required to complete a round trip shipment.

TABLE B4-1
DISTANCES AND TIMES REQUIRED FOR COMPLETION OF ROUND TRIP SHIPMENT OF
SPENT FUEL BY NLI 1/2 TRUCK CASK

Reactor to Destination	One-Way Distance (Miles)		Time Requirements			
	Loaded ^a	Empty	Transport (Hours) ^b	Turnaround (Hours) ^c	Total (Hours)	Total (Days)
From Surry to						
Eastern U.S. Site	565	514	31	36	67	2.8
Western U.S. Site	2,320	2,109	127	36	163	6.8
From Palisades to						
Eastern U.S. Site	686	624	37	36	73	3.0
Western U.S. Site	1,884	1,713	103	36	139	5.8
From St. Lucie to						
Eastern U.S. Site	862	784	47	36	83	3.5
Western U.S. Site	2,890	2,647	158	36	194	8.1
From Robinson to						
Eastern U.S. Site	384	349	21	36	57	2.4
Western U.S. Site	2,875	2,614	157	36	193	8.0
From Fitzpatrick to						
Eastern U.S. Site	1,041	946	57	36	93	3.9
Western U.S. Site	2,453	2,230	134	36	170	7.1
From Brunswick to						
Eastern U.S. Site	606	551	33	36	69	2.9
Western U.S. Site	2,822	2,565	154	36	190	7.9
From LaSalle to						
Eastern U.S. Site	593	539	32	36	68	2.8
Western U.S. Site	1,648	1,498	90	36	126	5.3
From Oconee to						
Eastern U.S. Site	210	191	11	36	47	2.0
Western U.S. Site	2,450	2,227	134	36	170	7.1
From Turkey Point to						
Eastern U.S. Site	1,001	910	55	36	91	3.8
Western U.S. Site	3,028	2,753	165	36	201	8.4
From Monticello to						
Eastern U.S. Site	1,113	1,012	61	36	97	4.0
Western U.S. Site	1,342	1,220	73	36	109	4.5
From Peach Bottom to						
Eastern U.S. Site	862	784	47	36	83	3.5
Western U.S. Site	2,525	2,295	138	36	174	7.3
From Pilgrim to						
Eastern U.S. Site	1,030	936	56	36	92	3.8
Western U.S. Site	2,773	2,521	151	36	187	7.8

TABLE B4-1 (Continued)
DISTANCES AND TIMES REQUIRED FOR COMPLETION OF ROUND TRIP SHIPMENT OF
SPENT FUEL BY NLI 1/2 TRUCK CASK

<u>Reactor to Destination</u>	<u>One-Way Distance</u> <u>(Miles)</u>		<u>Time Requirements</u>			
	<u>Loaded^a</u>	<u>Empty</u>	<u>Transport</u> <u>(Hours)^b</u>	<u>Turnaround</u> <u>(Hours)^c</u>	<u>Total</u> <u>(Hours)</u>	<u>Total</u> <u>(Days)</u>
<u>From Ginna to</u>						
Eastern U.S. Site	934	849	51	36	87	3.6
Western U.S. Site	2,346	2,133	128	36	164	6.8
<u>From Indian Point to</u>						
Eastern U.S. Site	1,199	1,090	65	36	101	4.2
Western U.S. Site	2,663	2,421	145	36	181	7.5
<u>From Millstone to</u>						
Eastern U.S. Site	979	890	53	36	89	3.7
Western U.S. Site	2,741	2,492	150	36	186	7.8
<u>From Prairie Island to</u>						
Eastern U.S. Site	1,098	998	60	36	96	4.0
Western U.S. Site	1,610	1,464	88	36	124	5.2
<u>From La Crosse to</u>						
Eastern U.S. Site	926	842	51	36	87	3.6
Western U.S. Site	1,507	1,370	82	36	118	4.9
<u>From Calvert Cliffs to</u>						
Eastern U.S. Site	641	583	35	36	71	3.0
Western U.S. Site	2,542	2,311	139	36	175	7.3
<u>From Oyster Creek to</u>						
Eastern U.S. Site	790	718	43	36	79	3.3
Western U.S. Site	2,639	2,399	144	36	180	7.5
<u>From Cooper to</u>						
Eastern U.S. Site	1,010	918	55	36	91	3.8
Western U.S. Site	1,243	1,130	68	36	104	4.3
<u>From Sequoyah to</u>						
Eastern U.S. Site	109	99	6	36	42	1.8
Western U.S. Site	2,240	2,036	122	36	158	6.6
<u>From Davis Besse to</u>						
Eastern U.S. Site	701	637	38	36	74	3.1
Western U.S. Site	1,980	1,800	108	36	144	6.0

^aIncludes an allowance of 10% contingency to avoid center of urban areas but requires escort vehicles around such areas.

^bAssumes an average speed of 35 mph for legal weight truck casks; no restrictions on time of operation.

^cTurnaround at reactor - loading 24 hours.
 Turnaround at destination - unloading 12 hours.

Rail shipping distances were developed by Pacific Northwest Laboratories (PNL). These distances were determined as follows:

- (1) Rail tariffs for some of the shorter distances were found to contain actual mileages; these were used when available
- (2) Where rail tariffs did not show actual distances, a distance equal to 112 percent of the highway mileages was used since PNL determined, that on the average, rail distances were 10-12 percent longer than the corresponding highway distances.

Train speeds vary according to the routing and distance traveled. Estimates of the range of time for rail shipments between specific reactor locations and both the Eastern U.S. site and the Western U.S. site were developed by Rockwell Hanford Operations Traffic Department; the mid point of this range was used for determining the total round trip transport time between points considered in this study.

Table B4-2 presents the estimated shipping distances involved for rail shipments of spent fuel between the various shipping and receiving locations considered and the estimated time required to complete a round trip shipment.

TABLE B4-2
DISTANCES AND TIMES REQUIRED FOR COMPLETION OF ROUND TRIP SHIPMENT OF SPENT FUEL
BY IF-300 RAIL CASK

Reactor to Destination	Round Trip Distance (Miles)	Round Trip Rail Transit Time (Hours)	Round Trip Heavy Haul Time (Hours)	Round Trip Heavy Haul Transfer Time (Hours)	Turnaround Time (Hours)	Total Time (Hours)	Total Time (Days)
<u>From Surry to</u>							
Eastern U.S. Site	1,100	193.0	11.7	8	144	356.7	14.9
Western U.S. Site	4,922	674.3	20.7	16	144	855.0	35.6
<u>From Palisades to</u>							
Eastern U.S. Site	1,168	191.5	-	0	144	335.5	14.0
Western U.S. Site	3,402	479.2	9.0	8	144	640.2	26.7
<u>From St. Lucie to</u>							
Eastern U.S. Site	1,558	239.7	3.3	8	144	395.0	16.5
Western U.S. Site	5,454	673.3	12.3	16	144	845.6	35.2
<u>From Robinson to</u>							
Eastern U.S. Site	794	193.7	-	0	144	337.7	14.1
Western U.S. Site	4,664	675.9	9.0	8	144	836.9	34.9
<u>From Fitzpatrick to</u>							
Eastern U.S. Site	1,624	238.8	-	0	144	382.8	16.0
Western U.S. Site	4,658	675.1	9.0	8	144	836.1	34.8
<u>From Brunswick to</u>							
Eastern U.S. Site	976	191.4	-	0	144	335.4	14.0
Western U.S. Site	5,054	673.9	9.0	8	144	834.9	34.8
<u>From LaSalle to</u>							
Eastern U.S. Site	1,080	240.0	-	0	144	384.0	16.0
Western U.S. Site	3,170	480.3	9.0	8	144	641.3	26.7
<u>From Oconee to</u>							
Eastern U.S. Site	594	191.6	3.3	8	144	346.9	14.5
Western U.S. Site	4,510	673.1	12.3	16	144	845.4	35.2
<u>From Turkey Point to</u>							
Eastern U.S. Site	1,862	238.7	3.3	8	144	394.0	16.4
Western U.S. Site	5,784	672.6	12.3	16	144	844.9	35.2
<u>From Monticello to</u>							
Eastern U.S. Site	1,986	336.6	-	0	144	480.6	20.0
Western U.S. Site	2,448	408.0	9.0	8	144	569.0	23.7
<u>From Peach Bottom to</u>							
Eastern U.S. Site	1,304	289.8	-	0	144	433.8	18.1
Western U.S. Site	4,660	675.4	9.0	8	144	836.4	34.8

TABLE B4-2 (Continued)
DISTANCES AND TIMES REQUIRED FOR COMPLETION OF ROUND TRIP SHIPMENT OF SPENT FUEL
BY IF-300 RAIL CASK

<u>Reactor to Destination</u>	<u>Round Trip Distance (Miles)</u>	<u>Round Trip Rail Transit Time (Hours)</u>	<u>Round Trip Heavy Haul Time (Hours)</u>	<u>Round Trip Heavy Haul Transfer Time (Hours)</u>	<u>Turnaround Time (Hours)</u>	<u>Total Time (Hours)</u>	<u>Total Time (Days)</u>
<u>From Pilgrim to</u>							
Eastern U.S. Site	2,044	335.1	8.3	8	144	495.4	20.6
Western U.S. Site	5,210	744.3	17.3	16	144	921.6	38.4
<u>From Ginna to</u>							
Eastern U.S. Site	1,620	289.3	1.7	8	144	443.0	18.5
Western U.S. Site	4,068	666.9	10.7	16	144	837.6	34.9
<u>From Indian Point to</u>							
Eastern U.S. Site	1,632	286.3	1.7	8	144	440.0	18.3
Western U.S. Site	4,910	672.6	10.7	16	144	843.3	35.1
<u>From Millstone to</u>							
Eastern U.S. Site	1,812	287.6	1.7	8	144	441.3	18.4
Western U.S. Site	5,130	675.0	10.7	16	144	845.7	35.2
<u>From Prairie Island to</u>							
Eastern U.S. Site	1,758	240.8	-	0	144	384.8	16.0
Western U.S. Site	2,624	410.0	9.0	8	144	571.0	23.8
<u>From La Crosse to</u>							
Eastern U.S. Site	1,584	240.0	-	0	144	384.0	16.0
Western U.S. Site	2,724	406.6	9.0	8	144	567.6	23.7
<u>From Calvert Cliffs to</u>							
Eastern U.S. Site	1,130	191.5	16.7	8	144	360.2	15.0
Western U.S. Site	4,754	669.6	25.7	16	144	855.3	35.6
<u>From Oyster Creek to</u>							
Eastern U.S. Site	1,456	238.7	8.3	8	144	399.0	16.6
Western U.S. Site	4,954	669.5	17.3	16	144	846.8	35.3
<u>From Cooper to</u>							
Eastern U.S. Site	1,800	240.0	-	0	144	384.0	16.0
Western U.S. Site	2,292	409.3	9.0	8	144	570.3	23.8
<u>From Sequoyah to</u>							
Eastern U.S. Site	234	117.0	-	0	144	261.0	10.9
Western U.S. Site	4,074	667.9	9.0	8	144	828.9	34.5
<u>From Davis Besse to</u>							
Eastern U.S. Site	914	190.4	-	0	144	334.4	13.9
Western U.S. Site	3,824	478.0	9.0	8	144	639.0	26.6

5.0 TOTAL COST OF TRANSPORT OF SPENT FUEL TO A FEDERAL INTERIM STORAGE FACILITY

The total estimated costs of transporting spent fuel from 22 specific reactors to two typical locations are shown in the following tables. Table B5-1 details those costs which can reasonably be expected to be incurred when transporting spent fuel by truck. Table B5-2 shows the estimates of the total cost of transporting spent fuel by rail. Both of these tables have been compiled utilizing the assumptions outlined in Sections 1.0 through 4.0 of this Exhibit B.

TABLE B5-1
ESTIMATED COSTS OF TRUCK SHIPMENT OF SPENT NUCLEAR FUEL^a
(1985 Dollars)

Reactor To Destination	Cask Use & Service Charge	Freight Charge ^b		Security Charge		Vehicle Detention Charge	Escort Charge	Total Cost	Total Cost (\$/MTU) ^c
		Loaded	Empty	Loaded	Empty				
From Surry to									
Eastern U.S. Site	\$3,341	\$1,789	\$1,080	\$ 791	\$ 82	\$705	\$ 741	\$ 8,529	\$18,501
Western U.S. Site	8,127	5,919	4,234	3,248	337	705	1,852	24,422	52,977
From Palisades to									
Eastern U.S. Site	3,671	1,994	1,272	672	100	705	926	9,341	20,262
Western U.S. Site	6,939	4,792	3,456	1,846	274	705	1,111	19,123	41,482
From St. Lucie to									
Eastern U.S. Site	4,151	2,308	1,584	845	125	705	1,482	11,200	24,295
Western U.S. Site	9,710	7,296	5,285	2,832	424	705	2,778	29,030	62,971
From Robinson to									
Eastern U.S. Site	2,847	1,470	816	376	56	705	741	7,011	15,208
Western U.S. Site	9,641	7,296	5,285	2,818	418	705	2,778	28,941	62,779
From Fitzpatrick to									
Eastern U.S. Site	4,639	2,651	1,886	1,020	151	705	1,111	12,164	33,235
Western U.S. Site	8,490	6,287	4,488	2,404	357	705	1,852	24,582	67,164
From Brunswick to									
Eastern U.S. Site	3,453	1,872	1,166	594	88	705	741	8,619	23,549
Western U.S. Site	9,496	7,183	5,194	2,766	410	705	2,593	28,346	77,448
From LaSalle to									
Eastern U.S. Site	3,417	1,823	1,118	581	86	705	926	8,657	23,653
Western U.S. Site	6,294	4,145	2,962	1,615	240	705	926	16,887	46,139
From Oconee to									
Eastern U.S. Site	2,373	1,156	629	206	31	705	926	6,025	13,070
Western U.S. Site	8,481	6,287	4,488	2,401	356	705	2,593	25,311	54,905
From Turkey Point to									
Eastern U.S. Site	4,530	2,563	1,848	981	146	705	1,667	12,439	26,983
Western U.S. Site	10,059	7,683	5,597	2,967	440	705	2,963	30,414	65,976
From Monticello to									
Eastern U.S. Site	4,836	2,837	2,040	1,091	162	705	1,482	13,152	35,934
Western U.S. Site	5,460	3,410	2,424	1,315	195	705	1,296	14,806	40,454
From Peach Bottom to									
Eastern U.S. Site	4,151	2,308	1,584	845	125	705	741	10,459	28,577
Western U.S. Site	8,686	6,414	4,598	2,475	367	705	1,852	25,097	68,571
From Pilgrim to									
Eastern U.S. Site	4,609	2,651	1,886	1,009	150	705	926	11,936	32,612
Western U.S. Site	9,363	7,046	5,088	2,718	403	705	2,037	27,360	74,754

TABLE B5-1 (Continued)
ESTIMATED COSTS OF TRUCK SHIPMENT OF SPENT NUCLEAR FUEL^a
(1985 Dollars)

Reactor To Destination	Cask Use & Service Charge	Freight Charge ^b		Security Charge		Vehicle Detention Charge	Escort Charge	Total Cost	Total Cost (\$/MTU) ^c
		Loaded	Empty	Loaded	Empty				
From Ginna to									
Eastern U.S. Site	\$4,347	\$2,430	\$1,680	\$ 915	\$136	\$705	\$ 926	\$11,140	\$24,164
Western U.S. Site	8,199	5,919	4,296	2,299	341	705	1,667	23,426	50,815
From Indian Point to									
Eastern U.S. Site	5,070	3,014	2,174	1,175	174	705	1,111	13,423	29,118
Western U.S. Site	9,063	6,801	4,896	2,610	387	705	2,037	26,499	57,482
From Millstone to									
Eastern U.S. Site	4,470	2,514	1,781	959	142	705	926	11,497	24,940
Western U.S. Site	9,276	6,929	5,002	2,686	399	705	1,852	26,848	58,238
From Prairie Island to									
Eastern U.S. Site	4,794	2,778	1,978	1,076	160	705	1,482	12,972	28,140
Western U.S. Site	6,191	4,101	2,928	1,578	234	705	1,482	17,219	37,352
From La Crosse to									
Eastern U.S. Site	4,326	2,475	1,680	907	135	705	1,296	11,524	31,486
Western U.S. Site	5,910	3,832	2,813	1,477	219	705	926	15,882	43,393
From Calvert Cliffs to									
Eastern U.S. Site	3,549	1,906	1,214	897	93	705	741	9,105	19,752
Western U.S. Site	8,733	6,414	4,694	2,491	370	705	1,667	25,074	54,391
From Oyster Creek to									
Eastern U.S. Site	3,954	2,161	1,469	1,106	115	705	1,111	10,621	29,019
Western U.S. Site	8,997	6,674	4,795	2,586	384	705	2,037	26,178	71,525
From Cooper to									
Eastern U.S. Site	4,554	2,563	1,848	990	147	705	1,296	12,103	33,068
Western U.S. Site	5,190	3,151	2,280	1,218	181	705	1,111	13,836	37,803
From Sequoyah to									
Eastern U.S. Site	2,097	833	499	107	16	705	0	4,257	9,234
Western U.S. Site	7,909	5,674	4,094	2,195	326	705	2,037	22,940	49,762
From Davis Besse to									
Eastern U.S. Site	3,711	2,043	1,334	687	102	705	741	9,324	20,225
Western U.S. Site	7,200	5,027	3,619	1,940	288	705	1,296	20,076	43,550

^aBased on use of NLI 1/2 truck cask with capacity for either one PWR or two BWR fuel assemblies.

^bBased on 49,000 lb gross shipping weight loaded, and 48,000 lb gross shipping weight empty.

^cBased on 0.461 MTU/PWR assembly and 0.183 MTU/BWR assembly, as introduced into the reactor. Unit cost will increase or decrease proportionately to corresponding decreases or increases in the uranium content of the fuel assemblies.

TABLE B5-2
ESTIMATED COSTS OF RAIL SHIPMENT OF SPENT NUCLEAR FUEL^a
(1905 Dollars)

<u>Reactor to Destination</u>	<u>Cask Use & Service Charge</u>	<u>Heavy Haul Charge</u>	<u>Rail Freight Charge^b</u>	<u>Escort Charge</u>	<u>Total Cost</u>	<u>Unit Cost (\$/MTU)^c</u>
<u>From Surry to</u>						
Eastern U.S. Site	\$ 46,364	\$ 9,622	\$20,086	\$4,920	\$ 80,992	\$25,098
Western U.S. Site	111,139	18,874	55,356	13,645	199,014	61,672
<u>From Palisades to</u>						
Eastern U.S. Site	44,652	-	20,865	4,610	70,128	21,731
Western U.S. Site	83,220	9,252	43,546	10,690	146,709	45,463
<u>From St. Lucie to</u>						
Eastern U.S. Site	51,353	8,760	24,511	5,488	90,112	27,924
Western U.S. Site	109,937	18,012	57,091	13,553	198,592	61,541
<u>From Robinson to</u>						
Eastern U.S. Site	43,896	-	16,839	4,256	64,991	20,140
Western U.S. Site	108,802	9,252	54,608	13,829	186,492	57,791
<u>From Fitzpatrick to</u>						
Eastern U.S. Site	49,767	-	25,339	5,574	80,680	24,493
Western U.S. Site	108,689	9,252	52,587	14,282	184,810	56,105
<u>From Brunswick to</u>						
Eastern U.S. Site	43,598	-	18,940	4,596	67,134	20,381
Western U.S. Site	108,533	9,252	56,136	14,003	187,924	57,050
<u>From LaSalle to</u>						
Eastern U.S. Site	49,920	-	18,829	5,344	74,093	22,493
Western U.S. Site	83,369	9,252	41,079	9,783	143,485	43,560
<u>From Oconee to</u>						
Eastern U.S. Site	45,103	8,718	14,738	4,441	73,000	22,622
Western U.S. Site	109,911	17,970	51,345	13,824	193,050	59,823
<u>From Turkey Point to</u>						
Eastern U.S. Site	33,227	8,760	27,360	3,736	73,082	22,647
Western U.S. Site	109,836	18,012	57,091	13,758	198,696	61,573
<u>From Monticello to</u>						
Eastern U.S. Site	62,479	-	28,251	7,649	98,379	29,866
Western U.S. Site	73,970	9,252	39,631	8,546	131,399	39,890
<u>From Peach Bottom to</u>						
Eastern U.S. Site	56,391	-	21,264	6,347	84,003	25,502
Western U.S. Site	108,727	9,252	53,240	13,438	184,658	56,059
<u>From Pilgrim to</u>						
Eastern U.S. Site	64,404	9,243	28,251	7,213	109,111	33,124
Western U.S. Site	119,810	18,496	56,868	14,781	209,955	63,739

TABLE B5-2 (Continued)
ESTIMATED COSTS OF RAIL SHIPMENT OF SPENT NUCLEAR FUEL^a
(1985 Dollars)

Reactor to Destination	Cask Use & Service Charge	Heavy Haul Charge	Rail Freight Charge ^b	Escort Charge	Total Cost	Unit Cost (\$MTU) ^c
<u>From Ginna to</u>						
Eastern U.S. Site	\$ 57,584	\$ 8,573	\$23,747	\$6,554	\$ 96,458	\$29,891
Western U.S. Site	108,882	17,826	50,534	13,517	190,758	59,113
<u>From Indian Point to</u>						
Eastern U.S. Site	57,198	8,573	25,339	6,344	97,454	30,200
Western U.S. Site	109,625	17,826	55,754	13,781	196,986	61,043
<u>From Millstone to</u>						
Eastern U.S. Site	57,367	8,522	26,962	6,460	99,311	30,775
Western U.S. Site	109,937	17,775	56,868	13,339	197,919	61,332
<u>From Prairie Island to</u>						
Eastern U.S. Site	50,027	-	27,789	5,861	83,677	25,930
Western U.S. Site	74,230	9,252	39,059	8,331	130,872	40,555
<u>From La Crosse to</u>						
Eastern U.S. Site	49,920	-	26,087	5,830	81,836	24,844
Western U.S. Site	73,784	9,252	39,631	8,291	130,958	39,757
<u>From Calvert Cliffs to</u>						
Eastern U.S. Site	46,825	10,401	20,532	4,495	82,252	25,489
Western U.S. Site	111,182	19,653	53,796	12,792	197,422	61,178
<u>From Oyster Creek to</u>						
Eastern U.S. Site	51,873	10,027	23,747	5,153	90,800	27,565
Western U.S. Site	110,083	19,280	55,356	12,407	197,126	59,844
<u>From Cooper to</u>						
Eastern U.S. Site	49,920	-	27,789	5,417	83,127	25,236
Western U.S. Site	74,137	9,252	33,949	7,816	125,155	37,995
<u>From Sequoyah to</u>						
Eastern U.S. Site	33,930	-	10,027	2,605	46,562	14,429
Western U.S. Site	107,753	9,252	47,828	12,093	176,927	54,827
<u>From Davis Besse to</u>						
Eastern U.S. Site	43,474	-	18,065	4,240	65,780	20,384
Western U.S. Site	50,570	9,252	45,870	5,210	110,902	34,367

^aBased on use of IF-300 rail cask with capacity for either 7 PWR or 18 BWR fuel assemblies.

^bBased on 164,000 lb gross shipping weight loaded, and 154,000 lb gross shipping weight empty. Reductions in rail freight charges may be possible through individual case negotiations with the railroads.

^cBased on 0.461 MTU/PWR assembly and 0.183 MTU/BWR assembly, as introduced into the reactor. Unit cost will increase or decrease proportionately to corresponding decreases or increases in the uranium content of the fuel assemblies.

EXHIBIT C

FIS SPENT FUEL ACCEPTANCE CRITERIA

EXHIBIT C
FIS SPENT FUEL ACCEPTANCE CRITERIA

1.0 GENERAL CRITERIA

The following sets forth the general criteria applicable to spent fuel acceptance for FIS:

- (1) The spent fuel shall have been used only in a commercial nuclear power plant operated in the United States.
- (2) The overall length of any PWR fuel assembly, or any canister of consolidated PWR fuel rods, shall not exceed 179-inches. The overall length of any BWR fuel assembly, or any canister of consolidated BWR fuel rods, shall not exceed 179-inches.
- (3) The maximum cross-sectional envelope dimension of any PWR assembly, or any canister of consolidated PWR fuel rods, shall not exceed 9-inches. The maximum cross-sectional envelope dimension of any BWR assembly, or any canister of consolidated BWR fuel rods, shall not exceed 6-inches.
- (4) The spent fuel shall not be defective, as defined in Section 2.0 of this Exhibit C.
- (5) The uranium contained in the spent fuel prior to irradiation shall not contain more than 3.5% uranium-235.
- (6) The spent fuel assemblies and the spent fuel assemblies from which canistered consolidated rods originated shall not have a thermal output in excess of 1 kW/assembly for PWR fuel and 0.4 kW/assembly for BWR fuel.
- (7) The canister used to contain consolidated fuel rods shall be constructed of stainless steel, shall be no less than a nominal 3/16-inch in thickness and shall be sealed by either welding or a metal-gasketed flange. The canister shall be free of residual water.
- (8) A detailed description of the spent fuel assemblies or canistered spent fuel rods, in both the form and detail prescribed by the Department, shall be submitted by the owner of the reactor from which the fuel was discharged. This description shall be examined by the Department and the Department shall have made a written finding that the spent fuel is compatible with handling and storage capabilities of the FIS facilities.

NON-DEFECTIVE FUEL

Non-defective fuel shall be defined as:

- (1) spent fuel assemblies which meet the general specifications set forth in Section 1.0 of this Exhibit C, which have been visually examined using underwater periscopes and/or remote TV scanning over the full length of all sides of the fuel assembly, no earlier than 180 days prior to the scheduled date of delivery to the Department, and which show no obvious evidence of existence of any of the following conditions to an extent which would require special handling or encapsulation at the FIS facility:
 - (a) fuel rod distortion
 - (b) cladding rupture or deterioration
 - (c) structural damage
 - (d) other condition of either the fuel rod(s) or assembly structure that is likely to result in (a) through (c), above, during transport to the FIS facilities or to interfere with the routine handling of the spent fuel assemblies at the FIS.
- (2) canisters of consolidated fuel rods, which meet the general specifications set forth in Section 1.0 of this Exhibit C, and which have been pressure tested, no earlier than 90 days prior to the scheduled date of delivery to the Department, and have been found to lose no pressure over a period of 4 hours when pressurized to no less than 50 psig.
- (3) spent fuel assemblies and canisters of consolidated fuel rods, meeting the applicable requirements of (1), above, for which certifications have been submitted to the Department regarding the details of the measurements and observations made and the results thereof.
- (4) spent fuel assemblies and canisters of consolidated fuel rods, meeting the applicable requirements of (1), (2) and (3), above, and which have been determined by the Department to be in condition suitable for storage after receipt at the FIS facilities.
- (5) spent fuel assemblies and canisters of consolidated fuel rods meeting the general specifications set forth in Section 1.0 of this Exhibit C and the applicable requirements of (1), (2), (3) and (4), above, and (a) for which the utility has performed a calculation of the expected thermal emission rate and shall have verified that no fuel assembly to be delivered to the

Department in the form of fuel as spent fuel assemblies or canistered consolidated spent fuel rods exceeds the maximum value set forth in Section 1.0(6) of this Exhibit C, and the Purchaser has delivered to the Department the analysis of the expected thermal emission rate of the spent fuel assembly or canister of consolidated fuel rods as of no earlier than 90 days before the date of delivery of the spent fuel to the Department, or (b) for which the utility has delivered a certification to the Department that no assembly to be delivered for FIS has been discharged from the reactor for less than 8 years.

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