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1988 Federal Interim Storage Fee Study: A Technical and Economic Analysis

November 1988

**Prepared by E.R. Johnson Associates, Inc.
for Pacific Northwest Laboratory
under Contract DE-AC06-76RLO 1830
with the U.S. Department of Energy**

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1988 FEDERAL INTERIM STORAGE FEE STUDY:
A TECHNICAL AND ECONOMIC ANALYSIS

E. R. Johnson Associates, Inc.
Oakton, Virginia

November 1988

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ABSTRACT

This document is the latest in a series of reports that are published annually by Pacific Northwest Laboratory (PNL) for the U.S. Department of Energy (DOE). The information in this report, which was prepared by E. R. Johnson Associates, Inc. under subcontract to PNL, will be used by the DOE to establish a payment schedule for interim storage of spent nuclear fuel under the Federal Interim Storage (FIS) Program. The FIS Program was mandated by the Nuclear Waste Policy Act of 1982. The information will be used to establish the schedule of charges for FIS services for the year commencing January 1, 1989.

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1988 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 1988, E. R. Johnson Associates, Inc. (JAI) was asked to review and analyze DOE/S-0022 and DOE/S-0023 and to update the content thereof 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, 1988. The results of this update were reported in a document entitled, 1987 Federal Interim Storage Fee Study: A Technical and Economic Analysis, PNL-6322, dated September 1987.

In preparation for the possibility of a revision to the payment charges for FIS services for 1989, JAI was asked to:

- o Review the data base of information that was used in the previous fee determinations (for 1984, 1985, 1986, 1987, and 1988).
- o Prepare estimates of costs for capital, operating, and decommissioning each of the FIS facilities cases reported on in PNL-6322.
- o Update spending schedules for each of the FIS facilities cases reported on in PNL-6322.
- o Review the fee structure to ensure that it will recover government expenses in a way that eliminates or minimizes the need for appropriations of federal funds to provide FIS. Since it is the Department's current position that funds will not be appropriated for FIS purposes and that procurements will be authorized only from funds available in the Interim Storage Fund, it is important that the fee structure provides funds for FIS expenditures in advance of the time the expenditures are made.
- o Recommend the magnitude of the fee to be collected from FIS users based on the background information and fee structure reviews noted above.

As a result of this work, JAI has updated the content of PNL-6322 to provide a basis for the Department to establish payment charges for FIS services in the Federal Register for the year commencing January 1, 1989. This report describes the results of the update which was performed.

^{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, (iv) impact aid payments made in accordance with section 136(e) of the Act, and (v) module costs (i.e., storage casks, drywells or silos).

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), and
- (ii) the total estimated cost of operation and decommissioning of the FIS facilities (including government administrative costs, storage fund management and impact aid).

The module costs were included in the Initial Payment to preclude the possible need to obtain appropriations for federal funds to support the purchase of the modules in advance of receipt of the Final Payment.

Charges for the transport of spent fuel from the reactor site to FIS facilities would be separately assessed at actual 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, to pay for storage modules, and to repay any funds borrowed from the U.S. Treasury that may have been needed earlier. 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 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 may become 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}
 (1989 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	\$1,220	\$1,324	\$1,251	\$ 691	\$ 914	\$ 838
100	697	730	697	433	525	491
300	329	320	313	242	251	245
800	214	190	196	180	164	168
1500	183	156	160	163	138	143
1900	175	146	152	159	131	137

^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}
(1989 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	\$ 624	\$ 691	\$ 642	\$ 277	\$ 433	\$ 384
100	367	382	362	194	253	233
300	189	173	173	132	130	130
800	133	107	114	111	91	97
1500	118	89	97	106	79	88
1900	114	84	93	105	76	85

^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}
(1989 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	\$ 596	\$ 633	\$ 609	\$ 414	\$ 481	\$ 454
100	330	348	335	239	272	258
300	140	147	140	110	121	115
800	81	83	82	69	73	71
1500	65	67	63	57	59	55
1900	61	62	59	54	55	52

^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 total unit charges set forth in Table 2-1 ranged from 3% to 6% higher than those set forth in the 1987 report at the 1900 MTU capacity level to 12% to 15% higher at the 50 MTU capacity level. The principal cause of this increase was the assumed increase in length of the storage period as a result of the 5 year delay in the startup of the MRS facility and/or repository facility contemplated by the Draft 1988 Mission Plan Amendment (DOE/RW-0187; June 1988), which resulted in the FIS program spanning the period 1989 through 2006 rather than the period 1988 through 2001 assumed in the 1987 report. A small portion of the increase was due to escalation.

JAI also estimated the costs of transporting spent fuel between each of twelve 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 ranged from \$14/kgU to \$57/kgU for a FIS facility located in the Eastern U.S., and ranged from \$40/kgU to \$83/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 6.0 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, PNL-5231, PNL-5559, PNL-6031, and PNL-6322 (which are subsequently referred to herein as the 1983 report, the 1984 report, the 1985 report, the 1986 report, and the 1987 report, respectively) were reviewed and evaluated with respect to applicability for establishing charges for FIS services for the calendar year 1989. The following sections summarize the bases used for establishing the 1989 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 were used in the 1983, 1984, 1985, 1986 and 1987 reports:

- (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).

JAI continues to recommend that the Department not make the selection of a specific method for use in FIS until the first contract(s) for FIS services is executed.

While 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, the feasibility and economics of the use of such facilities for FIS still have not been established. Therefore, 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 1989.

3.2 QUANTITIES OF SPENT FUEL TO BE STORED

The prospective needs of utility companies for spent fuel storage are expected to amount to about 229 MTU in 1989 increasing to as much as 1286 MTU in 1995, as described in the following Table 3-1.^{3,4/}

TABLE 3-1
PROSPECTIVE SOURCES OF SPENT FUEL FOR FIS
(Cumulative)

<u>Reactor</u>	<u>Cumulative Quantities (MTU)</u>						
	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
Oconee 1 & 2	133	157	181	205	229	253	276
Millstone 1	59	59	93	93	128	128	163
Palisades	7	34	34	61	61	88	88
St. Lucie	25	53	53	82	110	110	138
Crystal River	5	5	5	38	38	38	71
Robinson 2	0	12	38	38	59	59	79
Brunswick 1	0	0	26	26	59	59	93
La Salle 1 & 2	0	0	25	66	106	186	186
Brunswick 2	0	0	0	5	5	38	38
Calvert Cliffs 1 & 2	0	0	0	0	36	36	72
Prairie Island 1 & 2	0	0	0	0	0	23	39
Pilgrim	0	0	0	0	0	0	29
Indian Point	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>14</u>
Total	229	320	455	614	831	1018	1286

^{3/} Department of Energy. October 1988. Spent Fuel Storage Requirements 1988. DOE/RL-88-34. Richland Operations Office, Richland, Washington.

^{4/} If a requirement for FIS services occurs before 1991, 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, 1984, 1985, 1986 and 1987 studies, 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, 1984, 1985, 1986 and 1987 reports, 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 1989 and be completed so that storage operations could commence in mid-1992.
- (2) The FIS facility would receive spent fuel during the three-year period between mid-1992 and mid-1995. 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 2003 and terminating at the end of 2005. 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 2006.

This schedule represents a one-year delay in the start of the FIS program over that used in the 1987 report inasmuch as the program has been assumed to start one year later, but ends 5 years later than that assumed in the 1987 report as a result of a delay in the repository program. The Oraft 1988 Mission Plan Amendment (DOE/RW-0187) that was issued in June 1988 stated that:

"Schedules based on meeting the requirements of the Amendments Act show that the MRS facility should be available no later than 2003 and the repository will begin accepting waste in 2003."

Moreover, sec. 135(e) of the Act stated that any spent nuclear fuel stored under the FIS program was to be removed from FIS facilities no later than three years following the date upon which either a repository or MRS facility is available for disposal of spent nuclear fuel. Thus, for the purposes of this report, it was assumed that all fuel would be removed from FIS facilities by the end of 2005.

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 1987 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 2005 and for the decommissioning period.

3.6 CONSOLIDATED SPENT FUEL

For this study JAI continued to assume 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 0.6 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

In the development of the 1984 report, there were several design changes made to FIS facilities. During the course of this study a review was made of the resultant facility designs used in the 1984 report and it was concluded that no further design changes were either necessary or desirable for the development of FIS payment charges for 1989.

4.2 REVIEW OF AND REVISIONS IN 1985 FIS COST ESTIMATES

The estimates of the capital costs for transfer facilities and storage areas used in the development of the 1983 report, portions of which were modified in the 1984 report, were escalated to 1989 dollars using applicable cost indexes.

The estimates of the cost of concrete silos and canisters, and the estimates of government administration costs which were used in the development of the this report, were the same as those used for the 1983 report, escalated to 1989 dollars using applicable cost indexes. The estimate of the cost of drywells used in the development of this report were the same as those used for the 1984 report, escalated to 1989 dollars using applicable cost indexes. The estimates of cost of metal storage casks was derived from 1987 cost estimates obtained from cask design firms. For the purposes of this report, these 1987 costs were escalated to 1989 dollars.

The estimates of operating costs used in the development of the this report were were the same as those developed in the 1983 report, escalated to 1989 dollars. However, the time period for storage under the FIS program was extended to mid-1989 through 2005 in this report from the mid-1988 through 2000 period assumed in the 1987 report as a result of (i) the 5-year delay in repository or MRS facility availability projected by the Draft 1988 Mission Plan Amendment (OOE/RW-0187; June 1988), and (ii) an assumed 1-year later startup of FIS facilities.

The estimates of FIS development costs set forth in the 1983 report were reviewed and it was concluded that the same estimates would be applicable for use herein, escalated to 1989 dollars.

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, 1989)

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	\$ 28.1	\$ 31.5	\$ 29.0	\$ 10.1	\$18.2	\$ 15.6
100	33.5	34.9	32.8	15.5	21.6	19.5
300	54.0	48.4	48.5	35.9	35.1	35.2
800	104.5	82.0	87.5	86.5	68.6	74.1
1500	176.5	128.8	142.0	158.5	115.4	128.7
1900	217.4	155.5	173.2	199.3	142.2	159.8

^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 (less than 100 MTU) the capital cost of storage cask facilities is the lowest while the drywell facilities are the highest. However, at the higher capacities (more than 300 MTU) 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, 1989)

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	\$ 31.2	\$ 33.3	\$ 32.0	\$ 20.6	\$24.4	\$ 22.9
100	33.0	35.0	33.6	22.4	26.1	24.6
300	39.6	41.5	39.5	29.0	32.6	30.5
800	57.7	58.6	58.4	46.3	49.5	47.6
1500	84.8	86.3	81.2	71.4	74.4	69.1
1900	100.2	102.1	94.2	85.6	88.6	81.5

^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 the operating costs associated with storage casks are the lowest for the lower capacity facilities (800 MTU and less), while those associated with the silos are the lowest for the higher capacity facilities (more than 800 MTU). 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 during the storage-only period 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 located 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, 1989)

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	\$ 7.0	\$ 7.0	\$ 7.0	\$ 7.0	\$ 7.0	\$ 7.0
100	9.4	9.4	9.4	9.4	9.4	9.4
300	14.7	14.7	14.7	14.7	14.7	14.7
800	25.9	25.9	25.9	25.9	25.9	25.9
1500	40.5	40.5	40.5	40.5	37.5	39.0
1900	48.5	46.6	48.5	48.5	42.8	44.7

^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 some of 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 1989 at 2 percent/year.

TABLE 4-4
SUMMARY OF TOTAL DISCOUNTED COSTS FOR CONSTRUCTION AND OPERATIONS
OF FIS FACILITIES HAVING DIFFERENT TOTAL STORAGE CAPACITIES^{a,b}
(\$-millions, 1989)

Capacity Of FIS Facility (MTU)	Total Discounted Costs (Discounted @ 2%/yr to 1989)					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 57.8	\$ 62.8	\$ 59.2	\$ 32.1	\$42.9	\$ 39.2
100	65.5	68.7	65.5	39.8	48.8	45.5
300	91.1	88.0	86.3	65.5	68.1	66.3
800	154.4	135.3	139.9	128.0	115.3	118.5
1500	244.5	203.5	211.0	216.5	181.2	188.5
1900	295.4	242.2	251.3	266.5	218.5	228.3

^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.

^bDoes not include impact aid.

From the total discounted costs shown in Table 4-4, it can be seen that for the lower capacities (50-100 MTU and less) 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 (800 MTU and more), the cost of storage in dry wells is less than the other two cases, with the cost of storage in storage casks being the highest. The aforementioned relationships apply to both cases where transfer facilities exist at the FIS site and where they do not so exist, 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
(1989 Dollars)

<u>Reactor to Destination</u>	<u>Total Cost for Shipment</u>	
	<u>Truck Shipments^a</u>	<u>Rail Shipments^b</u>
<u>From Oconee to</u>		
Eastern U.S. Site	\$ 6,472	\$119,460
Western U.S. Site	27,145	231,722
<u>From Millstone to</u>		
Eastern U.S. Site	12,380	171,936
Western U.S. Site	28,941	254,279
<u>From Palisades to</u>		
Eastern U.S. Site	10,050	117,526
Western U.S. Site	20,614	207,148
<u>From St. Lucie to</u>		
Eastern U.S. Site	12,043	155,453
Western U.S. Site	31,270	264,413
<u>From Crystal River to</u>		
Eastern U.S. Site	10,269	131,413
Western U.S. Site	32,815	238,290
<u>From Robinson to</u>		
Eastern U.S. Site	7,531	91,807
Western U.S. Site	31,174	227,885
<u>From Brunswick to</u>		
Eastern U.S. Site	9,286	104,455
Western U.S. Site	30,536	240,472
<u>From LaSalle to</u>		
Eastern U.S. Site	9,316	110,422
Western U.S. Site	18,206	196,378
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	9,510	132,536
Western U.S. Site	27,035	247,207
<u>From Prairie Island to</u>		
Eastern U.S. Site	13,953	158,655
Western U.S. Site	18,546	174,749
<u>From Pilgrim to</u>		
Eastern U.S. Site	12,856	188,662
Western U.S. Site	29,485	258,498
<u>From Indian Point to</u>		
Eastern U.S. Site	14,453	159,834
Western U.S. Site	28,551	246,907

^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, 1984, 1985, 1986 and 1987 reports 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 module costs (i.e., storage casks, drywells, or silos)
- 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)*, and
- o the total estimated cost of operation and decommissioning of the FIS facilities (including government administrative costs, storage fund management and impact aid)

*This cost is not included in the FIS payment charges schedule which is issued annually by DOE.

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

6.2 METHOD OF COMPUTATION OF FEE

The same method for computation of the fees for FIS services as was described in the 1983, 1984, 1985, 1986 and 1987 reports 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).

Using the costs developed in Exhibit A, Section 9.0, the Initial Payments, Final Payments and total payments estimated to be required in 1989 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}
(1989 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	\$ 624	\$ 691	\$ 642	\$ 277	\$ 433	\$ 384
100	367	382	362	194	253	233
300	189	173	173	132	130	130
800	133	107	114	111	91	97
1500	118	89	97	106	79	88
1900	114	84	93	105	76	85

^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 6-2
ESTIMATED FINAL PAYMENT FOR FIS SERVICES
AT THE INDICATED INITIAL FIS CAPACITY LEVELS FOR EACH OF THE
ALTERNATIVE MODES OF STORAGE^{a,b}
(1989 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	\$ 596	\$ 633	\$ 609	\$ 414	\$ 481	\$ 454
100	330	348	335	239	272	258
300	140	147	140	110	121	115
800	81	83	82	69	73	71
1500	65	67	63	57	59	55
1900	61	62	59	54	55	52

^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}
(1989 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	\$1,220	\$1,324	\$1,251	\$ 691	\$ 914	\$ 838
100	697	730	697	433	525	491
300	329	320	313	242	251	245
800	214	190	196	180	164	168
1500	183	156	160	163	138	143
1900	175	146	152	159	131	137

^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
(1989 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 Oconee to</u>		
Eastern U.S. Site	\$14.04	\$37.02
Western U.S. Site	58.88	71.81
<u>From Millstone to</u>		
Eastern U.S. Site	26.85	53.28
Western U.S. Site	62.78	78.80
<u>From Palisades to</u>		
Eastern U.S. Site	21.80	36.42
Western U.S. Site	44.72	64.19
<u>From St. Lucie to</u>		
Eastern U.S. Site	26.12	48.17
Western U.S. Site	67.83	81.94
<u>From Crystal River to</u>		
Eastern U.S. Site	22.28	40.72
Western U.S. Site	71.18	73.84
<u>From Robinson to</u>		
Eastern U.S. Site	16.34	28.45
Western U.S. Site	67.62	70.62
<u>From Brunswick to</u>		
Eastern U.S. Site	25.32	31.71
Western U.S. Site	83.43	73.00
<u>From LaSalle to</u>		
Eastern U.S. Site	25.45	33.52
Western U.S. Site	49.74	59.62

TABLE 6-4 (Continued)
SUMMARY OF ESTIMATED UNIT COSTS FOR TRANSPORTING SPENT FUEL FROM
SPECIFIC REACTOR LOCATIONS TO FIS FACILITIES^a
 (1989 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 Calvert Cliffs to</u>		
Eastern U.S. Site	\$20.63	\$41.07
Western U.S. Site	58.64	76.61
<u>From Prairie Island to</u>		
Eastern U.S. Site	30.27	49.16
Western U.S. Site	40.23	54.15
<u>From Pilgrim to</u>		
Eastern U.S. Site	35.13	57.27
Western U.S. Site	80.56	78.48
<u>From Indian Point to</u>		
Eastern U.S. Site	31.35	49.53
Western U.S. Site	61.93	76.51

^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^{6/} 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 \$10/kgU for instances where an existing transfer facility can be utilized for FIS. These increases amount to about \$1/kgU 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 \$2/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 thereby correspondingly increasing the amount of time spent fuel is stored), there is an increase 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 \$12/kgU for instances where an existing transfer facility can be utilized. These increases amount to about \$2/kgU in both instances at the 1900 MTU capacity level.

^{6/}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 \$25/kgU for instances where a new transfer facility is built, and about \$18/kgU for instances where an existing transfer facility can be utilized for FIS. These decreases amount to about \$5-6/kgU for cases 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 \$120-130/kgU at the 100 MTU capacity level decreasing to \$6-8/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, 1984, 1985, 1986 and 1987 reports, 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 combin-

ation 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, 2006, whichever is later, the Department should determine the total costs incurred in design, construction, operation and decommissioning of the FIS system through December 31, 2006 -- 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 continued to be 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 1984 report and has found no basis to make any further changes thereto at the present time. For the convenience of the reader, the acceptance criteria contained in the 1984, 1985, 1986 and 1987 reports has been 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 \$4,985 (1989 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

A2-3

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 trunnions 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 trunnions 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 trunions 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. Metal 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 metal storage 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, 1989)

	<u>Capital Costs</u>		
	<u>Storage Cask</u>	<u>Drywell</u>	<u>Silo</u>
Site Preparation	\$ 13	\$ 13	\$ 13
Structures	7,444	7,444	7,444
Equipment	3,837	4,648	4,652
Equipment Installation (35% of equipment cost)	<u>1,343</u>	<u>1,627</u>	<u>1,628</u>
	12,637	13,732	13,737
Engineering (15%)	1,896	2,060	2,061
Licensing	<u>924</u>	<u>924</u>	<u>924</u>
	15,457	16,716	16,722
Contingency (35%)	<u>5,410</u>	<u>5,851</u>	<u>5,853</u>
Total	<u>\$20,867</u>	<u>\$22,567</u>	<u>\$22,575</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, 1989)

	<u>Capital Costs</u>		
	<u>Storage Cask</u>	<u>Drywell</u>	<u>Silo</u>
Equipment	\$ 979	\$ 4,919	\$ 4,922
Equipment Installation (35% of equipment cost)	<u>343</u>	<u>512^a</u>	<u>513^a</u>
	1,322	5,431	5,435
Engineering (15%)	198	815	815
Safety Review	<u>422</u>	<u>422</u>	<u>422</u>
	1,942	6,668	6,672
Contingency (35%)	<u>680</u>	<u>2,334</u>	<u>2,335</u>
Total	<u>\$ 2,622</u>	<u>\$ 9,002</u>	<u>\$ 9,007</u>

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

3.0 STORAGE CASKS

3.1 DESCRIPTION

The use of metal 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.

At the present time, several cask manufactures have metal storage cask designs; Ridihaigh, Eggers and Associates, Inc. (the REA-2023 cask)*, Transnuclear, Inc. (the TN-24 cask), GNS (the CASTOR-V cask), Nuclear Assurance Corporation, Westinghouse, and Combustion Engineering. For this study, the Transnuclear, Inc. TN-24 cask was selected, as it represents the capacity and cost typical of these large storage casks. The TN-24 cask is shown in Figure A3-1. The cask weight (loaded) is 100 U.S. tons; it is 16½ ft. in length and 8 ft. in diameter. It will store either 24 PWR or 52 BWR fuel assemblies. According to design data, the cask will limit the fuel clad temperature to 375°C, at a decay heat of 1.0 kW/PWR assembly (24 kW total).

It is assumed that each cask can be 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 manufacturers estimates and assuming delivery to a Western U.S. site, the 1989 cost of the metal storage cask was estimated to be \$1,070-thousand.

*This cask design is now owned by Mitsubishi.

A. Length 5030 mm
 B. Diameter 2400 mm
 C. Cavity Length 4140 mm

D. Cavity Diameter 1460 mm
 E. Lid Thickness 270 mm
 F. Bottom Thickness 260 mm

G. Wall Thickness 240 mm
 H. Shell Thickness 20 mm
 J. Shield Thickness 140 mm

FIGURE A3-1
 TN-24 CASK FOR SPENT FUEL STORAGE

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 \$22,617 (1989 dollars). Therefore, the total cost of the drywell assembly, including the canisters described in Section 1.0, is estimated to be \$27,602.

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 \$107,293 (1989 dollars). Therefore, the total cost of the silo assembly, including four of the canisters described in Section 1.0, is estimated to be \$127,233.

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 transfer 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.

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, 1989)

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	\$2,144	\$1,929	\$5,931	\$5,717	\$2,805	\$2,590
100 MTU	2,183	1,968	6,075	5,859	2,988	2,773
300 MTU	2,301	2,085	6,545	6,330	3,650	3,434
800 MTU	2,546	2,330	7,554	7,339	5,165	4,950
1500 MTU	2,869	2,654	8,853	8,637	7,204	6,990
1900 MTU	3,044	2,829	9,571	9,356	8,351	8,136

^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
(\$000, 1989)

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	\$1,831	\$1,924	\$2,008	\$2,077	\$1,915	\$1,984
100 MTU	1,904	1,998	2,145	2,214	2,031	2,101
300 MTU	2,186	2,279	2,682	2,751	2,389	2,459
800 MTU	3,021	3,114	4,152	4,222	3,664	3,733
1500 MTU	4,298	4,391	6,365	6,434	5,062	5,131
1900 MTU	5,028	5,121	7,630	7,699	5,862	5,931

TABLE A7-2
ESTIMATED ANNUAL OPERATING COSTS FOR STORAGE FACILITIES
AT GOVERNMENT SITE DURING STORAGE ONLY PERIOD
(\$000, 1989)

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	\$1,015	\$1,873	\$1,168	\$1,945	\$1,107	\$1,901
100 MTU	1,044	1,904	1,188	1,967	1,132	1,922
300 MTU	1,160	2,018	1,264	2,048	1,216	2,007
800 MTU	1,444	2,416	1,449	2,253	1,433	2,470
1500 MTU	1,850	3,084	1,749	2,920	1,734	2,928
1900 MTU	2,082	3,468	1,922	3,303	1,908	3,192

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
(\$000, 1989)

	<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	\$136	\$230	\$355	\$563	\$789	\$900

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 \$3.78-million and will be incurred in accordance with the following estimated schedule of expenditures:

<u>Year</u>	<u>Amount</u> <u>(\$000, 1989)</u>
1989	\$ 630 (half year)
1990	1,260
1991	1,260
1992	<u>630</u> (half year)
Total	<u>\$3,780</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-1989 and will be terminated at the end of CY-2006.
- (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) One-third of the total impact aid has been included in the Initial Payment, and 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 1989 dollars) was developed for each such case. The annual costs which were estimated to be incurred prior to the startup of the FIS system plus the annual costs of the storage modules required (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 1989 at a discount rate of 2%/year.

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 1989 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.

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 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 1989 @ 2%/Yr	Rev.	Disc. To 1989 @ 2%/Yr	Rev.	Disc. To 1989 @ 2%/Yr	Rev.	Disc. To 1989 @ 2%/Yr	Rev.	Disc. To 1989 @ 2%/Yr	Rev.	Disc. To 1989 @ 2%/Yr
1992	\$ 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
1993	\$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
1994	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
1995	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

TABLE A9-2
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 5 CASKS (50 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3432	1073			630	136	5271	5271
1990	249	145			1260	136	1790	1753
1991	8655	392			1260	136	10443	10037
1992	8530	319	892	962	630	136	11469	10807
1993			1783	1924		136	3843	3550
1994			1783	1924		136	3843	3481
1995			892	1899		136	2927	2599
1996				1873		136	2009	1749
1997				1873		136	2009	1713
1998				1873		136	2009	1681
1999				1873		136	2009	1648
2000				1873		136	2009	1616
2001				1873		136	2009	1584
2002				1873		136	2009	1553
2003				1924		136	2060	1561
2004				1924		136	2060	1531
2005				1924		136	2060	1501
2006				5629*		136	5765	4117
TOTAL	20866	1929	5350	31221	3780	2448	65594	57756

* - DECOMMISSIONING COST

INITIAL PAYMENT = 624 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 596 \$KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-3
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 10 CASKS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3432	1078			630	230	5370	5370
1990	249	145			1260	230	1884	1847
1991	8655	409			1260	230	10534	10144
1992	8530	336	1783	999	630	230	12508	11787
1993			3567	1998		230	5795	5354
1994			3567	1998		230	5795	5249
1995			1783	1951		230	3964	3520
1996				1904		230	2134	1858
1997				1904		230	2134	1821
1998				1904		230	2134	1786
1999				1904		230	2134	1751
2000				1904		230	2134	1716
2001				1904		230	2134	1683
2002				1904		230	2134	1650
2003				1998		230	2228	1689
2004				1998		230	2228	1655
2005				1998		230	2228	1623
2006				6707*		230	6937	4954
TOTAL	20866	1968	10700	32975	3780	4140	74429	65457

* - DECOMMISSIONING COST

INITIAL PAYMENT = 367 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 330 \$KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-4
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 29 CASKS (300 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIB DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3432	1094			630	355	5511	5511
1990	249	145			1260	355	2009	1970
1991	8655	459			1260	355	10729	10312
1992	8530	387	5172	1140	630	355	16214	15279
1993			10343	2279		355	12977	11989
1994			10343	2279		355	12977	11754
1995			5172	2149		355	7676	6816
1996				2018		355	2373	2066
1997				2018		355	2373	2025
1998				2018		355	2373	1986
1999				2018		355	2373	1947
2000				2018		355	2373	1909
2001				2018		355	2373	1871
2002				2018		355	2373	1834
2003				2279		355	2634	1996
2004				2279		355	2634	1957
2005				2279		355	2634	1919
2006				10796*		355	11151	7964
TOTAL	20866	2085	31030	39606	3780	6390	103757	91105

* - DECOMMISSIONING COST

INITIAL PAYMENT = 189 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 140 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIB DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3432	1126			630	563	5751	5751
1990	249	145			1260	563	2217	2174
1991	8655	566			1260	563	11044	10615
1992	8530	493	13553	1557	630	563	25326	23865
1993			27107	3114		563	30784	28440
1994			27107	3114		563	30784	27882
1995			13553	2765		563	16881	14990
1996				2416		563	2979	2593
1997				2416		563	2979	2543
1998				2416		563	2979	2493
1999				2416		563	2979	2444
2000				2416		563	2979	2396
2001				2416		563	2979	2349
2002				2416		563	2979	2303
2003				3114		563	3677	2787
2004				3114		563	3677	2732
2005				3114		563	3677	2678
2006				20903*		563	21466	15330
TOTAL	20866	2330	81320	57707	3780	10134	176137	154365

* - DECOMMISSIONING COST

INITIAL PAYMENT = 133 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 81 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3432	1168			630	789	6019	6019
1990	249	143			1260	789	2443	2393
1991	8633	707			1260	789	11411	10968
1992	8530	634	25302	2196	630	789	38281	36073
1993			51003	4391		789	56183	51904
1994			51003	4391		789	56183	50887
1995			25302	3738		789	30029	26665
1996				3084		789	3873	3372
1997				3084		789	3873	3306
1998				3084		789	3873	3241
1999				3084		789	3873	3177
2000				3084		789	3873	3115
2001				3084		789	3873	3054
2002				3084		789	3873	2994
2003				4391		789	5180	3926
2004				4391		789	5180	3849
2005				4391		789	5180	3773
2006				333068		789	36093	25778
TOTAL	20866	2634	153010	84783	3780	14202	279295	244496

* - DECOMMISSIONING COST

INITIAL PAYMENT = 118 \$/KgU (INCLUDES * 5/KgU IMPACT AID)

FINAL PAYMENT = 65 \$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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3432	1191			630	900	6153	6153
1990	249	143			1260	900	2554	2504
1991	8633	783			1260	900	11398	11148
1992	8530	710	32278	2561	630	900	45609	42978
1993			64537	5121		900	70578	65203
1994			64537	5121		900	70578	63923
1995			32278	4293		900	37473	33273
1996				3468		900	4368	3803
1997				3468		900	4368	3728
1998				3468		900	4368	3653
1999				3468		900	4368	3583
2000				3468		900	4368	3513
2001				3468		900	4368	3444
2002				3468		900	4368	3377
2003				5121		900	6021	4563
2004				5121		900	6021	4474
2005				5121		900	6021	4386
2006				434738		900	44373	31690
TOTAL	20866	2829	193670	100210	3780	16200	337555	295402

* - DECOMMISSIONING COST

INITIAL PAYMENT = 114 \$/KgU (INCLUDES * 5/KgU IMPACT AID)

FINAL PAYMENT = 61 \$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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	1785			630	136	6205	6205
1990	249	155			1260	136	1800	1765
1991	9395	1927			1260	136	12718	12224
1992	9270	1850	543	1039	630	136	13468	12691
1993			1086	2077		136	3299	3048
1994			1086	2077		136	3299	2988
1995			543	2011		136	2690	2389
1996				1945		136	2081	1812
1997				1945		136	2081	1776
1998				1945		136	2081	1741
1999				1945		136	2081	1707
2000				1945		136	2081	1674
2001				1945		136	2081	1641
2002				1945		136	2081	1609
2003				2077		136	2213	1677
2004				2077		136	2213	1644
2005				2077		136	2213	1612
2006				6309*		136	6445	4603
TOTAL	22568	5717	3258	33359	3780	2448	71130	62806

* - DECOMMISSIONING COST

INITIAL PAYMENT = 691 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 633 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	1804			630	230	6318	6318
1990	249	155			1260	230	1894	1857
1991	9395	1989			1260	230	12874	12374
1992	9270	1911	1086	1107	630	230	14234	13413
1993			2171	2214		230	4615	4264
1994			2171	2214		230	4615	4180
1995			1086	2091		230	3407	3025
1996				1967		230	2197	1913
1997				1967		230	2197	1875
1998				1967		230	2197	1838
1999				1967		230	2197	1802
2000				1967		230	2197	1767
2001				1967		230	2197	1732
2002				1967		230	2197	1698
2003				2214		230	2444	1852
2004				2214		230	2444	1816
2005				2214		230	2444	1780
2006				6988*		230	7218	5155
TOTAL	22568	5859	6514	35025	3780	4140	77886	68659

* - DECOMMISSIONING COST

INITIAL PAYMENT = 382 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 348 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	1863			630	355	6504	6504
1990	249	155			1260	355	2019	1979
1991	9395	2194			1260	355	13204	12691
1992	9270	2116	3252	1376	630	355	16999	16019
1993			6505	2751		355	9611	8879
1994			6505	2751		355	9611	8705
1995			3252	2400		355	6007	5334
1996				2048		355	2403	2092
1997				2048		355	2403	2051
1998				2048		355	2403	2011
1999				2048		355	2403	1971
2000				2048		355	2403	1933
2001				2048		355	2403	1895
2002				2048		355	2403	1858
2003				2751		355	3106	2354
2004				2751		355	3106	2308
2005				2751		355	3106	2263
2006				9682*		355	10037	7168
TOTAL	22568	6330	19514	41549	3780	6390	100131	88015

* - DECOMMISSIONING COST

INITIAL PAYMENT = 173 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 147 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	1997			630	563	6844	6844
1990	249	155			1260	563	2227	2183
1991	9395	2632			1260	563	13850	13312
1992	9270	2555	8676	2111	630	563	23805	22432
1993			17352	4222		563	22137	20451
1994			17352	4222		563	22137	20050
1995			8676	3258		563	12477	11079
1996				2253		563	2816	2451
1997				2253		563	2816	2403
1998				2253		563	2816	2356
1999				2253		563	2816	2310
2000				2253		563	2816	2265
2001				2253		563	2816	2220
2002				2253		563	2816	2177
2003				4222		563	4785	3626
2004				4222		563	4785	3555
2005				4222		563	4785	3486
2006				16393*		563	16956	12109
TOTAL	22568	7339	52056	58623	3780	10134	154500	135309

* - DECOMMISSIONING COST

INITIAL PAYMENT = 107 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 83 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	2166			630	789	7239	7239
1990	249	155			1260	789	2453	2405
1991	9395	3197			1260	789	14641	14072
1992	9270	3119	16262	3217	630	789	33287	31367
1993			32524	6434		789	39747	36720
1994			32524	6434		789	39747	36000
1995			16262	4677		789	21728	19294
1996				2920		789	3709	3229
1997				2920		789	3709	3166
1998				2920		789	3709	3104
1999				2920		789	3709	3043
2000				2920		789	3709	2983
2001				2920		789	3709	2925
2002				2920		789	3709	2867
2003				6434		789	7223	5474
2004				6434		789	7223	5367
2005				6434		789	7223	5262
2006				25755*		789	26544	18957
TOTAL	22568	8637	97572	86259	3780	14202	233018	203474

* - DECOMMISSIONING COST

INITIAL PAYMENT = 89 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 67 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-13

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	2260			630	900	7444	7444
1990	249	155			1260	900	2564	2514
1991	9395	3309			1260	900	15064	14479
1992	9270	3432	20600	3850	630	900	38682	36451
1993			41201	7699		900	49800	46008
1994			41201	7699		900	49800	45105
1995			20600	5501		900	27001	23976
1996				3303		900	4203	3659
1997				3303		900	4203	3587
1998				3303		900	4203	3517
1999				3303		900	4203	3448
2000				3303		900	4203	3380
2001				3303		900	4203	3314
2002				3303		900	4203	3249
2003				7699		900	8599	6517
2004				7699		900	8599	6389
2005				7699		900	8599	6264
2006				31105*		900	32005	22857
TOTAL	22568	9356	123602	102072	3780	16200	277578	242158

* - DECOMMISSIONING COST

INITIAL PAYMENT = 84 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 62 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3655	1534			630	136	5955	5955
1990	249	155			1260	136	1800	1765
1991	9398	489			1260	136	11283	10845
1992	9273	412	635	992	630	136	12078	11381
1993			1269	1984		136	3389	3131
1994			1269	1984		136	3389	3070
1995			635	1943		136	2714	2410
1996				1901		136	2037	1773
1997				1901		136	2037	1739
1998				1901		136	2037	1704
1999				1901		136	2037	1671
2000				1901		136	2037	1638
2001				1901		136	2037	1606
2002				1901		136	2037	1575
2003				1984		136	2120	1607
2004				1984		136	2120	1575
2005				1984		136	2120	1544
2006				5795*		136	5931	4236
TOTAL	22575	2590	3808	31957	3780	2448	67158	59225

* - DECOMMISSIONING COST

INITIAL PAYMENT = 642 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 609 \$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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3655	1538			630	230	6073	6073
1990	249	155			1260	230	1894	1857
1991	9398	569			1260	230	11457	11012
1992	9273	491	1251	1051	630	230	12926	12180
1993			2502	2101		230	4833	4465
1994			2502	2101		230	4833	4377
1995			1251	2012		230	3493	3102
1996				1922		230	2152	1873
1997				1922		230	2152	1837
1998				1922		230	2152	1801
1999				1922		230	2152	1765
2000				1922		230	2152	1731
2001				1922		230	2152	1697
2002				1922		230	2152	1664
2003				2101		230	2331	1767
2004				2101		230	2331	1732
2005				2101		230	2331	1698
2006				6571*		230	6801	4857
TOTAL	22575	2773	7506	33593	3780	4140	74367	65488

* - DECOMMISSIONING COST

INITIAL PAYMENT = 362 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 335 \$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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3653	1644			630	355	6284	6284
1990	249	155			1260	355	2019	1979
1991	9398	856			1260	355	11869	11408
1992	9273	779	3753	1230	630	355	16020	15096
1993			7505	2459		355	10319	9533
1994			7505	2459		355	10319	9346
1995			3753	2233		355	6341	5631
1996				2007		355	2362	2056
1997				2007		355	2362	2016
1998				2007		355	2362	1976
1999				2007		355	2362	1938
2000				2007		355	2362	1900
2001				2007		355	2362	1862
2002				2007		355	2362	1826
2003				2459		355	2814	2133
2004				2459		355	2814	2091
2005				2459		355	2814	2050
2006				9705*		355	10060	7184
TOTAL	22575	3434	22516	39512	3780	6390	98207	86309

* - DECOMMISSIONING COST

INITIAL PAYMENT = 173 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 140 \$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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3653	1842			630	563	6690	6690
1990	249	155			1260	563	2227	2183
1991	9398	1315			1260	563	12736	12241
1992	9273	1438	9989	1867	630	563	23760	22390
1993			19979	3733		563	24275	22426
1994			19979	3733		563	24275	21987
1995			9989	3102		563	13654	12124
1996				2470		563	3033	2640
1997				2470		563	3033	2589
1998				2470		563	3033	2538
1999				2470		563	3033	2488
2000				2470		563	3033	2439
2001				2470		563	3033	2392
2002				2470		563	3033	2345
2003				3733		563	4296	3256
2004				3733		563	4296	3192
2005				3733		563	4296	3129
2006				17492*		563	18055	12894
TOTAL	22575	4950	59936	58416	3780	10134	159791	139943

* - DECOMMISSIONING COST

INITIAL PAYMENT = 114 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 82 \$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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3655	2108			630	789	7182	7182
1990	249	155			1260	789	2453	2405
1991	9398	2402			1260	789	13849	13311
1992	9273	2325	18745	2566	630	789	34328	32348
1993			37490	5131		789	43410	40104
1994			37490	5131		789	43410	39318
1995			18745	4030		789	23564	20924
1996				2928		789	3717	3236
1997				2928		789	3717	3172
1998				2928		789	3717	3110
1999				2928		789	3717	3049
2000				2928		789	3717	2989
2001				2928		789	3717	2931
2002				2928		789	3717	2873
2003				5131		789	5920	4487
2004				5131		789	5920	4399
2005				5131		789	5920	4312
2006				28407*		789	29196	20851
TOTAL	22575	6990	112470	81154	3780	14202	241171	211001

* - DECOMMISSIONING COST

INITIAL PAYMENT = 97 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 63 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3655	2258			630	900	7443	7443
1990	249	155			1260	900	2564	2514
1991	9398	2900			1260	900	14458	13897
1992	9273	2823	23748	2966	630	900	40340	38013
1993			47497	5931		900	54328	50191
1994			47497	5931		900	54328	49207
1995			23748	4562		900	29210	25938
1996				3192		900	4092	3562
1997				3192		900	4092	3492
1998				3192		900	4092	3424
1999				3192		900	4092	3357
2000				3192		900	4092	3291
2001				3192		900	4092	3227
2002				3192		900	4092	3163
2003				5931		900	6831	5177
2004				5931		900	6831	5076
2005				5931		900	6831	4976
2006				34640*		900	35540	25381
TOTAL	22575	8136	142490	94167	3780	16200	287348	251329

* - DECOMMISSIONING COST

INITIAL PAYMENT = 93 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 59 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-20

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 5 CASKS (50 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	666	1101			630	136	2333	2333
1990	114	145			1260	136	1655	1623
1991	949	485			1260	136	2830	2720
1992	892	413	892	916	630	136	3879	3655
1993			1783	1831		136	3750	3464
1994			1783	1831		136	3750	3396
1995			892	1423		136	2451	2176
1996				1015		136	1151	1002
1997				1015		136	1151	982
1998				1015		136	1151	963
1999				1015		136	1151	944
2000				1015		136	1151	926
2001				1015		136	1151	908
2002				1015		136	1151	890
2003				1831		136	1967	1491
2004				1831		136	1967	1462
2005				1831		136	1967	1433
2006				2023*		136	2159	1542
TOTAL	2621	2144	5350	20622	3780	2448	36963	32110

* - DECOMMISSIONING COST

INITIAL PAYMENT = 277 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 414 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	666	1106			630	230	2632	2632
1990	114	145			1260	230	1749	1715
1991	949	502			1260	230	2941	2827
1992	892	430	1783	952	630	230	4917	4633
1993			3567	1904		230	5701	5267
1994			3567	1904		230	5701	5164
1995			1783	1474		230	3487	3096
1996				1044		230	1274	1109
1997				1044		230	1274	1087
1998				1044		230	1274	1066
1999				1044		230	1274	1045
2000				1044		230	1274	1025
2001				1044		230	1274	1005
2002				1044		230	1274	985
2003				1904		230	2134	1617
2004				1904		230	2134	1586
2005				1904		230	2134	1555
2006				3101*		230	3331	2379
TOTAL	2621	2183	10700	22355	3780	4140	45779	39793

* - DECOMMISSIONING COST

INITIAL PAYMENT = 194 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 239 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	666	1122			630	355	2773	2773
1990	114	145			1260	355	1874	1837
1991	949	553			1260	355	3117	2996
1992	892	481	5172	1093	630	355	8623	8126
1993			10343	2186		355	12884	11903
1994			10343	2186		355	12884	11669
1995			5172	1673		355	7200	6393
1996				1160		355	1515	1319
1997				1160		355	1515	1293
1998				1160		355	1515	1268
1999				1160		355	1515	1243
2000				1160		355	1515	1218
2001				1160		355	1515	1195
2002				1160		355	1515	1171
2003				2186		355	2541	1926
2004				2186		355	2541	1888
2005				2186		355	2541	1851
2006				7190*		355	7545	5388
TOTAL	2621	2301	31030	29006	3780	6390	75128	65457

* - DECOMMISSIONING COST

INITIAL PAYMENT = 132 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 110 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	666	1154			630	563	3013	3013
1990	114	145			1260	563	2082	2041
1991	949	660			1260	563	3432	3299
1992	892	587	13553	1511	630	563	17736	16713
1993			27107	3021		563	30691	28354
1994			27107	3021		563	30691	27798
1995			13553	2233		563	16349	14517
1996				1444		563	2007	1747
1997				1444		563	2007	1713
1998				1444		563	2007	1679
1999				1444		563	2007	1646
2000				1444		563	2007	1614
2001				1444		563	2007	1583
2002				1444		563	2007	1551
2003				3021		563	3584	2716
2004				3021		563	3584	2663
2005				3021		563	3584	2611
2006				17297*		563	17860	12755
TOTAL	2621	2546	81320	46254	3780	10134	146655	128013

* - DECOMMISSIONING COST

INITIAL PAYMENT = 111 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 69 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIB DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	666	1196			630	789	3281	3281
1990	114	143			1260	789	2308	2263
1991	949	800			1260	789	3798	3651
1992	892	728	25502	2149	630	789	30690	28920
1993			51003	4298		789	56090	51819
1994			51003	4298		789	56090	50802
1995			25502	3074		789	29363	26073
1996				1850		789	2639	2297
1997				1850		789	2639	2252
1998				1850		789	2639	2208
1999				1850		789	2639	2163
2000				1850		789	2639	2122
2001				1850		789	2639	2081
2002				1850		789	2639	2040
2003				4298		789	5087	3855
2004				4298		789	5087	3780
2005				4298		789	5087	3706
2006				31700*		789	32489	23202
TOTAL	2621	2869	153010	71363	3780	14202	247845	216519

* - DECOMMISSIONING COST

INITIAL PAYMENT = 106 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 57 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-25
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 181 CASKS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIB DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	666	1219			630	900	3415	3415
1990	114	143			1260	900	2419	2372
1991	949	876			1260	900	3985	3830
1992	892	804	32278	2514	630	900	38018	35825
1993			64537	5028		900	70485	65117
1994			64537	5028		900	70485	63840
1995			32278	3535		900	36733	32618
1996				2082		900	2982	2596
1997				2082		900	2982	2545
1998				2082		900	2982	2495
1999				2082		900	2982	2446
2000				2082		900	2982	2398
2001				2082		900	2982	2351
2002				2082		900	2982	2305
2003				5028		900	5928	4493
2004				5028		900	5928	4405
2005				5028		900	5928	4318
2006				39867*		900	40767	29114
TOTAL	2621	3044	193670	85650	3780	16200	304965	266483

* - DECOMMISSIONING COST

INITIAL PAYMENT = 105 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 54 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A9-26

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 118 DRYWELLS (50 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1813			630	136	4078	4078
1990	114	155			1260	136	1665	1632
1991	3723	2020			1260	136	7139	6862
1992	3666	1943	543	1004	630	136	7922	7465
1993			1086	2008		136	3230	2984
1994			1086	2008		136	3230	2926
1995			543	1588		136	2267	2013
1996				1168		136	1304	1135
1997				1168		136	1304	1113
1998				1168		136	1304	1091
1999				1168		136	1304	1070
2000				1168		136	1304	1049
2001				1168		136	1304	1028
2002				1168		136	1304	1008
2003				2008		136	2144	1625
2004				2008		136	2144	1593
2005				2008		136	2144	1562
2006				3638*		136	3774	2695
TOTAL	9002	5931	3258	24446	3780	2448	48865	42929

* - DECOMMISSIONING COST

INITIAL PAYMENT = 433 \$/KqU (INCLUDES \$ 5/KqU IMPACT AID)

FINAL PAYMENT = 481 \$KqU (INCLUDES \$ 10/KqU IMPACT AID)

TABLE A9-27

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1832			630	230	4191	4191
1990	114	155			1260	230	1759	1725
1991	3723	2083			1260	230	7296	7013
1992	3666	2005	1086	1073	630	230	8690	8189
1993			2171	2145		230	4546	4200
1994			2171	2145		230	4546	4117
1995			1086	1667		230	2983	2649
1996				1188		230	1418	1234
1997				1188		230	1418	1210
1998				1188		230	1418	1187
1999				1188		230	1418	1163
2000				1188		230	1418	1140
2001				1188		230	1418	1118
2002				1188		230	1418	1096
2003				2145		230	2375	1800
2004				2145		230	2375	1765
2005				2145		230	2375	1730
2006				4318*		230	4548	3248
TOTAL	9002	6075	6514	26099	3780	4140	55610	48775

* - DECOMMISSIONING COST

INITIAL PAYMENT = 253 \$/KqU (INCLUDES \$ 5/KqU IMPACT AID)

FINAL PAYMENT = 272 \$KqU (INCLUDES \$ 10/KqU IMPACT AID)

TABLE A9-28

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 707 DRYWELLS (300 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1893			630	355	4377	4377
1990	114	155			1260	355	1884	1847
1991	3723	2287			1260	355	7625	7329
1992	3666	2210	3252	1341	630	355	11454	10793
1993			6505	2682		355	9542	8815
1994			6505	2682		355	9542	8642
1995			3252	1973		355	5580	4955
1996				1264		355	1619	1409
1997				1264		355	1619	1382
1998				1264		355	1619	1355
1999				1264		355	1619	1328
2000				1264		355	1619	1302
2001				1264		355	1619	1277
2002				1264		355	1619	1252
2003				2682		355	3037	2302
2004				2682		355	3037	2257
2005				2682		355	3037	2212
2006				7012*		355	7367	5261
TOTAL	9002	6545	19514	32584	3780	6390	77815	68095

* - DECOMMISSIONING COST

INITIAL PAYMENT = 130 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 121 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	2025			630	563	4717	4717
1990	114	155			1260	563	2092	2051
1991	3723	2726			1260	563	8272	7951
1992	3666	2648	8676	2076	630	563	18259	17206
1993			17352	4152		563	22067	20387
1994			17352	4152		563	22067	19987
1995			8676	2801		563	12040	10691
1996				1449		563	2012	1752
1997				1449		563	2012	1717
1998				1449		563	2012	1684
1999				1449		563	2012	1651
2000				1449		563	2012	1618
2001				1449		563	2012	1586
2002				1449		563	2012	1553
2003				4152		563	4715	3573
2004				4152		563	4715	3503
2005				4152		563	4715	3435
2006				13722*		563	14285	10202
TOTAL	9002	7554	52056	49502	3780	10134	132028	115266

* - DECOMMISSIONING COST

INITIAL PAYMENT = 91 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 73 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	2194			630	789	5112	5112
1990	114	155			1260	789	2318	2273
1991	3723	3291			1260	789	9063	8711
1992	3666	3213	16262	3183	630	789	27743	26143
1993			32524	6365		789	39678	36656
1994			32524	6365		789	39678	35938
1995			16262	4057		789	21108	18743
1996				1749		789	2538	2209
1997				1749		789	2538	2166
1998				1749		789	2538	2124
1999				1749		789	2538	2082
2000				1749		789	2538	2041
2001				1749		789	2538	2001
2002				1749		789	2538	1962
2003				6365		789	7154	5422
2004				6365		789	7154	5316
2005				6365		789	7154	5211
2006				23085*		789	23874	17050
TOTAL	9002	8833	97572	74393	3780	14202	207802	181160

* - DECOMMISSIONING COST

INITIAL PAYMENT = 79 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 59 \$/KgU (INCLUDES \$ 9/KgU IMPACT AID)

TABLE A9-31

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	2288			630	900	5317	5317
1990	114	155			1260	900	2429	2381
1991	3723	3603			1260	900	9486	9118
1992	3666	3525	20600	3815	630	900	33136	31225
1993			41201	7630		900	49731	45944
1994			41201	7630		900	49731	45043
1995			20600	4776		900	26276	23332
1996				1922		900	2822	2457
1997				1922		900	2822	2409
1998				1922		900	2822	2361
1999				1922		900	2822	2315
2000				1922		900	2822	2270
2001				1922		900	2822	2225
2002				1922		900	2822	2181
2003				7630		900	8530	6465
2004				7630		900	8530	6338
2005				7630		900	8530	6214
2006				28435*		900	29335	20950
TOTAL	9002	9571	123602	88630	3780	16200	250785	218545

* - DECOMMISSIONING COST

INITIAL PAYMENT = 76 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 55 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIB DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1562			630	136	3827	3827
1990	114	155			1260	136	1665	1632
1991	3726	583			1260	136	5705	5483
1992	3669	505	635	998	630	136	6533	6156
1993			1269	1915		136	3320	3067
1994			1269	1915		136	3320	3007
1995			635	1511		136	2282	2026
1996				1107		136	1243	1082
1997				1107		136	1243	1061
1998				1107		136	1243	1040
1999				1107		136	1243	1020
2000				1107		136	1243	1000
2001				1107		136	1243	980
2002				1107		136	1243	961
2003				1915		136	2051	1554
2004				1915		136	2051	1524
2005				1915		136	2051	1494
2006				3124*		136	3260	2328
TOTAL	9008	2805	3808	22917	3780	2448	44766	39242

* - DECOMMISSIONING COST

INITIAL PAYMENT = 384 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 454 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIB DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1586			630	230	3945	3945
1990	114	155			1260	230	1759	1725
1991	3726	662			1260	230	5878	5650
1992	3669	585	1251	1016	630	230	7381	6955
1993			2502	2031		230	4763	4400
1994			2502	2031		230	4763	4314
1995			1251	1582		230	3063	2720
1996				1132		230	1362	1186
1997				1132		230	1362	1162
1998				1132		230	1362	1140
1999				1132		230	1362	1117
2000				1132		230	1362	1095
2001				1132		230	1362	1074
2002				1132		230	1362	1053
2003				2031		230	2261	1714
2004				2031		230	2261	1680
2005				2031		230	2261	1647
2006				3900*		230	4130	2949
TOTAL	9008	2988	7506	24577	3780	4140	51979	45526

* - DECOMMISSIONING COST

INITIAL PAYMENT = 233 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 258 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIB DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1673			630	355	4157	4157
1990	114	155			1260	355	1884	1847
1991	3726	950			1260	355	6291	6047
1992	3669	872	3753	1195	630	355	10474	9870
1993			7505	2389		355	10249	9468
1994			7505	2389		355	10249	9283
1995			3753	1803		355	5911	5249
1996				1216		355	1571	1368
1997				1216		355	1571	1341
1998				1216		355	1571	1315
1999				1216		355	1571	1289
2000				1216		355	1571	1263
2001				1216		355	1571	1239
2002				1216		355	1571	1214
2003				2389		355	2744	2080
2004				2389		355	2744	2039
2005				2389		355	2744	1999
2006				7035*		355	7390	5278
TOTAL	9008	3650	22516	30490	3780	6390	75834	66346

* - DECOMMISSIONING COST

INITIAL PAYMENT = 130 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 115 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIB DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1870			630	563	4562	4562
1990	114	155			1260	563	2092	2051
1991	3726	1609			1260	563	7158	6880
1992	3669	1531	9989	1832	630	563	18214	17163
1993			19979	3664		563	24206	22363
1994			19979	3664		563	24206	21924
1995			9989	2549		563	13101	11633
1996				1433		563	1996	1738
1997				1433		563	1996	1704
1998				1433		563	1996	1670
1999				1433		563	1996	1637
2000				1433		563	1996	1603
2001				1433		563	1996	1574
2002				1433		563	1996	1543
2003				3664		563	4227	3204
2004				3664		563	4227	3141
2005				3664		563	4227	3079
2006				14822*		563	15385	10987
TOTAL	9008	5165	59936	47554	3780	10134	135577	118458

* - DECOMMISSIONING COST

INITIAL PAYMENT = 97 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 71 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	2136			630	789	5054	5054
1990	114	155			1260	789	2318	2273
1991	3726	2495			1260	789	8270	7949
1992	3669	2418	18745	2531	630	789	28782	27122
1993			37490	5062		789	43341	40040
1994			37490	5062		789	43341	39255
1995			18745	3398		789	22932	20363
1996				1734		789	2523	2196
1997				1734		789	2523	2153
1998				1734		789	2523	2111
1999				1734		789	2523	2070
2000				1734		789	2523	2029
2001				1734		789	2523	1989
2002				1734		789	2523	1950
2003				5062		789	5851	4434
2004				5062		789	5851	4347
2005				5062		789	5851	4262
2006				25736*		789	26525	18943
TOTAL	9008	7204	112470	69113	3780	14202	215777	188540

* - DECOMMISSIONING COST

INITIAL PAYMENT = 88 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 55 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	2286			630	900	5315	5315
1990	114	155			1260	900	2429	2381
1991	3726	2994			1260	900	8880	8535
1992	3669	2916	23748	2931	630	900	34794	32787
1993			47497	5862		900	54259	50127
1994			47497	5862		900	54259	49144
1995			23748	3885		900	28533	25336
1996				1908		900	2808	2445
1997				1908		900	2808	2397
1998				1908		900	2808	2350
1999				1908		900	2808	2304
2000				1908		900	2808	2258
2001				1908		900	2808	2214
2002				1908		900	2808	2171
2003				5862		900	6762	5125
2004				5862		900	6762	5024
2005				5862		900	6762	4926
2006				31970*		900	32870	23475
TOTAL	9008	8351	142490	81452	3780	16200	261281	228314

* - DECOMMISSIONING COST

INITIAL PAYMENT = 85 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 52 \$/KgU (INCLUDES \$ 9/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 \$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>
New Facility Cases				
\$22.6 (Base Case)	\$68,659	\$730	\$242,158	\$146
15	59,889	641	233,390	140
10	54,087	582	227,601	137
Change per \$-million	1,157	12	1,155	1
Existing Facility Cases				
9.0 (Base Case)	\$48,775	\$525	\$218,545	\$131
8.0	47,605	513	217,392	130
Change per \$-million	1,170	12	1,153	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-MILLION TRANSFER FACILITY
 ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
 AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
 (\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	2667	1804			630	230	5331	5331
1990	249	155			1260	230	1894	1857
1991	6104	1989			1260	230	9583	9211
1992	5980	1911	1086	1088	630	230	10925	10295
1993			2171	2175		230	4576	4228
1994			2171	2175		230	4576	4145
1995			1086	2051		230	3367	2990
1996				1927		230	2157	1878
1997				1927		230	2157	1841
1998				1927		230	2157	1805
1999				1927		230	2157	1769
2000				1927		230	2157	1735
2001				1927		230	2157	1701
2002				1927		230	2157	1667
2003				2175		230	2405	1823
2004				2175		230	2405	1787
2005				2175		230	2405	1752
2006				5475*		230	5705	4074
TOTAL	15000	5859	6514	32978	3780	4140	68271	59889

* - DECOMMISSIONING COST

INITIAL PAYMENT = 310 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 331 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	2015	1804			630	230	4679	4679
1990	249	155			1260	230	1894	1857
1991	3930	1989			1260	230	7409	7121
1992	3806	1911	1086	1074	630	230	8737	8233
1993			2171	2148		230	4549	4203
1994			2171	2148		230	4549	4120
1995			1086	2025		230	3341	2967
1996				1901		230	2131	1855
1997				1901		230	2131	1819
1998				1901		230	2131	1783
1999				1901		230	2131	1748
2000				1901		230	2131	1714
2001				1901		230	2131	1680
2002				1901		230	2131	1647
2003				2148		230	2378	1802
2004				2148		230	2378	1767
2005				2148		230	2378	1732
2006				4475*		230	4705	3360
TOTAL	10000	5859	6514	31621	3780	4140	61914	54087

* - DECOMMISSIONING COST

INITIAL PAYMENT = 262 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 320 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-4

COST SENSITIVITY CASE -- \$15-MILLION TRANSFER FACILITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	2667	2260			630	900	6457	6457
1990	249	155			1260	900	2564	2514
1991	6104	3509			1260	900	11773	11316
1992	5980	3432	20600	3830	630	900	35372	33332
1993			41201	7660		900	49761	45971
1994			41201	7660		900	49761	45070
1995			20600	5462		900	26962	23941
1996				3264		900	4164	3625
1997				3264		900	4164	3554
1998				3264		900	4164	3484
1999				3264		900	4164	3416
2000				3264		900	4164	3349
2001				3264		900	4164	3283
2002				3264		900	4164	3219
2003				7660		900	8560	6487
2004				7660		900	8560	6360
2005				7660		900	8560	6236
2006				29592*		900	30492	21776
TOTAL	15000	9356	123602	100032	3780	16200	267970	233390

* - DECOMMISSIONING COST

INITIAL PAYMENT = 79 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 61 \$/KgU (INCLUDES \$ 9/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	2015	2260			630	900	5805	5805
1990	249	155			1260	900	2564	2514
1991	3930	3509			1260	900	9599	9226
1992	3806	3432	20600	3818	630	900	33186	31272
1993			41201	7635		900	49736	45948
1994			41201	7635		900	49736	45047
1995			20600	5437		900	26937	23919
1996				3238		900	4138	3602
1997				3238		900	4138	3532
1998				3238		900	4138	3462
1999				3238		900	4138	3395
2000				3238		900	4138	3328
2001				3238		900	4138	3263
2002				3238		900	4138	3199
2003				7635		900	8535	6468
2004				7635		900	8535	6342
2005				7635		900	8535	6217
2006				28592*		900	29492	21062
TOTAL	10000	9356	123602	98688	3780	16200	261626	227601

* - DECOMMISSIONING COST

INITIAL PAYMENT = 77 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 60 \$/KgU (INCLUDES \$ 9/KgU IMPACT AID)

TABLE A10-6

COST SENSITIVITY CASE -- \$8-MILLION TRANSFER FACILITY
 ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
 AT GOVERNMENT SITE WITH EXISTING FACILITIES
 (\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1368	1832			630	230	4060	4060
1990	114	155			1260	230	1759	1725
1991	3288	2083			1260	230	6861	6595
1992	3231	2005	1086	1070	630	230	8252	7776
1993			2171	2139		230	4540	4194
1994			2171	2139		230	4540	4112
1995			1086	1661		230	2977	2643
1996				1182		230	1412	1229
1997				1182		230	1412	1205
1998				1182		230	1412	1181
1999				1182		230	1412	1158
2000				1182		230	1412	1136
2001				1182		230	1412	1113
2002				1182		230	1412	1092
2003				2139		230	2369	1795
2004				2139		230	2369	1760
2005				2139		230	2369	1726
2006				4118*		230	4348	3105
TOTAL	8001	6075	6514	25818	3780	4140	54328	47605

* - DECOMMISSIONING COST

INITIAL PAYMENT = 244 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 269 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-7

COST SENSITIVITY CASE -- \$8-MILLION TRANSFER FACILITY
 ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
 AT GOVERNMENT SITE WITH EXISTING FACILITIES
 (\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1368	2288			630	900	5186	5186
1990	114	155			1260	900	2429	2381
1991	3288	3603			1260	900	9051	8700
1992	3231	3525	20600	3813	630	900	32699	30813
1993			41201	7626		900	49727	45940
1994			41201	7626		900	49727	45039
1995			20600	4772		900	26272	23329
1996				1917		900	2817	2452
1997				1917		900	2817	2404
1998				1917		900	2817	2357
1999				1917		900	2817	2311
2000				1917		900	2817	2266
2001				1917		900	2817	2221
2002				1917		900	2817	2178
2003				7626		900	8526	6462
2004				7626		900	8526	6335
2005				7626		900	8526	6211
2006				28235*		900	29135	20807
TOTAL	8001	9571	123602	88369	3780	16200	249523	217392

* - DECOMMISSIONING COST

INITIAL PAYMENT = 76 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 54 \$/KgU (INCLUDES \$ 8/KgU IMPACT AID)

The impact of reductions in the cost of individual modules (drywells) and canisters on FIS costs is shown in Table A10-8.

TABLE A10-8
IMPACT OF REDUCTIONS IN COST OF DRYWELLS AND CANISTERS
DN 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>				
\$22,617	\$68,659	\$730	\$242,158	\$146
15,000	66,652	710	204,116	124
10,000	65,344	696	179,137	108
Change per \$-thousand	263	3	4,995	3
<u>Canisters</u>				
\$ 4,985	\$68,659	\$730	\$242,158	\$146
3,500	68,288	726	235,123	142
2,000	67,914	723	228,018	138
Change per \$-thousand	250	2	4,737	3

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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3634	1804			630	230	6318	6318
1990	249	155			1260	230	1894	1857
1991	9395	1989			1260	230	12874	12374
1992	9270	1911	786	1103	630	230	13930	13127
1993			1572	2205		230	4007	3702
1994			1572	2205		230	4007	3629
1995			786	2081		230	3097	2750
1996				1957		230	2187	1904
1997				1957		230	2187	1867
1998				1957		230	2187	1830
1999				1957		230	2187	1794
2000				1957		230	2187	1759
2001				1957		230	2187	1724
2002				1957		230	2187	1691
2003				2205		230	2435	1845
2004				2205		230	2435	1809
2005				2205		230	2435	1774
2006				6629*		230	6859	4898
TOTAL	22568	5859	4716	34537	3780	4140	75600	66652

* - DECOMMISSIONING COST

INITIAL PAYMENT = 366 \$/KgU (INCLUDES * 5/KgU IMPACT AID)

FINAL PAYMENT = 344 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3634	1804			630	230	6318	6318
1990	249	155			1260	230	1894	1857
1991	9395	1989			1260	230	12874	12374
1992	9270	1911	589	1100	630	230	13730	12938
1993			1179	2199		230	3608	3333
1994			1179	2199		230	3608	3268
1995			589	2076		230	2895	2571
1996				1952		230	2182	1900
1997				1952		230	2182	1862
1998				1952		230	2182	1826
1999				1952		230	2182	1790
2000				1952		230	2182	1755
2001				1952		230	2182	1720
2002				1952		230	2182	1687
2003				2199		230	2429	1841
2004				2199		230	2429	1805
2005				2199		230	2429	1769
2006				6393*		230	6623	4730
TOTAL	22568	5859	3536	34228	3780	4140	74111	65344

* - DECOMMISSIONING COST

INITIAL PAYMENT = 355 \$/KgU (INCLUDES * 5/KgU IMPACT AID)

FINAL PAYMENT = 341 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	2260			630	900	7444	7444
1990	249	155			1260	900	2564	2514
1991	9395	3509			1260	900	15064	14479
1992	9270	3432	14915	3762	630	900	32909	31011
1993			29831	7523		900	38254	35341
1994			29831	7523		900	38254	34648
1995			14915	5325		900	21140	18772
1996				3127		900	4027	3506
1997				3127		900	4027	3437
1998				3127		900	4027	3370
1999				3127		900	4027	3304
2000				3127		900	4027	3239
2001				3127		900	4027	3175
2002				3127		900	4027	3113
2003				7523		900	8423	6384
2004				7523		900	8423	6258
2005				7523		900	8423	6136
2006				24283*		900	25183	17985
TOTAL	22568	9356	89492	92874	3780	16200	234270	204116

* - DECOMMISSIONING COST

INITIAL PAYMENT = 67 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 57 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	2260			630	900	7444	7444
1990	249	155			1260	900	2564	2514
1991	9395	3509			1260	900	15064	14479
1992	9270	3432	11184	3704	630	900	29120	27440
1993			22368	7407		900	30675	28339
1994			22368	7407		900	30675	27783
1995			11184	5209		900	17293	15356
1996				3011		900	3911	3405
1997				3011		900	3911	3338
1998				3011		900	3911	3273
1999				3011		900	3911	3208
2000				3011		900	3911	3145
2001				3011		900	3911	3084
2002				3011		900	3911	3023
2003				7407		900	8307	6296
2004				7407		900	8307	6172
2005				7407		900	8307	6051
2006				19806*		900	20706	14787
TOTAL	22568	9356	67104	86831	3780	16200	205839	179137

* - DECOMMISSIONING COST

INITIAL PAYMENT = 55 \$/KgU (INCLUDES \$ 3/KgU IMPACT AID)

FINAL PAYMENT = 53 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	1804			630	230	6318	6318
1990	249	155			1260	230	1894	1857
1991	9395	1989			1260	230	12874	12374
1992	9270	1911	1027	1107	630	230	14175	13357
1993			2055	2214		230	4499	4156
1994			2055	2214		230	4499	4075
1995			1027	2091		230	3348	2973
1996				1967		230	2197	1913
1997				1967		230	2197	1875
1998				1967		230	2197	1838
1999				1967		230	2197	1802
2000				1967		230	2197	1767
2001				1967		230	2197	1732
2002				1967		230	2197	1698
2003				2214		230	2444	1852
2004				2214		230	2444	1816
2005				2214		230	2444	1780
2006				6918*		230	7148	5105
TOTAL	22568	5859	6164	34955	3780	4140	77466	68288

* - DECOMMISSIONING COST

INITIAL PAYMENT = 379 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 347 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	1804			630	230	6318	6318
1990	249	155			1260	230	1894	1857
1991	9395	1989			1260	230	12874	12374
1992	9270	1911	968	1107	630	230	14116	13302
1993			1937	2214		230	4381	4047
1994			1937	2214		230	4381	3968
1995			968	2091		230	3289	2921
1996				1967		230	2197	1913
1997				1967		230	2197	1875
1998				1967		230	2197	1838
1999				1967		230	2197	1802
2000				1967		230	2197	1767
2001				1967		230	2197	1732
2002				1967		230	2197	1698
2003				2214		230	2444	1852
2004				2214		230	2444	1816
2005				2214		230	2444	1780
2006				6847*		230	7077	5054
TOTAL	22568	5859	5810	34884	3780	4140	77041	67914

* - DECOMMISSIONING COST

INITIAL PAYMENT = 376 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 347 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-15

COST SENSITIVITY CASE -- \$3,500 CANISTER

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 447B DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	2260			630	900	7444	7444
1990	249	135			1260	900	2564	2514
1991	9395	3509			1260	900	15064	14479
1992	9270	3432	19492	3850	630	900	37574	35407
1993			38984	7699		900	47583	43959
1994			38984	7699		900	47583	43097
1995			19492	5501		900	25893	22992
1996				3303		900	4203	3659
1997				3303		900	4203	3587
1998				3303		900	4203	3517
1999				3303		900	4203	3448
2000				3303		900	4203	3380
2001				3303		900	4203	3314
2002				3303		900	4203	3249
2003				7699		900	8599	6517
2004				7699		900	8599	6389
2005				7699		900	8599	6264
2006				29775*		900	30675	21907
TOTAL	22568	9356	116952	100742	3780	16200	269598	235123

* - DECOMMISSIONING COST

INITIAL PAYMENT = 81 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 61 \$/KgU (INCLUDES \$ 9/KgU IMPACT AID)

TABLE A10-16

COST SENSITIVITY CASE -- \$2,000 CANISTER

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 447B DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	2260			630	900	7444	7444
1990	249	135			1260	900	2564	2514
1991	9395	3509			1260	900	15064	14479
1992	9270	3432	18372	3850	630	900	36454	34351
1993			36745	7699		900	45344	41891
1994			36745	7699		900	45344	41069
1995			18372	5501		900	24773	21998
1996				3303		900	4203	3659
1997				3303		900	4203	3587
1998				3303		900	4203	3517
1999				3303		900	4203	3448
2000				3303		900	4203	3380
2001				3303		900	4203	3314
2002				3303		900	4203	3249
2003				7699		900	8599	6517
2004				7699		900	8599	6389
2005				7699		900	8599	6264
2006				28432*		900	29332	20948
TOTAL	22568	9356	110234	99399	3780	16200	261537	228018

* - DECOMMISSIONING COST

INITIAL PAYMENT = 77 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 61 \$/KgU (INCLUDES \$ 9/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 (past the 2003 date set forth in the Draft 1988 Mission Plan Amendment) is shown in Table A10-17.

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

<u>Year of Completion of FIS Activities</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				
2005 (Base Case)	\$68,659	\$730	\$242,158	\$146
2007	71,544	761	246,834	148
2010	75,664	806	253,511	153
Increase-per yr. of delay	1,401	15	2,271	1
Existing Transfer Facility Cases				
2005 (Base Case)	\$48,775	\$525	\$218,545	\$131
2007	50,572	545	221,228	132
2010	53,137	573	225,059	135
Increase-per yr. of delay	872	10	1,303	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 A10-17 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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	1804			630	230	6318	6318
1990	249	155			1260	230	1894	1857
1991	9395	1989			1260	230	12874	12374
1992	9270	1911	1086	1107	630	230	14234	13413
1993			2171	2214		230	4615	4264
1994			2171	2214		230	4615	4180
1995			1086	2091		230	3407	3025
1996				1967		230	2197	1913
1997				1967		230	2197	1875
1998				1967		230	2197	1838
1999				1967		230	2197	1802
2000				1967		230	2197	1767
2001				1967		230	2197	1732
2002				1967		230	2197	1698
2003				1967		230	2197	1665
2004				1967		230	2197	1632
2005				2214		230	2444	1780
2006				2214		230	2444	1745
2007				2214		230	2444	1711
2008				6988*		230	7218	4955
TOTAL	22568	5859	6514	38959	3780	4600	82280	71544

* - DECOMMISSIONING COST

INITIAL PAYMENT = 382 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 379 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	1804			630	230	6318	6318
1990	249	155			1260	230	1894	1857
1991	9395	1989			1260	230	12874	12374
1992	9270	1911	1086	1107	630	230	14234	13413
1993			2171	2214		230	4615	4264
1994			2171	2214		230	4615	4180
1995			1086	2091		230	3407	3025
1996				1967		230	2197	1913
1997				1967		230	2197	1875
1998				1967		230	2197	1838
1999				1967		230	2197	1802
2000				1967		230	2197	1767
2001				1967		230	2197	1732
2002				1967		230	2197	1698
2003				1967		230	2197	1665
2004				1967		230	2197	1632
2005				1967		230	2197	1600
2006				1967		230	2197	1569
2007				1967		230	2197	1538
2008				2214		230	2444	1678
2009				2214		230	2444	1645
2010				2214		230	2444	1612
2011				6988*		230	7218	4669
TOTAL	22568	5859	6514	44860	3780	5290	88871	75664

* - DECOMMISSIONING COST

INITIAL PAYMENT = 382 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 424 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	2260			630	900	7444	7444
1990	249	155			1260	900	2564	2514
1991	9395	3509			1260	900	15064	14479
1992	9270	3432	20600	3850	630	900	38682	36451
1993			41201	7699		900	49800	46008
1994			41201	7699		900	49800	45105
1995			20600	5501		900	27001	23976
1996				3303		900	4203	3659
1997				3303		900	4203	3587
1998				3303		900	4203	3517
1999				3303		900	4203	3448
2000				3303		900	4203	3380
2001				3303		900	4203	3314
2002				3303		900	4203	3249
2003				3303		900	4203	3185
2004				3303		900	4203	3123
2005				7699		900	8599	6264
2006				7699		900	8599	6141
2007				7699		900	8599	6021
2008				31105*		900	32005	21969
TOTAL	22568	9356	123602	108678	3780	18000	285984	246834

* - DECOMMISSIONING COST

INITIAL PAYMENT = 84 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 64 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	2260			630	900	7444	7444
1990	249	155			1260	900	2564	2514
1991	9395	3509			1260	900	15064	14479
1992	9270	3432	20600	3850	630	900	38682	36451
1993			41201	7699		900	49800	46008
1994			41201	7699		900	49800	45105
1995			20600	5501		900	27001	23976
1996				3303		900	4203	3659
1997				3303		900	4203	3587
1998				3303		900	4203	3517
1999				3303		900	4203	3448
2000				3303		900	4203	3380
2001				3303		900	4203	3314
2002				3303		900	4203	3249
2003				3303		900	4203	3185
2004				3303		900	4203	3123
2005				3303		900	4203	3062
2006				3303		900	4203	3002
2007				3303		900	4203	2943
2008				7699		900	8599	5903
2009				7699		900	8599	5787
2010				7699		900	8599	5673
2011				31105*		900	32005	20702
TOTAL	22568	9356	123602	118387	3780	20700	298593	253511

* - DECOMMISSIONING COST

INITIAL PAYMENT = 84 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 69 \$/KgU (INCLUDES \$ 10/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1832			630	230	4191	4191
1990	114	155			1260	230	1759	1725
1991	3723	2083			1260	230	7296	7013
1992	3666	2005	1086	1073	630	230	8690	8189
1993			2171	2145		230	4546	4200
1994			2171	2145		230	4546	4117
1995			1086	1667		230	2983	2649
1996				1188		230	1418	1234
1997				1188		230	1418	1210
1998				1188		230	1418	1187
1999				1188		230	1418	1163
2000				1188		230	1418	1140
2001				1188		230	1418	1118
2002				1188		230	1418	1096
2003				1188		230	1418	1075
2004				1188		230	1418	1054
2005				2145		230	2375	1730
2006				2145		230	2375	1696
2007				2145		230	2375	1663
2008				4318*		230	4548	3122
TOTAL	9002	6075	6514	28475	3780	4600	58446	50572

* - DECOMMISSIONING COST

INITIAL PAYMENT = 253 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 292 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1832			630	230	4191	4191
1990	114	155			1260	230	1759	1725
1991	3723	2083			1260	230	7296	7013
1992	3666	2005	1086	1073	630	230	8690	8189
1993			2171	2145		230	4546	4200
1994			2171	2145		230	4546	4117
1995			1086	1667		230	2983	2649
1996				1188		230	1418	1234
1997				1188		230	1418	1210
1998				1188		230	1418	1187
1999				1188		230	1418	1163
2000				1188		230	1418	1140
2001				1188		230	1418	1118
2002				1188		230	1418	1096
2003				1188		230	1418	1075
2004				1188		230	1418	1054
2005				1188		230	1418	1033
2006				1188		230	1418	1013
2007				1188		230	1418	993
2008				2145		230	2375	1630
2009				2145		230	2375	1598
2010				2145		230	2375	1567
2011				4318*		230	4548	2942
TOTAL	9002	6075	6514	32039	3780	5290	62700	53137

* - DECOMMISSIONING COST

INITIAL PAYMENT = 253 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 320 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	2288			630	900	5317	5317
1990	114	155			1260	900	2429	2381
1991	3723	3603			1260	900	9486	9118
1992	3666	3525	20600	3815	630	900	33136	31225
1993			41201	7630		900	49731	45944
1994			41201	7630		900	49731	45043
1995			20600	4776		900	26276	23332
1996				1922		900	2822	2457
1997				1922		900	2822	2409
1998				1922		900	2822	2361
1999				1922		900	2822	2315
2000				1922		900	2822	2270
2001				1922		900	2822	2225
2002				1922		900	2822	2181
2003				1922		900	2822	2139
2004				1922		900	2822	2097
2005				7630		900	8530	8214
2006				7630		900	8530	8092
2007				7630		900	8530	5972
2008				28435*		900	29335	20136
TOTAL	9002	9571	123602	92474	3780	18000	256429	221228

* - DECOMMISSIONING COST

INITIAL PAYMENT = 76 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 56 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	2288			630	900	5317	5317
1990	114	155			1260	900	2429	2381
1991	3723	3603			1260	900	9486	9118
1992	3666	3525	20600	3815	630	900	33136	31225
1993			41201	7630		900	49731	45944
1994			41201	7630		900	49731	45043
1995			20600	4776		900	26276	23332
1996				1922		900	2822	2457
1997				1922		900	2822	2409
1998				1922		900	2822	2361
1999				1922		900	2822	2315
2000				1922		900	2822	2270
2001				1922		900	2822	2225
2002				1922		900	2822	2181
2003				1922		900	2822	2139
2004				1922		900	2822	2097
2005				1922		900	2822	2056
2006				1922		900	2822	2015
2007				1922		900	2822	1976
2008				7630		900	8530	5855
2009				7630		900	8530	5740
2010				7630		900	8530	5628
2011				28435*		900	29335	18975
TOTAL	9002	9571	123602	98240	3780	20700	264895	225059

* - DECOMMISSIONING COST

INITIAL PAYMENT = 76 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 59 \$/KgU (INCLUDES \$ 9/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)	\$68,659	\$730	\$242,158	\$146
4 yrs.	68,594	733	239,965	146
5 yrs.	68,534	735	237,810	144
Change per yr. of receipt time	-62	+2	-2,174	+1
Existing Transfer Facility Cases				
3 yrs. (Base Case)	\$48,775	\$525	\$218,545	\$131
4 yrs.	49,334	534	217,507	131
5 yrs.	49,888	543	216,483	131
Change per yr. of receipt time	+557	+9	-1,031	0

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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	1804			630	230	6318	6318
1990	249	155			1260	230	1894	1857
1991	9395	1989			1260	230	12874	12374
1992	9270	1911	814	1076	630	230	13931	13127
1993			1629	2152		230	4011	3706
1994			1629	2152		230	4011	3633
1995			1629	2152		230	4011	3562
1996			814	2060		230	3104	2702
1997				1967		230	2197	1875
1998				1967		230	2197	1838
1999				1967		230	2197	1802
2000				1967		230	2197	1767
2001				1967		230	2197	1732
2002				1967		230	2197	1698
2003				2214		230	2444	1852
2004				2214		230	2444	1816
2005				2214		230	2444	1780
2006				6988*		230	7218	5155
TOTAL	22568	5859	6515	35024	3780	4140	77886	68594

* - DECOMMISSIONING COST

INITIAL PAYMENT = 382 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 351 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	1804			630	230	6318	6318
1990	249	155			1260	230	1894	1857
1991	9395	1989			1260	230	12874	12374
1992	9270	1911	651	1058	630	230	13750	12957
1993			1303	2116		230	3649	3371
1994			1303	2116		230	3649	3305
1995			1303	2116		230	3649	3240
1996			1303	2116		230	3649	3177
1997			651	2042		230	2923	2495
1998				1967		230	2197	1838
1999				1967		230	2197	1802
2000				1967		230	2197	1767
2001				1967		230	2197	1732
2002				1967		230	2197	1698
2003				2214		230	2444	1852
2004				2214		230	2444	1816
2005				2214		230	2444	1780
2006				6988*		230	7218	5155
TOTAL	22568	5859	6514	35029	3780	4140	77890	68534

* - DECOMMISSIONING COST

INITIAL PAYMENT = 381 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 354 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-29

COST SENSITIVITY CASE -- 4-YEAR RECEIPT OF SPENT FUEL
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	2260			630	900	7444	7444
1990	249	155			1260	900	2564	2514
1991	9395	3509			1260	900	15064	14479
1992	9270	3432	15450	3166	630	900	32848	30953
1993			30900	6332		900	38132	35228
1994			30900	6332		900	38132	34537
1995			30900	6332		900	38132	33860
1996			15450	4818		900	21168	18428
1997				3303		900	4203	3587
1998				3303		900	4203	3517
1999				3303		900	4203	3448
2000				3303		900	4203	3380
2001				3303		900	4203	3314
2002				3303		900	4203	3249
2003				7699		900	8599	6517
2004				7699		900	8599	6389
2005				7699		900	8599	6264
2006				31105*		900	32005	22857
TOTAL	22568	9356	123600	101000	3780	16200	276504	239965

* - DECOMMISSIONING COST

INITIAL PAYMENT = 84 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 62 \$/KgU (INCLUDES \$ 9/KgU IMPACT AID)

TABLE A10-30

COST SENSITIVITY CASE -- 5-YEAR RECEIPT OF SPENT FUEL
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	2260			630	900	7444	7444
1990	249	155			1260	900	2564	2514
1991	9395	3509			1260	900	15064	14479
1992	9270	3432	12360	2756	630	900	29348	27655
1993			24720	5512		900	31132	28761
1994			24720	5512		900	31132	28197
1995			24720	5512		900	31132	27644
1996			24720	5512		900	31132	27102
1997			12360	4408		900	17668	15079
1998				3303		900	4203	3517
1999				3303		900	4203	3448
2000				3303		900	4203	3380
2001				3303		900	4203	3314
2002				3303		900	4203	3249
2003				7699		900	8599	6517
2004				7699		900	8599	6389
2005				7699		900	8599	6264
2006				31105*		900	32005	22857
TOTAL	22568	9356	123600	99929	3780	16200	275433	237810

* - DECOMMISSIONING COST

INITIAL PAYMENT = 83 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 61 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1832			630	230	4191	4191
1990	114	155			1260	230	1759	1725
1991	3723	2083			1260	230	7296	7013
1992	3666	2005	814	1042	630	230	8387	7903
1993			1629	2083		230	3942	3642
1994			1629	2083		230	3942	3570
1995			1629	2083		230	3942	3500
1996			814	1636		230	2680	2333
1997				1188		230	1418	1210
1998				1188		230	1418	1187
1999				1188		230	1418	1163
2000				1188		230	1418	1140
2001				1188		230	1418	1118
2002				1188		230	1418	1096
2003				2145		230	2375	1800
2004				2145		230	2375	1765
2005				2145		230	2375	1730
2006				4318*		230	4548	3248
TOTAL	9002	6075	6515	26808	3780	4140	56320	49334

* - DECOMMISSIONING COST

INITIAL PAYMENT = 253 \$/KgU (INCLUDES * 5/KgU IMPACT AID)

FINAL PAYMENT = 281 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1832			630	230	4191	4191
1990	114	155			1260	230	1759	1725
1991	3723	2083			1260	230	7296	7013
1992	3666	2005	651	1024	630	230	8206	7733
1993			1303	2047		230	3580	3307
1994			1303	2047		230	3580	3243
1995			1303	2047		230	3580	3179
1996			1303	2047		230	3580	3117
1997			651	1618		230	2499	2133
1998				1188		230	1418	1187
1999				1188		230	1418	1163
2000				1188		230	1418	1140
2001				1188		230	1418	1118
2002				1188		230	1418	1096
2003				2145		230	2375	1800
2004				2145		230	2375	1765
2005				2145		230	2375	1730
2006				4318*		230	4548	3248
TOTAL	9002	6075	6514	27523	3780	4140	57034	49888

* - DECOMMISSIONING COST

INITIAL PAYMENT = 252 \$/KgU (INCLUDES * 5/KgU IMPACT AID)

FINAL PAYMENT = 291 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	2288			630	900	5317	5317
1990	114	155			1260	900	2429	2381
1991	3723	3603			1260	900	9486	9118
1992	3666	3525	15450	3132	630	900	27303	25728
1993			30900	6263		900	38063	35164
1994			30900	6263		900	38063	34475
1995			30900	6263		900	38063	33799
1996			15450	4093		900	20443	17797
1997				1922		900	2822	2409
1998				1922		900	2822	2361
1999				1922		900	2822	2315
2000				1922		900	2822	2270
2001				1922		900	2822	2225
2002				1922		900	2822	2181
2003				7630		900	8530	6465
2004				7630		900	8530	6338
2005				7630		900	8530	6214
2006				28435*		900	29335	20950
TOTAL	9002	9571	123600	88871	3780	16200	251024	217507

* - DECOMMISSIONING COST

INITIAL PAYMENT = 76 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 55 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	2288			630	900	5317	5317
1990	114	155			1260	900	2429	2381
1991	3723	3603			1260	900	9486	9118
1992	3666	3525	12360	2722	630	900	23803	22430
1993			24720	5443		900	31063	28697
1994			24720	5443		900	31063	28135
1995			24720	5443		900	31063	27583
1996			24720	5443		900	31063	27042
1997			12360	3683		900	16943	14461
1998				1922		900	2822	2361
1999				1922		900	2822	2315
2000				1922		900	2822	2270
2001				1922		900	2822	2225
2002				1922		900	2822	2181
2003				7630		900	8530	6465
2004				7630		900	8530	6338
2005				7630		900	8530	6214
2006				28435*		900	29335	20950
TOTAL	9002	9571	123600	89112	3780	16200	251265	216483

* - DECOMMISSIONING COST

INITIAL PAYMENT = 75 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 56 \$/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)	<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				
4 yr. (Base Case)	\$68,659	\$730	\$242,158	\$146
2 yr.	73,584	769	254,556	150
Increase per yr. of schedule shortening	2,462	20	6,199	2
Existing Transfer Facility Cases				
4 yr. (Base Case)	\$48,775	\$525	\$218,545	\$131
2 yr.	51,849	548	228,004	134
Increase per yr. of schedule shortening	1,537	12	4,730	2

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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	13298	3947			630	230	18103	18103
1990	9270	1911	1086	1107	1260	230	14864	14573
1991			2171	2214	1260	230	5873	5647
1992			2171	2214	630	230	5245	4942
1993			1086	2091		230	3407	3148
1994				1967		230	2197	1990
1995				1967		230	2197	1951
1996				1967		230	2197	1913
1997				1967		230	2197	1875
1998				1967		230	2197	1838
1999				1967		230	2197	1802
2000				1967		230	2197	1767
2001				1967		230	2197	1732
2002				1967		230	2197	1698
2003				2214		230	2444	1852
2004				2214		230	2444	1816
2005				2214		230	2444	1780
2006				6988*		230	7218	5155
TOTAL	22568	5858	6514	38959	3780	4140	81819	73584

* - DECOMMISSIONING COST

INITIAL PAYMENT = 371 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 398 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-37

COST SENSITIVITY CASE -- 2-YEAR CONSTRUCTION SCHEDULE
 ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
 AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
 (\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	13298	5924			630	900	20752	20752
1990	9270	3432	20600	3850	1260	900	39312	38541
1991			41201	7699	1260	900	51060	49077
1992			41201	7699	630	900	50430	47521
1993			20600	5501		900	27001	24945
1994				3303		900	4203	3807
1995				3303		900	4203	3732
1996				3303		900	4203	3659
1997				3303		900	4203	3587
1998				3303		900	4203	3517
1999				3303		900	4203	3448
2000				3303		900	4203	3380
2001				3303		900	4203	3314
2002				3303		900	4203	3249
2003				7699		900	8599	6517
2004				7699		900	8599	6389
2005				7699		900	8599	6264
2006				31105*		900	32005	22857
TOTAL	22568	9356	123602	108678	3780	16200	284184	254556

* - DECOMMISSIONING COST

INITIAL PAYMENT = 85 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 65 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	5335	4069			630	230	10264	10264
1990	3666	2005	1086	1073	1260	230	9320	9137
1991			2171	2145	1260	230	5806	5581
1992			2171	2145	630	230	5176	4877
1993			1086	1667		230	2983	2756
1994				1188		230	1418	1284
1995				1188		230	1418	1259
1996				1188		230	1418	1234
1997				1188		230	1418	1210
1998				1188		230	1418	1187
1999				1188		230	1418	1163
2000				1188		230	1418	1140
2001				1188		230	1418	1118
2002				1188		230	1418	1096
2003				2145		230	2375	1800
2004				2145		230	2375	1765
2005				2145		230	2375	1730
2006				4318*		230	4548	3248
TOTAL	9001	6074	6514	28475	3780	4140	57984	51849

* - DECOMMISSIONING COST

INITIAL PAYMENT = 237 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 311 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	5335	6046			630	900	12911	12911
1990	3666	3525	20600	3815	1260	900	33766	33104
1991			41201	7630	1260	900	50991	49011
1992			41201	7630	630	900	50361	47456
1993			20600	4776		900	26276	24275
1994				1922		900	2822	2556
1995				1922		900	2822	2506
1996				1922		900	2822	2457
1997				1922		900	2822	2409
1998				1922		900	2822	2361
1999				1922		900	2822	2315
2000				1922		900	2822	2270
2001				1922		900	2822	2225
2002				1922		900	2822	2181
2003				7630		900	8530	6465
2004				7630		900	8530	6338
2005				7630		900	8530	6214
2006				28435*		900	29335	20950
TOTAL	9001	9571	123602	92474	3780	16200	254628	228004

* - DECOMMISSIONING COST

INITIAL PAYMENT = 77 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 57 \$/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)	\$68,659	\$730	\$242,158	\$146
100% PWR Fuel	68,083	725	231,316	139
100% BWR Fuel	69,770	742	263,819	159
Change per kg/U difference in average content of drywell	18	0.2	342	0.2
Existing Transfer Facility Cases				
67% PWR Fuel (Base Case)	\$48,775	\$525	\$218,545	\$131
100% PWR Fuel	48,200	519	207,703	126
100% BWR Fuel	49,892	536	240,202	145
Change per kg/U difference in average content of drywell	18	0.2	342	0.2

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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	1805			630	230	6319	6319
1990	249	155			1260	230	1894	1857
1991	9395	1992			1260	230	12877	12377
1992	9270	1914			630	230	14148	13332
1993			998	1106		230	4438	4100
1994			1997	2211		230	4438	4020
1995			1997	2211		230	3316	2945
1996			998	2088		230	2194	1910
1997				1964		230	2194	1873
1998				1964		230	2194	1836
1999				1964		230	2194	1800
2000				1964		230	2194	1765
2001				1964		230	2194	1730
2002				1964		230	2194	1696
2003				2211		230	2441	1850
2004				2211		230	2441	1814
2005				2211		230	2441	1778
2006				6885*		230	7115	5081
TOTAL	22568	5866	5990	34882	3780	4140	77226	68083

* - DECOMMISSIONING COST

INITIAL PAYMENT = 378 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 347 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	1802			630	230	6316	6316
1990	249	155			1260	230	1894	1857
1991	9395	1983			1260	230	12868	12368
1992	9270	1906	1256	1109	630	230	14401	13570
1993			2512	2218		230	4960	4582
1994			2512	2218		230	4960	4492
1995			1256	2095		230	3581	3180
1996				1971		230	2201	1916
1997				1971		230	2201	1879
1998				1971		230	2201	1842
1999				1971		230	2201	1806
2000				1971		230	2201	1770
2001				1971		230	2201	1735
2002				1971		230	2201	1701
2003				2218		230	2448	1855
2004				2218		230	2448	1819
2005				2218		230	2448	1783
2006				7190*		230	7420	5299
TOTAL	22568	5846	7536	35281	3780	4140	79131	69770

* - DECOMMISSIONING COST

INITIAL PAYMENT = 392 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 350 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	2265			630	900	7449	7449
1990	249	155			1260	900	2564	2514
1991	9395	3527			1260	900	15082	14496
1992	9270	3449	18958	3829	630	900	37036	34900
1993			37916	7658		900	46474	42935
1994			37916	7658		900	46474	42093
1995			18958	5460		900	25318	22482
1996				3261		900	4161	3622
1997				3261		900	4161	3551
1998				3261		900	4161	3482
1999				3261		900	4161	3413
2000				3261		900	4161	3347
2001				3261		900	4161	3281
2002				3261		900	4161	3217
2003				7658		900	8558	6486
2004				7658		900	8558	6359
2005				7658		900	8558	6234
2006				29142*		900	30042	21455
TOTAL	22568	9396	113748	99548	3780	16200	265240	231316

* - DECOMMISSIONING COST

INITIAL PAYMENT = 78 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 61 \$/KgU (INCLUDES \$ 9/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	2249			630	900	7433	7433
1990	249	155			1260	900	2564	2514
1991	9395	3472			1260	900	15027	14443
1992	9270	3395	23880	3892	630	900	41967	39546
1993			47761	7783		900	56444	52146
1994			47761	7783		900	56444	51123
1995			23880	5585		900	30365	26963
1996				3387		900	4287	3732
1997				3387		900	4287	3659
1998				3387		900	4287	3587
1999				3387		900	4287	3517
2000				3387		900	4287	3448
2001				3387		900	4287	3380
2002				3387		900	4287	3314
2003				7783		900	8683	6581
2004				7783		900	8683	6452
2005				7783		900	8683	6325
2006				35024*		900	35924	25656
TOTAL	22568	9271	143282	107125	3780	16200	302226	263819

* - DECOMMISSIONING COST

INITIAL PAYMENT = 94 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 65 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-45

COST SENSITIVITY CASE -- 100% PHW FUEL
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 217 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(*000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1832			630	230	4191	4191
1990	114	155			1260	230	1759	1725
1991	3723	2083			1260	230	7298	7015
1992	3666	2007	998	1071	630	230	8602	8106
1993			1997	2142		230	4369	4036
1994			1997	2142		230	4369	3957
1995			998	1664		230	2892	2568
1996				1186		230	1416	1233
1997				1186		230	1416	1209
1998				1186		230	1416	1185
1999				1186		230	1416	1162
2000				1186		230	1416	1139
2001				1186		230	1416	1117
2002				1186		230	1416	1095
2003				2142		230	2372	1798
2004				2142		230	2372	1762
2005				2142		230	2372	1728
2006				4214*		230	4444	3174
TOTAL	9002	6079	5990	25961	3780	4140	54952	48200

* - DECOMMISSIONING COST

INITIAL PAYMENT = 248 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 271 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1830			630	230	4189	4189
1990	114	155			1260	230	1759	1725
1991	3723	2077			1260	230	7290	7007
1992	3666	1999	1256	1075	630	230	8856	8345
1993			2512	2149		230	4891	4519
1994			2512	2149		230	4891	4430
1995			1256	1671		230	3157	2803
1996				1193		230	1423	1239
1997				1193		230	1423	1215
1998				1193		230	1423	1191
1999				1193		230	1423	1167
2000				1193		230	1423	1144
2001				1193		230	1423	1122
2002				1193		230	1423	1100
2003				2149		230	2379	1803
2004				2149		230	2379	1768
2005				2149		230	2379	1733
2006				4520*		230	4750	3392
TOTAL	9002	6061	7536	26362	3780	4140	56881	49892

* - DECOMMISSIONING COST

INITIAL PAYMENT = 262 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 274 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	2293			630	900	5322	5322
1990	114	155			1260	900	2429	2381
1991	3723	3621			1260	900	9504	9135
1992	3666	3543	18958	3795	630	900	31492	29676
1993			37916	7589		900	46405	42871
1994			37916	7589		900	46405	42030
1995			18958	4735		900	24593	21838
1996				1880		900	2780	2420
1997				1880		900	2780	2373
1998				1880		900	2780	2326
1999				1880		900	2780	2281
2000				1880		900	2780	2236
2001				1880		900	2780	2192
2002				1880		900	2780	2149
2003				7589		900	8489	6434
2004				7589		900	8489	6307
2005				7589		900	8489	6184
2006				26472*		900	27372	19548
TOTAL	9002	9612	113748	86107	3780	16200	238449	207703

* - DECOMMISSIONING COST

INITIAL PAYMENT = 72 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 54 \$/KgU (INCLUDES \$ 8/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	2277			630	900	5306	5306
1990	114	155			1260	900	2429	2381
1991	3723	3565			1260	900	9448	9081
1992	3666	3488	23880	3857	630	900	36421	34320
1993			47761	7714		900	56375	52082
1994			47761	7714		900	56375	51061
1995			23880	4860		900	29640	26319
1996				2006		900	2906	2530
1997				2006		900	2906	2480
1998				2006		900	2906	2432
1999				2006		900	2906	2384
2000				2006		900	2906	2337
2001				2006		900	2906	2291
2002				2006		900	2906	2246
2003				7714		900	8614	6528
2004				7714		900	8614	6400
2005				7714		900	8614	6275
2006				32354*		900	33254	23749
TOTAL	9002	9485	143282	93683	3780	16200	275432	240202

* - DECOMMISSIONING COST

INITIAL PAYMENT = 87 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 58 \$/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)	\$68,659	\$730	\$242,158	\$146
4%	61,327	677	213,764	133
6%	55,410	631	190,645	122
Decrease per percent increase in discount rate	3,312	25	12,878	6
Existing Transfer Facility Cases				
2% (Base Case)	\$48,775	\$525	\$218,545	\$131
4%	43,354	487	192,694	120
6%	38,986	454	161,642	111
Decrease per percent increase in discount rate	2,447	18	11,726	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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	1804			630	230	6318	6318
1990	249	155			1260	230	1894	1821
1991	9395	1989			1260	230	12874	11903
1992	9270	1911	1086	1107	630	230	14234	12654
1993			2171	2214		230	4615	3945
1994			2171	2214		230	4615	3793
1995			1086	2091		230	3407	2693
1996				1967		230	2197	1670
1997				1967		230	2197	1605
1998				1967		230	2197	1544
1999				1967		230	2197	1484
2000				1967		230	2197	1427
2001				1967		230	2197	1372
2002				1967		230	2197	1319
2003				2214		230	2444	1411
2004				2214		230	2444	1357
2005				2214		230	2444	1305
2006				6988*		230	7218	3706
TOTAL	22568	5859	6514	35025	3780	4140	77886	61327

* - DECOMMISSIONING COST

INITIAL PAYMENT = 366 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 311 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	1804			630	230	6318	6318
1990	249	155			1260	230	1894	1787
1991	9395	1989			1260	230	12874	11458
1992	9270	1911	1086	1107	630	230	14234	11951
1993			2171	2214		230	4615	3656
1994			2171	2214		230	4615	3449
1995			1086	2091		230	3407	2402
1996				1967		230	2197	1461
1997				1967		230	2197	1378
1998				1967		230	2197	1300
1999				1967		230	2197	1227
2000				1967		230	2197	1157
2001				1967		230	2197	1092
2002				1967		230	2197	1030
2003				2214		230	2444	1081
2004				2214		230	2444	1020
2005				2214		230	2444	962
2006				6988*		230	7218	2681
TOTAL	22568	5859	6514	35025	3780	4140	77886	55410

* - DECOMMISSIONING COST

INITIAL PAYMENT = 351 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 280 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-52

COST SENSITIVITY CASE -- 4% DISCOUNT RATE
 ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
 AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
 (\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	2260			630	900	7444	7444
1990	249	155			1260	900	2564	2465
1991	9395	3509			1260	900	15064	13928
1992	9270	3432	20600	3850	630	900	38682	34388
1993			41201	7699		900	49800	42569
1994			41201	7699		900	49800	40932
1995			20600	5501		900	27001	21339
1996				3303		900	4203	3194
1997				3303		900	4203	3071
1998				3303		900	4203	2953
1999				3303		900	4203	2839
2000				3303		900	4203	2730
2001				3303		900	4203	2625
2002				3303		900	4203	2524
2003				7699		900	8599	4966
2004				7699		900	8599	4775
2005				7699		900	8599	4591
2006				31105*		900	32005	16431
TOTAL	22568	9356	123602	102072	3780	16200	277578	213764

* - DECOMMISSIONING COST

INITIAL PAYMENT = 78 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 55 \$/KgU (INCLUDES \$ 9/KgU IMPACT AID)

TABLE A10-53

COST SENSITIVITY CASE -- 6% DISCOUNT RATE
 ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
 AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
 (\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	2260			630	900	7444	7444
1990	249	155			1260	900	2564	2419
1991	9395	3509			1260	900	15064	13407
1992	9270	3432	20600	3850	630	900	38682	32478
1993			41201	7699		900	49800	39446
1994			41201	7699		900	49800	37213
1995			20600	5501		900	27001	19035
1996				3303		900	4203	2795
1997				3303		900	4203	2637
1998				3303		900	4203	2488
1999				3303		900	4203	2347
2000				3303		900	4203	2214
2001				3303		900	4203	2089
2002				3303		900	4203	1971
2003				7699		900	8599	3803
2004				7699		900	8599	3588
2005				7699		900	8599	3385
2006				31105*		900	32005	11886
TOTAL	22568	9356	123602	102072	3780	16200	277578	190645

* - DECOMMISSIONING COST

INITIAL PAYMENT = 72 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 50 \$/KgU (INCLUDES \$ 9/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1832			630	230	4191	4191
1990	114	155			1260	230	1759	1691
1991	3723	2083			1260	230	7296	6746
1992	3666	2005	1086	1073	630	230	8690	7725
1993			2171	2145		230	4546	3886
1994			2171	2145		230	4546	3736
1995			1086	1667		230	2983	2358
1996				1188		230	1418	1078
1997				1188		230	1418	1036
1998				1188		230	1418	996
1999				1188		230	1418	958
2000				1188		230	1418	921
2001				1188		230	1418	886
2002				1188		230	1418	852
2003				2145		230	2375	1372
2004				2145		230	2375	1319
2005				2145		230	2375	1268
2006				4318*		230	4548	2335
TOTAL	9002	6075	6514	26099	3780	4140	55610	43354

* - DECOMMISSIONING COST

INITIAL PAYMENT = 241 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 246 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1832			630	230	4191	4191
1990	114	155			1260	230	1759	1659
1991	3723	2083			1260	230	7296	6493
1992	3666	2005	1086	1073	630	230	8690	7296
1993			2171	2145		230	4546	3601
1994			2171	2145		230	4546	3397
1995			1086	1667		230	2983	2103
1996				1188		230	1418	943
1997				1188		230	1418	890
1998				1188		230	1418	839
1999				1188		230	1418	792
2000				1188		230	1418	747
2001				1188		230	1418	705
2002				1188		230	1418	665
2003				2145		230	2375	1050
2004				2145		230	2375	991
2005				2145		230	2375	935
2006				4318*		230	4548	1689
TOTAL	9002	6075	6514	26099	3780	4140	55610	38986

* - DECOMMISSIONING COST

INITIAL PAYMENT = 229 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 225 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	2288			630	900	5317	5317
1990	114	155			1260	900	2429	2336
1991	3723	3603			1260	900	9486	8770
1992	3666	3525	20600	3815	630	900	33136	29458
1993			41201	7630		900	49731	42510
1994			41201	7630		900	49731	40875
1995			20600	4776		900	26276	20766
1996				1922		900	2822	2144
1997				1922		900	2822	2062
1998				1922		900	2822	1983
1999				1922		900	2822	1906
2000				1922		900	2822	1833
2001				1922		900	2822	1763
2002				1922		900	2822	1695
2003				7630		900	8530	4926
2004				7630		900	8530	4736
2005				7630		900	8530	4554
2006				28435*		900	29335	15060
TOTAL	9002	9571	123602	88630	3780	16200	250785	192694

* - DECOMMISSIONING COST

INITIAL PAYMENT = 71 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 49 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	2288			630	900	5317	5317
1990	114	155			1260	900	2429	2292
1991	3723	3603			1260	900	9486	8443
1992	3666	3525	20600	3815	630	900	33136	27822
1993			41201	7630		900	49731	39392
1994			41201	7630		900	49731	37162
1995			20600	4776		900	26276	18524
1996				1922		900	2822	1877
1997				1922		900	2822	1771
1998				1922		900	2822	1670
1999				1922		900	2822	1576
2000				1922		900	2822	1487
2001				1922		900	2822	1402
2002				1922		900	2822	1323
2003				7630		900	8530	3773
2004				7630		900	8530	3559
2005				7630		900	8530	3358
2006				28435*		900	29335	10894
TOTAL	9002	9571	123602	88630	3780	16200	250785	171642

* - DECOMMISSIONING COST

INITIAL PAYMENT = 66 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 45 \$/KgU (INCLUDES \$ 8/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)	\$68,659	\$730	\$242,158	\$146
No NRC Licensing Activities	66,766	711	240,273	145
Savings	1,893	19	1,885	1
No NRC Security	58,569	620	232,064	139
Savings	10,090	110	10,094	7
No NRC Licensing or Security	56,679	601	230,182	138
Savings	11,980	129	11,976	8
Existing Transfer Facility Cases				
Full NRC Licensing (Base Case)	\$48,775	\$525	\$218,545	\$131
No NRC Licensing Activities	47,688	514	217,467	130
Savings	1,087	11	1,078	1
No NRC Security	38,689	415	208,458	125
Savings	10,086	110	10,087	6
No NRC Licensing or Security	37,610	404	207,380	125
Savings	11,165	121	11,165	6

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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3180	1031			630	230	5071	5071
1990	114	69			1260	230	1673	1640
1991	9327	1946			1260	230	12763	12267
1992	9270	1911	1086	1103	630	230	14230	13409
1993			2171	2206		230	4607	4256
1994			2171	2206		230	4607	4173
1995			1086	2082		230	3398	3017
1996				1958		230	2188	1905
1997				1958		230	2188	1867
1998				1958		230	2188	1831
1999				1958		230	2188	1795
2000				1958		230	2188	1760
2001				1958		230	2188	1725
2002				1958		230	2188	1691
2003				2206		230	2436	1846
2004				2206		230	2436	1810
2005				2206		230	2436	1774
2006				6672*		230	6902	4929
TOTAL	21891	4957	6514	34593	3780	4140	75875	66766

* - DECOMMISSIONING COST

INITIAL PAYMENT = 367 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 344 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	1804			630	230	6318	6318
1990	249	155			1260	230	1894	1857
1991	9395	1989			1260	230	12874	12374
1992	9270	1911	1086	655	630	230	13782	12987
1993			2171	1310		230	3711	3428
1994			2171	1310		230	3711	3361
1995			1086	1187		230	2503	2223
1996				1063		230	1293	1126
1997				1063		230	1293	1104
1998				1063		230	1293	1082
1999				1063		230	1293	1061
2000				1063		230	1293	1040
2001				1063		230	1293	1020
2002				1063		230	1293	1000
2003				1310		230	1540	1167
2004				1310		230	1540	1144
2005				1310		230	1540	1122
2006				6988*		230	7218	5155
TOTAL	22568	5859	6514	22821	3780	4140	65682	58569

* - DECOMMISSIONING COST

INITIAL PAYMENT = 382 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 238 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3180	1031			630	230	5071	5071
1990	114	69			1260	230	1673	1640
1991	9327	1946			1260	230	12763	12267
1992	9270	1911	1086	651	630	230	13778	12983
1993			2171	1302		230	3703	3421
1994			2171	1302		230	3703	3354
1995			1086	1179		230	2495	2215
1996				1055		230	1285	1119
1997				1055		230	1285	1097
1998				1055		230	1285	1075
1999				1055		230	1285	1054
2000				1055		230	1285	1033
2001				1055		230	1285	1013
2002				1055		230	1285	993
2003				1302		230	1532	1161
2004				1302		230	1532	1138
2005				1302		230	1532	1116
2006				6672*		230	6902	4929
TOTAL	21891	4957	6514	22397	3780	4140	63679	56679

* - DECOMMISSIONING COST

INITIAL PAYMENT = 367 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 234 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3180	1488			630	900	6198	6198
1990	114	69			1260	900	2343	2297
1991	9327	3466			1260	900	14953	14372
1992	9270	3432	20600	3846	630	900	38678	36447
1993			41201	7691		900	49792	46000
1994			41201	7691		900	49792	45098
1995			20600	5493		900	26993	23969
1996				3295		900	4195	3652
1997				3295		900	4195	3580
1998				3295		900	4195	3510
1999				3295		900	4195	3441
2000				3295		900	4195	3374
2001				3295		900	4195	3308
2002				3295		900	4195	3243
2003				7691		900	8591	6511
2004				7691		900	8591	6383
2005				7691		900	8591	6258
2006				30790*		900	31690	22632
TOTAL	21891	8455	123602	101649	3780	16200	275577	240273

* - DECOMMISSIONING COST

INITIAL PAYMENT = 83 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 62 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3654	2260			630	900	7444	7444
1990	249	155			1260	900	2564	2514
1991	9395	3509			1260	900	15064	14479
1992	9270	3432	20600	3398	630	900	38230	36025
1993			41201	6795		900	48896	45172
1994			41201	6795		900	48896	44287
1995			20600	4597		900	26097	23173
1996				2399		900	3299	2872
1997				2399		900	3299	2816
1998				2399		900	3299	2760
1999				2399		900	3299	2706
2000				2399		900	3299	2653
2001				2399		900	3299	2601
2002				2399		900	3299	2550
2003				6795		900	7695	5832
2004				6795		900	7695	5718
2005				6795		900	7695	5605
2006				31105*		900	32005	22857
TOTAL	22568	9356	123602	89868	3780	16200	265374	232064

* - DECOMMISSIONING COST

INITIAL PAYMENT = 83 \$/KqU (INCLUDES \$ 4/KqU IMPACT AID)

FINAL PAYMENT = 56 \$/KqU (INCLUDES \$ 9/KqU 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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	3180	1488			630	900	6198	6198
1990	114	69			1260	900	2343	2297
1991	9327	3466			1260	900	14953	14372
1992	9270	3432	20600	3394	630	900	38226	36021
1993			41201	6787		900	48888	45165
1994			41201	6787		900	48888	44279
1995			20600	4589		900	26089	23166
1996				2391		900	3291	2865
1997				2391		900	3291	2809
1998				2391		900	3291	2754
1999				2391		900	3291	2700
2000				2391		900	3291	2647
2001				2391		900	3291	2595
2002				2391		900	3291	2544
2003				6787		900	7687	5826
2004				6787		900	7687	5712
2005				6787		900	7687	5600
2006				30790*		900	31690	22632
TOTAL	21891	8455	123602	89445	3780	16200	263373	230182

* - DECOMMISSIONING COST

INITIAL PAYMENT = 82 \$/KqU (INCLUDES \$ 4/KqU IMPACT AID)

FINAL PAYMENT = 56 \$/KqU (INCLUDES \$ 9/KqU 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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1060			630	230	3419	3419
1990	114	69			1260	230	1673	1640
1991	3723	2039			1260	230	7252	6970
1992	3666	2003	1086	1070	630	230	8687	8186
1993			2171	2140		230	4541	4195
1994			2171	2140		230	4541	4113
1995			1086	1662		230	2978	2644
1996				1183		230	1413	1230
1997				1183		230	1413	1206
1998				1183		230	1413	1182
1999				1183		230	1413	1159
2000				1183		230	1413	1136
2001				1183		230	1413	1114
2002				1183		230	1413	1092
2003				2140		230	2370	1796
2004				2140		230	2370	1761
2005				2140		230	2370	1726
2006				4138*		230	4368	3119
TOTAL	9002	5173	6514	25851	3780	4140	54460	47688

* - DECOMMISSIONING COST

INITIAL PAYMENT = 244 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 270 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1832			630	230	4191	4191
1990	114	155			1260	230	1759	1725
1991	3723	2083			1260	230	7296	7013
1992	3666	2003	1086	621	630	230	8238	7763
1993			2171	1241		230	3642	3365
1994			2171	1241		230	3642	3299
1995			1086	763		230	2079	1846
1996				285		230	515	448
1997				285		230	515	440
1998				285		230	515	431
1999				285		230	515	422
2000				285		230	515	414
2001				285		230	515	406
2002				285		230	515	398
2003				1241		230	1471	1115
2004				1241		230	1471	1093
2005				1241		230	1471	1072
2006				4318*		230	4548	3248
TOTAL	9002	6075	6514	13902	3780	4140	43413	38689

* - DECOMMISSIONING COST

INITIAL PAYMENT = 253 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 162 \$/KgU (INCLUDES \$ 10/KgU IMPACT AID)

TABLE A10-67

COST SENSITIVITY CASE -- NO NRC LICENSING OR SECURITY
 ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 234 DRYWELLS (100 MTU)
 AT GOVERNMENT SITE WITH EXISTING FACILITIES
 (\$000, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1060			630	230	3419	3419
1990	114	69			1260	230	1673	1640
1991	3723	2039			1260	230	7252	6970
1992	3666	2005	1086	618	630	230	8235	7760
1993			2171	1236		230	3637	3360
1994			2171	1236		230	3637	3294
1995			1086	759		230	2073	1843
1996				281		230	511	445
1997				281		230	511	436
1998				281		230	511	428
1999				281		230	511	419
2000				281		230	511	411
2001				281		230	511	403
2002				281		230	511	395
2003				1236		230	1466	1111
2004				1236		230	1466	1089
2005				1236		230	1466	1068
2006				4138*		230	4368	3119
TOTAL	9002	5173	6514	13662	3780	4140	42271	37610

* - DECOMMISSIONING COST

INITIAL PAYMENT = 244 \$/KgU (INCLUDES \$ 5/KgU IMPACT AID)

FINAL PAYMENT = 160 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1516			630	900	4545	4545
1990	114	69			1260	900	2343	2297
1991	3723	3560			1260	900	9443	9076
1992	3666	3525	20600	3813	630	900	33134	31223
1993			41201	7626		900	49727	45940
1994			41201	7626		900	49727	45039
1995			20600	4772		900	26272	23329
1996				1917		900	2817	2452
1997				1917		900	2817	2404
1998				1917		900	2817	2357
1999				1917		900	2817	2311
2000				1917		900	2817	2266
2001				1917		900	2817	2221
2002				1917		900	2817	2178
2003				7626		900	8526	6462
2004				7626		900	8526	6335
2005				7626		900	8526	6211
2006				28255*		900	29155	20821
TOTAL	9002	8670	123602	88389	3780	16200	249643	217467

* - DECOMMISSIONING COST

INITIAL PAYMENT = 76 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 54 \$/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	2288			630	900	5317	5317
1990	114	155			1260	900	2429	2381
1991	3723	3603			1260	900	9486	9118
1992	3666	3525	20600	3363	630	900	32684	30799
1993			41201	6726		900	48827	45109
1994			41201	6726		900	48827	44224
1995			20600	3873		900	25373	22531
1996				1019		900	1919	1671
1997				1019		900	1919	1638
1998				1019		900	1919	1606
1999				1019		900	1919	1574
2000				1019		900	1919	1543
2001				1019		900	1919	1513
2002				1019		900	1919	1483
2003				6726		900	7626	5780
2004				6726		900	7626	5666
2005				6726		900	7626	5555
2006				28435*		900	29335	20950
TOTAL	9002	9571	123602	76434	3780	16200	238589	208458

* - DECOMMISSIONING COST

INITIAL PAYMENT = 76 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 49 \$KgU (INCLUDES \$ 8/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, 1989)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1989	1499	1516			630	900	4545	4545
1990	114	69			1260	900	2343	2297
1991	3723	3560			1260	900	9443	9076
1992	3666	3525	20600	3361	630	900	32682	30797
1993			41201	6722		900	48823	45105
1994			41201	6722		900	48823	44221
1995			20600	3868		900	25368	22526
1996				1014		900	1914	1666
1997				1014		900	1914	1634
1998				1014		900	1914	1602
1999				1014		900	1914	1570
2000				1014		900	1914	1539
2001				1014		900	1914	1509
2002				1014		900	1914	1480
2003				6722		900	7622	5777
2004				6722		900	7622	5663
2005				6722		900	7622	5552
2006				28255*		900	29155	20821
TOTAL	9002	8670	123602	76192	3780	16200	237446	207380

* - DECOMMISSIONING COST

INITIAL PAYMENT = 76 \$/KgU (INCLUDES \$ 4/KgU IMPACT AID)

FINAL PAYMENT = 49 \$KgU (INCLUDES \$ 8/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 twelve (12) 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.

*Cost of rail transport assumes each reactor has the capability of handling a rail cask.

- (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 NAC rate schedule prevailing as of May 1988 for this cask, as follows:

<u>No. Days of Use</u>	<u>Charge</u>
1 - 10 days	\$44,000(minimum charge)
11 - 30 days	2,000/day
31 - 90 days	1,500/day
91 - 180 days	1,050/day
181 - 365 days	950/day

Utilizing this rate schedule and assuming that a cask would be used 300 days/year, a cask use charge of \$1,275/day results. JAI assumed that a 5% increase in cask use charges would be applicable for 1989, resulting in a daily use charge for the NLI 1/2 cask of \$1,339/day (1989 dollars).

Nuclear Packaging, Inc. suggested the use of a 1988 rate of \$4,500/day for the use of the IF-300 rail cask. JAI assumed a 5% increase in these cask use charges would be applicable for 1989, results in a daily use charge of \$4,725 in 1989 dollars.

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 TSMT 4007-A as amended through December 1987. All applicable portions of this tariff were escalated by 3% to obtain estimates for 1989. 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 estimated 1989 Mileage Commodity Rates for the distances pertinent to this study.

A security surveillance charge of \$0.95 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 \$0.15 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
 (1989 Dollars)

<u>Reactor to Destination</u>	<u>Rates in Dollars per 100 Pounds</u>	
	<u>Loaded</u>	<u>Empty</u>
<u>From Oconee to</u>		
Eastern U.S. Site	\$ 2.53	\$ 1.46
Western U.S. Site	13.52	10.40
<u>From Millstone to</u>		
Eastern U.S. Site	5.49	4.13
Western U.S. Site	15.14	11.60
<u>From Palisades to</u>		
Eastern U.S. Site	4.36	2.95
Western U.S. Site	10.48	8.00
<u>From St. Lucie to</u>		
Eastern U.S. Site	5.05	3.67
Western U.S. Site	15.95	12.25
<u>From Crystal River to</u>		
Eastern U.S. Site	4.55	3.13
Western U.S. Site	17.07	12.97
<u>From Robinson to</u>		
Eastern U.S. Site	3.21	1.88
Western U.S. Site	15.95	12.25
<u>From Brunswick to</u>		
Eastern U.S. Site	4.08	2.70
Western U.S. Site	15.70	12.04
<u>From LaSalle to</u>		
Eastern U.S. Site	3.99	2.60
Western U.S. Site	9.06	6.87
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	4.17	2.81
Western U.S. Site	14.02	10.89
<u>From Prairie Island to</u>		
Eastern U.S. Site	6.07	4.58
Western U.S. Site	8.97	6.78
<u>From Pilgrim to</u>		
Eastern U.S. Site	5.79	4.38
Western U.S. Site	15.40	11.79
<u>From Indian Point to</u>		
Eastern U.S. Site	6.58	5.04
Western U.S. Site	14.86	11.34

^aRates based upon Tariff ICC 4007-A, Item 2000, dated August 13, 1987 and escalated by 3% to approximate mid-1989 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	\$18.03
9 - 16	\$23.18
17 - 24	\$28.33
All Over 24	\$33.48

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 \$502.23 for loading and \$182.87 for unloading for a total charge of \$685.10/round trip.

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 \$26.20/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 labor costs to make the necessary escort arrangements in each locality and the cost of communicating with each locality involved in a shipment (i.e., telephone, mail, telex) was estimated at \$64.

Taking into consideration the above assumptions and estimated costs, it was estimated that there would be a total cost of \$194 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 1.2% (based on the increase in the index for freight for Class I railroads from 1984 to that projected by JAI for 1989) to obtain the 1989 values set forth in Table B3-2.

TABLE B3-2
RAIL FREIGHT RATES
(1989 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 Oconee to</u>		
Eastern U.S. Site	\$ 4.64	\$ 4.35
Western U.S. Site	16.19	15.18
<u>From Millstone to</u>		
Eastern U.S. Site	8.50	7.97
Western U.S. Site	17.93	16.81
<u>From Palisades to</u>		
Eastern U.S. Site	6.58	6.17
Western U.S. Site	13.73	12.87
<u>From St. Lucie to</u>		
Eastern U.S. Site	7.73	7.25
Western U.S. Site	18.00	16.88
<u>From Crystal River to</u>		
Eastern U.S. Site	7.19	6.74
Western U.S. Site	17.64	16.54
<u>From Robinson to</u>		
Eastern U.S. Site	5.31	4.98
Western U.S. Site	17.22	16.14
<u>From Brunswick to</u>		
Eastern U.S. Site	5.97	5.60
Western U.S. Site	17.70	16.60
<u>From LaSalle to</u>		
Eastern U.S. Site	5.94	5.57
Western U.S. Site	12.95	12.14
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	6.48	6.07
Western U.S. Site	16.96	15.91
<u>From Prairie Island to</u>		
Eastern U.S. Site	8.76	8.22
Western U.S. Site	12.32	11.55
<u>From Pilgrim to</u>		
Eastern U.S. Site	8.91	8.35
Western U.S. Site	17.93	16.81
<u>From Indian Point to</u>		
Eastern U.S. Site	7.99	7.49
Western U.S. Site	17.58	16.48

3.2.1 Heavy Haul Charges

Heavy haul charges are applicable to this study in the case of six reactor sites which do not have direct rail access. Also, these charges are assumed to apply in all 12 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 eight 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-30D RAIL CASK
(1989 Dollars)

<u>Reactor</u>	<u>Reactor to Railhead/Railhead to Western U.S. FIS Facility</u>				
	<u>One-Way Mileage</u>	<u>Heavy Haul Cost^a</u>	<u>Rigger Cost^b</u>	<u>Overweight Permit Cost^c</u>	<u>Total Cost</u>
Oconee	10	\$3,116	\$5,890	\$ 148	\$ 9,154
Millstone	5	2,926	5,890	225	9,041
St. Lucie	10	3,116	5,890	404	9,410
Calvert Cliffs	50	4,636	5,890	2,161	12,687
Pilgrim	25	3,686	5,890	96	9,672
Indian Point	5	2,926	5,890	193	9,009
Western U.S. FIS	27	3,762	5,890	-	9,652

^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) @ \$114/hr.

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

2x(4 hrs deadhead time plus 4 hrs loading/unloading time) @ \$160/hr, plus a crane charge @ \$1,665 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. Tariff values escalated to estimate 1989 charges.

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

<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 Oconee to</u>						
Eastern U.S. Site	210	191	11	36	47	2.0
Western U.S. Site	2,450	2,227	134	36	170	7.1
<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 Palisades to</u>						
Eastern U.S. Site	686	624	37	36	73	3.0
Western U.S. Site	1,884	1,713	103	36	139	5.8
<u>From St. Lucie to</u>						
Eastern U.S. Site	862	784	47	36	83	3.5
Western U.S. Site	2,890	2,647	158	36	194	8.1
<u>From Crystal River to</u>						
Eastern U.S. Site	743	675	41	36	77	3.2
Western U.S. Site	3,056	2,778	167	36	203	8.5
<u>From Robinson to</u>						
Eastern U.S. Site	384	349	21	36	57	2.4
Western U.S. Site	2,875	2,614	157	36	193	8.0
<u>From Brunswick to</u>						
Eastern U.S. Site	606	551	33	36	69	2.9
Western U.S. Site	2,822	2,565	154	36	190	7.9
<u>From LaSalle to</u>						
Eastern U.S. Site	593	539	32	36	68	2.8
Western U.S. Site	1,648	1,498	90	36	126	5.3

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 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 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 Pilgrim to</u>						
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
<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

^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. However, for the purposes of this study, the average rail transit speeds developed by PNL* were used. These were as follows:

<u>Total Distance (Miles)</u>	<u>Miles Per Day</u>
0 - 300	47 (1.96 mph)
301 - 1100	88 (3.67 mph)
1101 - 1900	143 (5.96 mph)
1901 - 2400	182 (7.58 mph)

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.

*Pacific Northwest Laboratory, Truck and Rail Charges for Shipping Spent Fuel and Nuclear Waste, PNL-5797, June 1986

TABLE B4-2
DISTANCES AND TIMES REQUIRED FOR COMPLETION OF ROUND TRIP SHIPMENT OF SPENT FUEL
BY 1F-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 Oconee to</u>							
Eastern U.S. Site	594	303.1	3.3	8	144	458.4	19.1
Western U.S. Site	4,510	595.0	12.3	16	144	767.3	32.0
<u>From Millstone to</u>							
Eastern U.S. Site	1,812	493.8	1.7	8	144	647.5	27.0
Western U.S. Site	5,130	676.8	10.7	16	144	847.5	35.3
<u>From Palisades to</u>							
Eastern U.S. Site	1,168	318.3	-	0	144	462.3	19.3
Western U.S. Site	3,402	570.8	9.0	8	144	731.8	30.5
<u>From St. Lucie to</u>							
Eastern U.S. Site	1,558	424.5	3.3	8	144	579.8	24.2
Western U.S. Site	5,454	719.5	12.3	16	144	891.8	37.2
<u>From Crystal River to</u>							
Eastern U.S. Site	1,374	374.4	-	-	144	518.4	21.6
Western U.S. Site	4,984	657.5	9.0	8	144	818.5	34.1
<u>From Robinson to</u>							
Eastern U.S. Site	794	216.3	-	0	144	360.3	15.0
Western U.S. Site	4,664	615.3	9.0	8	144	776.3	32.3
<u>From Brunswick to</u>							
Eastern U.S. Site	976	265.9	-	0	144	409.9	17.1
Western U.S. Site	5,054	666.8	9.0	8	144	827.8	34.5
<u>From LaSalle to</u>							
Eastern U.S. Site	1,080	294.3	-	0	144	438.3	18.3
Western U.S. Site	3,170	531.9	9.0	8	144	692.9	28.9
<u>From Calvert Cliffs to</u>							
Eastern U.S. Site	1,130	307.9	16.7	8	144	476.6	19.9
Western U.S. Site	4,754	627.2	25.7	16	144	812.9	33.9
<u>From Prairie Island to</u>							
Eastern U.S. Site	1,758	479.0	-	0	144	623.0	26.0
Western U.S. Site	2,624	440.3	9.0	8	144	601.3	25.1
<u>From Pilgrim to</u>							
Eastern U.S. Site	2,044	556.9	8.3	8	144	717.2	29.9
Western U.S. Site	5,210	687.3	17.3	16	144	864.6	36.0
<u>From Indian Point to</u>							
Eastern U.S. Site	1,632	444.7	1.7	8	144	598.4	24.9
Western U.S. Site	4,910	647.8	10.7	16	144	818.5	34.1

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

The total estimated costs of transporting spent fuel from 12 specific reactor sites 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
(1989 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 Oconee to									
Eastern U.S. Site	\$2,648	\$1,240	\$ 701	\$ 200	\$ 29	\$685	\$ 971	\$ 6,472	\$14,039
Western U.S. Site	9,464	6,625	4,992	2,328	334	685	2,718	27,145	58,883
From Millstone to									
Eastern U.S. Site	4,988	2,690	1,982	930	134	685	971	12,380	26,854
Western U.S. Site	10,350	7,419	5,568	2,604	374	685	1,941	28,941	62,778
From Palisades to									
Eastern U.S. Site	4,097	2,136	1,416	652	94	685	970	10,050	21,801
Western U.S. Site	7,742	5,135	3,840	1,790	257	685	1,165	20,614	44,716
From St. Lucie to									
Eastern U.S. Site	4,632	2,474	1,762	819	118	685	1,553	12,043	26,124
Western U.S. Site	10,835	7,816	5,880	2,746	397	685	2,912	31,270	67,830
From Crystal River to									
Eastern U.S. Site	4,269	2,230	1,502	706	101	685	776	10,269	22,275
Western U.S. Site	11,308	8,364	6,226	2,903	417	685	2,912	32,815	71,182
From Robinson to									
Eastern U.S. Site	3,177	1,573	902	365	52	685	776	7,531	16,336
Western U.S. Site	10,758	7,816	5,880	2,731	392	685	2,912	31,174	67,622
From Brunswick to									
Eastern U.S. Site	3,853	1,999	1,296	576	83	685	776	9,268	25,322
Western U.S. Site	10,596	7,693	5,779	2,681	385	685	2,718	30,536	83,432
From LaSalle to									
Eastern U.S. Site	3,813	1,955	1,248	563	81	685	971	9,316	25,453
Western U.S. Site	7,023	4,439	3,298	1,566	225	685	971	18,206	49,744

TABLE 85-1 (Continued)
ESTIMATED COSTS OF TRUCK SHIPMENT OF SPENT NUCLEAR FUEL^a
(1989 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 Calvert Cliffs to									
Eastern U.S. Site	\$3,960	\$2,043	\$1,349	\$ 609	\$ 87	\$685	\$ 776	\$ 9,510	\$20,628
Western U.S. Site	9,744	6,870	5,227	2,415	347	685	1,747	27,035	58,645
From Prairie Island to									
Eastern U.S. Site	5,350	2,974	2,198	1,043	150	685	1,553	13,953	30,267
Western U.S. Site	6,909	4,395	3,254	1,530	220	685	1,553	18,546	40,229
From Pilgrim to									
Eastern U.S. Site	5,142	2,837	2,102	978	140	685	971	12,856	35,127
Western U.S. Site	10,447	7,546	5,659	2,634	378	685	2,135	29,485	80,562
From Indian Point to									
Eastern U.S. Site	5,657	3,224	2,419	1,139	164	685	1,165	14,453	31,352
Western U.S. Site	10,113	7,281	5,443	2,530	363	685	2,135	28,551	61,932

^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
(1989 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 Oconee to</u>						
Eastern U.S. Site	90,246	9,154	14,309	5,751	119,460	37,019
Western U.S. Site	151,066	18,806	49,929	11,922	231,722	71,807
<u>From Millstone to</u>						
Eastern U.S. Site	127,457	9,041	26,214	9,224	171,936	53,280
Western U.S. Site	166,841	18,693	55,293	13,452	254,279	78,797
<u>From Palisades to</u>						
Eastern U.S. Site	91,007	0	20,293	6,226	117,526	36,420
Western U.S. Site	144,074	9,652	42,337	11,084	207,148	64,192
<u>From St. Lucie to</u>						
Eastern U.S. Site	114,159	9,410	23,842	8,042	155,453	48,173
Western U.S. Site	175,585	19,062	55,515	14,252	264,413	81,938
<u>From Crystal River to</u>						
Eastern U.S. Site	102,057	0	22,171	7,185	131,413	40,723
Western U.S. Site	161,146	9,652	54,401	13,091	238,290	73,843
<u>From Robinson to</u>						
Eastern U.S. Site	70,944	0	16,378	4,486	91,807	28,450
Western U.S. Site	152,835	9,652	53,096	12,302	227,885	70,618
<u>From Brunswick to</u>						
Eastern U.S. Site	80,707	0	18,415	5,333	104,455	31,711
Western U.S. Site	162,964	9,652	54,592	13,264	240,472	73,003

TABLE B5-2 (Continued)
ESTIMATED COSTS OF RAIL SHIPMENT OF SPENT NUCLEAR FUEL^a
(1989 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 LaSalle to</u>						
Eastern U.S. Site	\$ 86,286	\$ 0	\$18,319	\$5,817	\$110,422	\$33,522
Western U.S. Site	136,411	9,652	39,934	10,382	196,378	59,617
<u>From Calvert Cliffs to</u>						
Eastern U.S. Site	93,824	12,687	19,975	6,050	132,536	41,071
Western U.S. Site	160,029	22,339	52,319	12,524	247,207	76,606
<u>From Prairie Island to</u>						
Eastern U.S. Site	122,657	0	27,025	8,973	158,655	49,165
Western U.S. Site	118,375	9,652	37,992	8,730	174,749	54,152
<u>From Pilgrim to</u>						
Eastern U.S. Site	141,215	9,672	27,471	10,304	188,662	57,274
Western U.S. Site	170,232	19,324	55,293	13,649	258,498	78,475
<u>From Indian Point to</u>						
Eastern U.S. Site	117,801	9,009	24,638	8,386	159,834	49,530
Western U.S. Site	161,127	18,661	54,210	12,909	246,907	76,513

^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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