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1985 Federal Interim Storage Fee Study: A Technical and Economic Analysis

September 1985

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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1985 FEDERAL INTERIM STORAGE FEE STUDY:
A TECHNICAL AND ECONOMIC ANALYSIS

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September 1985

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1985 FEDERAL INTERIM STORAGE FEE STUDY
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1.0 INTRODUCTION

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

In accordance with this requirement, the Department of Energy (the Department) prepared and submitted a report to Congress entitled Payment Charges for Federal Interim Storage of Spent Nuclear Fuel from Civilian Nuclear Power Plants in the United States, DOE/S-0022, dated July 1983. The report was supplemented by a more detailed technical, contractual, and economic study and analysis which was contained in a report entitled Federal Interim Storage Fee Study for Civilian Spent Nuclear Fuel: A Technical and Economic Analysis, DOE/S-0023, dated July 1983. These reports formed the basis for the payment charges for Federal Interim Storage (FIS) services which were published in the Federal Register on December 2, 1983 and became effective on January 1, 1984 (F.R. 48:54391).

Under the provisions of the Act, the Department may revise these payment charges no more frequently than annually to reflect changing conditions. In preparation for the possibility of a revision to the payment charges for FIS services for 1985, E. R. Johnson Associates, Inc. (JAI) was asked to review and analyze DOE/S-0022 and DOE/S-0023 and to 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, 1985. The results of this update were reported in a document entitled, 1984 Federal Interim Storage Fee Study: A Technical and Economic Analysis, PNL-5231, dated July 1984.

In preparation for the possibility of a revision to the payment charges for FIS services for 1986, JAI was asked to:

- o Review the data base of information that was used in the previous fee determinations.
- o Prepare estimates of costs for capital, operating, and decommissioning each of the FIS facilities cases reported on in PNL-5231.
- o Update spending schedules for each of the FIS facilities cases reported on in PNL-5231.
- 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-5231 to provide a basis for the Department to establish payment charges for FIS services in the Federal Register for the year commencing January 1, 1986. 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}
 (1986 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	\$1,089	\$1,175	\$1,106	\$ 619	\$ 820	\$ 749
100	630	651	619	395	473	441
300	308	288	282	230	229	223
800	207	174	179	177	152	155
1500	179	142	146	162	127	132
1900	172	134	138	159	122	127

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

^b Based 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}
(1986 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	\$ 578	\$ 632	\$ 585	\$ 259	\$ 402	\$ 355
100	345	351	331	186	236	216
300	184	160	160	131	122	122
800	133	100	106	113	86	91
1500	119	83	90	108	74	82
1900	115	78	86	107	72	80

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

^b Based 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}
(1986 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	\$ 511	\$ 543	\$ 521	\$ 360	\$ 418	\$ 394
100	285	300	288	209	237	225
300	124	128	122	99	107	101
800	74	74	73	64	66	64
1500	60	59	56	54	53	50
1900	57	56	52	52	50	47

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

^b Based 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 was generally lower than that set forth in the 1984 report, except in the cask cases involving high total storage capacities at a site without existing transfer facilities. This was due to the fact that the 1985 costs used in the 1984 report were developed using escalation rates which were projected on the basis of cost increases experienced prior to 1984. The escalation rates which have been experienced since 1983 have been appreciably lower than those used in the 1984 report. The lower unit charges shown in Table 2-1 are the result of adjusting the charges included in the 1984 report to reflect actual escalation conditions and using these lower escalation rates to project the 1986 costs. However, the increase in the cost of casks since the issuance of the 1984 report more than offsets the lower costs in the rest of the cask storage system and, therefore, resulted in an increase in unit charges for cask storage in all but the lower storage capacities. In addition, inclusion of the cost of storage modules in the Initial Payment reduced the total cost for storage by about \$10/kgU for the cask cases and by about \$5/kgU for the drywell and silo cases as a result of the earlier availability of revenues for FIS services.

JAI also estimated the costs of transporting spent fuel between each of twenty-two reactor sites which are prospective candidates for FIS services and two sample locations for FIS facilities, one in the Eastern U.S. and one in the Western U.S. It was found that costs for shipments made under NRC and DOT regulations averaged from \$10/kgU to \$37/kgU for a FIS facility located in the Eastern U.S., and averaged from \$39/kgU to \$80/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 and PNL-5231 (which are subsequently referred to herein as the 1983 report and the 1984 report, respectively) were reviewed and evaluated with respect to applicability for establishing charges for FIS services for the calendar year 1986. The following sections summarize the bases used for establishing the 1986 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 and 1984 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 1986.

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 168 MTU in 1988 increasing to as much as 949 MTU in 1991, as described in the following Table 3-1.^{3,4/}

^{3/} Pacific Northwest Laboratory, Reactor-Specific Spent Fuel Discharge Projections: 1984 to 2020, PNL-5396, April 1985.

^{4/} If a requirement for FIS services occurs before 1989, this requirement would be met by temporary storage at existing Department facilities.

TABLE 3-1
PROSPECTIVE SOURCES OF SPENT FUEL FOR FIS^a

Reactor	Cumulative Quantities (MTU)								
	1986	1987	1988	1989	1990	1991	1992	1993	1994
Milestone 2	20	44	72	72	100	127	153	153	180
Palisades		1	23	23	47	69	69	93	116
Turkey Point 4		3	28	28	53	79	79	105	131
St. Lucie 1		1	1	27	53	53	80	105	105
Millstone 1		9	9	39	39	70	70	101	131
Turkey Point 3			21	44	44	69	92	92	118
Surry 1 & 2			14	69	96	120	169	193	218
Oconee 3				25	52	52	80	80	109
Robinson 2					4	24	43	63	63
Brunswick 2					11	11	40	70	70
La Salle 1 & 2					14	89	89	160	232
Prairie Island 1 & 2					8	37	64	93	122
Peach Bottom 2					12	52	52	93	134
Peach Bottom 3					11	51	51	92	133
Brunswick 1						11	40	40	70
La Crosse						1	3	6	8
Oconee 1 & 2						23	51	106	132
Monticello							16	16	33
Ginna						9	18	26	35
Fitzpatrick							31	31	63
Calvert Cliffs 1 & 2									51
Pilgrim 1								16	16
Indian Point 2									8
Oyster Creek									35
Cooper									10
Sequoyah 1 & 2									4
TOTAL	<u>20</u>	<u>57</u>	<u>168</u>	<u>327</u>	<u>544</u>	<u>949</u>	<u>1292</u>	<u>1734</u>	<u>2326</u>

^a Differences between the sum of the quantities of spent fuel from individual reactors and the annual totals shown are due to computer rounding.

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 and 1984 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 and 1984 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 1986 and be completed so that storage operations could commence in mid-1989.
- (2) The FIS facility would receive spent fuel during the three-year period between mid-1989 and mid-1992. It would ship spent fuel to a Monitored Retrievable Storage (MRS) facility or waste repository during the three-year period commencing at the beginning of 1998 and terminating at the end of 2000. One third of the storage capacity of the FIS facility would be received each year during the receiving period, and one-third would be shipped each year during the shipping period.
- (3) Decontamination and decommissioning of FIS facilities would be conducted in the year 2001.

This schedule represents a one-year compression of the FIS program over that used in the 1984 report (and a two-year schedule compression over that of the 1983 report) inasmuch as the program has been assumed to start one year later, but ends at the same time as was assumed before.

3.5 DEVELOPMENT OF THE FEE FOR FIS

The same basic assumptions concerning the development of charges for FIS of spent fuel were used by JAI in this study as were used in the development of the 1983 and 1984 reports, as follows:

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

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

3.6 CONSOLIDATED SPENT FUEL

For this study JAI 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 half of that involved in transporting intact fuel assemblies and, therefore, would result in a significant reduction in costs for utilities sending consolidated spent fuel to FIS.

4.0 COSTS FOR FIS OF SPENT FUEL

4.1 REVIEW OF AND REVISIONS IN FIS FACILITY DESIGNS

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 1986.

4.2 REVIEW OF AND REVISIONS IN 1984 FIS COST ESTIMATES

The estimates of the capital costs for transfer facilities and storage areas used in the development of the 1984 report were made in 1984 dollars, and were escalated to 1985 dollars using applicable cost indexes in order to present the costs in 1985 dollars in the report. For the purposes of this report, the 1984 estimates were escalated to 1986 dollars.

The estimates of the cost of canisters, concrete silos and drywells, and the estimates of government administration costs which were used in the development of the 1984 report, were the same as those used for the 1983 report, escalated to 1985 dollars using applicable cost indexes. For the purposes of this report, these 1983 estimates were escalated to 1986 dollars. The estimates of cost of metal storage casks was derived from 1984 cost information obtained from cask design firms. For the purposes of this report, these 1984 costs were escalated to 1986 dollars.

The estimates of operating costs used in the development of the 1984 report were modifications to the estimates used in the 1983 report and escalated to 1985. For the purposes of this report these revised 1983 estimates were escalated to 1986 dollars.

The estimates of FIS development costs as set forth in the 1983 report were reviewed and it was concluded that the same estimates would be applicable for use herein without escalation.

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, 1986)

Capacity Of FIS Facility (MTU)	Total Capital Cost					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 26.5	\$ 29.3	\$ 26.8	\$ 9.8	\$17.3	\$ 14.8
100	31.9	32.4	30.4	15.3	20.4	18.4
300	52.6	44.8	44.8	36.0	32.8	32.8
800	103.8	75.8	80.6	87.2	63.8	68.6
1500	176.8	119.0	130.9	160.1	107.0	118.9
1900	218.1	143.7	159.5	201.5	131.7	147.5

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

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

- (3) the cost of modules is lowest for the drywell and highest for the cask
- (4) at higher capacities, the cost advantages described in (1) and (2), above, are more than offset by the higher module cost of the storage casks.

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

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

TABLE 4-2
SUMMARY OF ESTIMATED TOTAL OPERATING COSTS FOR FIS FACILITIES
HAVING DIFFERENT TOTAL STORAGE CAPACITIES^a
(\$-millions, 1986)

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	\$ 26.3	\$ 28.1	\$ 26.9	\$ 17.7	\$21.0	\$ 19.7
100	28.0	29.6	28.3	19.4	22.5	21.1
300	34.5	35.6	33.7	25.9	28.5	26.5
800	51.8	51.1	50.6	42.6	43.9	42.1
1500	77.6	75.9	71.1	67.0	66.7	61.7
1900	92.3	90.0	82.7	80.8	79.7	72.9

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

From 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, while those associated with the silos are the lowest for the higher capacity facilities. Operating costs at the site with an existing transfer facility are lower than those at a site where a complete transfer facility has to be built, inasmuch as in the latter case it was assumed that a small caretaker operation would be required for the new facility, whereas in the former case it was assumed that the existing facility would either find other use during the storage only period or otherwise would have incurred caretaker expense in the absence of the FIS facility 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, 1986)

Capacity Of FIS Facility (MTU)	Total Special Cost					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 5.7	\$ 5.7	\$ 5.7	\$ 5.7	\$ 5.7	\$ 5.7
100	7.8	7.8	7.8	7.8	7.8	7.8
300	12.6	12.6	12.6	12.6	12.6	12.6
800	23.1	23.1	23.1	23.1	23.1	23.1
1500	36.8	35.3	35.3	36.8	32.3	32.3
1900	44.4	40.6	40.6	44.4	38.7	38.7

^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 1986 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, 1986)

Capacity Of FIS Facility (MTU)	Total Discounted Costs (Discounted @ 2%/yr to 1985)					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Drywell	Silo	Storage Cask	Drywell	Silo
50	\$ 51.6	\$ 55.8	\$ 52.4	\$ 28.7	\$38.5	\$ 35.0
100	59.2	61.1	58.1	36.3	43.8	40.7
300	85.1	79.0	77.3	62.1	61.8	60.0
800	149.0	123.0	126.9	125.6	105.7	108.5
1500	240.2	186.2	192.9	215.6	167.2	173.8
1900	291.7	222.1	230.4	266.4	202.2	210.8

^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.

^bDoes not include impact aid.

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

5.0 COSTS FOR SPENT FUEL TRANSPORT

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

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

TABLE 5-1
SUMMARY OF ESTIMATED COSTS FOR A SINGLE CASK SHIPMENT OF SPENT
FUEL FROM SPECIFIC REACTOR LOCATIONS TO FIS FACILITIES
(1986 Dollars)

<u>Reactor to Destination</u>	<u>Total Cost for Shipment</u>	
	<u>Truck Shipments^a</u>	<u>Rail Shipments^b</u>
<u>From Surry to</u>		
Eastern U.S. Site	\$ 8,906	\$ 85,506
Western U.S. Site	25,613	210,401
<u>From Palisades to</u>		
Eastern U.S. Site	9,700	73,415
Western U.S. Site	20,020	154,277
<u>From St. Lucie to</u>		
Eastern U.S. Site	11,562	95,319
Western U.S. Site	30,176	210,007
<u>From Robinson to</u>		
Eastern U.S. Site	7,268	69,670
Western U.S. Site	30,082	197,200
<u>From Fitzpatrick to</u>		
Eastern U.S. Site	12,665	85,591
Western U.S. Site	25,644	195,068
<u>From Brunswick to</u>		
Eastern U.S. Site	8,966	71,421
Western U.S. Site	29,487	198,534
<u>From LaSalle to</u>		
Eastern U.S. Site	8,980	79,159
Western U.S. Site	17,693	151,955
<u>From Oconee to</u>		
Eastern U.S. Site	6,200	77,469
Western U.S. Site	26,172	203,782
<u>From Turkey Point to</u>		
Eastern U.S. Site	12,843	98,082
Western U.S. Site	31,598	210,028
<u>From Monticello to</u>		
Eastern U.S. Site	13,630	104,259
Western U.S. Site	15,414	138,643
<u>From Peach Bottom to</u>		
Eastern U.S. Site	10,922	89,601
Western U.S. Site	26,194	195,753
<u>From Pilgrim to</u>		
Eastern U.S. Site	12,451	115,657
Western U.S. Site	28,555	222,197

TABLE 5-1 (Continued)
SUMMARY OF ESTIMATED COSTS FOR A SINGLE CASK SHIPMENT OF SPENT
FUEL FROM SPECIFIC REACTOR LOCATIONS TO FIS FACILITIES
(1986 Dollars)

<u>Reactor to Destination</u>	<u>Total Cost for Shipment</u>	
	<u>Truck Shipments^a</u>	<u>Rail Shipments^b</u>
<u>From Ginna to</u>		
Eastern U.S. Site	\$11,603	\$101,993
Western U.S. Site	24,468	201,391
<u>From Indian Point to</u>		
Eastern U.S. Site	13,985	103,083
Western U.S. Site	27,636	207,785
<u>From Millstone to</u>		
Eastern U.S. Site	11,986	104,983
Western U.S. Site	28,047	209,352
<u>From Prairie Island to</u>		
Eastern U.S. Site	13,394	88,357
Western U.S. Site	17,930	138,468
<u>From LaCrosse to</u>		
Eastern U.S. Site	11,891	86,479
Western U.S. Site	16,539	138,534
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	9,526	87,631
Western U.S. Site	26,210	209,965
<u>From Oyster Creek to</u>		
Eastern U.S. Site	11,071	96,167
Western U.S. Site	27,294	209,251
<u>From Cooper to</u>		
Eastern U.S. Site	12,559	88,244
Western U.S. Site	14,427	133,210
<u>From Sequoyah to</u>		
Eastern U.S. Site	4,500	50,448
Western U.S. Site	23,937	188,996
<u>From Davis Besse to</u>		
Eastern U.S. Site	9,722	70,397
Western U.S. Site	20,988	156,569

^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 and 1984 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. However, JAI has determined that in order to assure that adequate funds are available for payment of costs as they are incurred, without the necessity of borrowing from the Treasury or the appropriation of funds, storage module costs should be included in the Initial Payment rather than in the Final Payment as has been recommended in the preceding reports.

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 and 1984 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 1986 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}
(1986 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	\$ 578	\$ 632	\$ 585	\$ 259	\$ 402	\$ 355
100	345	351	331	186	236	216
300	184	160	160	131	122	122
800	133	100	106	113	86	91
1500	119	83	90	108	74	82
1900	115	78	86	107	72	80

^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}
(1986 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	\$ 511	\$ 543	\$ 521	\$ 360	\$ 418	\$ 394
100	285	300	288	209	237	225
300	124	128	122	99	107	101
800	74	74	73	64	66	64
1500	60	59	56	54	53	50
1900	57	56	52	52	50	47

^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}
(1986 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	\$1,089	\$1,175	\$1,106	\$ 619	\$ 820	\$ 749
100	630	651	619	395	473	441
300	308	288	282	230	229	223
800	207	174	179	177	152	155
1500	179	142	146	162	127	132
1900	172	134	138	159	122	127

^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
(1986 Dollars)

<u>Reactor to Destination</u>	<u>Total Cost for Shipment (\$/kgU)</u>	
	<u>By Truck^b</u>	<u>By Rail^c</u>
<u>From Surry to</u>		
Eastern U.S. Site	\$19.32	\$26.50
Western U.S. Site	55.56	65.20
<u>From Palisades to</u>		
Eastern U.S. Site	21.04	22.75
Western U.S. Site	43.43	47.81
<u>From St. Lucie to</u>		
Eastern U.S. Site	25.08	29.54
Western U.S. Site	65.46	65.08
<u>From Robinson to</u>		
Eastern U.S. Site	15.77	21.59
Western U.S. Site	65.25	61.11
<u>From Fitzpatrick to</u>		
Eastern U.S. Site	34.58	25.98
Western U.S. Site	70.07	59.22
<u>From Brunswick to</u>		
Eastern U.S. Site	24.50	21.68
Western U.S. Site	80.57	60.27
<u>From LaSalle to</u>		
Eastern U.S. Site	24.54	24.03
Western U.S. Site	48.34	46.13
<u>From Oconee to</u>		
Eastern U.S. Site	13.45	24.01
Western U.S. Site	56.77	63.15
<u>From Turkey Point to</u>		
Eastern U.S. Site	27.86	30.39
Western U.S. Site	68.54	65.08
<u>From Monticello to</u>		
Eastern U.S. Site	37.24	31.65
Western U.S. Site	42.12	42.09
<u>From Peach Bottom to</u>		
Eastern U.S. Site	29.84	27.20
Western U.S. Site	71.57	59.43
<u>From Pilgrim to</u>		
Eastern U.S. Site	34.02	35.11
Western U.S. Site	78.02	67.46
<u>From Ginna to</u>		
Eastern U.S. Site	25.17	31.61
Western U.S. Site	53.08	62.41

TABLE 6-4 (Continued)
SUMMARY OF ESTIMATED UNIT COSTS FOR TRANSPORTING SPENT FUEL FROM
SPECIFIC REACTOR LOCATIONS TO FIS FACILITIES^a
(1986 Dollars)

<u>Reactor to Destination</u>	<u>Total Cost for Shipment (\$/kgU)</u>	
	<u>By Truck^b</u>	<u>By Rail^c</u>
<u>From Indian Point to</u>		
Eastern U.S. Site	\$30.34	\$31.94
Western U.S. Site	59.95	64.39
<u>From Millstone to</u>		
Eastern U.S. Site	26.00	32.53
Western U.S. Site	60.84	64.88
<u>From Prairie Island to</u>		
Eastern U.S. Site	29.05	27.38
Western U.S. Site	38.89	42.91
<u>From La Crosse to</u>		
Eastern U.S. Site	32.49	26.25
Western U.S. Site	45.19	42.06
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	20.66	27.16
Western U.S. Site	56.86	65.06
<u>From Oyster Creek to</u>		
Eastern U.S. Site	30.25	29.20
Western U.S. Site	74.57	63.52
<u>From Cooper to</u>		
Eastern U.S. Site	34.31	26.79
Western U.S. Site	39.42	40.44
<u>From Sequoyah to</u>		
Eastern U.S. Site	9.76	15.63
Western U.S. Site	51.92	58.57
<u>From Davis Besse to</u>		
Eastern U.S. Site	21.09	21.82
Western U.S. Site	45.53	48.52

^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 IMPACT OF INCLUDING THE COST OF MODULES IN THE INITIAL PAYMENT

JAI calculated the impact on the charges for FIS services which were occasioned by the inclusion of the cost of modules in the Initial Payment and found the following:

- (1) For all cask cases -- inclusion of the cost of the casks in the Initial Payment increased it by about \$97/kgU and correspondingly decreased the Final Payment by about \$104/kgU, for a net reduction in the sum of the two of about \$7/kgU.
- (2) For all drywell cases -- inclusion of the cost of the drywells in the Initial Payment increased it by about \$55/kgU and correspondingly decreased the Final Payment by about \$60/kgU, for a net reduction in the sum of the two of about \$5/kgU.
- (3) For all silo cases -- inclusion of the cost of the silos in the Initial Payment increased it by about \$64/kgU and correspondingly decreased the Final Payment by about \$69/kgU, for a net reduction in the sum of the two of about \$5/kgU.

6.4 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.

^{6/}The term "total fees" used in this section refers to the sum of the Initial and Final Payments.

- (3) For each year the term of the FIS program is extended (due to delay in repository startup), there is an increase in the total fees for FIS at the 100 MTU capacity level of about \$15/kgU for instances where a new transfer facility is built, and about \$9/kgU for instances where an existing transfer facility can be utilized for FIS. These increases amount to about \$1.20/kgU and \$0.80/kgU, respectively, at the 1900 MTU capacity level.
- (4) For each year the time over which spent fuel is received for storage increases, there is an 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, therefore, increasing the amount of time spent fuel is stored by a corresponding amount), there is an increase in the total fees for FIS at the 100 MTU capacity level of about \$19/kgU for instances where a new transfer facility is built, and about \$11/kgU for instances where an existing transfer facility can be utilized. These increases amount to about \$2/kgU and \$1.50/kgU, respectively, at the 1900 MTU capacity level.
- (6) A one kilogram decrease in the average amount of uranium contained in the spent fuel in a drywell from the 429 kgU loading assumed for this study causes an increase in the total fees for FIS by about \$0.20/kgU, in the range of 366 kg U to 461 kg U. Conversely, a one kilogram increase in the average amount of uranium contained in a drywell causes a decrease of \$0.20/kgU in the total fees for FIS.
- (7) An increase in the discount rate by one percentage point causes a decrease in the total fees for FIS at the 100 MTU capacity level of about \$20/kgU for instances where a new transfer facility is built, and about \$14/kgU for instances where an existing transfer facility can be utilized for FIS. These decreases amount to about \$4/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 about \$100/kgU at the 100 MTU capacity level decreasing to about \$6/kgU at the 1900 MTU capacity level.

6.5 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 and 1984 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 combination of types of location(s) and storage method(s) under consideration should apply.
- (5) Upon execution of the first contract(s) the Department should commence the design of the FIS facilities on the basis of the contractual commitments that then exist for FIS services. These facilities should have the capacity for storage of only that amount of spent fuel which is committed to storage under the then-existing contracts.
- (6) These first contract(s) should determine the fee for FIS services from the schedule of fees published in the Federal Register. The Initial Payment should be the unit price in effect for the total storage capacity required by such contract(s) or for 100 MTU, whichever is larger. This same Initial Payment should then be charged to all subsequent users of FIS services until the Initial Payment is next revised.
- (7) The Department should revise its fee (both the Initial and Final Payment) annually to reflect (among other things) the economies of a larger FIS operation which results from additional commitments for FIS services.

- (8) Upon completion of the preoperational activities (i.e., design, safety reviews, construction, and associated activities), the Department should determine the total costs incurred -- and should credit or debit the Final Payment of each user with the difference between the amounts paid as Initial Payments and its pro rata share of the total preoperational costs (net of its pro rata share of interest earned on advance payments made).
- (9) After decommissioning of the FIS system, or December 31, 2001, whichever is later, the Department should determine the total costs incurred in design, construction, operation and decommissioning of the FIS system through December 31, 2001 -- and should make final adjustments to the extent that there is a difference between the amounts paid by each user in Initial and Final Payments and the user's pro rata share of the aforementioned costs (net of its pro rata share of interest earned on advance payments made).

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

7.0 SPENT FUEL ACCEPTANCE CRITERIA FOR FIS

In developing revised spent fuel acceptance criteria, JAI 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 report 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 \$4,588 (1986 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

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

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

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

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

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

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

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

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

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

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

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

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

2.2 FACILITIES FOR RECEIVING, CANNING AND TRANSFER

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

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

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

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

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

2.3 MODIFICATION OF EXISTING FACILITIES

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

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

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

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

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

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

The handling procedure at the existing hot cell was assumed to differ from a new FIS transfer facility. The vehicles (trucks) bringing the casks to the existing hot cell are assumed to move directly into and out of the cell through shielded, air-lock doors. The cask tie-downs, personnel barriers, and impact limiters are removed. The trunnions are engaged with a yoke using the 150-ton bridge crane. The cask is lifted clear of the vehicle and rotated to a vertical position. It is then moved to a special cask holder where it is locked in place to prevent tipping during unloading or from any seismic activity. This holder also serves as a scaffold for worker access to the top of the cask to remove head bolts and attach head lifting slings. The outer head is removed and stored and the inner head bolts removed. 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, 1986)

	<u>Capital Costs</u>		
	<u>Storage Cask</u>	<u>Drywell</u>	<u>Silo</u>
Site Preparation	\$ 12	\$ 12	\$ 12
Structures	6,771	6,771	6,771
Equipment	3,646	4,414	4,421
Equipment Installation (35% of equipment cost)	<u>1,276</u>	<u>1,545</u>	<u>1,547</u>
	11,705	12,742	12,751
Engineering (15%)	1,756	1,911	1,913
Licensing	<u>830</u>	<u>830</u>	<u>830</u>
	14,291	15,483	15,494
Contingency (35%)	<u>5,002</u>	<u>5,419</u>	<u>5,423</u>
Total	<u>\$19,293</u>	<u>\$20,902</u>	<u>\$20,917</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, 1986)

	<u>Capital Costs</u>		
	<u>Storage Cask</u>	<u>Drywell</u>	<u>Silo</u>
Equipment	\$ 930	\$ 4,795	\$ 4,798
Equipment Installation (35% of equipment cost)	<u>326</u>	<u>487^a</u>	<u>488^a</u>
	1,256	5,282	5,286
Engineering (15%)	188	792	793
Safety Review	<u>379</u>	<u>379</u>	<u>379</u>
	1,823	6,453	6,458
Contingency (35%)	<u>638</u>	<u>2,259</u>	<u>2,260</u>
Total	<u>\$ 2,461</u>	<u>\$ 8,712</u>	<u>\$ 8,718</u>

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

3.0 STORAGE CASKS

3.1 DESCRIPTION

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

At the present time, several cask manufactures have metal storage cask designs; Ridihalgh, Eggers and Associates, Inc. (the REA-2023 cask), Transnuclear, Inc. (the TN-24 cask), GNS (the CASTOR-V cask), and Nuclear Assurance Corporation. 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 a f.o.b. Midwest U.S. basis, the 1986 cost of the metal storage cask was estimated to be \$1,050,000. Freight costs to both the Eastern U.S. site and the Western U.S. site have been estimated to amount to \$14,600 and \$34,200, respectively. Therefore, the total costs of the cask when used at an Eastern U.S. site is about \$1,064,600 and is about \$1,084,200 when used at a Western U.S. site.

A. Length 5030 mm	D. Cavity Diameter 1460 mm	G. Wall Thickness 240 mm
B. Diameter 2400 mm	E. Lid Thickness 270 mm	H. Shell Thickness 20 mm
C. Cavity Length 4140 mm	F. Bottom Thickness 260 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 \$20,897 (1986 dollars). Therefore, the total cost of the drywell assembly, including the canisters described in Section 1.0, is estimated to be \$25,485.

FIGURE A4-1
SCHEMATIC DIAGRAM OF DRYWELL

5.0 CONCRETE SILOS

5.1 DESCRIPTION

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

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

5.2 ESTIMATED COST

The cost of the silos described in Section 5.1 was estimated to be \$98,755 (1986 dollars). Therefore, the total cost of the silo assembly, including four of the canisters described in Section 1.0, is estimated to be \$117,107.

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, 1986)

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	\$1,965	\$1,769	\$5,544	\$5,346	\$2,567	\$2,369
100 MTU	1,999	1,800	5,678	5,479	2,736	2,538
300 MTU	2,106	1,908	6,110	5,911	3,345	3,146
800 MTU	2,333	2,134	7,038	6,841	4,740	4,544
1500 MTU	2,631	2,432	8,233	8,034	6,617	6,420
1900 MTU	2,792	2,593	8,894	8,695	7,672	7,473

^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, 1986)

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	\$1,765	\$1,852	\$1,933	\$1,995	\$1,845	\$1,907
100 MTU	1,838	1,924	2,062	2,124	1,955	2,017
300 MTU	2,117	2,203	2,568	2,630	2,297	2,359
800 MTU	2,937	3,023	3,953	4,015	3,512	3,574
1500 MTU	4,193	4,278	6,050	6,112	4,851	4,913
1900 MTU	4,909	4,996	7,246	7,308	5,615	5,678

TABLE A7-2
ESTIMATED ANNUAL OPERATING COSTS FOR STORAGE FACILITIES
AT GOVERNMENT SITE DURING STORAGE ONLY PERIOD
(\$000, 1986)

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	\$ 932	\$1,804	\$1,087	\$1,872	\$1,025	\$1,829
100 MTU	965	1,834	1,106	1,892	1,044	1,848
300 MTU	1,081	1,950	1,178	1,968	1,127	1,925
800 MTU	1,367	2,347	1,354	2,157	1,327	2,369
1500 MTU	1,778	3,013	1,638	2,801	1,607	2,801
1900 MTU	2,010	3,395	1,801	3,167	1,768	3,048

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, 1986)

	<u>Total Capacity of FIS Facilities</u>					
	<u>50</u>	<u>100</u>	<u>300</u>	<u>800</u>	<u>1,500</u>	<u>1,900</u>
	<u>MTU</u>	<u>MTU</u>	<u>MTU</u>	<u>MTU</u>	<u>MTU</u>	<u>MTU</u>
Annual Total	\$122	\$207	\$319	\$506	\$709	\$809

8.2 FIS DEVELOPMENT COSTS

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

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

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

8.3 IMPACT AID

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

- (1) Impact aid will commence at the beginning of CY-1986 and will be terminated at the end of CY-2001.
- (2) The total impact aid will amount to the lesser of the following alternatives:
 - (a) 10% of the total cost of establishing and operating the FIS system -- including all capital, operating and decommissioning costs of the storage facilities involved, plus a pro rata share of research and development, government administration and trust fund management, but will exclude the cost of shipping.
 - (b) \$15/kgU contained in the spent fuel stored.
- (3) 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 1986 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 1986 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 1986 for all spent fuel to be stored, the revenues would be as follows:

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

where P_1 is the unit cost (or Initial Payment)

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

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

Year	Capacity											
	50 MTU		100 MTU		300 MTU		600 MTU		1500 MTU		1900 MTU	
	Rev.	Disc. To 1986 @ 25/Yr	Rev.	Disc. To 1986 @ 25/Yr	Rev.	Disc. To 1986 @ 25/Yr	Rev.	Disc. To 1986 @ 25/Yr	Rev.	Disc. To 1986 @ 25/Yr	Rev.	Disc. To 1986 @ 25/Yr
1989	\$ 0 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
1990	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
1991	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
1992	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	<u>150 P₂</u>	<u>145.7 P₂</u>	<u>100 P₂</u>	<u>91.5 P₂</u>	<u>300 P₂</u>	<u>274.5 P₂</u>	<u>1800 P₂</u>	<u>1731.9 P₂</u>	<u>11500 P₂</u>	<u>11372.4 P₂</u>	<u>11900 P₂</u>	<u>11738.3 P₂</u>

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

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

TABLE A9-2

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 5 CASKS (50 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3155	969			500	122	4746	4746
1987	224	130			1000	122	1476	1447
1988	8013	367	904		1000	122	10406	10002
1989	7901	302	1807	926	500	122	11558	10891
1990			1807	1852		122	3781	3493
1991			904	1852		122	2878	2607
1992				1828		122	1950	1732
1993				1804		122	1926	1677
1994				1804		122	1926	1644
1995				1804		122	1926	1612
1996				1804		122	1926	1580
1997				1804		122	1926	1549
1998				1852		122	1974	1556
1999				1852		122	1974	1525
2000				1852		122	1974	1496
2001				5297*		122	5419	4025
TOTAL	19293	1768	5422	26331	3000	1952	57766	51584

* - Decommissioning cost

Initial Payment = 578 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 511 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3155	973			500	207	4835	4835
1987	224	130			1000	207	1561	1530
1988	8013	381	1807		1000	207	11408	10965
1989	7901	316	3614	962	500	207	13500	12721
1990			3614	1924		207	5745	5307
1991			1807	1924		207	3938	3567
1992				1879		207	2086	1852
1993				1834		207	2041	1777
1994				1834		207	2041	1742
1995				1834		207	2041	1708
1996				1834		207	2041	1674
1997				1834		207	2041	1642
1998				1924		207	2131	1680
1999				1924		207	2131	1647
2000				1924		207	2131	1615
2001				6387*		207	6594	4899
TOTAL	19293	1800	10842	28019	3000	3312	66265	59161

* - Decommissioning cost

Initial Payment = 345 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 285 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3155	967			500	319	4961	4961
1987	224	130			1000	319	1673	1640
1988	8013	427	5240		1000	319	14999	14417
1989	7901	362	10481	1102	500	319	20665	19473
1990			10481	2203		319	13003	12013
1991			5240	2203		319	7762	7030
1992				2077		319	2396	2128
1993				1950		319	2269	1975
1994				1950		319	2269	1937
1995				1950		319	2269	1899
1996				1950		319	2269	1861
1997				1950		319	2269	1825
1998				2203		319	2522	1989
1999				2203		319	2522	1950
2000				2203		319	2522	1911
2001				10528*		319	10847	8059
TOTAL	19293	1906	31442	34472	3000	5104	95217	85068

* - Decommissioning cost

Initial Payment = 184 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 124 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-5

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 74 CASKS (200 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3155	1016			500	506	5177	5177
1987	224	130			1000	506	1860	1824
1988	8013	526	13733		1000	506	23778	22855
1989	7901	461	27466	1512	500	506	38346	36134
1990			27466	3023		506	30995	28635
1991			13733	3023		506	17262	15635
1992				2685		506	3191	2834
1993				2347		506	2853	2484
1994				2347		506	2853	2435
1995				2347		506	2853	2387
1996				2347		506	2853	2340
1997				2347		506	2853	2295
1998				3023		506	3529	2783
1999				3023		506	3529	2728
2000				3023		506	3529	2675
2001				20765*		506	21271	15805
TOTAL	19293	2133	82398	51812	3000	8096	166732	149026

* - Decommissioning cost

Initial Payment = 133 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 74 \$/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, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3155	1055			500	709	5419	5419
1987	224	130			1000	709	2063	2023
1988	8013	654	25840		1000	709	36218	34812
1989	7901	591	51680	2139	500	709	60520	59856
1990			51680	4278		709	56667	52352
1991			25840	4278		709	30827	27921
1992				3846		709	4355	3867
1993				3013		709	3722	3240
1994				3013		709	3722	3177
1995				3013		709	3722	3114
1996				3013		709	3722	3053
1997				3013		709	3722	2993
1998				4278		709	4987	3932
1999				4278		709	4987	3855
2000				4278		709	4987	3790
2001				35353*		709	36062	26795
TOTAL	19293	2432	155040	77593	3000	11344	268702	240189

* - Decommissioning cost

Initial Payment = 119 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 60 \$/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, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3155	1076			500	809	5540	5540
1987	224	130			1000	809	2163	2121
1988	8013	726	32707		1000	809	43255	41575
1989	7901	661	65413	2498	500	809	77782	73296
1990			65413	4996		809	71218	65794
1991			32707	4996		809	38512	34882
1992				4196		809	5005	4444
1993				3395		809	4204	3660
1994				3395		809	4204	3588
1995				3395		809	4204	3518
1996				3395		809	4204	3449
1997				3395		809	4204	3381
1998				4996		809	5805	4577
1999				4996		809	5805	4487
2000				4996		809	5805	4399
2001				43625*		809	44434	33015
TOTAL	19293	2593	196240	92274	3000	12944	326344	291726

* - Decommissioning cost

Initial Payment = 115 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 57 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	1631			500	122	5618	5618
1987	224	139			1000	122	1485	1456
1988	8713	1823	501		1000	122	12159	11687
1989	8601	1753	1002	998	500	122	12976	12228
1990			1002	1995		122	3119	2981
1991			501	1995		122	2618	2371
1992				1934		122	2056	1826
1993				1872		122	1994	1736
1994				1872		122	1994	1702
1995				1872		122	1994	1668
1996				1872		122	1994	1636
1997				1872		122	1994	1604
1998				1995		122	2117	1669
1999				1995		122	2117	1637
2000				1995		122	2117	1604
2001				5851*		122	5973	4408
TOTAL	20903	5346	5006	28118	3000	1952	62325	55761

* - Decommissioning cost

Initial Payment = 632 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 543 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	1648			500	207	5720	5720
1987	224	139			1000	207	1570	1539
1988	8713	1880	1002		1000	207	12802	12305
1989	8601	1811	2005	1062	500	207	14186	13368
1990			2005	2124		207	4336	4006
1991			1002	2124		207	3333	3019
1992				2008		207	2215	1967
1993				1892		207	2099	1827
1994				1892		207	2099	1791
1995				1892		207	2099	1756
1996				1892		207	2099	1722
1997				1892		207	2099	1688
1998				2124		207	2331	1838
1999				2124		207	2331	1802
2000				2124		207	2331	1767
2001				6479*		207	6686	4968
TOTAL	20903	5478	6014	29629	3000	3312	68336	61083

* - Decommissioning cost

Initial Payment = 351 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 300 \$/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, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	1705			500	319	5889	5889
1987	224	139			1000	319	1682	1649
1988	8713	2068	3003		1000	319	15103	14517
1989	8601	1999	6006	1315	500	319	18740	17659
1990			6006	2630		319	8955	8273
1991			3003	2630		319	5952	5391
1992				2299		319	2618	2325
1993				1968		319	2287	1991
1994				1968		319	2287	1952
1995				1968		319	2287	1914
1996				1968		319	2287	1876
1997				1968		319	2287	1839
1998				2630		319	2949	2325
1999				2630		319	2949	2280
2000				2630		319	2949	2235
2001				8966*		319	9285	6899
TOTAL	20903	5911	18018	35570	3000	5104	88506	79014

* - Decommissioning cost

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

Final Payment = 128 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-11

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 1896 DRYWELLS (800 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	1826			500	506	6197	6197
1987	224	139			1000	506	1869	1832
1988	8713	2473	8011		1000	506	20703	19899
1989	8601	2403	16022	2008	500	506	30040	28307
1990			16022	4015		506	20543	18979
1991			8011	4015		506	12532	11351
1992				3086		506	3592	3190
1993				2157		506	2663	2318
1994				2157		506	2663	2273
1995				2157		506	2663	2228
1996				2157		506	2663	2185
1997				2157		506	2663	2142
1998				4015		506	4521	3565
1999				4015		506	4521	3495
2000				4015		506	4521	3426
2001				15162*		506	15668	11642
TOTAL	20903	6841	48066	51116	3000	8096	138022	123029

* - Decommissioning cost

Initial Payment = 100 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 74 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	1982			500	709	6556	6556
1987	224	139			1000	709	2072	2031
1988	8713	2991	15015		1000	709	28428	27324
1989	8601	2922	30030	3056	500	709	45818	45175
1990			30030	6112		709	36851	34045
1991			15015	6112		709	21836	19778
1992				4457		709	5166	4587
1993				2801		709	3510	3056
1994				2801		709	3510	2996
1995				2801		709	3510	2937
1996				2801		709	3510	2879
1997				2801		709	3510	2823
1998				6112		709	6821	5578
1999				6112		709	6821	5273
2000				6112		709	6821	5169
2001				23805*		709	24514	18214
TOTAL	20903	8034	90090	75683	3000	11344	209254	186221

* - Decommissioning cost

Initial Payment = 83 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 59 \$/KgU (Includes \$9/KgU impact aid)

TABLE A9-13

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	2068			500	809	6742	6742
1987	224	139			1000	809	2172	2129
1988	8713	3279	19020		1000	809	32821	31547
1989	8601	3209	38041	3654	500	809	54814	51652
1990			38041	7308		809	46158	42643
1991			19020	7308		809	27137	24579
1992				5238		809	6047	5370
1993				3167		809	3976	3461
1994				3167		809	3976	3393
1995				3167		809	3976	3327
1996				3167		809	3976	3262
1997				3167		809	3976	3198
1998				7308		809	8117	6400
1999				7308		809	8117	6275
2000				7308		809	8117	6152
2001				28744*		809	29553	21958
TOTAL	20903	8695	114122	90011	3000	12944	249675	222088

* - Decommissioning cost

Initial Payment = 78 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 56 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3366	1384			500	122	5372	5372
1987	224	139			1000	122	1485	1456
1988	8719	458	584		1000	122	10863	10460
1989	8607	388	1168	954	500	122	11739	11062
1990			1168	1907		122	3197	2954
1991			584	1907		122	2613	2367
1992				1848		122	1990	1767
1993				1829		122	1951	1698
1994				1829		122	1951	1665
1995				1829		122	1951	1633
1996				1829		122	1951	1600
1997				1829		122	1951	1569
1998				1907		122	2029	1600
1999				1907		122	2029	1568
2000				1907		122	2029	1538
2001				5358*		122	5480	4072
TOTAL	20916	2369	3504	26860	3000	1952	58601	52381

* - Decommissioning cost

Initial Payment = 585 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 521 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3366	1406			500	207	5479	5479
1987	224	139			1000	207	1570	1539
1988	8719	531	1152		1000	207	11609	11158
1989	8607	462	2303	1009	500	207	13083	12333
1990			2303	2017		207	4527	4182
1991			1152	2017		207	3376	3053
1992				1933		207	2140	1900
1993				1848		207	2055	1789
1994				1848		207	2055	1754
1995				1848		207	2055	1720
1996				1848		207	2055	1686
1997				1848		207	2055	1653
1998				2017		207	2224	1754
1999				2017		207	2224	1719
2000				2017		207	2224	1686
2001				6073*		207	6280	4666
TOTAL	20916	2538	6910	28340	3000	3312	65016	58076

* - Decommissioning cost

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

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

B

TABLE A9-16

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 177 SILOS (300 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3366	1486			500	319	5671	5671
1987	224	139			1000	319	1682	1649
1988	8719	796	3454		1000	319	14298	13733
1989	8607	726	6908	1180	500	319	18240	17188
1990			6908	2359		319	9586	8856
1991			3454	2359		319	6132	5554
1992				2142		319	2461	2185
1993				1925		319	2244	1954
1994				1925		319	2244	1915
1995				1925		319	2244	1878
1996				1925		319	2244	1841
1997				1925		319	2244	1805
1998				2359		319	2678	2112
1999				2359		319	2678	2070
2000				2359		319	2678	2030
2001				8957*		319	9276	6892
TOTAL	20916	3147	20724	33699	3000	5104	86590	77333

* - Decommissioning cost

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

Final Payment = 122 \$/KgU (Includes \$10/KgU impact aid)

B

TABLE A9-17

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 471 SILOS (800 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3366	1668			500	506	6040	6040
1987	224	139			1000	506	1869	1832
1988	8719	1403	9194		1000	506	20822	20013
1989	8607	1333	18389	1787	500	506	31122	29327
1990			18389	3574		506	22469	20758
1991			9194	3574		506	13274	12023
1992				2972		506	3478	3088
1993				2369		506	2875	2503
1994				2369		506	2875	2454
1995				2369		506	2875	2406
1996				2369		506	2875	2359
1997				2369		506	2875	2312
1998				3574		506	4080	3217
1999				3574		506	4080	3154
2000				3574		506	4080	3092
2001				16125*		506	16631	12357
TOTAL	20916	4543	55166	50599	3000	8096	142320	126935

* - Decommissioning cost

Initial Payment = 106 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 73 \$/KgU (Includes \$10/KgU impact aid)

B

TABLE A9-18

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 884 SILOS (1500 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3366	1913			500	709	6488	6488
1987	224	139			1000	709	2072	2031
1988	8719	2219	17253		1000	709	29900	28739
1989	8607	2149	34506	2457	500	709	48928	46106
1990			34506	4913		709	40128	37072
1991			17253	4913		709	20875	20719
1992				3257		709	4566	4034
1993				2801		709	3510	3056
1994				2801		709	3510	2996
1995				2801		709	3510	2937
1996				2801		709	3510	2879
1997				2801		709	3510	2823
1998				4913		709	5622	4433
1999				4913		709	5622	4346
2000				4913		709	5622	4261
2001				26171*		709	26880	19972
TOTAL	20916	6420	103518	71055	3000	11344	216253	192912

* - Decommissioning cost

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

Final Payment = 56 \$/KgU (Includes \$9/KgU impact aid)

B

TABLE A9-19

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 1120 SILOS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3366	2050			500	809	6725	6725
1987	224	139			1000	809	2172	2129
1988	8719	2677	21858		1000	809	35063	33701
1989	8607	2607	43717	2839	500	809	59079	55671
1990			43717	5678		809	50204	46381
1991			21858	5678		809	28345	25673
1992				4363		809	5172	4593
1993				3048		809	3857	3358
1994				3048		809	3857	3292
1995				3048		809	3857	3227
1996				3048		809	3857	3164
1997				3048		809	3857	3102
1998				5678		809	6487	5115
1999				5678		809	6487	5015
2000				5678		809	6487	4916
2001				31908*		809	32717	24309
TOTAL	20916	7473	131150	82740	3000	12944	258223	230371

* - Decommissioning cost

Initial Payment = 86 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 52 \$/KgU (Includes \$9/KgU impact aid)

TABLE A9-20

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 5 CASKS (50 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	612	994			500	122	2228	2228
1987	102	130			1000	122	1354	1327
1988	899	453	904		1000	122	3378	3247
1989	848	388	1807	883	500	122	4548	4256
1990			1807	1765		122	3694	3413
1991			904	1765		122	2791	2528
1992				1549		122	1471	1306
1993				932		122	1054	918
1994				932		122	1054	900
1995				932		122	1054	882
1996				932		122	1054	865
1997				932		122	1054	848
1998				1765		122	1887	1488
1999				1765		122	1887	1459
2000				1765		122	1887	1430
2001				1970*		122	2092	1554
TOTAL	2461	1965	5422	17687	3000	1952	32487	28679

* - Decommissioning cost

Initial Payment = 259 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 360 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	612	999			500	207	2318	2318
1987	102	130			1000	207	1439	1411
1988	899	467	1807		1000	207	4380	4210
1989	848	402	3614	919	500	207	6490	6116
1990			3614	1838		207	5659	5228
1991			1807	1838		207	3852	3489
1992				1402		207	1609	1429
1993				965		207	1172	1020
1994				965		207	1172	1000
1995				965		207	1172	981
1996				965		207	1172	961
1997				965		207	1172	943
1998				1838		207	2045	1612
1999				1838		207	2045	1581
2000				1838		207	2045	1550
2001				3060*		207	3267	2427
TOTAL	2461	1998	10842	19396	3000	3312	41009	36276

* - Decommissioning cost

Initial Payment = 186 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 209 \$/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, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	612	1013			500	319	2444	2444
1987	102	130			1000	319	1551	1551
1988	899	514	5240		1000	319	7972	7972
1989	848	449	10481	1059	500	319	13656	12948
1990			10481	2117		319	12917	11933
1991			5240	2117		319	7676	6932
1992				1599		319	1918	1703
1993				1081		319	1400	1279
1994				1081		319	1400	1195
1995				1081		319	1400	1171
1996				1081		319	1400	1148
1997				1081		319	1400	1126
1998				2117		319	2436	1971
1999				2117		319	2436	1843
2000				2117		319	2436	1816
2001				7202*		319	7521	5548
TOTAL	2461	2106	31442	25550	3000	5104	59963	52180

* - Decommissioning cost

Initial Payment = 131 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 99 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-23

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 75 CASKS (800 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	612	1042			500	506	2660	2660
1987	102	130			1000	506	1738	1704
1988	899	612	13733		1000	506	16750	16700
1989	848	547	27466	1469	500	506	31336	29529
1990			27466	2937		506	30909	28755
1991			13733	2937		506	17176	15757
1992				2152		506	2658	2460
1993				1367		506	1873	1731
1994				1367		506	1873	1709
1995				1367		506	1873	1677
1996				1367		506	1873	1647
1997				1367		506	1873	1616
1998				2937		506	3443	2715
1999				2937		506	3443	2622
2000				2937		506	3443	2509
2001				17438*		506	17944	13733
TOTAL	2461	2331	62398	42579	3000	6096	140835	125724

* - Decommissioning cost

Initial Payment = 113 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 64 \$/KgU (Includes \$10/KgU impact aid)

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 140 CASKS (1800 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	612	1081			500	709	2902	2902
1987	102	130			1000	709	1941	1903
1988	899	742	25840		1000	709	29190	28057
1989	848	677	51680	2097	500	709	56511	53252
1990			51680	4193		709	56582	52273
1991			25840	4193		709	30742	27844
1992				2986		709	3695	3281
1993				1778		709	2487	2165
1994				1778		709	2487	2123
1995				1778		709	2487	2081
1996				1778		709	2487	2040
1997				1778		709	2487	2000
1998				4193		709	4902	3865
1999				4193		709	4902	3799
2000				4193		709	4902	3715
2001				32026*		709	32735	24323
TOTAL	2461	2630	155040	66964	3000	11344	241439	215613

* - Decommissioning cost

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

Final Payment = 54 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	612	1102			500	809	3023	3023
1987	102	130			1000	809	2041	2001
1988	899	812	32707		1000	809	36227	34920
1989	848	747	65413	2455	500	809	70772	66690
1990			65413	4909		809	71131	65714
1991			32707	4909		809	38425	34803
1992				3460		809	4269	3791
1993				2010		809	2819	2454
1994				2010		809	2819	2406
1995				2010		809	2819	2359
1996				2010		809	2819	2313
1997				2010		809	2819	2267
1998				4909		809	5718	4509
1999				4909		809	5718	4420
2000				4909		809	5718	4334
2001				40298*		809	41107	30543
TOTAL	2461	2791	196240	80808	3000	12944	298244	266447

* - Decommissioning cost

Initial Payment = 107 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 52 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC TOTAL COSTS
1986	1428	1657			500	122	3707	3707
1987	102	139			1000	122	1363	1363
1988	3617	1908	501		1000	122	7148	6878
1989	3565	1839	1002	967	500	122	7995	7534
1990			1002	1933		122	3057	2824
1991			501	1933		122	2556	2318
1992				1510		122	1632	1436
1993				1087		122	1209	1051
1994				1087		122	1209	1037
1995				1087		122	1209	1011
1996				1087		122	1209	991
1997				1087		122	1209	970
1998				1933		122	2055	1821
1999				1933		122	2055	1589
2000				1933		122	2055	1558
2001				3452*		122	3574	2656
TOTAL	8712	5545	3006	21029	3000	1952	43242	38518

* - Decommissioning cost

Initial Payment = 402 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 418 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-27
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC TOTAL COSTS
1986	1428	1674			500	207	3809	3809
1987	102	139			1000	207	1448	1420
1988	3617	1967	1002		1000	207	7792	7490
1989	3565	1897	2005	1021	500	207	9208	8574
1990			2005	2062		207	4274	3949
1991			1002	2062		207	3271	2967
1992				1584		207	1791	1590
1993				1106		207	1313	1140
1994				1106		207	1313	1121
1995				1106		207	1313	1099
1996				1106		207	1313	1077
1997				1106		207	1313	1056
1998				2062		207	2269	1789
1999				2062		207	2269	1754
2000				2062		207	2269	1720
2001				4081*		207	4288	3186
TOTAL	8712	5677	6014	22536	3000	3312	49251	43340

* - Decommissioning cost

Initial Payment = 236 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 257 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-28

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 707 DRYWELLS (300 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	1731			500	319	3978	3978
1987	102	139			1000	319	1560	1529
1988	3617	2155	3003		1000	319	10094	9702
1989	3565	2085	6006	1294	500	319	13759	12965
1990			6006	2568		319	8893	8216
1991			3003	2568		319	5890	5335
1992				1873		319	2192	1946
1993				1178		319	1497	1303
1994				1178		319	1497	1278
1995				1178		319	1497	1253
1996				1178		319	1497	1228
1997				1178		319	1497	1204
1998				2568		319	2887	2276
1999				2568		319	2887	2232
2000				2568		319	2887	2188
2001				6568*		319	6887	5117
TOTAL	8712	6110	18018	28455	3000	5104	69399	61750

* - Decommissioning cost

Initial Payment = 122 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 107 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	1852			500	506	4286	4286
1987	102	139			1000	506	1747	1713
1988	3617	2558	8011		1000	506	15692	15083
1989	3565	2489	16022	1977	500	506	25059	23614
1990			16022	3953		506	20481	18921
1991			8011	3953		506	12470	11294
1992				2654		506	3160	2806
1993				1354		506	1860	1619
1994				1354		506	1860	1587
1995				1354		506	1860	1556
1996				1354		506	1860	1526
1997				1354		506	1860	1496
1998				3953		506	4459	3516
1999				3953		506	4459	3447
2000				3953		506	4459	3379
2001				12763*		506	13269	9859
TOTAL	8712	7038	48066	43929	3000	8096	118841	105702

* - Decommissioning cost

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

Final Payment = 66 \$/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, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	2007			500	709	4644	4644
1987	102	139			1000	709	1950	1950
1988	3617	3077	15015		1000	709	23418	22519
1989	3565	3008	30030	3025	500	709	40837	38482
1990			30030	6050		709	36789	33987
1991			15015	6050		709	21774	19711
1992				3844		709	4553	4043
1993				1638		709	2347	2047
1994				1638		709	2347	2047
1995				1638		709	2347	1981
1996				1638		709	2347	1921
1997				1638		709	2347	1881
1998				6050		709	6759	5221
1999				6050		709	6759	5221
2000				6050		709	6759	5121
2001				21407*		709	22116	15431
TOTAL	8712	8231	90090	66716	3000	11344	183093	167221

* - Decommissioning cost

Initial Payment = 74 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 53 \$/KgU (Includes \$8/KgU impact aid)

TABLE A9-31

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	2094			500	809	4331	4331
1987	102	139			1000	809	2050	2010
1988	3617	3365	19020		1000	809	27311	26731
1989	3565	3295	38041	3623	500	809	49333	46959
1990			38041	7246		809	46096	42586
1991			19020	7246		809	27075	24523
1992				4524		809	5333	4706
1993				1801		809	2510	2272
1994				1801		809	2510	2228
1995				1801		809	2510	2184
1996				1801		809	2510	2141
1997				1801		809	2510	2099
1998				7246		809	8055	6351
1999				7246		809	8055	6327
2000				7246		809	8055	6105
2001				26343*		809	27154	20176
TOTAL	8712	8893	114122	79727	3000	12944	227398	202159

* - Decommissioning cost

Initial Payment = 72 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 50 \$/KgU (Includes \$8/KgU impact aid)

TABLE A9-32

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 30 SILOS (30 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1429	1410			500	122	3461	3461
1987	102	139			1000	122	1363	1336
1988	3619	543	584		1000	122	5868	5640
1989	3568	474	1168	923	500	122	6755	6365
1990			1168	1845		122	3135	2896
1991			584	1845		122	2551	2311
1992				1433		122	1557	1383
1993				1023		122	1147	999
1994				1025		122	1147	979
1995				1025		122	1147	960
1996				1025		122	1147	941
1997				1025		122	1147	922
1998				1845		122	1967	1551
1999				1845		122	1967	1521
2000				1845		122	1967	1491
2001				2958*		122	3080	2288
TOTAL	8718	2566	3504	19666	3000	1952	39406	35044

* - Decommissioning cost

Initial Payment = 355 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 394 \$/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, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1429	1432			500	207	3568	3568
1987	102	139			1000	207	1448	1420
1988	3619	617	1152		1000	207	6595	6339
1989	3568	547	2303	978	500	207	8103	7636
1990			2303	1955		207	4465	4125
1991			1152	1955		207	3314	3002
1992				1500		207	1707	1516
1993				1044		207	1251	1089
1994				1044		207	1251	1068
1995				1044		207	1251	1047
1996				1044		207	1251	1026
1997				1044		207	1251	1006
1998				1955		207	2162	1705
1999				1955		207	2162	1671
2000				1955		207	2162	1639
2001				3673*		207	3880	2883
TOTAL	8718	2735	6910	21146	3000	3312	45821	40740

* - Decommissioning cost

Initial Payment = 216 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 225 \$/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, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1429	1511			500	319	3759	3759
1987	102	139			1000	319	1560	1529
1988	3619	882	3454		1000	319	9274	8914
1989	3568	812	6908	1149	500	319	13256	12491
1990			6908	2297		319	9524	8798
1991			3454	2297		319	6070	5498
1992				1712		319	2031	1802
1993				1127		319	1446	1256
1994				1127		319	1446	1234
1995				1127		319	1446	1210
1996				1127		319	1446	1188
1997				1127		319	1446	1163
1998				2297		319	2616	2063
1999				2297		319	2616	2020
2000				2297		319	2616	1988
2001				6557*		319	6876	5108
TOTAL	8718	3344	20724	26538	3000	5104	67428	60028

* - Decommissioning cost

Initial Payment = 122 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 101 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-35

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 471 SILOS (800 MTL)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1429	1693			500	506	4128	4128
1987	102	139			1000	506	1747	1713
1988	3619	1489	9194		1000	506	15808	15194
1989	3568	1419	18389	1756	500	506	26138	24630
1990			18389	3512		506	22407	20701
1991			9194	3512		506	13212	11967
1992				2420		506	2926	2598
1993				1327		506	1833	1596
1994				1327		506	1833	1564
1995				1327		506	1833	1534
1996				1327		506	1833	1504
1997				1327		506	1833	1474
1998				3512		506	4018	3168
1999				3512		506	4018	3106
2000				3512		506	4018	3045
2001				13723*		506	14231	10574
TOTAL	8718	4740	55166	42096	3000	8096	121816	108496

* - Decommissioning cost

Initial Payment = 91 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 64 \$/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, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1429	1938			500	709	4576	4576
1987	102	139			1000	709	1950	1912
1988	3619	2305	17253		1000	709	24886	23920
1989	3568	2235	34506	2426	500	709	43944	41409
1990			34506	4851		709	40066	37015
1991			17253	4851		709	22813	20662
1992				3229		709	3938	3497
1993				1607		709	2316	2016
1994				1607		709	2316	1977
1995				1607		709	2316	1938
1996				1607		709	2316	1900
1997				1607		709	2316	1863
1998				4851		709	5560	4384
1999				4851		709	5560	4298
2000				4851		709	5560	4214
2001				23771*		709	24480	18189
TOTAL	8718	6617	103518	61716	3000	11344	194913	173770

* - Decommissioning cost

Initial Payment = 82 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 50 \$/KgU (Includes \$8/KgU impact aid)

TABLE A9-37

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 1120 SILOS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1429	2076			500	809	4814	4814
1987	102	139			1000	809	2050	2010
1988	3619	2763	21858		1000	809	30049	28882
1989	3568	2693	43717	2808	500	809	54095	50975
1990			43717	5615		809	50141	46323
1991			21858	5615		809	28282	25616
1992				3692		809	4501	3997
1993				1768		809	2577	2243
1994				1768		809	2577	2199
1995				1768		809	2577	2156
1996				1768		809	2577	2114
1997				1768		809	2577	2073
1998				5615		809	6424	5063
1999				5615		809	6424	4966
2000				5615		809	6424	4869
2001				29508*		809	30317	22526
TOTAL	8718	7671	131150	72923	3000	12944	236406	210828

* - Decommissioning cost

Initial Payment = 80 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 47 \$/KgU (Includes \$8/KgU impact aid)

10.0 SENSITIVITY OF COSTS TO CHANGES IN CONDITIONS

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

10.1 IMPACT OF COST CHANGES

The impact of design improvements which result in a reduction in capital cost of a new transfer facility to \$15.5-million and \$10-million, and a reduction in the capital cost of modifying an existing transfer facility to 7.7 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				
\$20.9 (Base Case)	\$61,083	\$651	\$222,088	\$134
15.5	54,830	587	215,845	129
10	48,468	522	209,478	127
Change per \$-million	1,157	12	1,157	1
Existing Facility Cases				
8.7 (Base Case)	\$43,840	\$473	\$202,159	\$122
7.7	42,677	461	201,007	121
Change per \$-million	1,163	12	1,152	1

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

TABLE A10-2
COST SENSITIVITY CASE -- \$15.5-MILLION TRANSFER FACILITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
 AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
 (\$000, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	2660	1648			500	207	5015	5015
1987	224	139			1000	207	1570	1539
1988	6563	1880	1002		1000	207	10452	10046
1989	6251	1811	2003	1048	500	207	11822	11140
1990			2003	2096		207	4308	3980
1991			1002	2096		207	3305	2993
1992				1980		207	2187	1942
1993				1864		207	2071	1803
1994				1864		207	2071	1768
1995				1864		207	2071	1733
1996				1864		207	2071	1699
1997				1864		207	2071	1666
1998				2096		207	2303	1816
1999				2096		207	2303	1780
2000				2096		207	2303	1745
2001				5098*		207	5605	4165
TOTAL	15498	5478	6014	28226	3000	3312	61528	54830

* - Decommissioning cost

Initial Payment = 299 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 288 \$/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, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1942	1648			500	207	4297	4297
1987	224	139			1000	207	1570	1539
1988	3972	1880	1002		1000	207	8061	7748
1989	3860	1811	2003	1034	500	207	9417	8874
1990			2003	2068		207	4280	3954
1991			1002	2068		207	3277	2968
1992				1952		207	2159	1917
1993				1835		207	2042	1778
1994				1835		207	2042	1743
1995				1835		207	2042	1709
1996				1835		207	2042	1675
1997				1835		207	2042	1642
1998				2068		207	2275	1794
1999				2068		207	2275	1759
2000				2068		207	2275	1724
2001				4298*		207	4505	3347
TOTAL	9998	5478	6014	26799	3000	3312	54601	48468

* - Decommissioning cost

Initial Payment = 246 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 276 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-4

COST SENSITIVITY CASE -- \$15.5 MILLION TRANSFER FACILITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC TOTAL COSTS
1986	2660	2068			500	809	6037	6037
1987	224	139			1000	809	2172	2128
1988	6363	3279	19020		1000	809	30471	29288
1989	6251	3209	38041	3641	500	809	52451	49428
1990			38041	7281		809	46131	42611
1991			19020	7281		809	27110	24558
1992				5211		809	6020	5340
1993				3140		809	3949	3438
1994				3140		809	3949	3378
1995				3140		809	3949	3308
1996				3140		809	3949	3248
1997				3140		809	3949	3178
1998				7281		809	8090	6378
1999				7281		809	8090	6258
2000				7281		809	8090	6128
2001				27663*		809	28472	21158
TOTAL	15498	8695	114122	88620	3000	12944	242879	215841

* - Decommissioning cost

Initial Payment = 75 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 54 \$/KgU (Includes \$8/KgU impact aid)

TABLE A10-5

COST SENSITIVITY CASE -- \$10 MILLION TRANSFER FACILITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1942	2068			500	809	5319	5319
1987	224	139			1000	809	2172	2129
1988	3972	3279	19020		1000	809	28080	26990
1989	3860	3209	38041	3626	500	809	50045	47159
1990			38041	7252		809	46102	42591
1991			19020	7252		809	27081	24528
1992				5182		809	5991	5320
1993				3111		809	3920	3413
1994				3111		809	3920	3346
1995				3111		809	3920	3280
1996				3111		809	3920	3216
1997				3111		809	3920	3153
1998				7252		809	8061	6356
1999				7252		809	8061	6231
2000				7252		809	8061	6109
2001				26563*		809	27372	20338
TOTAL	9998	8695	114122	87186	3000	12944	235945	209478

* - Decommissioning cost

Initial Payment = 73 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 54 \$/KgU (Includes \$8/KgU impact aid)

TABLE A10-6
COST SENSITIVITY CASE -- \$7.7 MILLION TRANSFER FACILITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
 AT GOVERNMENT SITE WITH EXISTING FACILITIES
 (\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1297	1674			500	207	3678	3678
1987	102	139			1000	207	1448	1420
1988	3182	1967	1002		1000	207	7358	7072
1989	3131	1897	2005	1028	500	207	8768	8262
1990			2005	2056		207	4268	3943
1991			1002	2056		207	3265	2957
1992				1579		207	1786	1586
1993				1101		207	1308	1139
1994				1101		207	1308	1116
1995				1101		207	1308	1094
1996				1101		207	1308	1073
1997				1101		207	1308	1052
1998				2056		207	2263	1784
1999				2056		207	2263	1749
2000				2056		207	2263	1715
2001				3881*		207	4088	3037
TOTAL	7712	5677	6014	22272	3000	3312	47988	42677

* - Decommissioning cost

Initial Payment = 226 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 235 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-7
COST SENSITIVITY CASE -- \$7.7 MILLION TRANSFER FACILITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
 AT GOVERNMENT SITE WITH EXISTING FACILITIES
 (\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1297	2094			500	809	4700	4700
1987	102	139			1000	809	2050	2010
1988	3182	3365	19020		1000	809	27376	26313
1989	3131	3295	38041	3621	500	809	49397	46548
1990			38041	7242		809	46092	42582
1991			19020	7242		809	27071	24519
1992				4519		809	5328	4731
1993				1796		809	2605	2268
1994				1796		809	2605	2223
1995				1796		809	2605	2180
1996				1796		809	2605	2137
1997				1796		809	2605	2095
1998				7242		809	8051	6348
1999				7242		809	8051	6224
2000				7242		809	8051	6102
2001				26145*		809	26954	20027
TOTAL	7712	8893	114122	79475	3000	12944	226146	201007

* - Decommissioning cost

Initial Payment = 71 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 50 \$/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
ON FIS SYSTEM COSTS

<u>Item Cost (\$)</u>	<u>100 MTU</u>		<u>1900 MTU</u>	
	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kgU)</u>	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kg)</u>
<u>Drywells</u>				
\$20,897	\$61,083	\$651	\$222,088	\$134
15,000	59,510	635	192,192	116
10,000	58,167	621	166,856	100
Change per \$-thousand	268	3	5,069	3
<u>Canisters</u>				
\$ 4,588	\$61,083	\$651	\$222,088	\$134
3,500	60,806	648	216,818	130
2,000	60,422	644	209,552	126
Change per \$-thousand	255	3	4,844	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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	1648			500	207	5720	5720
1987	224	139			1000	207	1570	1539
1988	8713	1880	770		1000	207	12570	12082
1989	8601	1811	1541	1059	500	207	13719	12928
1990			1541	2117		207	3865	3571
1991			770	2117		207	3094	2802
1992				2001		207	2208	1961
1993				1885		207	2092	1821
1994				1885		207	2092	1786
1995				1885		207	2092	1750
1996				1885		207	2092	1716
1997				1885		207	2092	1683
1998				2117		207	2324	1832
1999				2117		207	2324	1797
2000				2117		207	2324	1761
2001				6201*		207	6408	4761
TOTAL	20903	5478	4622	29271	3000	3312	66586	59510

* - Decommissioning cost

Initial Payment = 338 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 297 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	1648			500	207	5720	5720
1987	224	139			1000	207	1570	1539
1988	8713	1880	574		1000	207	12374	11894
1989	8601	1811	1148	1055	500	207	13322	12554
1990			1148	2110		207	3465	3201
1991			574	2110		207	2891	2618
1992				1994		207	2201	1954
1993				1878		207	2085	1815
1994				1878		207	2085	1780
1995				1878		207	2085	1745
1996				1878		207	2085	1710
1997				1878		207	2085	1677
1998				2110		207	2317	1827
1999				2110		207	2317	1791
2000				2110		207	2317	1756
2001				5965*		207	6172	4586
TOTAL	20903	5478	3444	28954	3000	3312	65091	58167

* - Decommissioning cost

Initial Payment = 327 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 294 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	2068			500	809	6742	6742
1987	224	139			1000	809	2172	2129
1988	8713	3279	14619		1000	809	28420	27316
1989	8601	3209	29238	3586	500	809	45943	43293
1990			29238	7171		809	37218	34384
1991			14619	7171		809	22599	20469
1992				5101		809	5910	5248
1993				3030		809	3839	3342
1994				3030		809	3839	3277
1995				3030		809	3839	3212
1996				3030		809	3839	3149
1997				3030		809	3839	3088
1998				7171		809	7980	6292
1999				7171		809	7980	6169
2000				7171		809	7980	6048
2001				23462*		809	24271	18034
TOTAL	20903	8695	87714	83154	3000	12944	216410	192192

* - Decommissioning cost

Initial Payment = 65 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 51 \$/KgU (Includes \$7/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	2068			500	809	6742	6742
1987	224	139			1000	809	2172	2129
1988	8713	3279	10888		1000	809	24689	23730
1989	8601	3209	21775	3528	500	809	38422	36206
1990			21775	7056		809	29640	27383
1991			10888	7056		809	18753	16985
1992				4986		809	5795	5146
1993				2915		809	3724	3242
1994				2915		809	3724	3178
1995				2915		809	3724	3116
1996				2915		809	3724	3055
1997				2915		809	3724	2995
1998				7056		809	7865	6201
1999				7056		809	7865	6080
2000				7056		809	7865	5961
2001				18985*		809	19794	14707
TOTAL	20903	8695	65526	77354	3000	12944	188222	166856

* - Decommissioning cost

Initial Payment = 53 \$/KgU (Includes \$3/KgU impact aid)

Final Payment = 47 \$/KgU (Includes \$6/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	1648			500	207	5720	5720
1987	224	139			1000	207	1570	1539
1988	8713	1880	960		1000	207	12760	12265
1989	8601	1811	1919	1062	500	207	14100	13287
1990			1919	2124		207	4250	3926
1991			960	2124		207	3291	2981
1992				2008		207	2215	1967
1993				1892		207	2099	1827
1994				1892		207	2099	1791
1995				1892		207	2099	1756
1996				1892		207	2099	1722
1997				1892		207	2099	1688
1998				2124		207	2331	1838
1999				2124		207	2331	1802
2000				2124		207	2331	1767
2001				6428*		207	6635	4930
TOTAL	20903	5478	5758	29578	3000	3312	68029	60806

* - Decommissioning cost

Initial Payment = 349 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 299 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	1648			500	207	5720	5720
1987	224	139			1000	207	1570	1539
1988	8713	1880	901		1000	207	12701	12208
1989	8601	1811	1801	1062	500	207	13982	13176
1990			1801	2124		207	4132	3817
1991			901	2124		207	3232	2927
1992				2008		207	2215	1967
1993				1892		207	2099	1827
1994				1892		207	2099	1791
1995				1892		207	2099	1756
1996				1892		207	2099	1722
1997				1892		207	2099	1688
1998				2124		207	2331	1838
1999				2124		207	2331	1802
2000				2124		207	2331	1767
2001				6357*		207	6564	4877
TOTAL	20903	5478	3404	29507	3000	3312	67604	60422

* - Decommissioning cost

Initial Payment = 345 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 299 \$/KgU (Includes \$10/KgU impact aid)

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

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	2068			500	809	6742	6742
1987	224	139			1000	809	2172	2129
1988	8713	3279	18208		1000	809	32009	30768
1989	8601	3209	36417	3654	500	809	53190	50122
1990			36417	7308		809	44534	41140
1991			18208	7308		809	26325	23840
1992				5238		809	6047	5570
1993				3167		809	3976	3461
1994				3167		809	3976	3393
1995				3167		809	3976	3327
1996				3167		809	3976	3262
1997				3167		809	3976	3198
1998				7308		809	8117	6400
1999				7308		809	8117	6275
2000				7308		809	8117	6153
2001				27770*		809	28579	21235
TOTAL	20903	8695	109250	89037	3000	12944	243829	216318

* - Decommissioning cost

Initial Payment = 76 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 54 \$/KgU (Includes \$8/KgU impact aid)

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

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	2068			500	809	6742	6742
1987	224	139			1000	809	2172	2129
1988	8713	3279	17089		1000	809	30890	29691
1989	8601	3209	34178	3654	500	809	50951	48012
1990			34178	7308		809	42295	39074
1991			17089	7308		809	25206	22830
1992				5238		809	6047	5570
1993				3167		809	3976	3461
1994				3167		809	3976	3393
1995				3167		809	3976	3327
1996				3167		809	3976	3262
1997				3167		809	3976	3198
1998				7308		809	8117	6400
1999				7308		809	8117	6275
2000				7308		809	8117	6153
2001				26426*		809	27235	20236
TOTAL	20903	8695	102534	87693	3000	12944	235769	209552

* - Decommissioning cost

Initial Payment = 72 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 54 \$/KgU (Includes \$8/KgU impact aid)

10.2 IMPACT OF SCHEDULE CHANGES

The impact on FIS costs of extending the FIS program by 2 years and by 5 years as a result of a delay in repository startup 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				
2000 (Base Case)	\$61,083	\$651	\$222,088	\$134
2002	63,958	682	226,714	137
2005	68,062	727	233,315	140
Increase-per yr. of delay	1,396	15	2,245	1.20
Existing Transfer Facility Cases				
2000 (Base Case)	\$43,840	\$473	\$202,159	\$122
2002	45,562	492	204,726	124
2005	48,021	519	208,390	126
Increase-per yr. of delay	836	9	1,246	0.80

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

TABLE A10-18
COST SENSITIVITY CASE -- 2 YEAR EXTENSION OF FIS PROGRAM

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
 AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
 (\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	1648			500	207	5720	5720
1987	224	139			1000	207	1570	1539
1988	8713	1880	1002		1000	207	12802	12305
1989	8601	1811	2005	1062	500	207	14186	13368
1990			2005	2124		207	4336	4006
1991			1002	2124		207	3333	3019
1992				2008		207	2215	1967
1993				1892		207	2099	1827
1994				1892		207	2099	1791
1995				1892		207	2099	1756
1996				1892		207	2099	1722
1997				1892		207	2099	1688
1998				1892		207	2099	1655
1999				1892		207	2099	1623
2000				2124		207	2331	1591
2001				2124		207	2331	1560
2002				2124		207	2331	1529
2003				6479*		207	6686	4499
TOTAL	20903	3478	6014	33413	3000	3726	72534	63995

* - Decommissioning cost

Initial Payment = 351 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 331 \$/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
 (\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	1648			500	207	5720	5720
1987	224	139			1000	207	1570	1539
1988	8713	1880	1002		1000	207	12302	12305
1989	8601	1811	2005	1062	500	207	14186	13368
1990			2005	2124		207	4336	4006
1991			1002	2124		207	3333	3019
1992				2008		207	2215	1967
1993				1892		207	2099	1827
1994				1892		207	2099	1791
1995				1892		207	2099	1756
1996				1892		207	2099	1722
1997				1892		207	2099	1688
1998				1892		207	2099	1655
1999				1892		207	2099	1623
2000				1892		207	2099	1591
2001				1892		207	2099	1560
2002				1892		207	2099	1529
2003				2124		207	2331	1665
2004				2124		207	2331	1632
2005				2124		207	2331	1600
2006				6479*		207	6686	4499
TOTAL	20903	3478	6014	39089	3000	4347	78831	68062

* - Decommissioning cost

Initial Payment = 351 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 376 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	2068			500	809	6742	6742
1987	224	139			1000	809	2172	2129
1988	8713	3279	19020		1000	809	32821	31547
1989	8601	3209	38041	3654	500	809	54814	51652
1990			38041	7308		809	46158	42643
1991			19020	7308		809	27137	24579
1992				5238		809	6047	5370
1993				3167		809	3976	3461
1994				3167		809	3976	3393
1995				3167		809	3976	3327
1996				3167		809	3976	3262
1997				3167		809	3976	3198
1998				3167		809	3976	3135
1999				3167		809	3976	3074
2000				7308		809	8117	6152
2001				7308		809	8117	6031
2002				7308		809	8117	5913
2003				28744*		809	29553	21106
TOTAL	20903	8695	114122	96345	3000	14562	257627	226714

* - Decommissioning cost

Initial Payment = 78 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 59 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	2068			500	809	6742	6742
1987	224	139			1000	809	2172	2129
1988	8713	3279	19020		1000	809	32821	31547
1989	8601	3209	38041	3654	500	809	54814	51652
1990			38041	7308		809	46158	42643
1991			19020	7308		809	27137	24579
1992				5238		809	6047	5370
1993				3167		809	3976	3461
1994				3167		809	3976	3393
1995				3167		809	3976	3327
1996				3167		809	3976	3262
1997				3167		809	3976	3198
1998				3167		809	3976	3135
1999				3167		809	3976	3074
2000				3167		809	3976	3013
2001				3167		809	3976	2954
2002				3167		809	3976	2896
2003				7308		809	8117	5797
2004				7308		809	8117	5683
2005				7308		809	8117	5572
2006				28744*		809	29553	19888
TOTAL	20903	8695	114122	105846	3000	16989	269555	233315

* - Decommissioning cost

Initial Payment = 78 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 62 \$/KgU (Includes \$9/KgU impact aid)

TABLE A10-22
COST SENSITIVITY CASE -- 2 YEAR EXTENSION OF FIS PROGRAM

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	1674			500	207	3809	3809
1987	102	139			1000	207	1448	1448
1988	3617	1967	1002		1000	207	7793	7490
1989	3565	1897	2005	1031	500	207	9205	8674
1990			2005	2062		207	4274	3949
1991			1002	2062		207	3271	2983
1992				1584		207	1791	1590
1993				1106		207	1313	1143
1994				1106		207	1313	1121
1995				1106		207	1313	1099
1996				1106		207	1313	1077
1997				1106		207	1313	1056
1998				1106		207	1313	1035
1999				1106		207	1313	1015
2000				2062		207	2269	1720
2001				2062		207	2269	1650
2002				2062		207	2269	1620
2003				4081*		207	4288	3061
TOTAL	8712	5677	6014	24748	3000	3726	51877	45581

* - Decommissioning cost

Initial Payment = 236 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 256 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	1674			500	207	3809	3809
1987	102	139			1000	207	1448	1448
1988	3617	1967	1002		1000	207	7793	7490
1989	3565	1897	2005	1031	500	207	9205	8674
1990			2005	2062		207	4274	3949
1991			1002	2062		207	3271	2983
1992				1584		207	1791	1590
1993				1106		207	1313	1143
1994				1106		207	1313	1121
1995				1106		207	1313	1099
1996				1106		207	1313	1077
1997				1106		207	1313	1056
1998				1106		207	1313	1035
1999				1106		207	1313	1015
2000				1106		207	1313	995
2001				1106		207	1313	975
2002				1106		207	1313	955
2003				2062		207	2269	1600
2004				2062		207	2269	1589
2005				2062		207	2269	1568
2006				4081*		207	4288	2886
TOTAL	8712	5677	6014	28066	3000	4347	55816	48021

* - Decommissioning cost

Initial Payment = 236 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 283 \$/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
 (\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	2094			500	809	4831	4831
1987	102	139			1000	809	2050	2010
1988	3617	3365	19020		1000	809	27811	26731
1989	3365	3295	38041	3623	500	809	49833	46959
1990			38041	7246		809	46096	42586
1991			19020	7246		809	27075	24523
1992				4524		809	5333	4736
1993				1801		809	2610	2272
1994				1801		809	2610	2228
1995				1801		809	2610	2184
1996				1801		809	2610	2141
1997				1801		809	2610	2099
1998				1801		809	2610	2058
1999				1801		809	2610	2018
2000				7246		809	8055	6105
2001				7246		809	8055	5985
2002				7246		809	8055	5868
2003				26345*		809	27154	19392
TOTAL	8712	8893	114122	83329	3000	14562	232618	204726

* - Decommissioning cost

Initial Payment = 72 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 52 \$/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
 (\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	2094			500	809	4831	4831
1987	102	139			1000	809	2050	2010
1988	3617	3365	19020		1000	809	27811	26731
1989	3365	3295	38041	3623	500	809	49833	46959
1990			38041	7246		809	46096	42586
1991			19020	7246		809	27075	24523
1992				4524		809	5333	4736
1993				1801		809	2610	2272
1994				1801		809	2610	2228
1995				1801		809	2610	2184
1996				1801		809	2610	2141
1997				1801		809	2610	2099
1998				1801		809	2610	2058
1999				1801		809	2610	2018
2000				1801		809	2610	1978
2001				1801		809	2610	1939
2002				1801		809	2610	1901
2003				7246		809	8055	5753
2004				7246		809	8055	5640
2005				7246		809	8055	5529
2006				26345*		809	27154	18274
TOTAL	8712	8893	114122	88732	3000	16989	240448	208390

* - Decommissioning cost

Initial Payment = 72 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 54 \$/KgU (Includes \$8/KgU impact aid)

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

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

<u>Number of Years Spent Fuel Received</u>	<u>100 MTU</u>		<u>1900 MTU</u>	
	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kgU)</u>	<u>Total Discounted Cost (\$000)</u>	<u>Total Unit Cost (\$/kg)</u>
<u>New Transfer Facility Cases</u>				
3 yrs. (Base Case)	\$61,083	\$651	\$222,088	\$134
4 yrs.	61,020	652	219,989	133
5 yrs.	60,970	655	217,937	133
Change per yr. of receipt time	-56	+2	-2,076	-0.5
<u>Existing Transfer Facility Cases</u>				
3 yrs. (Base Case)	\$43,840	\$473	\$202,159	\$122
4 yrs.	44,415	481	201,207	121
5 yrs.	44,988	490	200,276	122
Change per yr. of receipt time	+574	+8.5	-942	-

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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	1648			500	207	5720	5720
1987	224	139			1000	207	1570	1539
1988	8713	1880	752		1000	207	12552	12065
1989	8601	1811	1504	1033	500	207	13656	12868
1990			1504	2065		207	3776	3488
1991			1504	2065		207	3776	3420
1992			752	2065		207	3024	2685
1993				1979		207	2186	1903
1994				1892		207	2099	1791
1995				1892		207	2099	1756
1996				1892		207	2099	1722
1997				1892		207	2099	1688
1998				2124		207	2331	1838
1999				2124		207	2331	1802
2000				2124		207	2331	1767
2001				6479*		207	6686	4968
TOTAL	20903	5478	6016	29626	3000	3312	68335	61020

* - Decommissioning cost

Initial Payment = 350 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 302 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	1648			500	207	5720	5720
1987	224	139			1000	207	1570	1539
1988	8713	1880	601		1000	207	12401	11919
1989	8601	1811	1203	1017	500	207	13339	12570
1990			1203	2033		207	3443	3181
1991			1203	2033		207	3443	3118
1992			1203	2033		207	3443	3057
1993			601	2033		207	2841	2473
1994				1963		207	2170	1852
1995				1892		207	2099	1756
1996				1892		207	2099	1722
1997				1892		207	2099	1688
1998				2124		207	2331	1838
1999				2124		207	2331	1802
2000				2124		207	2331	1767
2001				6479*		207	6686	4968
TOTAL	20903	5478	6014	29639	3000	3312	68346	60970

* - Decommissioning cost

Initial Payment = 350 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 305 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC TOTAL COSTS
1986	3363	2068			500	809	6742	6742
1987	224	139			1000	809	2172	2172
1988	8713	3279	14265		1000	809	29066	26971
1989	8601	3209	28530	3006	500	809	44635	42071
1990			28530	6011		809	35350	32651
1991			28530	6011		809	35350	32011
1992			14265	6011		809	21025	18721
1993				4589		809	5398	4691
1994				3167		809	3976	3291
1995				3167		809	3976	3291
1996				3167		809	3976	3261
1997				3167		809	3976	3191
1998				7308		809	8117	6401
1999				7308		809	8117	6271
2000				7308		809	8117	6151
2001				28744*		809	29553	21951
TOTAL	20903	8695	114120	88964	3000	12944	248626	219981

* - Decommissioning cost

Initial Payment = 77 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 56 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC TOTAL COSTS
1986	3363	2068			500	809	6742	6742
1987	224	139			1000	809	2172	2172
1988	8713	3279	11412		1000	809	25213	24231
1989	8601	3209	22824	2618	500	809	38561	36331
1990			22824	5235		809	28868	26671
1991			22824	5235		809	28868	26141
1992			22824	5235		809	28868	25631
1993			11412	5235		809	17456	15191
1994				4201		809	5010	4271
1995				3167		809	3976	3321
1996				3167		809	3976	3261
1997				3167		809	3976	3191
1998				7308		809	8117	6401
1999				7308		809	8117	6271
2000				7308		809	8117	6151
2001				28744*		809	29553	21951
TOTAL	20903	8695	114120	87928	3000	12944	247590	217931

* - Decommissioning cost

Initial Payment = 77 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 56 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	1674			500	207	3809	3809
1987	102	139			1000	207	1448	1420
1988	3617	1967	752		1000	207	7543	7250
1989	3565	1897	1504	1002	500	207	8675	8175
1990			1504	2003		207	3714	3431
1991			1504	2003		207	3714	3364
1992			752	2003		207	2962	2630
1993				1555		207	1762	1534
1994				1106		207	1313	1121
1995				1106		207	1313	1099
1996				1106		207	1313	1077
1997				1106		207	1313	1056
1998				2062		207	2269	1789
1999				2062		207	2269	1754
2000				2062		207	2269	1720
2001				4081*		207	4288	3186
TOTAL	8712	5677	6016	23257	3000	3312	49974	44415

* - Decommissioning cost

Initial Payment = 235 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 246 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	1674			500	207	3809	3809
1987	102	139			1000	207	1448	1420
1988	3617	1967	601		1000	207	7392	7105
1989	3565	1897	1203	986	500	207	8358	7876
1990			1203	1971		207	3381	3124
1991			1203	1971		207	3381	3062
1992			1203	1971		207	3381	3002
1993			601	1971		207	2779	2419
1994				1539		207	1746	1490
1995				1106		207	1313	1099
1996				1106		207	1313	1077
1997				1106		207	1313	1056
1998				2062		207	2269	1789
1999				2062		207	2269	1754
2000				2062		207	2269	1720
2001				4081*		207	4288	3186
TOTAL	8712	5677	6014	23994	3000	3312	50709	44988

* - Decommissioning cost

Initial Payment = 235 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 255 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	2094			500	809	4831	4831
1987	102	139			1000	809	2050	2010
1988	3617	3363	14265		1000	809	23056	2316
1989	3363	3295	28530	2975	500	809	39674	3738
1990			28530	5949		809	35298	3160
1991			28530	5949		809	35298	3190
1992			14265	5949		809	21023	1860
1993				3875		809	4684	4078
1994				1801		809	2610	2228
1995				1801		809	2610	2184
1996				1801		809	2610	2141
1997				1801		809	2610	2099
1998				7246		809	8055	6351
1999				7246		809	8055	6227
2000				7246		809	8055	6105
2001				26345*		809	27154	20176
TOTAL	8712	8893	114120	79984	3000	12944	227653	201207

* - Decommissioning cost

Initial Payment = 71 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 50 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	2094			500	809	4831	4831
1987	102	139			1000	809	2050	2010
1988	3617	3363	11412		1000	809	20203	19418
1989	3363	3295	22824	2587	500	809	33580	31643
1990			22824	5173		809	28806	26612
1991			22824	5173		809	28806	26090
1992			22824	5173		809	28806	25579
1993			11412	5173		809	17394	15143
1994				3487		809	4296	3667
1995				1801		809	2610	2184
1996				1801		809	2610	2141
1997				1801		809	2610	2099
1998				7246		809	8055	6351
1999				7246		809	8055	6227
2000				7246		809	8055	6105
2001				26345*		809	27154	20176
TOTAL	8712	8893	114120	80252	3000	12944	227921	200276

* - Decommissioning cost

Initial Payment = 71 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 51 \$/KgU (Includes \$8/KgU impact aid)

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

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

FIS Facility Construction Time (yr)	100 MTU		1900 MTU	
	Total Discounted Cost (\$000)	Total Unit Cost (\$/kgU)	Total Discounted Cost (\$000)	Total Unit Cost (\$/kgU)
New Transfer Facility Cases				
4 yr. (Base Case)	\$61,083	\$651	\$222,088	\$134
2 yr.	65,788	689	233,860	138
Increase per yr. of schedule shortening	2,353	19	5,886	2
Existing Transfer Facility Cases				
4 yr. (Base Case)	\$43,840	\$473	\$202,159	\$122
2 yr.	46,728	495	211,064	125
Increase per yr. of schedule shortening	1,444	11	4,453	1.5

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

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

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	12302	3668	1002		500	207	17679	17679
1987	8601	1811	2005	1062	1000	207	14686	14686
1988			2005	2124	1000	207	5336	5129
1989			1002	2124	500	207	3853	3613
1990				2008		207	2215	2046
1991				1892		207	2099	1901
1992				1892		207	2099	1864
1993				1892		207	2099	1827
1994				1892		207	2099	1791
1995				1892		207	2099	1756
1996				1892		207	2099	1722
1997				1892		207	2099	1688
1998				2124		207	2331	1838
1999				2124		207	2331	1802
2000				2124		207	2331	1767
2001				6479*		207	6686	4968
TOTAL	20903	5479	6014	33413	3000	3312	72621	65788

* - Decommissioning cost

Initial Payment = 343 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 346 \$/KgU (Includes \$10/KgU impact aid)

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

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4476 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	12302	5486	19020		500	809	38117	38117
1987	8601	3209	38041	3634	1000	809	55314	54229
1988			38041	7308	1000	809	47158	45327
1989			19020	7308	500	809	27607	26043
1990				5238		809	6047	5586
1991				3167		809	3976	3601
1992				3167		809	3976	3551
1993				3167		809	3976	3461
1994				3167		809	3976	3393
1995				3167		809	3976	3327
1996				3167		809	3976	3262
1997				3167		809	3976	3198
1998				7308		809	8117	6400
1999				7308		809	8117	6275
2000				7308		809	8117	6152
2001				28744*		809	29553	21958
TOTAL	20903	8695	114122	96345	3000	12944	256009	233860

* - Decommissioning cost

Initial Payment = 79 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 59 \$/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, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	5147	3780	1002		500	207	10636	10636
1987	3565	1897	2005	1031	1000	207	9705	9515
1988			2005	2062	1000	207	5274	5069
1989			1002	2062	500	207	3771	3553
1990				1584		207	1791	1653
1991				1106		207	1313	1189
1992				1106		207	1313	1166
1993				1106		207	1313	1143
1994				1106		207	1313	1121
1995				1106		207	1313	1099
1996				1106		207	1313	1077
1997				1106		207	1313	1056
1998				2062		207	2269	1789
1999				2062		207	2269	1754
2000				2062		207	2269	1720
2001				4081*		207	4288	3186
TOTAL	8712	5677	6014	24748	3000	3312	51463	46728

* - Decommissioning cost

Initial Payment = 224 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 271 \$/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, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	5147	5598	19020		500	809	31074	31074
1987	3565	3295	38041	3623	1000	809	50333	49346
1988			38041	7246	1000	809	47096	45267
1989			19020	7246	500	809	27575	25985
1990				4524		809	5333	4927
1991				1801		809	2610	2364
1992				1801		809	2610	2318
1993				1801		809	2610	2272
1994				1801		809	2610	2228
1995				1801		809	2610	2184
1996				1801		809	2610	2141
1997				1801		809	2610	2099
1998				7246		809	8053	6351
1999				7246		809	8053	6227
2000				7246		809	8053	6105
2001				26345*		809	27154	20176
TOTAL	8712	8893	114122	83329	3000	12944	231000	211064

* - Decommissioning cost

Initial Payment = 73 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 52 \$/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)	\$61,083	\$651	\$222,088	\$134
100% PWR Fuel	60,543	644	211,919	128
100% BWR Fuel	62,128	661	242,408	146
Change per kg/U difference in average content of drywell	17	0.18	321	0.19
Existing Transfer Facility Cases				
67% PWR Fuel (Base Case)	\$43,840	\$473	\$202,159	\$122
100% PWR Fuel	43,301	467	191,989	116
100% BWR Fuel	44,879	484	222,478	134
Change per kg/U difference in average content of drywell	17	0.18	321	0.19

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, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	1649			500	207	5721	5721
1987	224	139			1000	207	1570	1539
1988	8713	1883	922		1000	207	12725	12231
1989	8601	1814	1843	1061	500	207	14026	13217
1990			1843	2122		207	4172	3854
1991			922	2122		207	3251	2945
1992				2006		207	2213	1965
1993				1889		207	2096	1823
1994				1889		207	2096	1789
1995				1889		207	2096	1754
1996				1889		207	2096	1719
1997				1889		207	2096	1686
1998				2122		207	2329	1836
1999				2122		207	2329	1800
2000				2122		207	2329	1765
2001				6384*		207	6591	4897
TOTAL	20903	5485	2530	29506	3000	3312	67736	60543

* - Decommissioning cost

Initial Payment = 346 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 298 \$/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, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	1647			500	207	5719	5719
1987	224	139			1000	207	1570	1539
1988	8713	1875	1160		1000	207	12955	12452
1989	8601	1806	2319	1064	500	207	14497	13661
1990			2319	2128		207	4654	4300
1991			1160	2128		207	3495	3166
1992				2012		207	2219	1970
1993				1895		207	2102	1830
1994				1895		207	2102	1794
1995				1895		207	2102	1759
1996				1895		207	2102	1724
1997				1895		207	2102	1691
1998				2128		207	2335	1841
1999				2128		207	2335	1805
2000				2128		207	2335	1770
2001				6666*		207	6873	5107
TOTAL	20903	5467	6958	29857	3000	3312	69497	62128

* - Decommissioning cost

Initial Payment = 360 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 301 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC TOTAL COSTS
1986	3365	2073			500	809	6747	6747
1987	224	139			1000	809	2172	2129
1988	8713	3295	17504		1000	809	31321	30105
1989	8601	3226	35008	3635	500	809	51779	48792
1990			35008	7270		809	42087	39806
1991			17504	7270		809	25583	23177
1992				5200		809	6009	5300
1993				3129		809	3938	3429
1994				3129		809	3938	3361
1995				3129		809	3938	3293
1996				3129		809	3938	3225
1997				3129		809	3938	3157
1998				7270		809	8079	6570
1999				7270		809	8079	6245
2000				7270		809	8079	6120
2001				26932*		809	27741	20612
TOTAL	20903	8753	105024	87762	3000	12944	238366	211916

* - Decommissioning cost

Initial Payment = 74 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 54 \$/KgU (Includes \$8/KgU impact aid)

TABLE A10-44
COST SENSITIVITY CASE -- 100% BWR FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 5191 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC TOTAL COSTS
1986	3365	2058			500	809	6732	6732
1987	224	139			1000	809	2172	2129
1988	8713	3246	22049		1000	809	35817	34426
1989	8601	3176	44098	3693	500	809	60877	57366
1990			44098	7385		809	52292	48317
1991			22049	7385		809	30243	27391
1992				5315		809	6124	5408
1993				3244		809	4053	3526
1994				3244		809	4053	3457
1995				3244		809	4053	3391
1996				3244		809	4053	3323
1997				3244		809	4053	3260
1998				7385		809	8194	6461
1999				7385		809	8194	6336
2000				7385		809	8194	6210
2001				32363*		809	33172	24649
TOTAL	20903	8619	132294	94516	3000	12944	272276	242408

* - Decommissioning cost

Initial Payment = 88 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 58 \$/KgU (Includes \$9/KgU impact aid)

TABLE A10-45

COST SENSITIVITY CASE -- 100% PWR FUEL

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 217 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	1675			500	207	3810	3810
1987	102	139			1000	207	1448	1420
1988	3617	1969	922		1000	207	7715	7415
1989	3565	1900	1840	1050	500	207	9045	8523
1990			1840	2060		207	4110	3797
1991			922	2060		207	3189	2888
1992				1582		207	1789	1589
1993				1104		207	1311	1141
1994				1104		207	1311	1119
1995				1104		207	1311	1097
1996				1104		207	1311	1075
1997				1104		207	1311	1054
1998				2060		207	2267	1788
1999				2060		207	2267	1752
2000				2060		207	2267	1718
2001				3985*		207	4192	3115
TOTAL	8712	5683	5530	22417	3000	3312	48654	45301

* - Decommissioning cost

Initial Payment = 231 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 236 \$/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, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	1673			500	207	3808	3808
1987	102	139			1000	207	1448	1420
1988	3617	1961	1160		1000	207	7945	7636
1989	3565	1892	2319	1033	500	207	9516	8967
1990			2319	2065		207	4591	4241
1991			1160	2065		207	3432	3108
1992				1588		207	1795	1594
1993				1110		207	1317	1147
1994				1110		207	1317	1124
1995				1110		207	1317	1102
1996				1110		207	1317	1080
1997				1110		207	1317	1059
1998				2065		207	2272	1791
1999				2065		207	2272	1756
2000				2065		207	2272	1722
2001				4267*		207	4474	3324
TOTAL	8712	5665	6958	22763	3000	3312	50410	44879

* - Decommissioning cost

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

Final Payment = 239 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	2099			500	809	4826	4826
1987	102	139			1000	809	2050	2010
1988	3617	3382	17504		1000	809	26312	25297
1989	3565	3312	35008	3604	500	809	46798	44097
1990			35008	7208		809	43025	39748
1991			17504	7208		809	25521	23110
1992				4486		809	5295	4700
1993				1763		809	2572	2230
1994				1763		809	2572	2190
1995				1763		809	2572	2150
1996				1763		809	2572	2110
1997				1763		809	2572	2060
1998				7208		809	8017	6320
1999				7208		809	8017	6190
2000				7208		809	8017	6070
2001				24534*		809	25343	16800
TOTAL	8712	8932	105024	77479	3000	12944	216091	191980

* - Decommissioning cost

Initial Payment = 68 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 48 \$/KgU (Includes \$7/KgU impact aid)

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

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 5191 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	2084			500	809	4821	4821
1987	102	139			1000	809	2050	2010
1988	3617	3332	22049		1000	809	30807	29610
1989	3565	3262	44098	3662	500	809	55896	52670
1990			44098	7323		809	52230	48250
1991			22049	7323		809	30181	27330
1992				4601		809	5410	4800
1993				1878		809	2687	2330
1994				1878		809	2687	2290
1995				1878		809	2687	2240
1996				1878		809	2687	2200
1997				1878		809	2687	2160
1998				7323		809	8132	6410
1999				7323		809	8132	6280
2000				7323		809	8132	6160
2001				29965*		809	30774	22860
TOTAL	8712	8817	132294	84233	3000	12944	250000	222470

* - Decommissioning cost

Initial Payment = 81 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 53 \$/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)	\$61,081	\$651	\$222,088	\$134
4%	55,172	609	199,474	124
6%	50,298	573	180,695	116
Decrease per percent increase in discount rate	2,696	19.5	10,348	4.5
Existing Transfer Facility Cases				
2% (Base Case)	\$43,840	473	\$202,159	\$122
4%	39,436	442	181,469	114
6%	35,816	416	164,285	105
Decrease per percent increase in discount rate	2,006	14.2	9,469	4.2

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 A10-49 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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC TOTAL COST
1986	3365	1648			500	207	5720	5720
1987	224	139			1000	207	1570	1511
1988	8713	1880	1002		1000	207	12802	11834
1989	8601	1811	2005	1062	500	207	14186	12611
1990			2005	2124		207	4336	3708
1991			1002	2124		207	3333	2731
1992				2008		207	2215	1751
1993				1892		207	2099	1591
1994				1892		207	2099	1531
1995				1892		207	2099	1471
1996				1892		207	2099	1411
1997				1892		207	2099	1351
1998				2124		207	2331	1451
1999				2124		207	2331	1401
2000				2124		207	2331	1341
2001				6479*		207	6686	3711
TOTAL	20903	5478	6014	29629	3000	3312	66336	55171

* - Decommissioning cost

Initial Payment = 337 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 272 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC TOTAL COST
1986	3365	1648			500	207	5720	5720
1987	224	139			1000	207	1570	1481
1988	8713	1880	1002		1000	207	12802	11394
1989	8601	1811	2005	1062	500	207	14186	11911
1990			2005	2124		207	4336	3437
1991			1002	2124		207	3333	2491
1992				2008		207	2215	1561
1993				1892		207	2099	1391
1994				1892		207	2099	1311
1995				1892		207	2099	1241
1996				1892		207	2099	1171
1997				1892		207	2099	1101
1998				2124		207	2331	1151
1999				2124		207	2331	1091
2000				2124		207	2331	1031
2001				6479*		207	6686	2791
TOTAL	20903	5478	6014	29629	3000	3312	66336	50291

* - Decommissioning cost

Initial Payment = 324 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 249 \$/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, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3363	2068			500	809	6742	6742
1987	224	139			1000	809	2172	2088
1988	8713	3279	19020		1000	809	32821	30345
1989	8601	3209	38041	3654	500	809	54814	48729
1990			38041	7308		809	46158	39456
1991			19020	7308		809	27137	22305
1992				5238		809	6047	4779
1993				3167		809	3976	3021
1994				3167		809	3976	2905
1995				3167		809	3976	2793
1996				3167		809	3976	2686
1997				3167		809	3976	2583
1998				7308		809	8117	5070
1999				7308		809	8117	4875
2000				7308		809	8117	4667
2001				28744*		809	29553	16410
TOTAL	20903	8695	114122	90011	3000	12944	249675	199474

* - Decommissioning cost

Initial Payment = 74 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 50 \$/KgU (Includes \$8/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, 1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3363	2068			500	809	6742	6742
1987	224	139			1000	809	2172	2049
1988	8713	3279	19020		1000	809	32821	29211
1989	8601	3209	38041	3654	500	809	54814	46023
1990			38041	7308		809	46158	36561
1991			19020	7308		809	27137	20278
1992				5238		809	6047	4263
1993				3167		809	3976	2644
1994				3167		809	3976	2495
1995				3167		809	3976	2353
1996				3167		809	3976	2220
1997				3167		809	3976	2095
1998				7308		809	8117	4034
1999				7308		809	8117	3806
2000				7308		809	8117	3590
2001				28744*		809	29553	12531
TOTAL	20903	8695	114122	90011	3000	12944	249675	180695

* - Decommissioning cost

Initial Payment = 70 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 46 \$/KgU (Includes \$8/KgU impact aid)

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

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
 AT GOVERNMENT SITE WITH EXISTING FACILITIES
 (\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	1674			500	207	3809	3809
1987	102	139			1000	207	1448	1392
1988	3617	1967	1002		1000	207	7793	7205
1989	3565	1897	2005	1031	500	207	9205	8183
1990			2005	2062		207	4274	3653
1991			1002	2062		207	3271	2689
1992				1584		207	1791	1415
1993				1106		207	1313	998
1994				1106		207	1313	959
1995				1106		207	1313	922
1996				1106		207	1313	887
1997				1106		207	1313	853
1998				2062		207	2269	1417
1999				2062		207	2269	1363
2000				2062		207	2269	1310
2001				4081*		207	4288	2581
TOTAL	8712	5677	6014	22536	3000	3312	49251	39436

* - Decommissioning cost

Initial Payment = 226 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 216 \$/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
 (\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	1674			500	207	3809	3809
1987	102	139			1000	207	1448	1366
1988	3617	1967	1002		1000	207	7793	6936
1989	3565	1897	2005	1031	500	207	9205	7729
1990			2005	2062		207	4274	3585
1991			1002	2062		207	3271	2444
1992				1584		207	1791	1263
1993				1106		207	1313	873
1994				1106		207	1313	824
1995				1106		207	1313	777
1996				1106		207	1313	733
1997				1106		207	1313	692
1998				2062		207	2269	1128
1999				2062		207	2269	1064
2000				2062		207	2269	1004
2001				4081*		207	4288	1789
TOTAL	8712	5677	6014	22536	3000	3312	49251	35816

* - Decommissioning cost

Initial Payment = 217 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 199 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	2094			500	809	4831	4831
1987	102	139			1000	809	2050	1971
1988	3617	3365	19020		1000	809	27811	25713
1989	3565	3295	38041	3623	500	809	49833	44301
1990			38041	7246		809	46096	39403
1991			19020	7246		809	27075	22254
1992				4524		809	5333	4215
1993				1801		809	2610	1983
1994				1801		809	2610	1907
1995				1801		809	2610	1834
1996				1801		809	2610	1763
1997				1801		809	2610	1693
1998				7246		809	8055	5031
1999				7246		809	8055	4838
2000				7246		809	8055	4652
2001				26345*		809	27154	15078
TOTAL	8712	8893	114122	79727	3000	12944	227398	181469

* - Decommissioning cost

Initial Payment = 68 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 46 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	2094			500	809	4831	4831
1987	102	139			1000	809	2050	1934
1988	3617	3365	19020		1000	809	27811	24752
1989	3565	3295	38041	3623	500	809	49833	41841
1990			38041	7246		809	46096	36512
1991			19020	7246		809	27075	20232
1992				4524		809	5333	3760
1993				1801		809	2610	1736
1994				1801		809	2610	1638
1995				1801		809	2610	1545
1996				1801		809	2610	1457
1997				1801		809	2610	1375
1998				7246		809	8055	4003
1999				7246		809	8055	3776
2000				7246		809	8055	3563
2001				26345*		809	27154	11330
TOTAL	8712	8893	114122	79727	3000	12944	227398	164285

* - Decommissioning cost

Initial Payment = 64 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 41 \$/KgU (Includes \$7/KgU impact aid)

10.5 IMPACT OF NRC LICENSING STATUS

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

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

	100 MTU		1900 MTU	
	Total Discounted Cost (\$000)	Total Unit Cost (\$/kgU)	Total Discounted Cost (\$000)	Total Unit Cost (\$/kgU)
New Transfer Facility Cases				
Full NRC Licensing (Base Case)	\$61,083	\$651	\$222,088	\$134
No NRC Licensing Activities	59,394	633	220,395	132
Savings	1,689	18	1,693	2
No NRC Security	53,120	564	214,129	128
Savings	7,963	87	7,959	6
No NRC Licensing or Security	51,432	546	212,437	127
Savings	9,651	105	9,651	7
Existing Transfer Facility Cases				
Full NRC Licensing (Base Case)	\$43,840	\$473	\$202,159	\$122
No NRC Licensing Activities	42,869	463	201,196	122
Savings	971	10	963	0
No NRC Security	35,877	386	194,194	116
Savings	7,963	87	7,965	6
No NRC Licensing or Security	34,905	376	193,234	116
Savings	8,935	97	8,925	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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	2938	955			500	207	4600	4600
1987	102	62			1000	207	1271	1244
1988	8652	1842	1002		1000	207	12703	12210
1989	8601	1811	2005	1059	500	207	14183	13265
1990			2005	2117		207	4329	3999
1991			1002	2117		207	3326	3012
1992				2001		207	2208	1961
1993				1885		207	2092	1821
1994				1885		207	2092	1786
1995				1885		207	2092	1750
1996				1885		207	2092	1716
1997				1885		207	2092	1683
1998				2117		207	2324	1832
1999				2117		207	2324	1797
2000				2117		207	2324	1761
2001				6195*		207	6402	4757
TOTAL	20293	4670	6014	29265	3000	3312	66554	59394

* - Decommissioning cost

Initial Payment = 337 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 296 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	1648			500	207	5720	5720
1987	224	139			1000	207	1570	1539
1988	8713	1880	1002		1000	207	12802	12305
1989	8601	1811	2005	651	500	207	15775	12980
1990			2005	1302		207	3514	3246
1991			1002	1302		207	2511	2274
1992				1187		207	1594	1238
1993				1071		207	1278	1113
1994				1071		207	1278	1091
1995				1071		207	1278	1069
1996				1071		207	1278	1048
1997				1071		207	1278	1029
1998				1302		207	1509	1190
1999				1302		207	1509	1167
2000				1302		207	1509	1144
2001				6479*		207	6686	4968
TOTAL	20903	5478	6014	20182	3000	3312	58889	53120

* - Decommissioning cost

Initial Payment = 351 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 213 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	2938	955			500	207	4600	4600
1987	102	62			1000	207	1371	1371
1988	8652	1842	1002		1000	207	12703	12210
1989	8601	1811	2005	648	500	207	13772	12978
1990			2005	1295		207	3507	3200
1991			1002	1295		207	2504	2318
1992				1180		207	1387	1212
1993				1064		207	1271	1105
1994				1064		207	1271	1085
1995				1064		207	1271	1064
1996				1064		207	1271	1043
1997				1064		207	1271	1022
1998				1295		207	1502	1184
1999				1295		207	1502	1161
2000				1295		207	1502	1138
2001				6195*		207	6402	4757
TOTAL	20293	4670	6014	19818	3000	3312	57107	51402

* - Decommissioning cost

Initial Payment = 337 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 209 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	2938	1374			500	809	5621	5621
1987	102	62			1000	809	1973	1973
1988	8652	3240	19020		1000	809	32721	31450
1989	8601	3209	38041	3651	500	809	54811	51650
1990			38041	7301		809	46151	42656
1991			19020	7301		809	27130	24572
1992				5231		809	6040	5363
1993				3160		809	3969	3485
1994				3160		809	3969	3388
1995				3160		809	3969	3281
1996				3160		809	3969	3206
1997				3160		809	3969	3122
1998				7301		809	8110	6295
1999				7301		809	8110	6219
2000				7301		809	8110	6146
2001				28460*		809	29269	21717
TOTAL	20293	7885	114122	89647	3000	12944	247891	220345

* - Decommissioning cost

Initial Payment = 77 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 35 \$/KgU (Includes \$8/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	3365	2068			500	809	6742	6742
1987	224	139			1000	809	2172	2129
1988	8713	3279	19020		1000	809	32821	31547
1989	8601	3209	38041	3244	500	809	54404	51266
1990			38041	6487		809	45337	41884
1991			19020	6487		809	26316	23835
1992				4417		809	5226	4641
1993				2346		809	3155	2747
1994				2346		809	3155	2693
1995				2346		809	3155	2640
1996				2346		809	3155	2588
1997				2346		809	3155	2537
1998				6487		809	7296	5753
1999				6487		809	7296	5640
2000				6487		809	7296	5529
2001				28744*		809	29553	21958
TOTAL	20903	8695	114122	80570	3000	12944	240234	214129

* - Decommissioning cost

Initial Payment = 78 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 50 \$/KgU (Includes \$8/KgU impact aid)

TABLE A10-64
COST SENSITIVITY CASE -- NO NRC LICENSING OR SECURITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	2938	1374			500	809	5621	5621
1987	102	62			1000	809	1973	1934
1988	8652	3240	19020		1000	809	32721	31450
1989	8601	3209	38041	3240	500	809	54400	51262
1990			38041	6480		809	45330	41878
1991			19020	6480		809	26309	23829
1992				4410		809	5219	4634
1993				2339		809	3148	2741
1994				2339		809	3148	2687
1995				2339		809	3148	2634
1996				2339		809	3148	2582
1997				2339		809	3148	2532
1998				6480		809	7289	5747
1999				6480		809	7289	5635
2000				6480		809	7289	5524
2001				28460*		809	29269	21747
TOTAL	20293	7885	114122	80205	3000	12944	238449	212437

* - Decommissioning cost

Initial Payment = 77 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 50 \$/KgU (Includes \$8/KgU impact aid)

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

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	980			500	207	3115	3115
1987	102	62			1000	207	1371	1344
1988	3617	1928	1002		1000	207	7754	7453
1989	3565	1897	2005	1029	500	207	9203	8672
1990			2005	2057		207	4269	3944
1991			1002	2057		207	3266	2958
1992				1580		207	1787	1587
1993				1102		207	1309	1140
1994				1102		207	1309	1117
1995				1102		207	1309	1095
1996				1102		207	1309	1074
1997				1102		207	1309	1053
1998				2057		207	2264	1785
1999				2057		207	2264	1750
2000				2057		207	2264	1716
2001				3919*		207	4126	3066
TOTAL	8712	4867	6014	22323	3000	3312	48228	42869

* - Decommissioning cost

Initial Payment = 228 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 235 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	1674			500	207	3809	3809
1987	102	139			1000	207	1448	1420
1988	3617	1967	1002		1000	207	7793	7490
1989	3565	1897	2005	620	500	207	8794	8287
1990			2005	1240		207	3452	3189
1991			1002	1240		207	2449	2218
1992				763		207	970	861
1993				285		207	492	428
1994				285		207	492	420
1995				285		207	492	412
1996				285		207	492	404
1997				285		207	492	396
1998				1240		207	1447	1141
1999				1240		207	1447	1119
2000				1240		207	1447	1097
2001				4081*		207	4288	3186
TOTAL	8712	5677	6014	13089	3000	3312	39804	35877

* - Decommissioning cost

Initial Payment = 236 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 150 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-67
COST SENSITIVITY CASE -- NO NRC LICENSING OR SECURITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	980			500	207	3115	3115
1987	102	62			1000	207	1371	1344
1988	3617	1928	1002		1000	207	7754	7433
1989	3565	1897	2005	618	500	207	8792	8285
1990			2005	1233		207	3447	3184
1991			1002	1233		207	2444	2214
1992				758		207	965	857
1993				281		207	488	425
1994				281		207	488	417
1995				281		207	488	408
1996				281		207	488	400
1997				281		207	488	392
1998				1233		207	1442	1137
1999				1233		207	1442	1115
2000				1233		207	1442	1093
2001				3919*		207	4126	3066
TOTAL	8712	4867	6014	12875	3000	3312	38780	34905

* - Decommissioning cost

Initial Payment = 228 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 148 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	1400			500	809	4137	4137
1987	102	62			1000	809	1973	1934
1988	3617	3326	19020		1000	809	27772	26694
1989	3565	3295	38041	3622	500	809	49832	46958
1990			38041	7243		809	46093	42583
1991			19020	7243		809	27072	24520
1992				4520		809	5329	4732
1993				1797		809	2606	2269
1994				1797		809	2606	2224
1995				1797		809	2606	2181
1996				1797		809	2606	2138
1997				1797		809	2606	2096
1998				7243		809	8052	6349
1999				7243		809	8052	6224
2000				7243		809	8052	6102
2001				26183*		809	26992	20055
TOTAL	8712	8083	114122	79525	3000	12944	226386	201196

* - Decommissioning cost

Initial Payment = 72 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 50 \$/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
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	2094			500	809	4831	4831
1987	102	139			1000	809	2050	2010
1988	3617	3365	19020		1000	809	27811	26731
1989	3565	3295	38041	3213	500	809	49423	46572
1990			38041	6425		809	45275	41827
1991			19020	6425		809	26254	23779
1992				3702		809	4511	4006
1993				979		809	1788	1557
1994				979		809	1788	1526
1995				979		809	1788	1496
1996				979		809	1788	1467
1997				979		809	1788	1438
1998				6425		809	7234	5704
1999				6425		809	7234	5592
2000				6425		809	7234	5482
2001				26345*		809	27134	20176
TOTAL	8712	8895	114122	70280	3000	12944	217951	194194

* - Decommissioning cost

Initial Payment = 72 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 44 \$/KgU (Includes \$7/KgU impact aid)

TABLE A10-70
COST SENSITIVITY CASE -- NO NRC LICENSING OR SECURITY

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1986)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1986	1428	1400			500	809	4137	4137
1987	102	62			1000	809	1973	1934
1988	3617	3326	19020		1000	809	27772	26694
1989	3565	3295	38041	3211	500	809	49421	46571
1990			38041	6422		809	45272	41824
1991			19020	6422		809	26251	23776
1992				3699		809	4508	4003
1993				975		809	1784	1533
1994				975		809	1784	1523
1995				975		809	1784	1493
1996				975		809	1784	1464
1997				975		809	1784	1435
1998				6422		809	7231	5702
1999				6422		809	7231	5590
2000				6422		809	7231	5480
2001				26183*		809	26952	20055
TOTAL	8712	8083	114122	70078	3000	12944	216929	193234

* - Decommissioning cost

Initial Payment = 72 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 44 \$/KgU (Includes \$7/KgU impact aid)

EXHIBIT B

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

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

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

1.0 CASKS USED IN STUDY

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

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

2.0 ESTIMATED COSTS OF CASK USE AND SERVICE

Estimates of the cask use charge for the NLI 1/2 cask were based on an estimated 1986 rate schedule developed by NAC for this cask, as follows:

<u>No. Days of Use</u>	<u>Charge</u>
1 - 10 days	\$41,000(minimum charge)
11 - 30 days	2,000/day
31 - 90 days	1,500/day
91 - 180 days	1,100/day
181 - 365 days	1,000/day

Utilizing this rate schedule and assuming that a cask would be used 300 days/year, a cask use charge of \$1,300/day results.

General Electric provided a current quotation for the use of the IF-300 rail cask which amounted to \$3,500/day. GE currently expects no increase in daily use and service charges for 1986.

3.0 FREIGHT COSTS

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

3.1 TRUCK TARIFFS

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

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

The reference tariff is ICC TRSM 4007-A, dated October 15, 1984. Although originally issued in 1984, all items in this tariff which are applicable to this study represent current 1985 prices. Tri-State Motor Transit Co. (TSMT) recommends, however, increasing the existing rates by 6% to reflect proposed increases in 1986. Therefore, all rates used in this study which were taken from this tariff have been increased from their present value by 6% in order to provide a reasonable estimation of 1986 rates. The Mileage Commodity Rates are described in Item No. 2000 of the tariff. The rates are based on a cents per 100 pound basis and use a weight of 48,000 lbs for the empty cask and 49,000 lbs. for the loaded truck cask. Table B3-1 sets forth the Mileage Commodity Rates for the distances pertinent to this study.

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

TABLE B3-1
RATES FOR TRANSPORT OF NLI 1/2 TRUCK CASK^a
(1986 Dollars)

<u>Reactor to Destination</u>	<u>Rates in Dollars per 100 Pounds</u>	
	<u>Loaded</u>	<u>Empty</u>
<u>From Surry to</u>		
Eastern U.S. Site	\$ 3.79	\$ 2.43
Western U.S. Site	12.57	9.53
<u>From Palisades to</u>		
Eastern U.S. Site	4.23	2.86
Western U.S. Site	10.18	7.77
<u>From St. Lucie to</u>		
Eastern U.S. Site	4.90	3.56
Western U.S. Site	15.49	11.89
<u>From Robinson to</u>		
Eastern U.S. Site	3.12	1.83
Western U.S. Site	15.49	11.89
<u>From Fitzpatrick to</u>		
Eastern U.S. Site	5.62	4.25
Western U.S. Site	13.33	10.10
<u>From Brunswick to</u>		
Eastern U.S. Site	3.96	2.62
Western U.S. Site	15.24	11.69
<u>From LaSalle to</u>		
Eastern U.S. Site	3.87	2.52
Western U.S. Site	8.80	6.67
<u>From Oconee to</u>		
Eastern U.S. Site	2.46	1.42
Western U.S. Site	13.13	10.10
<u>From Turkey Point to</u>		
Eastern U.S. Site	5.44	4.16
Western U.S. Site	16.30	12.59
<u>From Monticello to</u>		
Eastern U.S. Site	6.02	4.59
Western U.S. Site	7.24	5.45
<u>From Peach Bottom to</u>		
Eastern U.S. Site	4.90	3.56
Western U.S. Site	13.61	10.35
<u>From Pilgrim to</u>		
Eastern U.S. Site	5.62	4.25
Western U.S. Site	14.96	11.45

TABLE 83-1 (Continued)
RATES FOR TRANSPORT OF NLI 1/2 TRUCK CASK^a
 (1986 Dollars)

<u>Reactor to Destination</u>	<u>Rates in Dollars per 100 Pounds</u>	
	<u>Loaded</u>	<u>Empty</u>
<u>From Ginna to</u>		
Eastern U.S. Site	\$ 5.16	\$ 3.77
Western U.S. Site	12.57	9.67
<u>From Indian Point to</u>		
Eastern U.S. Site	6.39	4.89
Western U.S. Site	14.43	11.01
<u>From Millstone to</u>		
Eastern U.S. Site	5.33	4.01
Western U.S. Site	14.70	11.20
<u>From Prairie Island to</u>		
Eastern U.S. Site	5.89	4.36
Western U.S. Site	8.71	6.58
<u>From La Crosse to</u>		
Eastern U.S. Site	5.16	3.77
Western U.S. Site	8.14	6.14
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	4.05	2.73
Western U.S. Site	13.61	10.57
<u>From Oyster Creek to</u>		
Eastern U.S. Site	4.59	3.31
Western U.S. Site	14.16	10.78
<u>From Cooper to</u>		
Eastern U.S. Site	5.44	4.16
Western U.S. Site	6.69	5.13
<u>From Sequoyah to</u>		
Eastern U.S. Site	1.76	1.12
Western U.S. Site	12.04	9.34
<u>From Davis Besse to</u>		
Eastern U.S. Site	4.34	3.00
Western U.S. Site	10.67	8.14

^aRates based upon Tariff ICC 4007-A, Item 2000, dated October 15, 1984 and escalated by 6% to approximate mid-1986 charges.

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

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

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

3.1.1 Escort Charges for NLI 1/2 Truck Cask

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

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

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

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

- (1) Each major locality through which the shipment passes will require an escort.
- (2) Escorts in each of these localities will be provided by off-duty, local police at a charge of \$21.40/hr per person, including provision of a vehicle.
- (3) A minimum of 4 hours will be required for transit from 5 miles outside the locality, through locality, to 5 miles on the other side of the locality.
- (4) The time to make the necessary escort arrangements in each locality will amount to 1 person-hour. The cost of this time is estimated to amount to \$26.50.
- (5) The cost of communicating with each locality involved in a shipment (i.e., telephone, mail, telex) was estimated at \$27.

Taking into consideration the above assumptions and estimated costs, it was estimated that there would be a total cost of \$160 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 2% to obtain the 1986 values set forth in Table B3-2.

TABLE B3-2
RAIL FREIGHT RATES
(1986 Dollars)

<u>Reactor to Destination</u>	<u>Rates in Dollars per 100 Pounds</u>	
	<u>Class 40 Loaded</u>	<u>Class 37½ Empty</u>
<u>From Surry to</u>		
Eastern U.S. Site	\$ 6.39	\$ 5.99
Western U.S. Site	17.60	16.49
<u>From Palisades to</u>		
Eastern U.S. Site	6.63	6.22
Western U.S. Site	13.84	12.97
<u>From St. Lucie to</u>		
Eastern U.S. Site	7.79	7.30
Western U.S. Site	18.15	17.01
<u>From Robinson to</u>		
Eastern U.S. Site	5.36	5.02
Western U.S. Site	17.36	16.27
<u>From Fitzpatrick to</u>		
Eastern U.S. Site	8.06	7.55
Western U.S. Site	16.71	15.67
<u>From Brunswick to</u>		
Eastern U.S. Site	6.02	5.64
Western U.S. Site	17.84	16.73
<u>From LaSalle to</u>		
Eastern U.S. Site	5.99	5.61
Western U.S. Site	13.06	12.24
<u>From Oconee to</u>		
Eastern U.S. Site	4.68	4.39
Western U.S. Site	16.32	15.30
<u>From Turkey Point to</u>		
Eastern U.S. Site	8.69	8.15
Western U.S. Site	18.15	17.01
<u>From Monticello to</u>		
Eastern U.S. Site	8.98	8.42
Western U.S. Site	12.60	11.81
<u>From Peach Bottom to</u>		
Eastern U.S. Site	6.76	6.33
Western U.S. Site	16.92	15.86
<u>From Pilgrim to</u>		
Eastern U.S. Site	8.98	8.42
Western U.S. Site	18.07	16.94

TABLE B3-2 (Continued)

RAIL FREIGHT RATES
(1986 Dollars)

<u>Reactor to Destination</u>	<u>Rates in Dollars per 100 Pounds</u>	
	<u>Class 40 Loaded</u>	<u>Class 37½ Empty</u>
<u>From Ginna to</u>		
Eastern U.S. Site	\$ 7.55	\$ 7.08
Western U.S. Site	16.07	15.06
<u>From Indian Point to</u>		
Eastern U.S. Site	8.06	7.55
Western U.S. Site	17.72	16.62
<u>From Millstone to</u>		
Eastern U.S. Site	8.57	8.04
Western U.S. Site	18.07	16.94
<u>From Prairie Island to</u>		
Eastern U.S. Site	8.83	8.28
Western U.S. Site	12.41	11.64
<u>From La Crosse to</u>		
Eastern U.S. Site	8.29	7.77
Western U.S. Site	12.60	11.81
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	6.53	6.12
Western U.S. Site	17.10	16.03
<u>From Oyster Creek to</u>		
Eastern U.S. Site	7.55	7.08
Western U.S. Site	17.60	16.49
<u>From Cooper to</u>		
Eastern U.S. Site	8.83	8.28
Western U.S. Site	10.79	10.12
<u>From Sequoyah to</u>		
Eastern U.S. Site	3.18	2.99
Western U.S. Site	15.20	14.25
<u>From Davis Besse to</u>		
Eastern U.S. Site	5.74	5.39
Western U.S. Site	14.58	13.67

3.2.1 Heavy Haul Charges

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

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

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

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

TABLE B3-3
ESTIMATED HEAVY HAUL & TRANSFER CHARGES PER ROUND TRIP SHIPMENT
OF AN IF-300 RAIL CASK
(1986 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>
Surry	35	\$3,806	\$5,592	\$193	\$ 9,591
Turkey Point	10	2,908	5,592	243	8,743
St. Lucie	10	2,908	5,592	243	8,743
Pilgrim	25	3,447	5,592	76	9,115
Oconee	10	2,908	5,592	98	8,598
Ginna	5	2,729	5,592	127	8,448
Indian Point	5	2,729	5,592	127	8,448
Millstone	5	2,729	5,592	148	8,469
Oyster Creek	25	3,447	5,592	689	9,728
Calvert Cliffs	50	4,344	5,592	769	10,705
Western U.S. FIS	27	3,520	5,592	-	9,112

^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) @ \$107.70/hr.

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

2x(4 hrs deadhead time plus 4 hrs loading/unloading time) @ \$145.72/hr, plus a crane charge @ \$1,630 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 by 6% to estimate 1986 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 Surry to</u>						
Eastern U.S. Site	565	514	31	36	67	2.8
Western U.S. Site	2,320	2,109	127	36	163	6.8
<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 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 Fitzpatrick to</u>						
Eastern U.S. Site	1,041	946	57	36	93	3.9
Western U.S. Site	2,453	2,230	134	36	170	7.1
<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
<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 Turkey Point to</u>						
Eastern U.S. Site	1,001	910	55	36	91	3.8
Western U.S. Site	3,028	2,753	165	36	201	8.4
<u>From Monticello to</u>						
Eastern U.S. Site	1,113	1,012	61	36	97	4.0
Western U.S. Site	1,342	1,220	73	36	109	4.5
<u>From Peach Bottom to</u>						
Eastern U.S. Site	862	784	47	36	83	3.5
Western U.S. Site	2,525	2,295	138	36	174	7.3
<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

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

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

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

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

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

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

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

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

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

TABLE B4-2

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

<u>Reactor to Destination</u>	<u>Round Trip Distance (Miles)</u>	<u>Round Trip Rail Transit Time (Hours)</u>	<u>Round Trip Heavy Haul Time (Hours)</u>	<u>Round Trip Heavy Haul Transfer Time (Hours)</u>	<u>Turnaround Time (Hours)</u>	<u>Total Time (Hours)</u>	<u>Total Time (Days)</u>
<u>From Surry to</u>							
Eastern U.S. Site	1,100	193.0	11.7	8	144	356.7	14.9
Western U.S. Site	4,922	674.3	20.7	16	144	855.0	35.6
<u>From Pallsades to</u>							
Eastern U.S. Site	1,168	191.5	-	0	144	335.5	14.0
Western U.S. Site	3,402	479.2	9.0	8	144	640.2	26.7
<u>From St. Lucie to</u>							
Eastern U.S. Site	1,558	239.7	3.3	8	144	395.0	16.5
Western U.S. Site	5,454	673.3	12.3	16	144	845.6	35.2
<u>From Robinson to</u>							
Eastern U.S. Site	794	193.7	-	0	144	337.7	14.1
Western U.S. Site	4,664	675.9	9.0	8	144	836.9	34.9
<u>From Fitzpatrick to</u>							
Eastern U.S. Site	1,624	238.8	-	0	144	382.8	16.0
Western U.S. Site	4,656	675.1	9.0	8	144	836.1	34.8
<u>From Brunswick to</u>							
Eastern U.S. Site	976	191.4	-	0	144	335.4	14.0
Western U.S. Site	5,054	673.9	9.0	8	144	834.9	34.8
<u>From LaSalle to</u>							
Eastern U.S. Site	1,080	240.0	-	0	144	384.0	16.0
Western U.S. Site	3,170	480.3	9.0	8	144	641.3	26.7
<u>From Oconee to</u>							
Eastern U.S. Site	594	191.6	3.3	8	144	346.9	14.5
Western U.S. Site	4,510	673.1	12.3	16	144	845.4	35.2
<u>From Turkey Point to</u>							
Eastern U.S. Site	1,862	238.7	3.3	8	144	394.0	16.4
Western U.S. Site	5,784	672.6	12.3	16	144	844.9	35.2
<u>From Monticello to</u>							
Eastern U.S. Site	1,986	336.6	-	0	144	480.6	20.0
Western U.S. Site	2,448	408.0	9.0	8	144	569.0	23.7
<u>From Peach Bottom to</u>							
Eastern U.S. Site	1,304	289.8	-	0	144	433.8	18.1
Western U.S. Site	4,660	675.4	9.0	8	144	836.4	34.8

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

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

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

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

TABLE B5-1
ESTIMATED COSTS OF TRUCK SHIPMENT OF SPENT NUCLEAR FUEL^a
(1986 Dollars)

Reactor To Destination	Cask Use & Service Charge	Freight Charge ^b		Security Charge		Vehicle Detention Charge	Escort Charge	Total Cost	Total Cost (\$/MTU) ^c
		Loaded	Empty	Loaded	Empty				
From Surry to									
Eastern U.S. Site	\$3,620	\$1,857	\$1,166	\$ 836	\$ 82	\$705	\$ 640	\$ 8,906	\$19,319
Western U.S. Site	8,804	6,159	4,574	3,434	337	705	1,600	25,613	55,560
From Pallsades to									
Eastern U.S. Site	3,977	2,073	1,373	672	100	705	800	9,700	21,041
Western U.S. Site	7,517	4,988	3,730	1,846	274	705	960	20,020	43,427
From St. Lucie to									
Eastern U.S. Site	4,497	2,401	1,709	845	125	705	1,280	11,562	25,080
Western U.S. Site	10,519	7,590	5,707	2,832	424	705	2,399	30,176	65,458
From Robinson to									
Eastern U.S. Site	3,084	1,529	878	376	56	705	640	7,268	15,766
Western U.S. Site	10,445	7,590	5,707	2,818	418	705	2,399	30,082	65,254
From Fitzpatrick to									
Eastern U.S. Site	5,025	2,754	2,040	1,020	151	705	960	12,655	34,577
Western U.S. Site	9,198	6,532	4,848	2,404	357	705	1,600	25,644	70,066
From Brunswick to									
Eastern U.S. Site	3,741	1,940	1,258	594	88	705	640	8,966	24,497
Western U.S. Site	10,287	7,468	5,611	2,766	410	705	2,240	29,487	80,566
From LaSalle to									
Eastern U.S. Site	3,702	1,896	1,210	581	86	705	800	8,980	24,536
Western U.S. Site	6,819	4,312	3,202	1,615	240	705	800	17,693	48,342
From Oconee to									
Eastern U.S. Site	2,571	1,205	682	206	31	705	800	6,200	13,449
Western U.S. Site	9,188	6,434	4,848	2,401	356	705	2,240	26,172	56,772
From Turkey Point to									
Eastern U.S. Site	4,908	2,666	1,997	981	146	705	1,440	12,843	27,859
Western U.S. Site	10,897	7,987	6,043	2,967	440	705	2,559	31,598	68,542
From Monticello to									
Eastern U.S. Site	5,239	2,950	2,203	1,091	162	705	1,280	13,630	37,240
Western U.S. Site	5,915	3,548	2,616	1,315	195	705	1,120	15,414	42,115
From Peach Bottom to									
Eastern U.S. Site	4,497	2,401	1,709	845	125	705	640	10,922	29,842
Western U.S. Site	9,410	6,669	4,968	2,475	367	705	1,600	26,194	71,568
From Pilgrim to									
Eastern U.S. Site	4,993	2,754	2,040	1,009	150	705	800	12,451	34,019
Western U.S. Site	10,143	7,330	5,496	2,718	403	705	1,760	28,555	78,019

TABLE 85-1 (Continued)
ESTIMATED COSTS OF TRUCK SHIPMENT OF SPENT NUCLEAR FUEL^a
(1986 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				
<u>From Ginna to</u>									
Eastern U.S. Site	\$4,709	\$2,528	\$1,810	\$ 915	\$136	\$705	\$ 800	\$11,603	\$25,169
Western U.S. Site	8,882	6,159	4,642	2,299	341	705	1,440	24,468	53,076
<u>From Indian Point to</u>									
Eastern U.S. Site	5,493	3,131	2,347	1,175	174	705	960	13,985	30,336
Western U.S. Site	9,818	7,071	5,285	2,610	387	705	1,760	27,636	59,948
<u>From Millstone to</u>									
Eastern U.S. Site	4,843	2,612	1,925	959	142	705	800	11,986	26,000
Western U.S. Site	10,049	7,203	5,405	2,686	399	705	1,600	28,047	60,839
<u>From Prairie Island to</u>									
Eastern U.S. Site	5,194	2,886	2,093	1,076	160	705	1,280	13,394	29,054
Western U.S. Site	6,707	4,268	3,158	1,578	234	705	1,280	17,930	38,894
<u>From La Crosse to</u>									
Eastern U.S. Site	4,686	2,528	1,810	907	135	705	1,120	11,891	32,489
Western U.S. Site	6,402	3,989	2,947	1,477	219	705	800	16,539	45,189
<u>From Calvert Cliffs to</u>									
Eastern U.S. Site	3,844	1,985	1,310	949	93	705	640	9,526	20,664
Western U.S. Site	9,641	6,669	5,074	2,491	370	705	1,440	26,210	56,855
<u>From Oyster Creek to</u>									
Eastern U.S. Site	4,284	2,249	1,589	1,169	115	705	960	11,071	30,249
Western U.S. Site	9,747	6,938	5,174	2,586	384	705	1,760	27,294	74,574
<u>From Cooper to</u>									
Eastern U.S. Site	4,934	2,666	1,997	990	147	705	1,120	12,559	34,314
Western U.S. Site	5,623	3,278	2,462	1,218	181	705	960	14,427	39,418
<u>From Sequoyah to</u>									
Eastern U.S. Site	2,272	862	538	107	16	705	0	4,500	9,761
Western U.S. Site	8,568	5,900	4,483	2,195	326	705	1,760	23,937	51,924
<u>From Davis Besse to</u>									
Eastern U.S. Site	4,021	2,127	1,440	687	102	705	640	9,722	21,089
Western U.S. Site	7,800	5,228	3,907	1,940	288	705	1,120	20,988	45,527

^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 number of assemblies shipped.

TABLE 85-2
ESTIMATED COSTS OF RAIL SHIPMENT OF SPENT NUCLEAR FUEL^a
(1986 Dollars)

<u>Reactor to Destination</u>	<u>Cask Use & Service Charge</u>	<u>Heavy Haul Charge</u>	<u>Rail Freight Charge</u>	<u>Escort Charge</u>	<u>Total Cost</u>	<u>Unit Cost (\$/MTU)^c</u>
<u>From Surry to</u>						
Eastern U.S. Site	\$ 52,011	\$ 9,592	\$19,704	\$4,199	\$ 85,506	\$26,497
Western U.S. Site	124,675	18,703	54,259	12,764	210,401	65,200
<u>From Palisades to</u>						
Eastern U.S. Site	48,923	-	20,452	4,040	73,415	22,750
Western U.S. Site	93,356	9,112	42,671	9,138	154,277	47,808
<u>From St. Lucie to</u>						
Eastern U.S. Site	57,608	8,744	24,018	4,949	95,319	29,538
Western U.S. Site	123,326	17,855	55,961	12,865	210,007	65,078
<u>From Robinson to</u>						
Eastern U.S. Site	49,242	-	16,521	3,907	69,670	21,590
Western U.S. Site	122,054	9,112	53,526	12,508	197,200	61,109
<u>From Fitzpatrick to</u>						
Eastern U.S. Site	55,828	-	24,845	4,918	85,591	25,984
Western U.S. Site	121,927	9,112	51,536	12,493	195,068	59,219
<u>From Brunswick to</u>						
Eastern U.S. Site	48,908	-	18,558	3,955	71,421	21,682
Western U.S. Site	121,751	9,112	55,022	12,649	198,534	60,271
<u>From LaSalle to</u>						
Eastern U.S. Site	56,000	-	18,463	4,696	79,159	24,031
Western U.S. Site	93,523	9,112	40,268	9,052	151,955	46,131
<u>From Oconee to</u>						
Eastern U.S. Site	50,596	8,599	14,436	3,838	77,469	24,007
Western U.S. Site	123,297	17,710	50,327	12,448	203,782	63,149
<u>From Turkey Point to</u>						
Eastern U.S. Site	57,466	8,744	26,803	5,069	98,082	30,394
Western U.S. Site	123,213	17,855	55,961	12,999	210,028	65,085
<u>From Monticello to</u>						
Eastern U.S. Site	70,089	-	27,694	6,476	104,259	31,651
Western U.S. Site	82,979	9,112	38,851	7,701	138,643	42,090
<u>From Peach Bottom to</u>						
Eastern U.S. Site	63,259	-	20,835	5,507	89,601	27,201
Western U.S. Site	121,970	9,112	52,173	12,498	195,753	59,427
<u>From Pilgrim to</u>						
Eastern U.S. Site	72,248	9,116	27,694	6,599	115,657	35,111
Western U.S. Site	134,403	18,227	55,722	13,845	222,197	67,455

TABLE B5-2 (Continued)
ESTIMATED COSTS OF RAIL SHIPMENT OF SPENT NUCLEAR FUEL^a
(1986 Dollars)

Reactor to Destination	Cask Use & Service Charge	Heavy Haul Charge	Rail Freight ^b Charge	Escort Charge	Total Cost	Unit Cost (\$/MTU) ^c
<u>From Ginna to</u>						
Eastern U.S. Site	\$ 64,597	\$ 8,449	\$23,285	\$5,662	\$101,993	\$31,606
Western U.S. Site	122,143	17,560	49,547	12,141	201,391	62,408
<u>From Indian Point to</u>						
Eastern U.S. Site	64,164	8,449	24,845	5,625	103,083	31,944
Western U.S. Site	122,977	17,560	54,656	12,592	207,785	64,390
<u>From Millstone to</u>						
Eastern U.S. Site	64,354	8,470	26,436	5,723	104,983	32,533
Western U.S. Site	123,326	17,581	55,722	12,723	209,352	64,875
<u>From Prairie Island to</u>						
Eastern U.S. Site	56,120	-	27,232	5,005	88,357	27,381
Western U.S. Site	83,271	9,112	38,278	7,807	138,468	42,909
<u>From La Crosse to</u>						
Eastern U.S. Site	56,000	-	25,561	4,917	86,479	26,253
Western U.S. Site	82,770	9,112	38,851	7,801	138,534	42,056
<u>From Calvert Cliffs to</u>						
Eastern U.S. Site	52,528	10,706	20,134	4,263	87,631	27,156
Western U.S. Site	124,723	19,817	52,730	12,695	209,965	65,065
<u>From Oyster Creek to</u>						
Eastern U.S. Site	58,191	9,729	23,285	4,962	96,167	29,195
Western U.S. Site	123,490	18,840	54,259	12,662	209,251	63,525
<u>From Cooper to</u>						
Eastern U.S. Site	56,000	-	27,232	5,012	88,244	26,789
Western U.S. Site	83,167	9,112	33,280	7,651	133,210	40,440
<u>From Sequoyah to</u>						
Eastern U.S. Site	38,063	-	9,820	2,565	50,448	15,633
Western U.S. Site	120,877	9,112	46,873	12,134	188,996	58,567
<u>From Davis Besse to</u>						
Eastern U.S. Site	48,769	-	17,714	3,914	70,397	21,815
Western U.S. Site	93,188	9,112	44,963	9,306	156,569	48,518

^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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