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1986 Federal Interim Storage Fee Study: A Technical and Economic Analysis

September 1986

**Prepared by E.R. Johnson Associates, Inc.
for Pacific Northwest Laboratory
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1986 FEDERAL INTERIM STORAGE FEE STUDY:
A TECHNICAL AND ECONOMIC ANALYSIS

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TABLE OF CONTENTS

	<u>Page</u>
1.0 INTRODUCTION	1-1
2.0 SUMMARY AND CONCLUSIONS	2-1
3.0 BASES FOR THE STUDY	3-1
3.1 Storage Methods Considered	3-1
3.2 Quantities of Spent Fuel to be Stored	3-1
3.3 Location and Existing Capabilities of FIS Site	3-3
3.4 Schedule of Construction and Operation	3-4
3.5 Development of the Fee for FIS	3-4
3.6 Consolidated Spent Fuel	3-5
4.0 COSTS FOR FIS OF SPENT FUEL	4-1
4.1 Review of and Revisions in FIS Facility Designs	4-1
4.2 Review of and Revisions in 1985 FIS Cost Estimates	4-1
5.0 COSTS FOR SPENT FUEL TRANSPORT	5-1
6.0 FEE METHODOLOGY AND FEE COMPUTATION	6-1
6.1 Method of Fee Collection	6-1
6.2 Method of Computation of Fee	6-2
6.3 Sensitivity of Fees to Changes in Conditions	6-7
6.4 Establishment of Fees for FIS Services	6-8
7.0 SPENT FUEL ACCEPTANCE CRITERIA FOR FIS	7-1
EXHIBIT A - DESIGN DESCRIPTION AND ESTIMATED COSTS FOR THE DRY STORAGE OF SPENT NUCLEAR FUEL IN FEDERAL INTERIM STORAGE FACILITIES	
EXHIBIT B - ESTIMATED COSTS FOR TRANSPORT OF SPENT FUEL FROM VARIOUS REACTOR SITES TO FEDERAL INTERIM STORAGE FACILITIES	
EXHIBIT C - FIS SPENT FUEL ACCEPTANCE CRITERIA	

1986 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 1986, 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, 1986. The results of this update were reported in a document entitled, 1985 Federal Interim Storage Fee Study: A Technical and Economic Analysis, PNL-5559, dated September 1985.

In preparation for the possibility of a revision to the payment charges for FIS services for 1987, 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-5559.
- o Update spending schedules for each of the FIS facilities cases reported on in PNL-5559.
- 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-5559 to provide a basis for the Department to establish payment charges for FIS services in the Federal Register for the year commencing January 1, 1987. 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}
 (1987 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	\$1,169	\$1,097	\$ 628	\$ 833	\$ 760
100	632	646	614	402	478	446
300	313	285	279	236	230	223
800	211	173	176	182	151	154
1500	184	139	144	167	126	130
1900	177	131	135	164	121	124

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

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

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

TABLE 2-2
ESTIMATED INITIAL PAYMENT FOR FIS SERVICES
AT THE INDICATED INITIAL FIS CAPACITY LEVELS FOR EACH OF THE
ALTERNATIVE MODES OF STORAGE^{a,b}
(1987 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	\$ 598	\$ 648	\$ 599	\$ 275	\$ 421	\$ 372
100	357	358	337	196	244	224
300	191	161	161	137	124	123
800	137	100	105	117	85	91
1500	123	81	89	112	73	81
1900	120	77	84	111	71	78

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

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

TABLE 2-3
ESTIMATED FINAL PAYMENT FOR FIS SERVICES
AT THE INDICATED INITIAL FIS CAPACITY LEVELS FOR EACH OF THE
ALTERNATIVE MODES OF STORAGE^{a,b}
(1987 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	\$ 491	\$ 521	\$ 498	\$ 353	\$ 412	\$ 388
100	275	288	277	206	234	222
300	122	124	118	99	106	100
800	74	73	71	65	66	63
1500	61	58	55	55	53	49
1900	57	54	51	53	50	46

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

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

The magnitude of the total unit charges set forth in Table 2-1 was about the same as that set forth in the 1985 report; in some instances the unit charges were slightly higher and in other instances they were slightly lower. This was due to the fact that escalation of costs was offset by the shorter period of time over which the FIS program would be in effect until its completion in 2001 and the cost savings associated therewith (the storage program in this report spanned the period from 1987 through 2001, while that in the 1985 report spanned the period from 1986 through 2001).

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 \$38/kgU for a FIS facility located in the Eastern U.S., and averaged from \$40/kgU to \$83/kgU for a FIS facility located in the Western U.S., depending on the mode of shipment involved. These estimates are subject to change because of uncertainties in shipping cask design, licensing and fabrication costs, and the possible impact of carrier deregulation.

In view of the limited amount of spent fuel that is expected to be received for FIS compared to the total amount of spent fuel stored at reactor locations, and the requirements of the Act that the Department recover the costs associated with the FIS program, it is recommended that the Department (i) establish fees for FIS and the method of collection thereof in the manner described in Section 6.0 of this report, (ii) accept only non-defective spent fuel assemblies and canistered consolidated fuel rods meeting specific acceptance criteria, (iii) require specific measurements and calculations to be made on the fuel and loaded casks delivered to the Department to support certifications with respect to the condition thereof, and (iv) obtain reimbursement for additional costs incurred as a result of its receiving defective fuel or shipping casks that are not delivered in full accordance with specific certifications required by the Department, in addition to the published charges for FIS services.

3.0 BASES FOR THE STUDY

The overall bases for DOE/S-0023, PNL-5231, and PNL-5559 (which are subsequently referred to herein as the 1983 report, the 1984 report, and the 1985 report, respectively) were reviewed and evaluated with respect to applicability for establishing charges for FIS services for the calendar year 1987. The following sections summarize the bases used for establishing the 1987 charges.

3.1 STORAGE METHODS CONSIDERED

For the purposes of this study, JAI used the same basic assumptions with respect to the methods of storage to be considered for FIS purposes that were used in the 1983, 1984 and 1985 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 1987.

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 203 MTU in 1988 increasing to as much as 813 MTU in 1991, as described in the following Table 3-1.^{3,4/}

^{3/}Spent Fuel Storage Requirements An Update of DOE/RL-85-2, DOE/RL-86-5, September 1986.

^{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	Metric Tons Initial Heavy Metal								
	1986	1987	1988	1989	1990	1991	1992	1993	1994
Surry 1 & 2	27	27	71	121	145	170	218	242	266
Palisades	0	7	7	34	60	60	87	87	113
Oconee 1 & 2	0	44	72	100	155	183	238	266	322
St. Lucie 1	0	2	30	30	57	86	86	115	144
Millstone 1	0	23	23	59	59	95	95	130	166
Robinson 2	0	0	0	0	17	38	38	63	84
Brunswick 1	0	0	0	0	29	29	64	64	98
La Salle CTY 1 & 2	0	0	0	0	26	66	146	186	226
Peach Bottom 2	0	0	0	0	20	61	61	102	142
Brunswick 2	0	0	0	0	0	7	7	41	76
Peach Bottom 3	0	0	0	0	0	18	56	56	94
Calvert Cliffs 1 & 2	0	0	0	0	0	0	11	45	80
Pilgrim 1	0	0	0	0	0	0	28	28	63
La Crosse	0	0	0	0	0	0	1	4	7
Oconee 3	0	0	0	0	0	0	19	19	46
Prairie Island 1 & 2	0	0	0	0	0	0	0	6	35
Byron 1 & 2	0	0	0	0	0	0	0	0	6
Indian Point 2	0	0	0	0	0	0	0	0	8
B Valley 1	0	0	0	0	0	0	0	0	23
Oyster Creek 1	0	0	0	0	0	0	0	0	27
Cooper STN	0	0	0	0	0	0	0	0	7
Millstone 2	0	0	0	0	0	0	0	0	18
Fort Calhoun	0	0	0	0	0	0	0	0	1
Davis-Besse 1	0	0	0	0	0	0	0	0	4
TOTAL	<u>27</u>	<u>103</u>	<u>203</u>	<u>343</u>	<u>570</u>	<u>813</u>	<u>1156</u>	<u>1456</u>	<u>2057</u>

^aDifferences 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, 1984 and 1985 studies, this study continued to consider the use of two generic types of government sites -- one assumed to have existing facilities for transferring spent fuel from shipping casks to storage modules, and a second without such facilities. It was assumed that NRC licensing would apply to all FIS activities except the modification and operation of an existing transfer facility. JAI also estimated the costs involved in shipping spent fuel to sites in both the Eastern and the Western U.S. A site for FIS of spent fuel probably will not be specified until there are clear indications that FIS services will be required.

JAI reviewed the prospect of locating FIS facilities at reactors, as permitted by Sec. 135(a)(1)(B) and (C) of the Act, but concluded that the Department probably could not develop storage capability at such locations sooner than utility companies acting on their own. For these and the other reasons set forth in the 1983, 1984 and 1985 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 1987 and be completed so that storage operations could commence in mid-1990.
- (2) The FIS facility would receive spent fuel during the three-year period between mid-1990 and mid-1993. 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 1985 report (and a three-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 1985 report, as follows:

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

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

3.6 CONSOLIDATED SPENT FUEL

For this study JAI continued to assume that canistered consolidated spent fuel rods would be acceptable for storage at the FIS facilities, but that consolidation would not be a criterion for acceptance, nor would the disassembly and consolidation of spent fuel be included in the capabilities of the FIS facilities. It would be expected that the Department would collect the same fee for storage of canistered consolidated spent fuel rods as for intact fuel assemblies until the cost effects of storing consolidated fuel become known. However, the cost of transporting consolidated spent fuel rods from the reactors to FIS facilities is expected to be about 0.6 of that involved in transporting intact fuel assemblies and, therefore, would result in a significant reduction in costs for utilities sending consolidated spent fuel to FIS.

4.0 COSTS FOR FIS OF SPENT FUEL

4.1 REVIEW OF AND REVISIONS IN FIS FACILITY DESIGNS

In the development of the 1984 report, there were several design changes made to FIS facilities. During the course of this study a review was made of the resultant facility designs used in the 1984 report and it was concluded that no further design changes were either necessary or desirable for the development of FIS payment charges for 1987.

4.2 REVIEW OF AND REVISIONS IN 1985 FIS COST ESTIMATES

The estimates of the capital costs for transfer facilities and storage areas used in the development of the 1983 report, portions of which were modified in the 1984 report, were escalated to 1987 dollars using applicable cost indexes.

The estimates of the cost of concrete silos and drywells, and the estimates of government administration costs which were used in the development of the this report, were the same as those used for the 1983 report, escalated to 1987 dollars using applicable cost indexes. The estimate of the cost of canisters used in the development of this report were the same as those used for the 1984 report, escalated to 1987 dollars using applicable cost indexes. The estimates of cost of metal storage casks was derived from 1986 cost information obtained from cask design firms. For the purposes of this report, these 1986 costs were escalated to 1987 dollars.

The estimates of operating costs used in the development of the this report were were the same as those developed in the 1983 report, escalated to 1987 dollars.

The estimates of FIS development costs set forth in the 1983 report were reviewed and it was concluded that the same estimates would be applicable for use herein, escalated to 1987 dollars.

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

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

for transfer/encapsulation, (ii) the cost of the storage area, and (iii) the cost of the storage modules.

TABLE 4-1
SUMMARY OF ESTIMATED CAPITAL COSTS FOR FIS FACILITIES
HAVING DIFFERENT TOTAL STORAGE CAPACITIES^a
(\$-millions, 1987)

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	\$ 27.0	\$ 29.5	\$ 27.0	\$ 10.3	\$17.8	\$ 15.3
100	32.8	32.6	30.5	16.0	20.9	18.8
300	54.7	44.9	44.8	38.0	33.2	33.1
800	108.9	75.5	80.3	92.1	63.8	68.5
1500	186.0	118.1	130.0	169.3	106.4	118.2
1900	229.8	142.5	158.4	213.0	130.8	146.6

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

From the capital cost data shown in Table 4-1, it can be seen that for the lower capacities (less than 100 MTU) the capital cost of storage cask facilities is the lowest while the drywell facilities are the highest. However, at the higher capacities (more than 300 MTU) the capital cost of drywell facilities is the lowest while the storage cask facilities are the highest. This is due to the following:

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

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

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

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

TABLE 4-2
SUMMARY OF ESTIMATED TOTAL OPERATING COSTS FOR FIS FACILITIES
HAVING DIFFERENT TOTAL STORAGE CAPACITIES^a
(\$-millions, 1987)

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	\$ 25.0	\$ 26.6	\$ 25.4	\$ 17.2	\$20.4	\$ 19.1
100	26.7	28.1	26.9	18.9	21.9	20.6
300	33.4	34.0	32.1	25.6	27.8	25.9
800	51.1	49.5	48.6	42.9	43.1	41.2
1500	77.3	73.6	68.6	68.0	65.7	60.5
1900	92.2	87.4	80.0	82.2	78.6	71.6

^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 (100 MTU and less), while those associated with the silos are the lowest for the higher capacity facilities (800 MTU and more). 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, 1987)

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	\$ 6.2	\$ 6.2	\$ 6.2	\$ 6.2	\$ 6.2	\$ 6.2
100	8.3	8.3	8.3	8.3	8.3	8.3
300	13.1	13.1	13.1	13.1	13.1	13.1
800	23.5	23.5	23.5	23.5	23.5	23.5
1500	37.2	34.2	35.7	37.2	32.7	32.7
1900	44.8	39.1	41.0	44.8	39.1	39.1

^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 1987 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, 1987)

Capacity Of FIS Facility (MTU)	Total Discounted Costs (Discounted @ 2%/yr to 1987)					
	At Site Without Existing Transfer Facilities			At Site With Existing Transfer Facilities		
	Storage Cask	Orywell	Silo	Storage Cask	Orywell	Silo
50	\$ 51.6	\$ 55.5	\$ 52.0	\$ 29.2	\$39.2	\$ 35.6
100	59.5	60.7	57.6	37.1	44.4	41.2
300	86.3	78.3	76.5	63.9	62.0	60.1
800	152.5	121.4	124.9	129.7	105.1	107.6
1500	246.8	183.1	189.3	223.1	165.4	171.5
1900	300.1	218.1	225.9	275.8	199.6	207.7

^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.

^bDoes not include impact aid.

From the total discounted costs shown in Table 4-4, it can be seen that for the lower capacities (50-100 MTU and less) the cost of storage in storage casks is less than the other two cases, with the cost of storage in drywells being the highest. However, for the higher capacities (800 MTU and more), the cost of storage in drywells is less than the other two cases, with the cost of storage in storage casks being the highest. The cost of storage for all modes of storage are close to each other in the 100-300 MTU capacity range. 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 fuel from most 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
(1987 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	\$ 8,974	\$ 88,926
Western U.S. Site	25,035	218,676
<u>From Palisades to</u>		
Eastern U.S. Site	9,905	76,316
Western U.S. Site	20,455	160,273
<u>From St. Lucie to</u>		
Eastern U.S. Site	11,835	99,075
Western U.S. Site	30,943	218,172
<u>From Robinson to</u>		
Eastern U.S. Site	7,416	72,557
Western U.S. Site	30,850	204,950
<u>From Fitzpatrick to</u>		
Eastern U.S. Site	12,926	88,907
Western U.S. Site	26,258	202,795
<u>From Brunswick to</u>		
Eastern U.S. Site	9,144	74,288
Western U.S. Site	30,231	206,267
<u>From LaSalle to</u>		
Eastern U.S. Site	9,169	82,451
Western U.S. Site	18,062	157,929
<u>From Oconee to</u>		
Eastern U.S. Site	6,338	80,748
Western U.S. Site	26,842	211,919
<u>From Turkey Point to</u>		
Eastern U.S. Site	13,148	101,846
Western U.S. Site	32,415	281,187
<u>From Monticello to</u>		
Eastern U.S. Site	13,946	108,429
Western U.S. Site	15,757	143,983
<u>From Peach Bottom to</u>		
Eastern U.S. Site	11,135	93,360
Western U.S. Site	26,811	203,497
<u>From Pilgrim to</u>		
Eastern U.S. Site	12,706	120,304
Western U.S. Site	29,238	231,052

TABLE 5-1 (Continued)
SUMMARY OF ESTIMATED COSTS FOR A SINGLE CASK SHIPMENT OF SPENT
FUEL FROM SPECIFIC REACTOR LOCATIONS TO FIS FACILITIES
 (1987 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	\$11,843	\$106,157
Western U.S. Site	25,038	209,436
<u>From Indian Point to</u>		
Eastern U.S. Site	14,284	107,221
Western U.S. Site	28,302	215,899
<u>From Millstone to</u>		
Eastern U.S. Site	12,234	109,133
Western U.S. Site	28,710	217,521
<u>From Prairie Island to</u>		
Eastern U.S. Site	13,749	91,722
Western U.S. Site	18,347	143,825
<u>From LaCrosse to</u>		
Eastern U.S. Site	12,161	89,820
Western U.S. Site	16,885	143,863
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	9,387	91,146
Western U.S. Site	26,821	218,153
<u>From Oyster Creek to</u>		
Eastern Site	11,262	101,378
Western U.S. Site	29,140	217,466
<u>From Cooper to</u>		
Eastern U.S. Site	13,289	91,602
Western U.S. Site	15,298	138,545
<u>From Sequoyah to</u>		
Eastern U.S. Site	4,548	52,647
Western U.S. Site	24,453	196,641
<u>From Davis Besse to</u>		
Eastern U.S. Site	9,911	73,272
Western U.S. Site	21,465	162,540

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

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

6.0 FEE METHODOLOGY AND FEE COMPUTATION

6.1 METHOD OF FEE COLLECTION

JAI has reviewed the proposed method of fee collection set forth in the 1983, 1984 and 1985 reports and the alternative methods that were considered therein, and has concluded that the combined interests of the Department and the FIS users would still be best served by a two-part fee involving an Initial Payment upon execution of a contract for FIS services, followed by a Final Payment upon delivery of the spent fuel to the Department.

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

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

The Final Payment would cover the sum of the following:

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

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

The Initial Payment received from all users would be calculated to provide the funds necessary to design, license (where applicable) and construct the FIS facilities, purchase storage modules, and repay any funds borrowed from the U.S. Treasury that may have been needed earlier. The Final Payments received would also include an adjustment for differences between the actual preoperational costs and those used to calculate the Initial Payment, and the estimated future costs of facility operation and decommissioning.

6.2 METHOD OF COMPUTATION OF FEE

The same method for computation of the fees for FIS services as was described in the 1983, 1984 and 1985 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 1987 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}
(1987 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	\$ 598	\$ 648	\$ 599	\$ 275	\$ 421	\$ 372
100	357	358	337	196	244	224
300	191	161	161	137	124	123
800	137	100	105	117	85	91
1500	123	81	89	112	73	81
1900	120	77	84	111	71	78

^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}
(1987 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	\$ 491	\$ 521	\$ 498	\$ 353	\$ 412	\$ 388
100	275	288	277	206	234	222
300	122	124	118	99	106	100
800	74	73	71	65	66	63
1500	61	58	55	55	53	49
1900	57	54	51	53	50	46

^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}
(1987 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	\$1,169	\$1,097	\$ 628	\$ 833	\$ 760
100	632	646	614	402	478	446
300	313	285	279	236	230	223
800	211	173	176	182	151	154
1500	184	139	144	167	126	130
1900	177	131	135	164	121	124

^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
(1987 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	\$19.08	\$27.56
Western U.S. Site	54.31	67.76
<u>From Palisades to</u>		
Eastern U.S. Site	21.48	23.65
Western U.S. Site	44.37	49.67
<u>From St. Lucie to</u>		
Eastern U.S. Site	25.67	30.70
Western U.S. Site	67.12	67.61
<u>From Robinson to</u>		
Eastern U.S. Site	16.09	22.48
Western U.S. Site	66.92	63.51
<u>From Fitzpatrick to</u>		
Eastern U.S. Site	35.32	26.99
Western U.S. Site	71.74	61.56
<u>From Brunswick to</u>		
Eastern U.S. Site	24.98	22.55
Western U.S. Site	82.60	62.62
<u>From LaSalle to</u>		
Eastern U.S. Site	25.05	25.03
Western U.S. Site	49.35	47.94
<u>From Oconee to</u>		
Eastern U.S. Site	13.75	25.02
Western U.S. Site	58.23	65.67
<u>From Turkey Point to</u>		
Eastern U.S. Site	28.52	31.56
Western U.S. Site	70.32	67.61
<u>From Monticello to</u>		
Eastern U.S. Site	38.10	32.92
Western U.S. Site	43.05	43.71
<u>From Peach Bottom to</u>		
Eastern U.S. Site	30.42	28.34
Western U.S. Site	73.25	61.78
<u>From Pilgrim to</u>		
Eastern U.S. Site	34.72	36.52
Western U.S. Site	79.88	70.14
<u>From Ginna to</u>		
Eastern U.S. Site	25.69	32.90
Western U.S. Site	54.31	64.90

TABLE 6-4 (Continued)
SUMMARY OF ESTIMATED UNIT COSTS FOR TRANSPORTING SPENT FUEL FROM
SPECIFIC REACTOR LOCATIONS TO FIS FACILITIES^a
 (1987 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	\$30.98	\$33.23
Western U.S. Site	61.39	66.90
<u>From Millstone to</u>		
Eastern U.S. Site	26.54	33.82
Western U.S. Site	62.28	67.41
<u>From Prairie Island to</u>		
Eastern U.S. Site	29.82	28.42
Western U.S. Site	39.80	44.57
<u>From La Crosse to</u>		
Eastern U.S. Site	33.23	27.27
Western U.S. Site	46.14	43.67
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	20.36	28.24
Western U.S. Site	58.18	67.60
<u>From Oyster Creek to</u>		
Eastern U.S. Site	30.77	30.78
Western U.S. Site	79.62	66.02
<u>From Cooper to</u>		
Eastern U.S. Site	36.31	27.81
Western U.S. Site	41.80	42.06
<u>From Sequoyah to</u>		
Eastern U.S. Site	9.87	16.31
Western U.S. Site	53.04	60.94
<u>From Davis Besse to</u>		
Eastern U.S. Site	21.50	22.71
Western U.S. Site	46.56	50.37

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

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

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

6.3 SENSITIVITY OF FEES TO CHANGES IN CONDITIONS

The sensitivity of the total fees^{6/} for FIS to changing conditions of cost, schedule, mix of spent fuel types, and discount rate, and to whether or not the facility was subject to NRC licensing, was determined for the drywell cases at storage capacity levels of 100 MTU and 1900 MTU (see Section 10.0 of Exhibit A). The results of these fee sensitivity studies are summarized below:

- (1) A change of \$1-million in the capital cost of transfer facilities at the FIS site causes a corresponding change in the total fees for FIS of about \$12/kgU at the 100 MTU capacity level, decreasing to about \$1/kgU at the 1900 MTU capacity level.
- (2) A change of \$1,000 in the cost of canisters or drywells causes a corresponding change in the total fees for FIS of about \$3/kgU at all capacity levels.
- (3) For each year the term of the FIS program is extended (due to delay in repository startup), there is an increase in the total fees for FIS at the 100 MTU capacity level of about \$16/kgU for instances where a new transfer facility is built, and about \$10/kgU for instances where an existing transfer facility can be utilized for FIS. These increases amount to about \$2/kgU and \$1/kgU, respectively, at the 1900 MTU capacity level.
- (4) For each year the time over which spent fuel is received for storage increases, there is a increase in the total fees for FIS at the 100 MTU capacity level of about \$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 \$20/kgU for instances where a new transfer facility is built, and about \$12/kgU for instances where an existing transfer facility can be utilized. These increases amount to about \$2.5/kgU and \$1/kgU, respectively, at the 1900 MTU capacity level.

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

- (6) A one kilogram decrease in the average amount of uranium contained in the spent fuel in a drywell from the 429 kgU loading assumed for this study causes an increase in the total fees for FIS by about \$0.20/kgU, in the range of 366 kg U to 461 kg U. Conversely, a one kilogram increase in the average amount of uranium contained in a drywell causes a decrease of \$0.20/kgU in the total fees for FIS.
- (7) An increase in the discount rate by one percentage point causes a decrease in the total fees for FIS at the 100 MTU capacity level of about \$19/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 \$4.5/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.

6.4 ESTABLISHMENT OF FEES FOR FIS SERVICES

JAI recommends that the Department establish its fee for FIS services in the same basic manner as it did in the 1983, 1984 and 1985 reports, and which is described below:

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

ation of types of location(s) and storage method(s) under consideration should apply.

- (5) Upon execution of the first contract(s) the Department should commence the design of the FIS facilities on the basis of the contractual commitments that then exist for FIS services. These facilities should have the capacity for storage of only that amount of spent fuel which is committed to storage under the then-existing contracts.
- (6) These first contract(s) should determine the fee for FIS services from the schedule of fees published in the Federal Register. The Initial Payment should be the unit price in effect for the total storage capacity required by such contract(s) or for 100 MTU, whichever is larger. This same Initial Payment should then be charged to all subsequent users of FIS services until the Initial Payment is next revised.
- (7) The Department should revise its fee (both the Initial and Final Payment) annually to reflect (among other things) the economies of a larger FIS operation which results from additional commitments for FIS services.
- (8) Upon completion of the preoperational activities (i.e., design, safety reviews, construction, and associated activities), the Department should determine the total costs incurred -- and should credit or debit the Final Payment of each user with the difference between the amounts paid as Initial Payments and its pro rata share of the total preoperational costs (net of its pro rata share of interest earned on advance payments made).
- (9) After decommissioning of the FIS system, or December 31, 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 and 1985 reports has been included in Exhibit C to this report.

EXHIBIT A

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

EXHIBIT A
TABLE OF CONTENTS

	<u>Page</u>
1.0 SPENT FUEL CANISTERS	A1-1
1.1 Description	A1-2
1.2 Estimated Cost	A1-2
2.0 RECEIVING AND HANDLING FACILITIES	A2-1
2.1 Facilities for Receiving and Transfer	A2-1
2.2 Facilities for Receiving, Canning and Transfer	A2-7
2.3 Modification of Existing Facilities	A2-8
2.4 Estimated Costs	A2-10
3.0 STORAGE CASKS	A3-1
3.1 Description	A3-1
3.2 Estimated Cost	A3-1
4.0 DRYWELLS	A4-1
4.1 Description	A4-1
4.2 Estimated Cost	A4-1
5.0 CONCRETE SILOS	A5-1
5.1 Description	A5-1
5.2 Estimated Cost	A5-1
6.0 STORAGE FACILITY COSTS	A6-1
6.1 Cask Storage Facilities	A6-1
6.2 Drywell Storage Facilities	A6-2
6.3 Silo Storage Facilities	A6-3
6.4 Estimated Costs	A6-4
7.0 OPERATING COSTS FOR FIS SYSTEM	A7-1
7.1 Loading, Storage and Removal	A7-1
7.2 Decontamination and Decommissioning	A7-4
8.0 OTHER ASSOCIATED STORAGE COSTS	A8-1
8.1 Government Administrative Costs	A8-1
8.2 FIS Development Costs	A8-1
8.3 Impact Aid	A8-2
9.0 TOTAL COST OF FIS STORAGE	A9-1
10.0 SENSITIVITY OF COSTS TO CHANGES IN CONDITIONS	A10-1
10.1 Impact of Cost Changes	A10-1
10.2 Impact of Schedule Changes	A10-10
10.3 Impact of Mix of Spent Fuel Types	A10-23
10.4 Impact of Discount Rate	A10-28
10.5 Impact of NRC Licensing Status	A10-33

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 \$4,541 (1987 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, 1987)

	Capital Costs		
	Storage Cask	Drywell	Silo
Site Preparation	\$ 12	\$ 12	\$ 12
Structures	6,781	6,781	6,781
Equipment	3,703	4,485	4,490
Equipment Installation (35% of equipment cost)	1,296	1,570	1,572
	11,792	12,848	12,855
Engineering (15%)	1,769	1,927	1,928
Licensing	872	872	872
	14,433	15,647	15,655
Contingency (35%)	5,052	5,476	5,479
Total	<u>\$19,485</u>	<u>\$21,123</u>	<u>\$21,134</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, 1987)

	<u>Capital Costs</u>		
	<u>Storage Cask</u>	<u>Drywell</u>	<u>Silo</u>
Equipment	\$ 945	\$ 5,095	\$ 5,098
Equipment Installation (35% of equipment cost)	331	494 ^a	495 ^a
	1,276	5,589	5,593
Engineering (15%)	191	838	839
Safety Review	398	398	398
	1,865	6,825	6,830
Contingency (35%)	653	2,389	2,391
Total	<u>\$ 2,518</u>	<u>\$ 9,214</u>	<u>\$ 9,221</u>

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

Estimates were made of the cost of additional 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 A-2 for each of the three methods of dry storage considered.

TABLE A-2
ESTIMATED COSTS OF ADDITIONS AND MODIFICATIONS TO AN EXISTING
HOT CELL FOR TRANSFER AND ENCAPSULATION OF SPENT FUEL
(1980, 1984)

Capital Costs			Equipment
Storage	Transfer	Encaps.	
2,000	2,000	2,000	Equipment Installation
2,000	2,000	2,000	(Cost of equipment cost)
2,000	2,000	2,000	Engineering (15%)
2,000	2,000	2,000	Safety Review
2,000	2,000	2,000	Contingency (15%)
2,000	2,000	2,000	Total

Assumes no installation cost for new storage tanks used for dry storage

3.0 STORAGE CASKS

3.1 DESCRIPTION

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

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

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

3.2 ESTIMATED COST

Based upon manufacturers estimates and assuming delivery to a Western U.S. site, the 1987 cost of the metal storage cask was estimated to be \$1,147,380.

*This cask design is now owned by Mitsubishi.

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 \$20,609 (1987 dollars). Therefore, the total cost of the drywell assembly, including the canisters described in Section 1.0, is estimated to be \$25,150.

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 \$97,729 (1987 dollars). Therefore, the total cost of the silo assembly, including four of the canisters described in Section 1.0, is estimated to be \$115,893.

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, 1987)

Capacity	Storage Method					
	Storage Cask		Drywell		Silo	
	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities	At Site With Existing Transfer Facilities	At Site With No Existing Transfer Facilities
50 MTU	\$2,019	\$1,824	\$5,622	\$5,426	\$2,566	\$2,370
100 MTU	2,054	1,857	5,755	5,557	2,732	2,537
300 MTU	2,161	1,964	6,182	5,987	3,336	3,140
800 MTU	2,385	2,188	7,104	6,906	4,720	4,523
1500 MTU	2,677	2,482	8,289	8,094	6,575	6,379
1900 MTU	2,838	2,643	8,946	8,749	7,619	7,423

^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, 1987)

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	\$1,797	\$1,885	\$1,970	\$2,029	\$1,878	\$1,939
100 MTU	1,872	1,960	2,099	2,159	1,992	2,052
300 MTU	2,162	2,248	2,617	2,677	2,338	2,399
800 MTU	3,004	3,091	4,030	4,089	3,567	3,628
1500 MTU	4,290	4,376	6,162	6,220	4,921	4,982
1900 MTU	5,022	5,108	7,380	7,438	5,691	5,752

TABLE A7-2
ESTIMATED ANNUAL OPERATING COSTS FOR STORAGE FACILITIES
AT GOVERNMENT SITE DURING STORAGE ONLY PERIOD
(\$000, 1987)

<u>Capacity</u>	<u>Storage Method</u>					
	<u>Storage Cask</u>		<u>Drywell</u>		<u>Silo</u>	
	<u>At Site With Existing Transfer Facilities</u>	<u>At Site With No Existing Transfer Facilities</u>	<u>At Site With Existing Transfer Facilities</u>	<u>At Site With No Existing Transfer Facilities</u>	<u>At Site With Existing Transfer Facilities</u>	<u>At Site With No Existing Transfer Facilities</u>
50 MTU	\$ 966	\$1,838	\$1,118	\$1,902	\$1,056	\$1,856
100 MTU	998	1,868	1,136	1,921	1,079	1,876
300 MTU	1,122	1,988	1,208	1,995	1,158	1,952
800 MTU	1,425	2,399	1,382	2,184	1,358	2,392
1500 MTU	1,857	3,083	1,663	2,816	1,636	2,818
1900 MTU	2,102	3,475	1,823	3,176	1,795	3,065

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, 1987)

	<u>Total Capacity of FIS Facilities</u>					
	<u>50</u> <u>MTU</u>	<u>100</u> <u>MTU</u>	<u>300</u> <u>MTU</u>	<u>800</u> <u>MTU</u>	<u>1,500</u> <u>MTU</u>	<u>1,900</u> <u>MTU</u>
Annual Total	\$128	\$217	\$335	\$531	\$745	\$849

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 \$3.6-million and will be incurred in accordance with the following estimated schedule of expenditures:

<u>Year</u>	<u>Amount</u> <u>(\$000, 1987)</u>
1985	\$ 594
1986	1,188
1987	1,188
1988	<u>594</u> (half year)
Total	<u><u>\$3,564</u></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-1987 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 1987 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 1987 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 1987 for all spent fuel to be stored, the revenues would be as follows:

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

where P_1 is the unit cost (or Initial Payment)

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

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

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

Year	Capacity											
	50 MTU		100 MTU		300 MTU		800 MTU		1500 MTU		1900 MTU	
	Rev.	Disc. To 1987 @ 2%/Yr	Rev.	Disc. To 1987 @ 2%/Yr	Rev.	Disc. To 1987 @ 2%/Yr	Rev.	Disc. To 1987 @ 2%/Yr	Rev.	Disc. To 1987 @ 2%/Yr	Rev.	Disc. To 1987 @ 2%/Yr
1990	\$ 8 P ₂	\$ 7.5 P ₂	\$ 17 P ₂	\$16.0 P ₂	\$ 50 P ₂	\$ 47.1 P ₂	\$133 P ₂	\$125.3 P ₂	\$ 250 P ₂	\$ 235.6 P ₂	\$ 317 P ₂	\$ 298.7 P ₂
1991	\$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
1992	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
1993	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>\$50 P₂</u>	<u>\$45.7 P₂</u>	<u>\$100 P₂</u>	<u>\$91.5 P₂</u>	<u>\$300 P₂</u>	<u>\$274.5 P₂</u>	<u>\$800 P₂</u>	<u>\$731.9 P₂</u>	<u>\$1500 P₂</u>	<u>\$1372.4 P₂</u>	<u>\$1900 P₂</u>	<u>\$1738.3 P₂</u>

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

TABLE A9-2

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 5 CASKS (50 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3212	1013			594	128	4947	4947
1988	235	137			1188	128	1688	1655
1989	8077	371			1188	128	9764	9385
1990	7960	303	956	943	594	128	10884	10256
1991			1912	1885		128	3925	3626
1992			1912	1885		128	3925	3535
1993			956	1862		128	2946	2616
1994				1838		128	1966	1712
1995				1838		128	1966	1678
1996				1838		128	1966	1645
1997				1838		128	1966	1613
1998				1885		128	2013	1619
1999				1885		128	2013	1587
2000				1885		128	2013	1556
2001				5409*		128	5537	4196
TOTAL	19484	1824	5736	24991	3564	1920	57519	51646

* - Decommissioning cost

Initial Payment = 598 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 491 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3212	1017			594	217	5040	5040
1988	235	137			1188	217	1777	1742
1989	8077	386			1188	217	9868	9485
1990	7960	317	1912	980	594	217	11980	11289
1991			3825	1960		217	6002	5545
1992			3825	1960		217	6002	5436
1993			1912	1914		217	4043	3590
1994				1868		217	2085	1815
1995				1868		217	2085	1780
1996				1868		217	2085	1745
1997				1868		217	2085	1710
1998				1960		217	2177	1751
1999				1960		217	2177	1717
2000				1960		217	2177	1683
2001				6563*		217	6780	5138
TOTAL	19484	1857	11474	26729	3564	3255	66363	59466

* - Decommissioning cost

Initial Payment = 357 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 275 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3212	1031			594	335	5172	5172
1988	235	137			1188	335	1895	1858
1989	8077	432			1188	335	10032	9642
1990	7960	364	5546	1124	594	335	15923	15005
1991			11091	2248		335	13674	12633
1992			11091	2248		335	13674	12385
1993			5546	2118		335	7999	7103
1994				1988		335	2323	2022
1995				1988		335	2323	1983
1996				1988		335	2323	1944
1997				1988		335	2323	1906
1998				2248		335	2583	2077
1999				2248		335	2583	2037
2000				2248		335	2583	1997
2001				10944*		335	11279	8548
TOTAL	19484	1964	33274	33378	3564	5025	96689	86312

* - Decommissioning cost

Initial Payment = 191 \$/KgU (Includes \$5/KgU impact aid)

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

TABLE A9-5

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 76 CASKS (800 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3212	1061			594	531	5398	5398
1988	235	137			1188	531	2091	2050
1989	8077	530			1188	531	10326	9925
1990	7960	462	14533	1546	594	531	25626	24148
1991			29067	3091		531	32689	30200
1992			29067	3091		531	32689	29607
1993			14533	2745		531	17809	15814
1994				2399		531	2930	2551
1995				2399		531	2930	2501
1996				2399		531	2930	2452
1997				2399		531	2930	2404
1998				3091		531	3622	2913
1999				3091		531	3622	2856
2000				3091		531	3622	2800
2001				21775*		531	22306	16905
TOTAL	19484	2190	87200	51117	3564	7965	171520	152524

* - Decommissioning cost

Initial Payment = 137 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3212	1099			594	745	5650	5650
1988	235	137			1188	745	2305	2260
1989	8077	657			1188	745	10667	10253
1990	7960	589	27346	2188	594	745	39422	37148
1991			54692	4376		745	59813	55258
1992			54692	4376		745	59813	54174
1993			27346	3730		745	31821	28256
1994				3083		745	3828	3333
1995				3083		745	3828	3267
1996				3083		745	3828	3203
1997				3083		745	3828	3140
1998				4376		745	5121	4119
1999				4376		745	5121	4038
2000				4376		745	5121	3959
2001				37208*		745	37953	28764
TOTAL	19484	2482	164076	77338	3564	11175	278119	246822

* - Decommissioning cost

Initial Payment = 123 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 61 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3212	1120			594	849	5775	5775
1988	235	137			1188	849	2409	2362
1989	8077	727			1188	849	10841	10420
1990	7960	659	34613	2554	594	849	47229	44505
1991			69225	5108		849	75182	69457
1992			69225	5108		849	75182	68095
1993			34613	4292		849	39754	35300
1994				3475		849	4324	3764
1995				3475		849	4324	3690
1996				3475		849	4324	3618
1997				3475		849	4324	3547
1998				5108		849	5957	4791
1999				5108		849	5957	4697
2000				5108		849	5957	4605
2001				45961*		849	46810	35476
TOTAL	19484	2643	207676	92247	3564	12735	338349	300102

* - Decommissioning cost

Initial Payment = 120 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	1654			594	128	5802	5802
1988	235	146			1188	128	1697	1664
1989	8790	1849			1188	128	11955	11491
1990	8672	1776	495	1015	594	128	12680	11949
1991			989	2029		128	3146	2906
1992			989	2029		128	3146	2849
1993			495	1966		128	2589	2299
1994				1902		128	2030	1767
1995				1902		128	2030	1733
1996				1902		128	2030	1699
1997				1902		128	2030	1665
1998				2029		128	2157	1735
1999				2029		128	2157	1701
2000				2029		128	2157	1667
2001				5903*		128	6031	4571
TOTAL	21123	5425	2968	26637	3564	1920	61637	55498

* - Decommissioning cost

Initial Payment = 648 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 521 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	1671			594	217	5908	5908
1988	235	146			1188	217	1786	1751
1989	8790	1906			1188	217	12101	11631
1990	8672	1833	989	1080	594	217	13385	12613
1991			1978	2159		217	4354	4022
1992			1978	2159		217	4354	3944
1993			989	2040		217	3246	2882
1994				1921		217	2138	1861
1995				1921		217	2138	1825
1996				1921		217	2138	1789
1997				1921		217	2138	1754
1998				2159		217	2376	1911
1999				2159		217	2376	1873
2000				2159		217	2376	1837
2001				6523*		217	6740	5108
TOTAL	21123	5556	5934	28122	3564	3255	67554	60709

* - Decommissioning cost

Initial Payment = 358 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 288 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	1728			594	335	6083	6083
1988	235	146			1188	335	1904	1867
1989	8790	2093			1188	335	12406	11924
1990	8672	2020	2964	1339	594	335	15924	15006
1991			5927	2677		335	8939	8258
1992			5927	2677		335	8939	8096
1993			2964	2336		335	5635	5004
1994				1995		335	2330	2028
1995				1995		335	2330	1989
1996				1995		335	2330	1950
1997				1995		335	2330	1911
1998				2677		335	3012	2422
1999				2677		335	3012	2375
2000				2677		335	3012	2328
2001				8978*		335	9313	7058
TOTAL	21123	5987	17782	34018	3564	5025	87499	78299

* - Decommissioning cost

Initial Payment = 161 \$/KgU (Includes \$5/KgU impact aid)

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

TABLE A9-11

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 1886 DRYWELLS (800 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	1847			594	531	6398	6398
1988	235	146			1188	531	2100	2059
1989	8790	2493			1188	531	13002	12497
1990	8672	2420	7905	2045	594	531	22167	20888
1991			15811	4089		531	20431	18875
1992			15811	4089		531	20431	18505
1993			7905	3137		531	11573	10276
1994				2184		531	2715	2364
1995				2184		531	2715	2317
1996				2184		531	2715	2272
1997				2184		531	2715	2227
1998				4089		531	4620	3716
1999				4089		531	4620	3643
2000				4089		531	4620	3571
2001				15092*		531	15623	11840
TOTAL	21123	6906	47432	49455	3564	7965	136445	121448

* - Decommissioning cost

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

Final Payment = 73 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	2002			594	745	6767	6767
1988	235	146			1188	745	2314	2269
1989	8790	3009			1188	745	13732	13199
1990	8672	2936	14818	3110	594	745	30875	29094
1991			29635	6220		745	36600	33813
1992			29635	6220		745	36600	33150
1993			14818	4518		745	20081	17831
1994				2816		745	3561	3100
1995				2816		745	3561	3039
1996				2816		745	3561	2980
1997				2816		745	3561	2921
1998				6220		745	6965	5602
1999				6220		745	6965	5492
2000				6220		745	6965	5384
2001				23624*		745	24369	18469
TOTAL	21123	8093	88906	73616	3564	11175	206477	183110

* - Decommissioning cost

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

Final Payment = 58 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	2088			594	849	6957	6957
1988	235	146			1188	849	2418	2371
1989	8790	3294			1188	849	14121	13573
1990	8672	3221	18770	3719	594	849	35825	33759
1991			37541	7438		849	45828	42338
1992			37541	7438		849	45828	41508
1993			18770	5307		849	24926	22134
1994				3176		849	4025	3504
1995				3176		849	4025	3435
1996				3176		849	4025	3368
1997				3176		849	4025	3302
1998				7438		849	8287	6665
1999				7438		849	8287	6534
2000				7438		849	8287	6406
2001				28499*		849	29348	22242
TOTAL	21123	8749	112622	87419	3564	12735	246212	218096

* - Decommissioning cost

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

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

TABLE A9-14

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 30 SILOS (50 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3427	1376			594	128	5525	5525
1988	235	146			1188	128	1697	1664
1989	8795	461			1188	128	10572	10161
1990	8677	388	578	970	594	128	11335	10681
1991			1156	1939		128	3223	2978
1992			1156	1939		128	3223	2919
1993			578	1898		128	2604	2312
1994				1856		128	1984	1727
1995				1856		128	1984	1693
1996				1856		128	1984	1660
1997				1856		128	1984	1628
1998				1939		128	2067	1662
1999				1939		128	2067	1630
2000				1939		128	2067	1598
2001				5395*		128	5523	4186
TOTAL	21134	2371	3468	25382	3564	1920	57839	52024

* - Decommissioning cost

Initial Payment = 599 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 498 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3427	1398			594	217	5636	5636
1988	235	146			1188	217	1786	1751
1989	8795	533			1188	217	10733	10316
1990	8677	460	1140	1026	594	217	12114	11415
1991			2279	2052		217	4548	4202
1992			2279	2052		217	4548	4119
1993			1140	1964		217	3321	2949
1994				1876		217	2093	1822
1995				1876		217	2093	1786
1996				1876		217	2093	1751
1997				1876		217	2093	1717
1998				2050		217	2267	1823
1999				2050		217	2267	1788
2000				2050		217	2267	1752
2001				6102*		217	6319	4789
TOTAL	21134	2537	6838	26850	3564	3255	64178	57616

* - Decommissioning cost

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

Final Payment = 277 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-16

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 177 SILOS (300 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3427	1476			594	335	5832	5832
1988	235	146			1188	335	1904	1867
1989	8795	795			1188	335	11113	10681
1990	8677	722	3418	1200	594	335	14946	14084
1991			6836	2399		335	9570	8841
1992			6836	2399		335	9570	8668
1993			3418	2176		335	5929	5265
1994				1952		335	2287	1991
1995				1952		335	2287	1952
1996				1952		335	2287	1914
1997				1952		335	2287	1876
1998				2399		335	2734	2199
1999				2399		335	2734	2156
2000				2399		335	2734	2113
2001				8956*		335	9291	7041
TOTAL	21134	3139	20508	32135	3564	5025	85505	76480

* - Decommissioning cost

Initial Payment = 161 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 118 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-17

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 471 SILOS (800 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3427	1657			594	531	6209	6209
1988	235	146			1188	531	2100	2059
1989	8795	1397			1188	531	11911	11448
1990	8677	1324	9099	1814	594	531	22039	20768
1991			18198	3628		531	22357	20654
1992			18198	3628		531	22357	20249
1993			9099	3010		531	12640	11224
1994				2392		531	2923	2545
1995				2392		531	2923	2495
1996				2392		531	2923	2446
1997				2392		531	2923	2398
1998				3628		531	4159	3345
1999				3628		531	4159	3279
2000				3628		531	4159	3215
2001				16050*		531	16581	12566
TOTAL	21134	4524	54594	48582	3564	7965	140363	124900

* - Decommissioning cost

Initial Payment = 105 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 71 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-18

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 884 SILOS (1500 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3427	1899			594	745	6665	6665
1988	235	146			1188	745	2314	2269
1989	8795	2203			1188	745	12931	12429
1990	8677	2130	17074	2491	594	745	31711	29882
1991			34148	4982		745	39875	36838
1992			34148	4982		745	39875	36116
1993			17074	3900		745	21719	19286
1994				2818		745	3563	3102
1995				2818		745	3563	3041
1996				2818		745	3563	2981
1997				2818		745	3563	2923
1998				4982		745	5727	4606
1999				4982		745	5727	4516
2000				4982		745	5727	4427
2001				25991*		745	26736	20263
TOTAL	21134	6378	102444	68564	3564	11175	213259	189344

* - Decommissioning cost

Initial Payment = 89 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 55 \$/KgU (Includes \$9/KgU impact aid)

TABLE A9-19

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 1120 SILOS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3427	2035			594	849	6905	6905
1988	235	146			1188	849	2418	2371
1989	8795	2658			1188	849	13490	12966
1990	8677	2585	21632	2876	594	849	37213	35067
1991			43264	5752		849	49865	46068
1992			43264	5752		849	49865	45164
1993			21632	4409		849	26890	23878
1994				3065		849	3914	3407
1995				3065		849	3914	3341
1996				3065		849	3914	3275
1997				3065		849	3914	3211
1998				5752		849	6601	5309
1999				5752		849	6601	5205
2000				5752		849	6601	5103
2001				31670*		849	32519	24645
TOTAL	21134	7424	129792	79975	3564	12735	254624	225915

* - Decommissioning cost

Initial Payment = 84 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 51 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	635	1039			594	128	2396	2396
1988	107	137			1188	128	1560	1529
1989	915	456			1188	128	2687	2583
1990	861	388	956	899	594	128	3826	3605
1991			1912	1797		128	3837	3545
1992			1912	1797		128	3837	3475
1993			956	1382		128	2466	2190
1994				966		128	1094	952
1995				966		128	1094	934
1996				966		128	1094	915
1997				966		128	1094	897
1998				1797		128	1925	1548
1999				1797		128	1925	1518
2000				1797		128	1925	1488
2001				2055*		128	2183	1654
TOTAL	2518	2020	5736	17185	3564	1920	32943	29229

* - Decommissioning cost

Initial Payment = 275 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 353 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	635	1043			594	217	2489	2489
1988	107	137			1188	217	1649	1617
1989	915	471			1188	217	2791	2683
1990	861	403	1912	936	594	217	4923	4639
1991			3825	1872		217	5914	5464
1992			3825	1872		217	5914	5356
1993			1912	1435		217	3564	3165
1994				998		217	1215	1058
1995				998		217	1215	1037
1996				998		217	1215	1017
1997				998		217	1215	997
1998				1872		217	2089	1680
1999				1872		217	2089	1647
2000				1872		217	2089	1615
2001				3209*		217	3426	2596
TOTAL	2518	2054	11474	18932	3564	3255	41797	37060

* - Decommissioning cost

Initial Payment = 196 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 206 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	635	1057			594	335	2621	2621
1988	107	137			1188	335	1767	1732
1989	915	518			1188	335	2956	2941
1990	861	450	5546	1081	594	335	8867	8356
1991			11091	2162		335	13588	12553
1992			11091	2162		335	13588	12307
1993			5546	1642		335	7523	6680
1994				1122		335	1457	1268
1995				1122		335	1457	1244
1996				1122		335	1457	1219
1997				1122		335	1457	1195
1998				2162		335	2497	2008
1999				2162		335	2497	1969
2000				2162		335	2497	1930
2001				7591*		335	7926	6007
TOTAL	2518	2162	33274	25612	3564	5025	72155	63930

* - Decommissioning cost

Initial Payment = 137 \$/KgU (Includes \$5/KgU impact aid)

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

TABLE A9-23
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 76 CASKS (800 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	635	1086			594	531	2846	2846
1988	107	137			1188	531	1963	1925
1989	915	615			1188	531	3249	3123
1990	861	547	14533	1502	594	531	18568	17497
1991			29067	3004		531	32602	30119
1992			29067	3004		531	32602	29529
1993			14533	2215		531	17279	15343
1994				1425		531	1956	1703
1995				1425		531	1956	1669
1996				1425		531	1956	1637
1997				1425		531	1956	1605
1998				3004		531	3535	2843
1999				3004		531	3535	2787
2000				3004		531	3535	2733
2001				18421*		531	18952	14363
TOTAL	2518	2385	87200	42858	3564	7965	146490	129722

* - Decommissioning cost

Initial Payment = 117 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 65 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-24

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 143 CASKS (1500 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	635	1124			594	745	3098	3098
1988	107	137			1188	745	2177	2134
1989	915	742			1188	745	3590	3451
1990	861	674	27346	2145	594	745	32365	30498
1991			54692	4290		745	59727	55179
1992			54692	4290		745	59727	54097
1993			27346	3074		745	31165	27674
1994				1857		745	2602	2265
1995				1857		745	2602	2221
1996				1857		745	2602	2177
1997				1857		745	2602	2135
1998				4290		745	5035	4049
1999				4290		745	5035	3970
2000				4290		745	5035	3892
2001				33854*		745	34599	26222
TOTAL	2518	2677	164076	67951	3564	11175	251961	223062

* - Decommissioning cost

Initial Payment = 112 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 55 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	635	1145			594	849	3223	3223
1988	107	137			1188	849	2281	2236
1989	915	812			1188	849	3764	3618
1990	861	744	34613	2511	594	849	40172	37855
1991			69225	5022		849	75096	69377
1992			69225	5022		849	75096	68017
1993			34613	3562		849	39024	34652
1994				2102		849	2951	2569
1995				2102		849	2951	2519
1996				2102		849	2951	2469
1997				2102		849	2951	2421
1998				5022		849	5871	4722
1999				5022		849	5871	4629
2000				5022		849	5871	4538
2001				42606*		849	43435	32933
TOTAL	2518	2838	207676	82197	3564	12735	311528	275778

* - Decommissioning cost

Initial Payment = 111 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 53 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	1680			594	128	3910	3910
1988	107	146			1188	128	1569	1538
1989	3826	1934			1188	128	7076	6801
1990	3773	1861	495	985	594	128	7836	7384
1991			989	1970		128	3087	2852
1992			989	1970		128	3087	2796
1993			495	1544		128	2167	1924
1994				1118		128	1246	1085
1995				1118		128	1246	1063
1996				1118		128	1246	1043
1997				1118		128	1246	1022
1998				1970		128	2098	1687
1999				1970		128	2098	1654
2000				1970		128	2098	1622
2001				3561*		128	3689	2796
TOTAL	9214	5621	2968	20412	3564	1920	43699	39177

* - Decommissioning cost

Initial Payment = 421 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 412 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	1697			594	217	4016	4016
1988	107	146			1188	217	1658	1625
1989	3826	1992			1188	217	7223	6943
1990	3773	1919	989	1050	594	217	8342	8049
1991			1978	2099		217	4294	3967
1992			1978	2099		217	4294	3889
1993			989	1618		217	2824	2508
1994				1136		217	1353	1178
1995				1136		217	1353	1155
1996				1136		217	1353	1132
1997				1136		217	1353	1110
1998				2099		217	2316	1863
1999				2099		217	2316	1826
2000				2099		217	2316	1790
2001				4180*		217	4397	3332
TOTAL	9214	5754	5954	21887	3564	3255	49608	44383

* - Decommissioning cost

Initial Payment = 244 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 234 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	1753			594	335	4190	4190
1988	107	146			1188	335	1776	1741
1989	3826	2178			1188	335	7527	7235
1990	3773	2105	2964	1309	594	335	11080	10441
1991			5927	2617		335	8879	8203
1992			5927	2617		335	8879	8042
1993			2964	1913		335	5212	4628
1994				1208		335	1543	1343
1995				1208		335	1543	1317
1996				1208		335	1543	1291
1997				1208		335	1543	1266
1998				2617		335	2952	2374
1999				2617		335	2952	2328
2000				2617		335	2952	2282
2001				6636*		335	6971	5283
TOTAL	9214	6182	17782	27775	3564	5025	69542	61964

* - Decommissioning cost

Initial Payment = 124 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 106 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	1873			594	531	4506	4506
1988	107	146			1188	531	1972	1933
1989	3826	2578			1188	531	8123	7808
1990	3773	2505	7905	2015	594	531	17323	16324
1991			15811	4030		531	20372	18821
1992			15811	4030		531	20372	18452
1993			7905	2706		531	11142	9894
1994				1382		531	1913	1665
1995				1382		531	1913	1633
1996				1382		531	1913	1601
1997				1382		531	1913	1569
1998				4030		531	4561	3668
1999				4030		531	4561	3596
2000				4030		531	4561	3526
2001				12750*		531	13281	10065
TOTAL	9214	7102	47432	43149	3564	7965	118426	105061

* - Decommissioning cost

Initial Payment = 85 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	2028			594	745	4875	4875
1988	107	146			1188	745	2186	2143
1989	3826	3094			1188	745	8853	8509
1990	3773	3021	14818	3081	594	745	26032	24531
1991			29635	6162		745	36542	33759
1992			29635	6162		745	36542	33097
1993			14818	3913		745	19476	17294
1994				1663		745	2408	2096
1995				1663		745	2408	2055
1996				1663		745	2408	2015
1997				1663		745	2408	1975
1998				6162		745	6907	5555
1999				6162		745	6907	5446
2000				6162		745	6907	5339
2001				21282*		745	22027	16694
TOTAL	9214	8289	88906	65738	3564	11175	186886	165383

* - Decommissioning cost

Initial Payment = 73 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	2113			594	849	5064	5064
1988	107	146			1188	849	2290	2245
1989	3826	3379			1188	849	9242	9883
1990	3773	3306	18770	3690	594	849	30982	29195
1991			37541	7380		849	45770	42284
1992			37541	7380		849	45770	41455
1993			18770	4602		849	24221	21508
1994				1823		849	2672	2326
1995				1823		849	2672	2281
1996				1823		849	2672	2236
1997				1823		849	2672	2192
1998				7380		849	8229	6618
1999				7380		849	8229	6489
2000				7380		849	8229	6361
2001				26156*		849	27005	20466
TOTAL	9214	8944	112622	78640	3564	12735	225719	199603

* - Decommissioning cost

Initial Payment = 71 \$/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, 1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1509	1402			594	128	3633	3633
1988	107	146			1188	128	1569	1538
1989	3829	546			1188	128	5691	5470
1990	3775	473	578	939	594	128	6487	6113
1991			1156	1878		128	3162	2921
1992			1156	1878		128	3162	2864
1993			578	1467		128	2173	1930
1994				1056		128	1184	1031
1995				1056		128	1184	1011
1996				1056		128	1184	991
1997				1056		128	1184	971
1998				1878		128	2006	1613
1999				1878		128	2006	1582
2000				1878		128	2006	1551
2001				3051*		128	3179	2409
TOTAL	9220	2567	3468	19071	3564	1920	39810	35628

* - Decommissioning cost

Initial Payment = 372 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 388 \$/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, 1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1509	1423			594	217	3743	3743
1988	107	146			1188	217	1658	1625
1989	3829	618			1188	217	5852	5625
1990	3775	545	1140	996	594	217	7267	6848
1991			2279	1992		217	4488	4146
1992			2279	1992		217	4488	4065
1993			1140	1536		217	2893	2569
1994				1079		217	1296	1128
1995				1079		217	1296	1106
1996				1079		217	1296	1084
1997				1079		217	1296	1063
1998				1992		217	2209	1777
1999				1992		217	2209	1742
2000				1992		217	2209	1708
2001				3758*		217	3975	3013
TOTAL	9220	2732	6838	20566	3564	3255	46175	41242

* - Decommissioning cost

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

Final Payment = 222 \$/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, 1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1509	1502			594	335	3940	3940
1988	107	146			1188	335	1776	1741
1989	3829	880			1188	335	6232	5990
1990	3775	807	3418	1169	594	335	10098	9516
1991			6836	2338		335	9509	8785
1992			6836	2338		335	9509	8613
1993			3418	1748		335	5501	4885
1994				1158		335	1493	1300
1995				1158		335	1493	1274
1996				1158		335	1493	1249
1997				1158		335	1493	1225
1998				2338		335	2673	2150
1999				2338		335	2673	2108
2000				2338		335	2673	2066
2001				6613*		335	6948	5266
TOTAL	9220	3335	20508	25852	3564	5025	67504	60108

* - Decommissioning cost

Initial Payment = 123 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 100 \$/KgU (Includes \$10/KgU impact aid)

TABLE A9-35
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 471 SILOS (800 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000, 1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1509	1682			594	531	4316	4316
1988	107	146			1188	531	1972	1933
1989	3829	1482			1188	531	7030	6757
1990	3775	1409	9099	1784	594	531	17192	16200
1991			18198	3567		531	22296	20598
1992			18198	3567		531	22296	20194
1993			9099	2463		531	12093	10738
1994				1358		531	1889	1644
1995				1358		531	1889	1612
1996				1358		531	1889	1581
1997				1358		531	1889	1550
1998				3567		531	4098	3296
1999				3567		531	4098	3231
2000				3567		531	4098	3168
2001				13707*		531	14238	10791
TOTAL	9220	4719	54594	41221	3564	7965	121283	107609

* - Decommissioning cost

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

Final Payment = 63 \$/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, 1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1509	1924			594	745	4772	4772
1988	107	146			1188	745	2186	2143
1989	3829	2289			1188	745	8051	7738
1990	3775	2215	17074	2461	594	745	26864	25315
1991			34148	4921		745	39814	36782
1992			34148	4921		745	39814	36061
1993			17074	3279		745	21098	18734
1994				1636		745	2381	2073
1995				1636		745	2381	2032
1996				1636		745	2381	1992
1997				1636		745	2381	1953
1998				4921		745	5666	4557
1999				4921		745	5666	4468
2000				4921		745	5666	4380
2001				23648*		745	24393	18487
TOTAL	9220	6574	102444	60537	3564	11175	193514	171487

* - Decommissioning cost

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

Final Payment = 49 \$/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, 1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1509	2061			594	849	5013	5013
1988	107	146			1188	849	2290	2245
1989	3829	2743			1188	849	8609	8275
1990	3775	2670	21632	2846	594	849	32366	30499
1991			43264	5691		849	49804	46011
1992			43264	5691		849	49804	45109
1993			21632	3743		849	26224	23286
1994				1795		849	2644	2302
1995				1795		849	2644	2257
1996				1795		849	2644	2212
1997				1795		849	2644	2169
1998				5691		849	6540	5260
1999				5691		849	6540	5157
2000				5691		849	6540	5056
2001				29326*		849	30175	22869
TOTAL	9220	7620	129792	71550	3564	12735	234481	207720

* - Decommissioning cost

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

Final Payment = 46 \$/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 \$8.2 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				
\$21.1 (Base Case)	\$60,709	\$646	\$218,096	\$131
15.5	54,210	580	211,589	127
10	47,847	515	205,240	124
Change per \$-million	1,159	12	1,158	1
Existing Facility Cases				
9.2 (Base Case)	\$44,383	\$478	\$199,603	\$121
8.2	43,231	466	198,450	120
Change per \$-million	1,152	12	1,153	1

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

TABLE A10-2
COST SENSITIVITY CASE -- \$15.5-MILLION TRANSFER FACILITY
 ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
 AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
 (\$000, 1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	2692	1671			594	217	5174	5174
1988	233	146			1188	217	1786	1751
1989	6345	1906			1188	217	9656	9281
1990	6227	1833	989	1065	594	217	10925	10295
1991			1978	2130		217	4325	3996
1992			1978	2130		217	4325	3917
1993			989	2011		217	3217	2857
1994				1892		217	2109	1836
1995				1892		217	2109	1800
1996				1892		217	2109	1765
1997				1892		217	2109	1730
1998				2130		217	2347	1888
1999				2130		217	2347	1851
2000				2130		217	2347	1814
2001				5398*		217	5615	4255
TOTAL	15499	5556	5934	26692	3564	3255	60300	54210

* - Decommissioning cost

Initial Payment = 304 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 276 \$/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, 1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1975	1671			594	217	4457	4457
1988	233	146			1188	217	1786	1751
1989	3953	1906			1188	217	7264	6982
1990	3833	1833	989	1051	594	217	8519	8028
1991			1978	2101		217	4296	3969
1992			1978	2101		217	4296	3891
1993			989	1982		217	3188	2831
1994				1863		217	2080	1811
1995				1863		217	2080	1775
1996				1863		217	2080	1740
1997				1863		217	2080	1706
1998				2101		217	2318	1864
1999				2101		217	2318	1828
2000				2101		217	2318	1792
2001				4298*		217	4515	3422
TOTAL	9998	5556	5934	25288	3564	3255	55595	47847

* - Decommissioning cost

Initial Payment = 251 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 264 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	2692	2088			594	849	6223	6223
1988	235	146			1188	849	2418	2371
1989	6345	3294			1188	849	11676	11223
1990	6227	3221	18770	3704	594	849	33365	31441
1991			37541	7408		849	45798	42310
1992			37541	7408		849	45798	41481
1993			18770	5277		849	24896	22107
1994				3146		849	3995	3478
1995				3146		849	3995	3410
1996				3146		849	3995	3343
1997				3146		849	3995	3277
1998				7408		849	8257	6641
1999				7408		849	8257	6511
2000				7408		849	8257	6383
2001				27374*		849	28223	21390
TOTAL	15499	8749	112622	85979	3564	12735	239148	211589

* - Decommissioning cost

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

Final Payment = 53 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1975	2088			594	849	5506	5506
1988	235	146			1188	849	2418	2371
1989	3953	3294			1188	849	9284	8923
1990	3835	3221	18770	3691	594	849	30960	29174
1991			37541	7381		849	45771	42285
1992			37541	7381		849	45771	41456
1993			18770	5250		849	24869	22083
1994				3119		849	3968	3454
1995				3119		849	3968	3387
1996				3119		849	3968	3320
1997				3119		849	3968	3255
1998				7381		849	8230	6619
1999				7381		849	8230	6489
2000				7381		849	8230	6362
2001				26274*		849	27123	20356
TOTAL	9998	8749	112622	84596	3564	12735	232264	205240

* - Decommissioning cost

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

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

TABLE A10-6

COST SENSITIVITY CASE -- \$8.2-MILLION TRANSFER FACILITY
 ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
 AT GOVERNMENT SITE WITH EXISTING FACILITIES
 (\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1377	1697			594	217	3885	3885
1988	107	146			1188	217	1658	1625
1989	3392	1992			1188	217	6789	6525
1990	3338	1919	989	1047	594	217	8104	7637
1991			1978	2094		217	4289	3962
1992			1978	2094		217	4289	3885
1993			989	1613		217	2819	2503
1994				1132		217	1349	1174
1995				1132		217	1349	1151
1996				1132		217	1349	1129
1997				1132		217	1349	1107
1998				2094		217	2311	1859
1999				2094		217	2311	1822
2000				2094		217	2311	1786
2001				3980*		217	4197	3181
TOTAL	8214	5754	5934	21638	3564	3255	48359	43231

* - Decommissioning cost

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

Final Payment = 231 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-7

COST SENSITIVITY CASE -- \$8.2-MILLION TRANSFER FACILITY
 ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
 AT GOVERNMENT SITE WITH EXISTING FACILITIES
 (\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1377	2113			594	849	4933	4933
1988	107	146			1188	849	2290	2243
1989	3392	3379			1188	849	8808	8466
1990	3338	3306	18770	3688	594	849	30545	28783
1991			37541	7375		849	45765	42280
1992			37541	7375		849	45765	41451
1993			18770	4597		849	24216	21503
1994				1818		849	2667	2322
1995				1818		849	2667	2276
1996				1818		849	2667	2332
1997				1818		849	2667	2188
1998				7375		849	8224	6614
1999				7375		849	8224	6485
2000				7375		849	8224	6357
2001				25956*		849	26805	20315
TOTAL	8214	8944	112622	78388	3564	12735	224467	198450

* - Decommissioning cost

Initial Payment = 70 \$/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 (\$/kgU)</u>
<u>Drywells</u>				
\$20,609	\$60,709	\$646	\$218,096	\$131
15,000	59,236	631	190,146	115
10,000	57,923	618	165,230	100
Change per \$-thousand	263	3	4,983	3
<u>Canisters</u>				
\$ 4,541	\$60,709	\$646	\$218,096	\$131
3,500	60,449	644	213,123	128
2,000	60,072	639	205,960	124
Change per \$-thousand	251	3	4,776	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, 1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	1671			594	217	5908	5908
1988	235	146			1188	217	1786	1751
1989	8790	1906			1188	217	12101	11631
1990	8672	1833	769	1076	594	217	13161	12402
1991			1537	2152		217	3906	3609
1992			1537	2152		217	3906	3538
1993			769	2033		217	3019	2681
1994				1914		217	2131	1855
1995				1914		217	2131	1819
1996				1914		217	2131	1783
1997				1914		217	2131	1748
1998				2152		217	2369	1905
1999				2152		217	2369	1868
2000				2152		217	2369	1831
2001				6258*		217	6475	4907
TOTAL	21123	5556	4612	27783	3564	3255	65893	59236

* - Decommissioning cost

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

Final Payment = 285 \$/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, 1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	1671			594	217	5908	5908
1988	235	146			1188	217	1786	1751
1989	8790	1906			1188	217	12101	11631
1990	8672	1833	572	1073	594	217	12961	12213
1991			1144	2146		217	3507	3240
1992			1144	2146		217	3507	3176
1993			572	2027		217	2816	2501
1994				1908		217	2125	1850
1995				1908		217	2125	1814
1996				1908		217	2125	1778
1997				1908		217	2125	1743
1998				2146		217	2363	1900
1999				2146		217	2363	1863
2000				2146		217	2363	1827
2001				6022*		217	6239	4728
TOTAL	21123	5556	3432	27484	3564	3255	64414	57923

* - Decommissioning cost

Initial Payment = 335 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 283 \$/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
 (\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	2088			594	849	6957	6957
1988	235	146			1188	849	2418	2371
1989	8790	3294			1188	849	14121	13573
1990	8672	3221	14584	3654	594	849	31574	29753
1991			29168	7308		849	37325	34483
1992			29168	7308		849	37325	33806
1993			14584	5177		849	20610	18301
1994				3046		849	3895	3391
1995				3046		849	3895	3324
1996				3046		849	3895	3259
1997				3046		849	3895	3195
1998				7308		849	8157	6560
1999				7308		849	8157	6432
2000				7308		849	8157	6306
2001				23475*		849	24324	18435
TOTAL	21123	8749	87504	81030	3564	12735	214705	190146

* - Decommissioning cost

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

Final Payment = 50 \$/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
 (\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	2088			594	849	6957	6957
1988	235	146			1188	849	2418	2371
1989	8790	3294			1188	849	14121	13573
1990	8672	3221	10852	3596	594	849	27784	26181
1991			21705	7192		849	29746	27481
1992			21705	7192		849	29746	26942
1993			10852	5061		849	16762	14884
1994				2930		849	3779	3290
1995				2930		849	3779	3225
1996				2930		849	3779	3162
1997				2930		849	3779	3100
1998				7192		849	8041	6467
1999				7192		849	8041	6340
2000				7192		849	8041	6216
2001				18997*		849	19846	15041
TOTAL	21123	8749	65114	75334	3564	12735	186619	165230

* - 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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	1671			594	217	5908	5908
1988	235	146			1188	217	1786	1751
1989	8790	1906			1188	217	12101	11631
1990	8672	1833	948	1080	594	217	13344	12574
1991			1897	2159		217	4273	3948
1992			1897	2159		217	4273	3870
1993			948	2040		217	3205	2846
1994				1921		217	2138	1861
1995				1921		217	2138	1825
1996				1921		217	2138	1789
1997				1921		217	2138	1754
1998				2159		217	2376	1911
1999				2159		217	2376	1873
2000				2159		217	2376	1837
2001				6474*		217	6691	5071
TOTAL	21123	5556	5690	28073	3564	3255	67261	60449

* - Decommissioning cost

Initial Payment = 356 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 288 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	1671			594	217	5908	5908
1988	235	146			1188	217	1786	1751
1989	8790	1906			1188	217	12101	11631
1990	8672	1833	889	1080	594	217	13285	12519
1991			1779	2159		217	4153	3839
1992			1779	2159		217	4153	3763
1993			889	2040		217	3146	2794
1994				1921		217	2138	1861
1995				1921		217	2138	1825
1996				1921		217	2138	1789
1997				1921		217	2138	1754
1998				2159		217	2376	1911
1999				2159		217	2376	1873
2000				2159		217	2376	1837
2001				6403*		217	6620	5017
TOTAL	21123	5556	5336	28002	3564	3255	66836	60072

* - Decommissioning cost

Initial Payment = 352 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 287 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	2088			594	849	6957	6957
1988	233	146			1188	849	2418	2371
1989	8790	3294			1188	849	14121	13573
1990	8672	3221	17993	3719	594	849	35048	33027
1991			35987	7438		849	44274	40902
1992			35987	7438		849	44274	40100
1993			17993	5307		849	24149	21444
1994				3176		849	4025	3504
1995				3176		849	4025	3435
1996				3176		849	4025	3368
1997				3176		849	4025	3302
1998				7438		849	8287	6665
1999				7438		849	8287	6534
2000				7438		849	8287	6406
2001				27566*		849	28415	21535
TOTAL	21123	8749	107960	86486	3564	12735	240617	213123

* - Decommissioning cost

Initial Payment = 74 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	2088			594	849	6957	6957
1988	233	146			1188	849	2418	2371
1989	8790	3294			1188	849	14121	13573
1990	8672	3221	16874	3719	594	849	33929	31972
1991			33748	7438		849	42035	38834
1992			33748	7438		849	42035	38072
1993			16874	5307		849	23030	20450
1994				3176		849	4025	3504
1995				3176		849	4025	3435
1996				3176		849	4025	3368
1997				3176		849	4025	3302
1998				7438		849	8287	6665
1999				7438		849	8287	6534
2000				7438		849	8287	6406
2001				26223*		849	27072	20517
TOTAL	21123	8749	101244	85143	3564	12735	232558	205960

* - Decommissioning cost

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

Final Payment = 53 \$/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)	\$60,709	\$646	\$218,096	\$131
2002	63,699	679	222,882	135
2005	67,967	725	229,714	139
Increase-per yr. of delay	1,452	16	2,324	2
Existing Transfer Facility Cases				
2000 (Base Case)	\$44,383	\$478	\$199,603	\$121
2002	46,196	497	202,309	122
2005	48,784	526	206,171	125
Increase-per yr. of delay	880	10	1,314	1

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

TABLE A10-18

COST SENSITIVITY CASE -- 2 YEAR EXTENSION OF FIS PROGRAM

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	1671			594	217	5908	5908
1988	235	146			1188	217	1786	1751
1989	8790	1906			1188	217	12101	11631
1990	8672	1833	989	1080	594	217	13385	12613
1991			1978	2159		217	4354	4022
1992			1978	2159		217	4354	3944
1993			989	2040		217	3246	2882
1994				1921		217	2138	1861
1995				1921		217	2138	1825
1996				1921		217	2138	1789
1997				1921		217	2138	1754
1998				1921		217	2138	1720
1999				1921		217	2138	1686
2000				2159		217	2376	1837
2001				2159		217	2376	1801
2002				2159		217	2376	1765
2003				6523*		217	6740	4910
TOTAL	21123	5556	5934	31964	3564	3689	71830	63699

* - Decommissioning cost

Initial Payment = 358 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 321 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	1671			594	217	5908	5908
1988	235	146			1188	217	1786	1751
1989	8790	1906			1188	217	12101	11631
1990	8672	1833	989	1080	594	217	13385	12613
1991			1978	2159		217	4354	4022
1992			1978	2159		217	4354	3944
1993			989	2040		217	3246	2882
1994				1921		217	2138	1861
1995				1921		217	2138	1825
1996				1921		217	2138	1789
1997				1921		217	2138	1754
1998				1921		217	2138	1720
1999				1921		217	2138	1686
2000				1921		217	2138	1653
2001				1921		217	2138	1620
2002				1921		217	2138	1589
2003				2159		217	2376	1731
2004				2159		217	2376	1697
2005				2159		217	2376	1664
2006				6523*		217	6740	4627
TOTAL	21123	5556	5934	37727	3564	4340	78244	67967

* - Decommissioning cost

Initial Payment = 358 \$/kgU (Includes \$5/KgU impact aid)

Final Payment = 367 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	2088			594	849	6957	6957
1988	235	146			1188	849	2418	2371
1989	8790	3294			1188	849	14121	13573
1990	8672	3221	18770	3719	594	849	35825	33759
1991			37541	7438		849	45828	42338
1992			37541	7438		849	45828	41508
1993			18770	5307		849	24926	22134
1994				3176		849	4025	3504
1995				3176		849	4025	3435
1996				3176		849	4025	3368
1997				3176		849	4025	3302
1998				3176		849	4025	3237
1999				3176		849	4025	3174
2000				7438		849	8287	6406
2001				7438		849	8287	6281
2002				7438		849	8287	6157
2003				28499*		849	29348	21378
TOTAL	21123	8749	112622	93771	3564	14453	254262	222882

* - Decommissioning cost

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

Final Payment = 58 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	2088			594	849	6957	6957
1988	235	146			1188	849	2418	2371
1989	8790	3294			1188	849	14121	13573
1990	8672	3221	18770	3719	594	849	35825	33759
1991			37541	7438		849	45828	42338
1992			37541	7438		849	45828	41508
1993			18770	5307		849	24926	22134
1994				3176		849	4025	3504
1995				3176		849	4025	3435
1996				3176		849	4025	3368
1997				3176		849	4025	3302
1998				3176		849	4025	3237
1999				3176		849	4025	3174
2000				3176		849	4025	3111
2001				3176		849	4025	3050
2002				3176		849	4025	2991
2003				7438		849	8287	6037
2004				7438		849	8287	5918
2005				7438		849	8287	5802
2006				28499*		849	29348	20145
TOTAL	21123	8749	112622	103299	3564	16980	266337	229714

* - Decommissioning cost

Initial Payment = 77 \$/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
 (\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	1697			594	217	4016	4016
1988	107	146			1188	217	1658	1625
1989	3826	1992			1188	217	7223	6943
1990	3773	1919	989	1050	594	217	8542	8049
1991			1978	2099		217	4294	3967
1992			1978	2099		217	4294	3889
1993			989	1618		217	2824	2508
1994				1136		217	1353	1178
1995				1136		217	1353	1155
1996				1136		217	1353	1132
1997				1136		217	1353	1110
1998				1136		217	1353	1088
1999				1136		217	1353	1067
2000				2099		217	2316	1790
2001				2099		217	2316	1755
2002				2099		217	2316	1721
2003				4180*		217	4397	3203
TOTAL	9214	5754	5934	24159	3564	3689	52314	46196

* - Decommissioning cost

Initial Payment = 244 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 253 \$/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
 (\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	1697			594	217	4016	4016
1988	107	146			1188	217	1658	1625
1989	3826	1992			1188	217	7223	6943
1990	3773	1919	989	1050	594	217	8542	8049
1991			1978	2099		217	4294	3967
1992			1978	2099		217	4294	3889
1993			989	1618		217	2824	2508
1994				1136		217	1353	1178
1995				1136		217	1353	1155
1996				1136		217	1353	1132
1997				1136		217	1353	1110
1998				1136		217	1353	1088
1999				1136		217	1353	1067
2000				1136		217	1353	1046
2001				1136		217	1353	1025
2002				1136		217	1353	1005
2003				2099		217	2316	1687
2004				2099		217	2316	1654
2005				2099		217	2316	1622
2006				4180*		217	4397	3018
TOTAL	9214	5754	5934	27567	3564	4340	56373	48784

* - Decommissioning cost

Initial Payment = 244 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 282 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	2113			594	849	5064	5064
1988	107	146			1188	849	2290	2245
1989	3826	3379			1188	849	9242	8883
1990	3773	3306	18770	3690	594	849	30982	29195
1991			37541	7380		849	45770	42284
1992			37541	7380		849	45770	41455
1993			18770	4602		849	24221	21508
1994				1823		849	2672	2326
1995				1823		849	2672	2281
1996				1823		849	2672	2236
1997				1823		849	2672	2192
1998				1823		849	2672	2149
1999				1823		849	2672	2107
2000				7380		849	8229	6361
2001				7380		849	8229	6237
2002				7380		849	8229	6114
2003				26156*		849	27005	19672
TOTAL	9214	8944	112622	82286	3564	14433	231063	202309

* - Decommissioning cost

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

Final Payment = 51 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	2113			594	849	5064	5064
1988	107	146			1188	849	2290	2245
1989	3826	3379			1188	849	9242	8883
1990	3773	3306	18770	3690	594	849	30982	29195
1991			37541	7380		849	45770	42284
1992			37541	7380		849	45770	41455
1993			18770	4602		849	24221	21508
1994				1823		849	2672	2326
1995				1823		849	2672	2281
1996				1823		849	2672	2236
1997				1823		849	2672	2192
1998				1823		849	2672	2149
1999				1823		849	2672	2107
2000				1823		849	2672	2066
2001				1823		849	2672	2025
2002				1823		849	2672	1985
2003				7380		849	8229	5994
2004				7380		849	8229	5877
2005				7380		849	8229	5762
2006				26156*		849	27005	18537
TOTAL	9214	8944	112622	87755	3564	16980	239079	206171

* - Decommissioning cost

Initial Payment = 71 \$/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 (\$/kgU)</u>
New Transfer Facility Cases				
3 yrs. (Base Case)	\$60,709	\$646	\$218,096	\$131
4 yrs.	60,658	648	216,046	130
5 yrs.	60,598	650	214,034	130
Change per yr. of receipt time	-56	+2	-2,031	-0.5
Existing Transfer Facility Cases				
3 yrs. (Base Case)	\$44,383	\$478	\$199,603	\$121
4 yrs.	44,964	487	198,687	120
5 yrs.	45,540	495	197,790	121
Change per yr. of receipt time	+579	+8.5	-907	-

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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	1671			594	217	5908	5908
1988	235	146			1188	217	1786	1751
1989	8790	1906			1188	217	12101	11631
1990	8672	1833	742	1051	594	217	13109	12353
1991			1484	2101		217	3802	3512
1992			1484	2101		217	3802	3444
1993			1484	2101		217	3802	3376
1994			742	2011		217	2970	2586
1995				1921		217	2138	1825
1996				1921		217	2138	1789
1997				1921		217	2138	1754
1998				2159		217	2376	1911
1999				2159		217	2376	1873
2000				2159		217	2376	1837
2001				6523*		217	6740	5108
TOTAL	21123	5556	5936	28128	3564	3255	67562	60658

* - Decommissioning cost

Initial Payment = 357 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 291 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	1671			594	217	5908	5908
1988	235	146			1188	217	1786	1751
1989	8790	1906			1188	217	12101	11631
1990	8672	1833	594	1033	594	217	12943	12196
1991			1187	2065		217	3469	3205
1992			1187	2065		217	3469	3142
1993			1187	2065		217	3469	3080
1994			1187	2065		217	3469	3020
1995			594	1993		217	2804	2393
1996				1921		217	2138	1789
1997				1921		217	2138	1754
1998				2159		217	2376	1911
1999				2159		217	2376	1873
2000				2159		217	2376	1837
2001				6523*		217	6740	5108
TOTAL	21123	5556	5936	28128	3564	3255	67562	60598

* - Decommissioning cost

Initial Payment = 357 \$/KgU (Includes \$5/kgU impact aid)

Final Payment = 293 \$/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
 (\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	2088			594	849	6957	6957
1988	235	146			1188	849	2418	2371
1989	8790	3294			1188	849	14121	13573
1990	8672	3221	14078	3058	594	849	30472	28714
1991			28155	6116		849	35120	32445
1992			28155	6116		849	35120	31809
1993			28155	6116		849	35120	31186
1994			14078	4646		849	19573	17039
1995				3176		849	4025	3425
1996				3176		849	4025	3368
1997				3176		849	4025	3302
1998				7438		849	8287	6665
1999				7438		849	8287	6534
2000				7438		849	8287	6406
2001				28499*		849	29348	22242
TOTAL	21123	8749	112621	86393	3564	12735	245185	216046

* - Decommissioning cost

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

Final Payment = 54 \$/KgU (Includes \$8/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
 (\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	2088			594	849	6957	6957
1988	235	146			1188	849	2418	2371
1989	8790	3294			1188	849	14121	13573
1990	8672	3221	11262	2662	594	849	27260	25688
1991			22524	5323		849	28696	26511
1992			22524	5323		849	28696	25991
1993			22524	5323		849	28696	25481
1994			22524	5323		849	28696	24982
1995			11262	4250		849	16361	13964
1996				3176		849	4025	3368
1997				3176		849	4025	3302
1998				7438		849	8287	6665
1999				7438		849	8287	6534
2000				7438		849	8287	6406
2001				28498*		849	29347	22241
TOTAL	21123	8749	112620	85368	3564	12735	244159	214034

* - Decommissioning cost

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

Final Payment = 54 \$/KgU (Includes \$8/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	1697			594	217	4016	4016
1988	107	146			1188	217	1658	1625
1989	3826	1992			1188	217	7223	6943
1990	3773	1919	742	1020	594	217	8265	7788
1991			1484	2040		217	3741	3456
1992			1484	2040		217	3741	3389
1993			1484	2040		217	3741	3322
1994			742	1588		217	2547	2217
1995				1136		217	1353	1155
1996				1136		217	1353	1132
1997				1136		217	1353	1110
1998				2099		217	2316	1863
1999				2099		217	2316	1826
2000				2099		217	2316	1790
2001				4181*		217	4398	3333
TOTAL	9214	5754	5936	22614	3364	3255	50337	44964

* - Decommissioning cost

Initial Payment = 244 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 243 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	1697			594	217	4016	4016
1988	107	146			1188	217	1658	1625
1989	3826	1992			1188	217	7223	6943
1990	3773	1919	594	1003	594	217	8100	7633
1991			1187	2006		217	3410	3150
1992			1187	2006		217	3410	3089
1993			1187	2006		217	3410	3028
1994			1187	2006		217	3410	2969
1995			594	1571		217	2382	2033
1996				1136		217	1353	1132
1997				1136		217	1353	1110
1998				2099		217	2316	1863
1999				2099		217	2316	1826
2000				2099		217	2316	1790
2001				4181*		217	4398	3333
TOTAL	9214	5754	5936	23348	3364	3255	51071	45540

* - Decommissioning cost

Initial Payment = 243 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 252 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	2113			594	849	5064	5064
1988	107	146			1188	849	2290	2245
1989	3826	3379			1188	849	9242	8883
1990	3773	3306	14078	3028	594	849	25628	24150
1991			28155	6056		849	35060	32390
1992			28155	6056		849	35060	31753
1993			28155	6056		849	35060	31132
1994			14078	3940		849	18867	16425
1995				1823		849	2672	2281
1996				1823		849	2672	2236
1997				1823		849	2672	2192
1998				7380		849	8229	6618
1999				7380		849	8229	6489
2000				7380		849	8229	6361
2001				26156*		849	27005	20466
TOTAL	9214	8944	112621	78901	3564	12735	225979	198687

* - Decommissioning cost

Initial Payment = 70 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	2113			594	849	5064	5064
1988	107	146			1188	849	2290	2245
1989	3826	3379			1188	849	9242	8883
1990	3773	3306	11262	2632	594	849	22416	21123
1991			22524	5264		849	28637	26456
1992			22524	5264		849	28637	25937
1993			22524	5264		849	28637	25429
1994			22524	5264		849	28637	24930
1995			11262	3544		849	15655	13361
1996				1823		849	2672	2236
1997				1823		849	2672	2192
1998				7380		849	8229	6618
1999				7380		849	8229	6489
2000				7380		849	8229	6361
2001				26156*		849	27005	20466
TOTAL	9214	8944	112620	79174	3564	12735	226251	197790

* - Decommissioning cost

Initial Payment = 70 \$/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)	\$60,709	\$646	\$218,096	\$131
2 yr.	65,472	685	229,765	136
Increase per yr. of schedule shortening	2,382	20	5,835	2.5
Existing Transfer Facility Cases				
4 yr. (Base Case)	\$44,383	\$478	\$199,603	\$121
2 yr.	47,342	501	208,444	123
Increase per yr. of schedule shortening	1,480	12	4,420	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 A10-35 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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	12451	3724			594	217	16986	16986
1988	8672	1833	989	1080	1188	217	13979	13705
1989			1978	2159	1188	217	5542	5327
1990			1978	2159	594	217	4948	4663
1991			989	2040		217	3246	2999
1992				1921		217	2138	1936
1993				1921		217	2138	1898
1994				1921		217	2138	1861
1995				1921		217	2138	1825
1996				1921		217	2138	1789
1997				1921		217	2138	1754
1998				2159		217	2376	1911
1999				2159		217	2376	1873
2000				2159		217	2376	1837
2001				6523*		217	6740	5108
TOTAL	21123	5557	5934	31964	3564	3255	71397	65472

* - Decommissioning cost

Initial Payment = 347 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 338 \$/KgU (Includes \$10/KgU impact aid)

TABLE A10-37

COST SENSITIVITY CASE -- 2-YEAR CONSTRUCTION SCHEDULE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 4478 DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	12451	5528			594	849	19422	19422
1988	8672	3221	18770	3719	1188	849	36419	35705
1989			37541	7438	1188	849	47016	45190
1990			37541	7438	594	849	46422	43744
1991			18770	5307		849	24926	23028
1992				3176		849	4025	3646
1993				3176		849	4025	3574
1994				3176		849	4025	3504
1995				3176		849	4025	3435
1996				3176		849	4025	3368
1997				3176		849	4025	3302
1998				7438		849	8287	6665
1999				7438		849	8287	6534
2000				7438		849	8287	6406
2001				28499*		849	29348	22242
TOTAL	21123	8749	112622	93771	3564	12735	252564	229765

* - Decommissioning cost

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

Final Payment = 58 \$/KgU (Includes \$8/KgU impact aid)

TABLE A10-38

COST SENSITIVITY CASE -- 2-YEAR CONSTRUCTION SCHEDULE

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 234 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITH EXISTING FACILITIES
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	5442	3835			594	217	10088	10088
1988	3773	1919	989	1050	1188	217	9136	8957
1989			1978	2099	1188	217	5482	5269
1990			1978	2099	594	217	4888	4606
1991			989	1618		217	2824	2609
1992				1136		217	1353	1225
1993				1136		217	1353	1201
1994				1136		217	1353	1178
1995				1136		217	1353	1153
1996				1136		217	1353	1132
1997				1136		217	1353	1110
1998				2099		217	2316	1863
1999				2099		217	2316	1826
2000				2099		217	2316	1790
2001				4181*		217	4398	3333
TOTAL	9215	5754	5934	24160	3564	3255	51882	47342

* - Decommissioning cost

Initial Payment = 230 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR. AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	5442	5639			594	849	12524	12524
1988	3773	3306	18770	3690	1188	849	31576	30957
1989			37541	7380	1188	849	46958	45135
1990			37541	7380	594	849	46364	43690
1991			18770	4602		849	24221	22376
1992				1823		849	2672	2420
1993				1823		849	2672	2373
1994				1823		849	2672	2326
1995				1823		849	2672	2281
1996				1823		849	2672	2236
1997				1823		849	2672	2192
1998				7380		849	8229	6618
1999				7380		849	8229	6489
2000				7380		849	8229	6361
2001				26156*		849	27005	20466
TOTAL	9215	8945	112622	82286	3564	12735	229367	208444

* - Decommissioning cost

Initial Payment = 71 \$/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)	\$60,709	\$646	\$218,096	\$131
100% PWR Fuel	60,180	641	208,222	125
100% BWR Fuel	61,714	656	237,801	143
Change per kg/U difference in average content of drywell	16	0.16	311	0.19
Existing Transfer Facility Cases				
67% PWR Fuel (Base Case)	\$44,383	\$478	\$199,603	\$121
100% PWR Fuel	43,855	473	189,730	114
100% BWR Fuel	45,400	489	219,314	131
Change per kg/U difference in average content of drywell	16	0.17	311	0.18

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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	1672			594	217	5909	5909
1988	235	146			1188	217	1786	1751
1989	8790	1908			1188	217	12103	11633
1990	8672	1835	910	1078	594	217	13306	12539
1991			1819	2156		217	4192	3873
1992			1819	2156		217	4192	3797
1993			910	2037		217	3164	2910
1994				1918		217	2135	1839
1995				1918		217	2135	1822
1996				1918		217	2135	1786
1997				1918		217	2135	1731
1998				2156		217	2373	1909
1999				2156		217	2373	1871
2000				2156		217	2373	1834
2001				6428*		217	6645	5036
TOTAL	21123	5561	5458	27995	3564	3255	66936	60180

* - Decommissioning cost

Initial Payment = 354 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 287 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	1670			594	217	5907	5907
1988	235	146			1188	217	1786	1751
1989	8790	1900			1188	217	12095	11625
1990	8672	1827	1144	1081	594	217	13535	12754
1991			2289	2162		217	4668	4313
1992			2289	2162		217	4668	4228
1993			1144	2043		217	3404	3023
1994				1924		217	2141	1864
1995				1924		217	2141	1827
1996				1924		217	2141	1791
1997				1924		217	2141	1756
1998				2162		217	2379	1913
1999				2162		217	2379	1876
2000				2162		217	2379	1839
2001				6706*		217	6923	5247
TOTAL	21123	5543	6866	28336	3564	3255	68687	61714

* - Decommissioning cost

Initial Payment = 366 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 290 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	2093			594	849	6962	6962
1988	235	146			1188	849	2418	2371
1989	8790	3310			1188	849	14137	13588
1990	8672	3237	17274	3700	594	849	34326	32346
1991			34548	7400		849	42797	39538
1992			34548	7400		849	42797	38763
1993			17274	5269		849	23392	20771
1994				3138		849	3987	3471
1995				3138		849	3987	3403
1996				3138		849	3987	3336
1997				3138		849	3987	3271
1998				7400		849	8249	6634
1999				7400		849	8249	6504
2000				7400		849	8249	6377
2001				26711*		849	27560	20887
TOTAL	21123	8786	103644	85232	3564	12735	235084	208222

* - Decommissioning cost

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

Final Payment = 53 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	2078			594	849	6947	6947
1988	235	146			1188	849	2418	2371
1989	8790	3260			1188	849	14087	13340
1990	8672	3187	21759	3757	594	849	38818	36579
1991			43518	7513		849	51880	47929
1992			43518	7513		849	51880	46989
1993			21759	5382		849	27990	24854
1994				3251		849	4100	3569
1995				3251		849	4100	3499
1996				3251		849	4100	3431
1997				3251		849	4100	3363
1998				7513		849	8362	6725
1999				7513		849	8362	6593
2000				7513		849	8362	6464
2001				32070*		849	32919	24948
TOTAL	21123	8671	130554	91778	3564	12735	268425	237801

* - Decommissioning cost

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

Final Payment = 57 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	1698			594	217	4017	4017
1988	107	146			1188	217	1658	1625
1989	3826	1994			1188	217	7225	6944
1990	3773	1921	910	1048	594	217	8463	7975
1991			1819	2096		217	4132	3817
1992			1819	2096		217	4132	3742
1993			910	1615		217	2742	2435
1994				1134		217	1351	1176
1995				1134		217	1351	1153
1996				1134		217	1351	1130
1997				1134		217	1351	1108
1998				2096		217	2313	1860
1999				2096		217	2313	1824
2000				2096		217	2313	1788
2001				4086*		217	4303	3261
TOTAL	9214	5759	5458	21765	3564	3255	49015	43855

* - Decommissioning cost

Initial Payment = 240 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 233 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	1695			594	217	4014	4014
1988	107	146			1188	217	1658	1625
1989	3826	1986			1188	217	7217	6937
1990	3773	1912	1144	1052	594	217	8692	8191
1991			2289	2103		217	4609	4258
1992			2289	2103		217	4609	4175
1993			1144	1622		217	2983	2649
1994				1141		217	1358	1182
1995				1141		217	1358	1159
1996				1141		217	1358	1136
1997				1141		217	1358	1114
1998				2103		217	2320	1866
1999				2103		217	2320	1829
2000				2103		217	2320	1793
2001				4364*		217	4581	3472
TOTAL	9214	5739	6866	22117	3564	3255	50755	45400

* - Decommissioning cost

Initial Payment = 253 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 236 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	2118			594	849	5069	5069
1988	107	146			1188	849	2290	2245
1989	3826	3395			1188	849	9258	8899
1990	3773	3322	17274	3671	594	849	29483	27782
1991			34548	7342		849	42739	39484
1992			34548	7342		849	42739	38710
1993			17274	4364		849	22687	20145
1994				1785		849	2634	2293
1995				1785		849	2634	2248
1996				1785		849	2634	2204
1997				1785		849	2634	2161
1998				7342		849	8191	6589
1999				7342		849	8191	6459
2000				7342		849	8191	6332
2001				24368*		849	25217	19111
TOTAL	9214	8981	103644	76453	3564	12735	214591	189730

* - Decommissioning cost

Initial Payment = 66 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	2103			594	849	5054	5054
1988	107	146			1188	849	2290	2245
1989	3826	3345			1188	849	9208	8850
1990	3773	3272	21759	3728	594	849	33975	32015
1991			43518	7455		849	51822	47876
1992			43518	7455		849	51822	46937
1993			21759	4677		849	27285	24228
1994				1899		849	2748	2392
1995				1899		849	2748	2345
1996				1899		849	2748	2299
1997				1899		849	2748	2254
1998				7455		849	8304	6679
1999				7455		849	8304	6548
2000				7455		849	8304	6419
2001				29727*		849	30576	23173
TOTAL	9214	8866	130554	82003	3564	12735	247936	219314

* - Decommissioning cost

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

Final Payment = 52 \$/KgU (Includes \$8/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)	\$60,709	\$646	\$218,096	\$131
4%	55,057	607	194,757	122
6%	50,342	572	175,183	113
Decrease per percent increase in discount rate	2,592	18.5	10,728	4.5
Existing Transfer Facility Cases				
2% (Base Case)	\$44,383	\$478	\$199,603	\$121
4%	40,077	449	177,927	111
6%	36,489	424	159,747	103
Decrease per percent increase in discount rate	1,974	13.5	9,964	4.5

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

TABLE A10-50
COST SENSITIVITY CASE -- 4% DISCOUNT RATE
ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 236 DRYWELLS (100 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	1671			594	217	5908	5908
1988	235	146			1188	217	1786	1717
1989	8790	1906			1188	217	12101	11188
1990	8672	1833	989	1080	594	217	13385	11899
1991			1978	2159		217	4354	3722
1992			1978	2159		217	4354	3579
1993			989	2040		217	3246	2565
1994				1921		217	2138	1625
1995				1921		217	2138	1562
1996				1921		217	2138	1502
1997				1921		217	2138	1444
1998				2159		217	2376	1543
1999				2159		217	2376	1484
2000				2159		217	2376	1427
2001				6523*		217	6740	3892
TOTAL	21123	5556	5934	28122	3564	3255	67554	55057

* - Decommissioning cost

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

Final Payment = 264 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	1671			594	217	5908	5908
1988	235	146			1188	217	1786	1685
1989	8790	1906			1188	217	12101	10770
1990	8672	1833	989	1080	594	217	13385	11238
1991			1978	2159		217	4354	3449
1992			1978	2159		217	4354	3254
1993			989	2040		217	3246	2288
1994				1921		217	2138	1422
1995				1921		217	2138	1341
1996				1921		217	2138	1265
1997				1921		217	2138	1194
1998				2159		217	2376	1252
1999				2159		217	2376	1181
2000				2159		217	2376	1114
2001				6523*		217	6740	2981
TOTAL	21123	5556	5934	28122	3564	3255	67554	50342

* - Decommissioning cost

Initial Payment = 328 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 244 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	2088			594	849	6957	6957
1988	235	146			1188	849	2418	2325
1989	8790	3294			1188	849	14121	13056
1990	8672	3221	18770	3719	594	849	35825	31848
1991			37541	7438		849	45828	39174
1992			37541	7438		849	45828	37667
1993			18770	5307		849	24926	19699
1994				3176		849	4025	3059
1995				3176		849	4025	2941
1996				3176		849	4025	2828
1997				3176		849	4025	2719
1998				7438		849	8287	5383
1999				7438		849	8287	5176
2000				7438		849	8287	4977
2001				28499*		849	29348	16948
TOTAL	21123	8749	112622	87419	3564	12735	246212	194757

* - Decommissioning cost

Initial Payment = 72 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	2088			594	849	6957	6957
1988	235	146			1188	849	2418	2281
1989	8790	3294			1188	849	14121	12568
1990	8672	3221	18770	3719	594	849	35825	30079
1991			37541	7438		849	45828	36300
1992			37541	7438		849	45828	34245
1993			18770	5307		849	24926	17572
1994				3176		849	4025	2677
1995				3176		849	4025	2525
1996				3176		849	4025	2382
1997				3176		849	4025	2248
1998				7438		849	8287	4365
1999				7438		849	8287	4118
2000				7438		849	8287	3885
2001				28499*		849	29348	12981
TOTAL	21123	8749	112622	87419	3564	12735	246212	175183

* - Decommissioning cost

Initial Payment = 67 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	1697			594	217	4016	4016
1988	107	146			1188	217	1658	1594
1989	3826	1992			1188	217	7223	6678
1990	3773	1919	989	1050	594	217	8542	7594
1991			1978	2099		217	4294	3671
1992			1978	2099		217	4294	3529
1993			989	1618		217	2824	2232
1994				1136		217	1353	1028
1995				1136		217	1353	989
1996				1136		217	1353	951
1997				1136		217	1353	914
1998				2099		217	2316	1504
1999				2099		217	2316	1447
2000				2099		217	2316	1391
2001				4180*		217	4397	2539
TOTAL	9214	5754	5934	21887	3564	3255	49608	40077

* - Decommissioning cost

Initial Payment = 232 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 217 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	1697			594	217	4016	4016
1988	107	146			1188	217	1658	1564
1989	3826	1992			1188	217	7223	6428
1990	3773	1919	989	1050	594	217	8542	7172
1991			1978	2099		217	4294	3401
1992			1978	2099		217	4294	3209
1993			989	1618		217	2824	1991
1994				1136		217	1353	900
1995				1136		217	1353	849
1996				1136		217	1353	801
1997				1136		217	1353	756
1998				2099		217	2316	1220
1999				2099		217	2316	1151
2000				2099		217	2316	1086
2001				4180*		217	4397	1945
TOTAL	9214	5754	5934	21887	3564	3255	49608	36489

* - Decommissioning cost

Initial Payment = 221 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 203 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	2113			594	849	5064	5064
1988	107	146			1188	849	2290	2202
1989	3826	3379			1188	849	9242	8545
1990	3773	3306	18770	3690	594	849	30982	27543
1991			37541	7380		849	45770	39124
1992			37541	7380		849	45770	37620
1993			18770	4602		849	24221	19142
1994				1823		849	2672	2031
1995				1823		849	2672	1952
1996				1823		849	2672	1877
1997				1823		849	2672	1803
1998				7380		849	8229	5345
1999				7380		849	8229	5140
2000				7380		849	8229	4942
2001				26156*		849	27005	13595
TOTAL	9214	8944	112622	78640	3564	12735	225719	177927

* - Decommissioning cost

Initial Payment = 66 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 45 \$/KgU (Includes \$7/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	2113			594	849	5064	5064
1988	107	146			1188	849	2290	2160
1989	3826	3379			1188	849	9242	8223
1990	3773	3306	18770	3690	594	849	30982	26013
1991			37541	7380		849	45770	36254
1992			37541	7380		849	45770	34202
1993			18770	4602		849	24221	17075
1994				1823		849	2672	1777
1995				1823		849	2672	1676
1996				1823		849	2672	1582
1997				1823		849	2672	1492
1998				7380		849	8229	4335
1999				7380		849	8229	4090
2000				7380		849	8229	3858
2001				26156*		849	27005	11944
TOTAL	9214	8944	112622	78640	3564	12735	225719	159747

* - Decommissioning cost

Initial Payment = 61 \$/KgU (Includes \$4/KgU impact aid)

Final Payment = 42 \$/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

	<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				
Full NRC Licensing (Base Case)	\$60,709	\$646	\$218,096	\$131
No NRC Licensing Activities	58,881	628	216,271	130
Savings	1,828	18	1,825	1
No NRC Security	53,392	566	210,779	127
Savings	7,317	80	7,317	4
No NRC Licensing or Security	51,566	548	208,957	126
Savings	9,143	98	9,139	5
Existing Transfer Facility Cases				
Full NRC Licensing (Base Case)	\$44,383	\$478	\$199,603	\$121
No NRC Licensing Activities	43,347	468	198,567	120
Savings	1,036	10	1,036	1
No NRC Security	37,063	398	192,280	116
Savings	7,320	80	7,323	5
No NRC Licensing or Security	36,029	388	191,243	115
Savings	8,354	90	8,360	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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	2961	932			594	217	4704	4704
1988	103	62			1188	217	1570	1539
1989	8724	1864			1188	217	11993	11527
1990	8672	1833	989	1076	594	217	13381	12609
1991			1978	2151		217	4346	4015
1992			1978	2151		217	4346	3936
1993			989	2032		217	3238	2875
1994				1912		217	2129	1853
1995				1912		217	2129	1817
1996				1912		217	2129	1781
1997				1912		217	2129	1747
1998				2151		217	2368	1904
1999				2151		217	2368	1867
2000				2151		217	2368	1831
2001				6217*		217	6434	4876
TOTAL	20460	4691	5934	27728	3564	3255	65632	58881

* - Decommissioning cost

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

Final Payment = 285 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	1671			594	217	5908	5908
1988	233	146			1188	217	1786	1751
1989	8790	1906			1188	217	12101	11631
1990	8672	1833	989	670	594	217	12975	12227
1991			1978	1340		217	3535	3266
1992			1978	1340		217	3535	3202
1993			989	1221		217	2427	2155
1994				1102		217	1319	1148
1995				1102		217	1319	1126
1996				1102		217	1319	1104
1997				1102		217	1319	1082
1998				1340		217	1557	1252
1999				1340		217	1557	1228
2000				1340		217	1557	1204
2001				6523*		217	6740	5108
TOTAL	21123	5556	5934	19522	3564	3255	58954	53392

* - Decommissioning cost

Initial Payment = 358 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 208 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	2961	932			594	217	4704	4704
1988	103	62			1188	217	1570	1539
1989	8724	1864			1188	217	11993	11527
1990	8672	1833	989	666	594	217	12971	12223
1991			1978	1332		217	3527	3258
1992			1978	1332		217	3527	3195
1993			989	1213		217	2419	2148
1994				1094		217	1311	1141
1995				1094		217	1311	1119
1996				1094		217	1311	1097
1997				1094		217	1311	1075
1998				1332		217	1549	1246
1999				1332		217	1549	1221
2000				1332		217	1549	1197
2001				6217*		217	6434	4876
TOTAL	20460	4691	5934	19132	3564	3255	57036	51566

* - Decommissioning cost

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

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

TABLE A10-62

COST SENSITIVITY CASE -- NO NRC LICENSING

ESTIMATED SPENDING SCHEDULE FOR STORAGE OF 447B DRYWELLS (1900 MTU)
AT GOVERNMENT SITE WITHOUT EXISTING FACILITIES
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	2961	1349			594	849	5753	5753
1988	103	62			1188	849	2202	2159
1989	8724	3252			1188	849	14013	13469
1990	8672	3221	18770	3715	594	849	35821	33755
1991			37341	7430		849	45820	42331
1992			37341	7430		849	45820	41501
1993			18770	5299		849	24918	22126
1994				3168		849	4017	3497
1995				3168		849	4017	3428
1996				3168		849	4017	3361
1997				3168		849	4017	3295
1998				7430		849	8279	6658
1999				7430		849	8279	6528
2000				7430		849	8279	6400
2001				28193*		849	29042	22010
TOTAL	20460	7884	112622	87029	3564	12735	244294	216271

* - Decommissioning cost

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

Final Payment = 54 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	3426	2088			594	849	6957	6957
1988	235	146			1188	849	2418	2371
1989	8790	3294			1188	849	14121	13573
1990	8672	3221	18770	3309	594	849	35415	33372
1991			37541	6618		849	45008	41580
1992			37541	6618		849	45008	40765
1993			18770	4489		849	24108	21407
1994				2359		849	3208	2793
1995				2359		849	3208	2758
1996				2359		849	3208	2684
1997				2359		849	3208	2632
1998				6618		849	7467	6005
1999				6618		849	7467	5888
2000				6618		849	7467	5772
2001				28499*		849	29348	22242
TOTAL	21123	8749	112622	78823	3564	12735	237616	210779

* - Decommissioning cost

Initial Payment = 77 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	2961	1349			594	849	5753	5753
1988	103	62			1188	849	2202	2159
1989	8724	3252			1188	849	14013	13469
1990	8672	3221	18770	3305	594	849	35411	33369
1991			37541	6610		849	45000	41573
1992			37541	6610		849	45000	40758
1993			18770	4481		849	24100	21400
1994				2351		849	3200	2786
1995				2351		849	3200	2731
1996				2351		849	3200	2678
1997				2351		849	3200	2625
1998				6610		849	7459	5999
1999				6610		849	7459	5881
2000				6610		849	7459	5766
2001				28193*		849	29042	22010
TOTAL	20460	7884	112622	78433	3564	12735	235698	208957

* - Decommissioning cost

Initial Payment = 76 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	938			594	217	3277	3277
1988	107	62			1188	217	1574	1543
1989	3826	1930			1188	217	7181	6902
1990	3773	1919	989	1047	594	217	8539	8046
1991			1978	2094		217	4289	3962
1992			1978	2094		217	4289	3885
1993			989	1613		217	2819	2503
1994				1132		217	1349	1174
1995				1132		217	1349	1131
1996				1132		217	1349	1129
1997				1132		217	1349	1107
1998				2094		217	2311	1839
1999				2094		217	2311	1822
2000				2094		217	2311	1786
2001				4007*		217	4224	3201
TOTAL	9214	4889	5934	21665	3564	3255	48521	43347

* - Decommissioning cost

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

Final Payment = 232 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	1697			594	217	4016	4016
1988	107	146			1188	217	1658	1625
1989	3826	1992			1188	217	7222	6943
1990	3773	1919	989	640	594	217	8132	7663
1991			1978	1280		217	3475	3210
1992			1978	1280		217	3475	3147
1993			989	799		217	2005	1780
1994				317		217	534	465
1995				317		217	534	456
1996				317		217	534	447
1997				317		217	534	438
1998				1280		217	1497	1204
1999				1280		217	1497	1180
2000				1280		217	1497	1157
2001				4180*		217	4397	3332
TOTAL	9214	5754	3934	13287	3564	3255	41008	37063

* - Decommissioning cost

Initial Payment = 244 \$/KgU (Includes \$5/KgU impact aid)

Final Payment = 154 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	958			594	217	3277	3277
1988	107	62			1188	217	1574	1543
1989	3826	1950			1188	217	7181	6902
1990	3773	1919	989	638	594	217	8130	7661
1991			1978	1275		217	3470	3206
1992			1978	1275		217	3470	3143
1993			989	794		217	2000	1776
1994				313		217	530	461
1995				313		217	530	452
1996				313		217	530	443
1997				313		217	530	435
1998				1275		217	1492	1200
1999				1275		217	1492	1176
2000				1275		217	1492	1153
2001				4007*		217	4224	3201
TOTAL	9214	4889	5934	13066	3564	3255	39922	36029

* - Decommissioning cost

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

Final Payment = 152 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	1374			594	849	4325	4325
1988	107	62			1188	849	2206	2163
1989	3826	3337			1188	849	9200	8843
1990	3773	3306	18770	3688	594	849	30980	29193
1991			37541	7375		849	45765	42280
1992			37541	7375		849	45765	41451
1993			18770	4597		849	24216	21503
1994				1818		849	2667	2322
1995				1818		849	2667	2276
1996				1818		849	2667	2232
1997				1818		849	2667	2188
1998				7375		849	8224	6614
1999				7375		849	8224	6485
2000				7375		849	8224	6357
2001				25983*		849	26832	20335
TOTAL	9214	8079	112622	78415	3564	12735	224629	198567

* - Decommissioning cost

Initial Payment = 70 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	2113			594	849	5064	5064
1988	107	146			1188	849	2290	2245
1989	3826	3379			1188	849	9242	8883
1990	3773	3306	18770	3280	594	849	30572	28809
1991			37541	6560		849	44950	41527
1992			37541	6560		849	44950	40713
1993			18770	3782		849	23401	20779
1994				1004		849	1853	1613
1995				1004		849	1853	1582
1996				1004		849	1853	1551
1997				1004		849	1853	1520
1998				6560		849	7409	5959
1999				6560		849	7409	5842
2000				6560		849	7409	5727
2001				26156*		849	27005	20466
TOTAL	9214	8944	112622	70034	3564	12735	217113	192280

* - Decommissioning cost

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

Final Payment = 45 \$/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
(\$000,1987)

YEAR	TRANS FACIL COSTS	STOR AREA COSTS	MODULE COSTS	OPERAT COSTS	FIS DEVEL COSTS	GOVT. ADMIN COSTS	TOTAL COSTS	DISC. TOTAL COSTS
1987	1508	1374			594	849	4325	4325
1988	107	62			1188	849	2206	2163
1989	3826	3337			1188	849	9200	8843
1990	3773	3306	18770	3278	594	849	30570	28807
1991			37541	6555		849	44945	41522
1992			37541	6555		849	44945	40708
1993			18770	3777		849	23396	20775
1994				999		849	1848	1609
1995				999		849	1848	1577
1996				999		849	1848	1546
1997				999		849	1848	1516
1998				6555		849	7404	5955
1999				6555		849	7404	5838
2000				6555		849	7404	5724
2001				25983*		849	26832	20335
TOTAL	9214	8079	112622	69809	3564	12735	216025	191243

* - Decommissioning cost

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

Final Payment = 45 \$/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
TABLE OF CONTENTS

	<u>Page</u>
1.0 CASKS USED IN STUDY	B1-1
2.0 ESTIMATED COSTS OF CASK USE AND SERVICE	B2-1
3.0 FREIGHT COSTS	B3-1
3.1 Truck Tariffs	B3-1
3.2 Rail Tariffs	B3-5
3.2.1 Heavy Haul Charges	B3-8
3.2.2 Escort Charges	B3-10
4.0 TIME REQUIRED TO EFFECT A SPENT FUEL SHIPMENT	B4-1
5.0 TOTAL COST OF TRANSPORT OF SPENT FUEL TO A FEDERAL INTERIM STORAGE FACILITY	B5-1

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 May 1987 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	1,900/day
31 - 90 days	1,400/day
91 - 180 days	1,000/day
181 - 365 days	900/day

Utilizing this rate schedule and assuming that a cask would be used 300 days/year, a cask use charge of \$1,203/day results. JAI assumed that a 5% increase in cask use charges would be applicable for 1987, resulting in a daily use charge for the NLI 1/2 cask of \$1,263/day (1987 dollars).

General Electric provided a current quotation for the use of the IF-300 rail cask which amounted to \$3,500/day. JAI assumed that a 5% increase in cask use charges would be applicable for 1987, resulting in a daily use charge for the IF-300 cask of \$3,675/day.

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, Tri-State Motor Transmitt Co. (TSMT) has advised that all items in this tariff which are applicable to this study represent current 1986 prices when increased by a 6% insurance surcharge. JAI recommends, however, increasing the 1986 rates by 5% to reflect proposed increases in 1987. Therefore, all rates used in this study which were taken from this tariff have been increased from the 1984 published value by 11.3% in order to provide a reasonable estimation of 1987 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 83-1 sets forth the estimated 1987 Mileage Commodity Rates for the distances pertinent to this study.

A security surveillance charge of \$1.02 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 \$0.17 per mile for the return of personnel is applicable to the return of the empty cask. A charge of \$0.20/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
(1987 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	\$ 3.98	\$ 2.55
Western U.S. Site	13.20	10.00
<u>From Palisades to</u>		
Eastern U.S. Site	4.44	3.01
Western U.S. Site	10.68	8.16
<u>From St. Lucie to</u>		
Eastern U.S. Site	5.14	3.74
Western U.S. Site	16.26	12.49
<u>From Robinson to</u>		
Eastern U.S. Site	3.27	1.93
Western U.S. Site	16.26	12.49
<u>From Brunswick to</u>		
Eastern U.S. Site	4.16	2.75
Western U.S. Site	16.00	12.28
<u>From LaSalle to</u>		
Eastern U.S. Site	4.06	2.65
Western U.S. Site	9.24	7.00
<u>From Oconee to</u>		
Eastern U.S. Site	2.58	1.49
Western U.S. Site	13.79	10.61
<u>From Peach Bottom to</u>		
Eastern U.S. Site	5.14	3.74
Western U.S. Site	14.29	10.86
<u>From Pilgrim to</u>		
Eastern U.S. Site	5.90	4.46
Western U.S. Site	15.70	12.02

TABLE 83-1 (Continued)
RATES FOR TRANSPORT OF NLI 1/2 TRUCK CASK^a
(1987 Dollars)

<u>Reactor to Destination</u>	<u>Rates in Dollars per 100 Pounds</u>	
	<u>Loaded</u>	<u>Empty</u>
<u>From Indian Point to</u>		
Eastern U.S. Site	\$ 6.71	\$ 5.13
Western U.S. Site	15.15	11.56
<u>From Millstone to</u>		
Eastern U.S. Site	5.60	4.21
Western U.S. Site	15.44	11.82
<u>From Prairie Island to</u>		
Eastern U.S. Site	6.19	4.67
Western U.S. Site	9.15	6.91
<u>From La Crosse to</u>		
Eastern U.S. Site	5.42	3.96
Western U.S. Site	8.55	6.44
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	4.25	2.87
Western U.S. Site	14.29	11.10
<u>From Oyster Creek to</u>		
Eastern U.S. Site	4.82	3.47
Western U.S. Site	14.87	11.32
<u>From Cooper to</u>		
Eastern U.S. Site	5.71	4.36
Western U.S. Site	7.02	5.39
<u>From Sequoyah to</u>		
Eastern U.S. Site	1.85	1.18
Western U.S. Site	12.64	9.67
<u>From Davis Besse to</u>		
Eastern U.S. Site	4.55	3.15
Western U.S. Site	11.21	8.55

^a Rates based upon Tariff ICC 4007-A, Item 2000, dated October 15, 1984 and escalated by 11.3% to approximate mid-1987 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	\$19.48
9 - 16	\$25.04
17 - 24	\$30.61
All Over 24	\$36.17

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 \$542.60 for loading and \$197.56 for unloading for a total charge of \$740.16/round trip.

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

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

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

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

- (1) Each major locality through which the shipment passes will require an escort.
- (2) Escorts in each of these localities will be provided by off-duty, local police at a charge of \$23.76/hr. per person, including provision of a vehicle.
- (3) A minimum of 4 hours will be required for transit from 5 miles outside the locality, through locality, to 5 miles on the other side of the locality.
- (4) The labor costs to make the necessary escort arrangements in each locality and the cost of communicating with each locality involved in a shipment (i.e., telephone, mail, telex) was estimated at \$57.

Taking into consideration the above assumptions and estimated costs, it was estimated that there would be a total cost of \$175 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 2.42% (based on the increase in the index for freight for Class I railroads from 1984 to that projected by JAI for 1987) to obtain the 1987 values set forth in Table B3-2.

TABLE B3-2
RAIL FREIGHT RATES
(1987 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	\$ 6.41	\$ 6.01
Western U.S. Site	17.67	16.56
<u>From Palisades to</u>		
Eastern U.S. Site	6.66	6.25
Western U.S. Site	13.90	13.03
<u>From St. Lucie to</u>		
Eastern U.S. Site	7.82	7.33
Western U.S. Site	18.22	17.08
<u>From Robinson to</u>		
Eastern U.S. Site	5.38	5.04
Western U.S. Site	17.43	16.34
<u>From Brunswick to</u>		
Eastern U.S. Site	6.04	5.66
Western U.S. Site	17.91	16.80
<u>From LaSalle to</u>		
Eastern U.S. Site	6.01	5.63
Western U.S. Site	13.11	12.29
<u>From Oconee to</u>		
Eastern U.S. Site	4.70	4.40
Western U.S. Site	16.39	15.36
<u>From Peach Bottom to</u>		
Eastern U.S. Site	6.79	6.36
Western U.S. Site	16.99	15.93
<u>From Pilgrim to</u>		
Eastern U.S. Site	9.01	8.45
Western U.S. Site	18.15	17.01

TABLE B3-2 (Continued)

RAIL FREIGHT RATES
(1987 Dollars)

<u>Reactor to Destination</u>	<u>Rates in Dollars per 100 Pounds</u>	
	<u>Class 40</u> <u>Loaded</u>	<u>Class 37½</u> <u>Empty</u>
<u>From Indian Point to</u>		
Eastern U.S. Site	\$ 8.09	\$ 7.58
Western U.S. Site	17.79	16.68
<u>From Millstone to</u>		
Eastern U.S. Site	8.60	8.07
Western U.S. Site	18.15	17.01
<u>From Prairie Island to</u>		
Eastern U.S. Site	8.87	8.32
Western U.S. Site	12.46	11.69
<u>From La Crosse to</u>		
Eastern U.S. Site	8.33	7.80
Western U.S. Site	12.65	11.86
<u>From Calvert Cliffs to</u>		
Eastern U.S. Site	6.55	6.15
Western U.S. Site	17.17	16.10
<u>From Oyster Creek to</u>		
Eastern U.S. Site	7.58	7.11
Western U.S. Site	17.67	16.56
<u>From Cooper to</u>		
Eastern U.S. Site	8.87	8.32
Western U.S. Site	10.84	10.16
<u>From Sequoyah to</u>		
Eastern U.S. Site	3.20	3.00
Western U.S. Site	15.26	14.31
<u>From Davis Besse to</u>		
Eastern U.S. Site	5.77	5.41
Western U.S. Site	14.64	13.72

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
(1987 Dollars)

Reactor to Railhead/Railhead to Western U.S. FIS Facility					
<u>Reactor</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	\$3,987	\$5,780	\$203	\$ 9,970
St. Lucie	10	3,056	5,780	255	9,091
Pilgrim	25	3,615	5,780	80	9,475
Oconee	10	3,056	5,780	102	8,938
Indian Point	5	2,869	5,780	134	8,783
Millstone	5	2,869	5,780	156	8,805
Oyster Creek	25	3,615	5,780	723	10,118
Calvert Cliffs	50	4,546	5,780	807	11,133
Western U.S. FIS	27	3,689	5,780	-	9,469

^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) @ \$111.79/hr.

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

2x(4 hrs deadhead time plus 4 hrs loading/unloading time) @ \$160.39/hr, plus a crane charge @ \$1,607 per day, 2 days per round trip.

^cPermits required for cask and for crane for each transfer, Ref. Item 675, ICC Tariff TRSM-4007-A. Tariff values escalated to estimate 1987 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 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 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 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

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

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

^c Turnaround 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 Palisades to</u>							
Eastern U.S. Site	1,168	191.5	-	0	144	335.5	14.0
Western U.S. Site	3,402	479.2	9.0	8	144	640.2	26.7
<u>From St. Lucie to</u>							
Eastern U.S. Site	1,558	239.7	3.3	8	144	395.0	16.5
Western U.S. Site	5,454	673.3	12.3	16	144	845.6	35.2
<u>From Robinson to</u>							
Eastern U.S. Site	794	193.7	-	0	144	337.7	14.1
Western U.S. Site	4,664	675.9	9.0	8	144	836.9	34.9
<u>From 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 Peach Bottom to</u>							
Eastern U.S. Site	1,304	289.8	-	0	144	433.8	18.1
Western U.S. Site	4,660	675.4	9.0	8	144	836.4	34.8

TABLE B4-2 (Continued)

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

<u>Reactor to Destination</u>	<u>Round Trip Distance (Miles)</u>	<u>Round Trip Rail Transit Time (Hours)</u>	<u>Round Trip Heavy Haul Time (Hours)</u>	<u>Round Trip Heavy Haul Transfer Time (Hours)</u>	<u>Turnaround Time (Hours)</u>	<u>Total Time (Hours)</u>	<u>Total Time (Days)</u>
<u>From Pilgrim to</u>							
Eastern U.S. Site	2,044	335.1	8.3	8	144	495.4	20.6
Western U.S. Site	5,210	744.3	17.3	16	144	921.6	38.4
<u>From 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 85-1 details those costs which can reasonably be expected to be incurred when transporting spent fuel by truck. Table 85-2 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
 (1987 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	\$3,517	\$1,950	\$1,224	\$ 576	\$ 87	\$740	\$ 699	\$ 8,794	\$19,077
Western U.S. Site	8,554	6,468	4,800	2,366	359	740	1,748	25,035	54,307
From Palisades to									
Eastern U.S. Site	3,864	2,176	1,445	700	106	740	874	9,905	21,485
Western U.S. Site	7,303	5,233	3,917	1,922	291	740	1,049	20,455	44,371
From St. Lucie to									
Eastern U.S. Site	4,369	2,519	1,795	879	133	740	1,399	11,835	25,672
Western U.S. Site	10,220	7,967	5,995	2,948	450	740	2,623	30,943	67,122
From Robinson to									
Eastern U.S. Site	2,997	1,602	926	392	59	740	699	7,416	16,086
Western U.S. Site	10,148	7,967	5,995	2,933	444	740	2,623	30,850	66,920
From Brunswick to									
Eastern U.S. Site	3,634	2,038	1,320	618	94	740	699	9,144	24,983
Western U.S. Site	9,994	7,840	5,894	2,878	436	740	2,448	30,231	82,599
From LaSalle to									
Eastern U.S. Site	3,597	1,989	1,272	605	92	740	874	9,169	25,051
Western U.S. Site	6,625	4,528	3,360	1,681	255	740	874	18,062	49,351
From Oconee to									
Eastern U.S. Site	2,497	1,264	715	214	32	740	874	6,338	13,748
Western U.S. Site	8,927	6,757	5,093	2,499	379	740	2,448	26,842	58,226
From Peach Bottom to									
Eastern U.S. Site	4,369	2,519	1,795	879	133	740	699	11,135	30,424
Western U.S. Site	9,142	7,002	5,213	2,576	390	740	1,748	26,811	73,254
From Pilgrim to									
Eastern U.S. Site	4,851	2,891	2,141	1,051	159	740	874	12,706	34,717
Western U.S. Site	9,854	7,693	5,770	2,828	429	740	1,923	29,238	79,884

TABLE B5-1 (Continued)
ESTIMATED COSTS OF TRUCK SHIPMENT OF SPENT NUCLEAR FUEL^a
(1987 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 Indian Point to									
Eastern U.S. Site	\$5,336	\$3,288	\$2,462	\$1,223	\$185	\$740	\$1,049	\$14,284	\$30,985
Western U.S. Site	9,539	7,424	5,549	2,716	412	740	1,923	28,302	61,393
From Millstone to									
Eastern U.S. Site	4,705	2,744	2,021	999	151	740	874	12,234	26,537
Western U.S. Site	9,763	7,566	5,674	2,796	424	740	1,748	28,710	62,278
From Prairie Island to									
Eastern U.S. Site	5,046	3,033	2,242	1,120	170	740	1,399	13,749	29,825
Western U.S. Site	6,516	4,484	3,317	1,642	249	740	1,399	18,347	39,798
From La Crosse to									
Eastern U.S. Site	4,553	2,656	1,901	945	143	740	1,224	12,161	33,227
Western U.S. Site	6,220	4,190	3,091	1,537	233	740	874	16,885	46,135
From Calvert Cliffs to									
Eastern U.S. Site	3,735	2,083	1,378	654	99	740	699	9,387	20,363
Western U.S. Site	9,191	7,002	5,328	2,593	393	740	1,574	26,821	58,180
From Oyster Creek to									
Eastern U.S. Site	4,162	2,362	1,666	1,161	122	740	1,049	11,262	30,770
Western U.S. Site	9,469	7,286	5,434	3,879	408	740	1,923	29,140	79,618
From Cooper to									
Eastern U.S. Site	4,793	2,798	2,093	1,485	156	740	1,224	13,289	36,309
Western U.S. Site	5,462	3,440	2,587	1,827	192	740	1,049	15,298	41,798
From Sequoyah to									
Eastern U.S. Site	2,207	907	566	111	17	740	0	4,548	9,866
Western U.S. Site	8,324	6,194	4,642	2,285	346	740	1,923	24,453	53,044
From Davis Besse to									
Eastern U.S. Site	3,906	2,230	1,512	715	108	740	699	9,911	21,498
Western U.S. Site	7,578	5,493	4,104	2,020	306	740	1,224	21,465	46,561

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

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

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

TABLE 85-2
ESTIMATED COSTS OF RAIL SHIPMENT OF SPENT NUCLEAR FUEL^a
(1987 Dollars)

<u>Reactor to Destination</u>	<u>Cask Use & Service Charge</u>	<u>Heavy Haul Charge</u>	<u>Rail Freight Charge^b</u>	<u>Escort Charge</u>	<u>Total Cost</u>	<u>Unit Cost (\$/MTU)^c</u>
<u>From Surry to</u>						
Eastern U.S. Site	\$ 54,612	\$ 9,970	\$19,768	\$4,576	\$ 88,926	\$27,557
Western U.S. Site	130,909	19,440	54,481	13,846	218,676	67,764
<u>From Palisades to</u>						
Eastern U.S. Site	51,370	0	20,547	4,399	76,316	23,649
Western U.S. Site	98,024	9,469	42,862	9,917	160,273	49,666
<u>From St. Lucie to</u>						
Eastern U.S. Site	60,488	9,091	24,113	5,383	99,075	30,702
Western U.S. Site	129,493	18,560	56,184	13,935	218,172	67,608
<u>From Robinson to</u>						
Eastern U.S. Site	51,704	0	16,585	4,268	72,557	22,484
Western U.S. Site	128,157	9,469	53,749	13,575	204,950	63,511
<u>From Brunswick to</u>						
Eastern U.S. Site	51,354	0	18,622	4,312	74,288	22,553
Western U.S. Site	127,839	9,469	55,244	13,714	206,267	62,619
<u>From LaSalle to</u>						
Eastern U.S. Site	58,800	0	18,527	5,124	82,451	25,031
Western U.S. Site	98,200	9,469	40,427	9,833	157,929	47,944
<u>From Oconee to</u>						
Eastern U.S. Site	53,126	8,938	14,484	4,200	80,748	25,023
Western U.S. Site	129,462	18,407	50,534	13,515	211,919	65,670
<u>From Peach Bottom to</u>						
Eastern U.S. Site	66,422	0	20,930	6,008	93,360	28,342
Western U.S. Site	128,068	9,469	52,396	13,564	203,497	61,778
<u>From Pilgrim to</u>						
Eastern U.S. Site	75,860	9,475	27,789	7,179	120,304	36,522
Western U.S. Site	141,123	18,944	55,961	15,024	231,052	70,143

TABLE B5-2 (Continued)
ESTIMATED COSTS OF RAIL SHIPMENT OF SPENT NUCLEAR FUEL^a
(1987 Dollars)

Reactor to Destination	Cask Use & Service Charge	Heavy Haul Charge	Rail Freight Charge ^b	Escort Charge	Total Cost	Unit Cost (\$/MTU) ^c
<u>From Indian Point to</u>						
Eastern U.S. Site	\$ 67,372	\$ 8,784	\$ 24,941	\$ 6,124	\$107,221	\$33,226
Western U.S. Site	129,126	18,253	54,863	13,657	215,899	66,904
<u>From Millstone to</u>						
Eastern U.S. Site	67,572	8,806	26,532	6,224	109,133	33,819
Western U.S. Site	129,493	18,275	55,961	13,792	217,521	67,407
<u>From Prairie Island to</u>						
Eastern U.S. Site	58,926	0	27,360	5,437	91,722	28,423
Western U.S. Site	87,434	9,469	38,437	8,484	143,825	44,569
<u>From La Crosse to</u>						
Eastern U.S. Site	58,800	0	25,673	5,347	89,820	27,268
Western U.S. Site	86,909	9,469	39,010	8,474	143,863	43,674
<u>From Calvert Cliffs to</u>						
Eastern U.S. Site	55,164	11,133	20,213	4,645	91,146	28,245
Western U.S. Site	130,959	20,603	52,814	13,777	218,153	67,602
<u>From Oyster Creek to</u>						
Eastern U.S. Site	62,478	10,118	23,381	5,401	101,378	30,777
Western U.S. Site	129,665	19,587	54,481	13,732	217,466	66,019
<u>From Cooper to</u>						
Eastern U.S. Site	58,800	0	27,360	5,442	91,602	27,809
Western U.S. Site	87,325	9,469	33,424	8,327	138,545	42,060
<u>From Sequoyah to</u>						
Eastern U.S. Site	39,966	0	9,868	2,813	52,647	16,314
Western U.S. Site	126,921	9,469	47,064	13,187	196,641	60,936
<u>From Davis Besse to</u>						
Eastern U.S. Site	51,208	0	17,794	4,270	73,272	22,706
Western U.S. Site	97,847	9,469	45,130	10,086	162,540	50,369

^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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