Statement of

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U. S. Nuclear Regulatory Commission

Before the

Committee on Interior and Insular Affairs

U. S. House of Representatives

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Mr. Chairman, members of the Committee, I appreciate this opportunity to report on the actions taken by the Commission to avoid a possible shortage of spent fuel storage capacity. My testimony will summarize the results of individual licensing reviews of proposed fuel pool expansions at power reactors, the status of proposed spent fuel transfers between reactors, and the status of proposed regulations governing the storage of spent fuel in an independent storage installation. Your letter of January 11 asked eight specific questions and answers to these questions are attached to this testimony.

Let me first give you an overview of the storage situation. Spent fuel assemblies from light-water reactors consist of highly radioactive fuel pins held together in a geometric cluster and are typically sixteen to eight~~een~~ feet long. Fuel assemblies from boiling-water reactors and pressurized-water reactors differ slightly but the basic components of each are the fuel pins. A fuel pin of either type is a section of metal tubing, approximately one-half inch in diameter and hermetically sealed, filled with ceramic pellets of uranium oxide. To date, no power reactor has had to cease operation because of a lack of storage space for spent fuel. A total of approximately 20,000 spent fuel assemblies have been generated by the past operation of licensed power reactors. About

15,000 of these assemblies are presently stored in power reactor pools, and the remaining 5,000 assemblies are either stored in away-from-reactor pools or have been reprocessed. Approximately 5,000 additional assemblies will be produced during this year. Many utilities have accomplished or proposed modifications which will provide sufficient storage for up to ten additional years of plant operation. Some existing storage racks are now full, however, and some pools are approaching the limits of their physical capacity. Even if all pending proposals to provide additional storage are approved and implemented, at least one facility could have a spent fuel storage problem within the next 3 years. No federal facility for interim or ultimate storage of spent fuel exists today. There is, however, a development program under way within the Department of Energy which has been reviewed by an Interagency Review Group established by the President. We understand that the DOE plan under development could result in storage facilities by 1983/1984 and a geologic repository by the early to mid 1990s. If it appears that no Federal involvement is forthcoming in interim storage facilities, there would likely be sufficient incentives for industry to provide the necessary interim capacity.

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Current NRC assessments regarding the environmental impacts of reactor operation consider the so-called once through, or no reprocessing fuel cycle. There is no assessment of long-term storage of spent fuel at reactor sites. The implicit assumption has been and continues to be disposal at a government-owned facility. Thus, it is clear that for continued licensing of nuclear power plants to proceed in the next decades it is necessary to develop and implement a waste management and disposal policy which is capable of dealing with the various forms that the waste might take. The Commission has, as a matter of policy, linked continued reactor licensing to ultimate implementation of a safe waste disposal program. In 1977, the Commission in denying a petition requesting a moratorium on new reactor operating licenses, said, "The Commission would not continue to license reactors if it did not have reasonable confidence that the wastes can and will in due course be disposed of safely".

LICENSING REVIEW PROCEDURES

Prior to 1975, spent fuel was stored under water in racks at reactor plants that were not built with any particular attempt to maximize the storage capacity. About five years ago, licensees of nuclear reactors began to recognize that they could not store fuel for only a short time and subsequently have it reprocessed as they originally had planned. As a result, they have taken, and are continuing to take, positive steps to provide additional storage capacity at individual plants which will permit continued reactor operation. The regulations do not require any particular storage capacity but 1-1/3 cores was the standard practice. The maximum potential increase in storage capability is limited by physical space considerations. Safety analyses for proposed increases in storage capacity have shown that, in general, these increases have a minimal impact on the original design or accident considerations. Spent fuel from operating reactors has been safely stored in a water environment for up to twenty years and reasonable extrapolations indicate that it can be safely stored for the life of a nuclear power plant.

On September 16, 1975, the Commission announced in the Federal Register (40 F. R. 42801) its intent to prepare a generic environmental impact statement on handling and storage of spent fuel from light water power reactors. This notice also announced the Commission's conclusion that it would not be in the public interest to defer all licensing actions associated with fuel storage modifications pending completion of the generic environmental impact statement. Because of the potential high public interest and the significance of proposals to increase spent fuel storage capacity, all fifty of the proposals received to date have been announced as Notices in the Federal Register. The majority of the proposals have not resulted in public comment. However, to date there have been requests for public hearings on 12 of the proposals. Hearings have been completed on five of the proposals and the Atomic Safety and Licensing Board has authorized the proposed expansion. Two of these adjudicatory decisions have been appealed to the United States courts of appeals. Hearing dates have not been established on the remaining seven proposals.

When a proposal is made by a licensee to increase the spent fuel storage capacity and after public notice of receipt of the proposal, the staff reviews the proposal and prepares (1) a safety evaluation report, and (2) an environmental impact appraisal. The Commission has identified factors that must be weighed in the environmental impact appraisal in in addition to the normal cost-benefit balance and other issues. In our safety review, the proposed design is reviewed against various NRC

Regulatory Guides, the NRC Standard Review Plan, and industry standards. Nuclear and thermal-hydraulic aspects of the review include the potential for inadvertant criticality, the ability of the heat removal system to maintain sufficient cooling, and the consequences of credible accidents. Mechanical, material, and structural aspects of the review cover the capability of the fuel assembly, storage racks, the spent fuel pool, and the spent fuel cooling system to withstand the effects of natural phenomena, such as earthquakes, tornadoes, and floods, thermal and corrosion effects, and normal operating conditions. The environmental aspects of the review include the potential thermal and radiological releases from the facility under normal and accident conditions, the potential for occupational radiation exposure, potential accident conditions, alternatives to the proposed action, and the cost-benefit balance.

EXISTING ONSITE STORAGE

The first proposal by a licensee for increasing the onsite storage capacity was submitted to the NRC in late 1974. Since then, there have been a total of 50 applications. These include 6 that are second-time modifications. The first-time applications provided increased storage capability for 60 of the 67 light water power reactors operating today. The average proposed capacity is up about a factor of three - from a nominal initial 1-1/3 cores to a total capacity of about 4 cores. Since reactors are operated with fuel cycles that discharge 1/4 to 1/3 of a core per year, each additional full-core storage capability provides 3 to 4 more years of spent fuel storage. The combined total available space, authorized and proposed, is equivalent to about 3 cores for each operating reactor. Thus, from an overall view point, if all this storage capacity were utilized by inter-facility transfers of fuel, continued reactor operation for 9 to 12 years would be possible before the reactor storage pools would be filled.

Almost all utilities with plants now undergoing NRC review for an operating license have proposed a storage capability substantially greater than existed at the construction permit review stage. The increased storage ranges from 2 to 6 cores, which provide a range from about 6 to 18 years of storage capability. If reactors currently operating, and those now under review for an operating license, utilize inter-facility transfer, there is sufficient storage until the late 1980's. The full cooperation and sharing of storage capacity of these 90 units is an idealized assumption that is not likely to be realized.

In 1977, the NRC began maintaining a status summary of spent fuel storge capacity at each operating facility. Information is being updated by licensees and is reported monthly in the NRC publication, "Operating Units Status Report," NUREG-0020. The information shows that the pools at the LaCrosse and Surry reactors are now filled, and that the pool at the Kewaunee reactor will be filled in 1979. Pools at Oconee, Point Beach and Big Rock reactors will be filled in 1980. These fill dates were estimated, based on a discharge rate of about 1/4 to 1/3 of the core into the pool at each refueling. Of these reactors, proposals have been filed by all plants, except Big Rock, either to increase on-site storage or to ship fuel off-site for storage. We understand that Big Rock intends to increase the on-site storage, but we have not received a proposal. For the situations cited above, only the proposed storage of Oconee fuel at McGuire involves shipment of spent fuel from one reactor site to another reactor site. This proposal is the subject of a current hearing. However, we have previously approved storage of spent fuel from the H. B. Robinson facility at the Brunswick facility and have applications under review involving the Dresden and Quad Cities facilities.

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While the technology for fuel storage and associated handling systems is well developed, the safety record indicates a need for continued careful scrutiny. The most serious event during the past 10 years occurred during a facility's first refueling. This incident resulted in one worker receiving 25 rem and a companion receiving about 17 rem during entry into an area adjacent to a fuel transfer tube containing newly discharged fuel. About 20 events involving dropping, tipping, or mishandling of spent fuel assemblies have occurred. None of these events resulted in appreciable personnel exposures or releases of radioactivity. About 6 other events, including pool liner leaks and instrument line failures, resulted in small amounts of pool water being inadvertently released to the environment. The maximum resulting release was less than one percent of license restrictions on liquid releases.

Several facilities have experienced swelling problems with the materials used to fabricate fuel storage racks. Gases were being generated within sealed portions of the racks requiring holes to be drilled to vent the gases and prevent the buildup of high internal pressures. The State of Minnesota (the Minnesota Pollution Control Agency) has petitioned the NRC to prohibit the use of such racks at the Monticello Plant and has requested a hearing on the matter. The staff is currently reviewing the request by the Minnesota Pollution Control Agency.

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While fuel movements within a pool to accommodate increased storage would increase somewhat the potential for occurrence of fuel mishandling events, such activities are not likely to increase the frequency or severity of the types of reported events.

SPENT FUEL TRANSPORTATION

The transportation of nuclear fuel and waste is regulated principally by the Department of Transportation and the NRC. The regulations cover both shippers and carriers and provide protection to transport workers and the general public from the hazards of radiation.

To develop and implement consistent regulations and avoid duplication, DOT and NRC have partitioned their regulatory responsibilities under a Memorandum of Understanding. In general, DOT is responsible for regulating safety in transportation of all hazardous materials (including radioactive materials), and NRC is responsible for regulating safety in receipt, possession, use, and transfer of byproduct, source, and special nuclear materials. DOT is primarily concerned with the conditions of carriage and NRC is primarily concerned with the evaluation and certification of certain package designs.

Primary reliance for safety in transportation of radioactive material is placed on the packaging. The standards established in the DOT and NRC regulations provide that the packaging shall prevent the loss or dispersion of the radioactive contents, provide adequate shielding and heat dissipation, and prevent nuclear criticality under both normal and accident conditions of transportation. Both normal conditions of transportation and postulated accident conditions that must be considered are specified in the regulations.

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Within the limitations of the regulatory standards, radioactive materials, including spent fuel, may be safely transported in routine commerce using conventional transportation equipment. No special restrictions on the speed of vehicles or routing are considered necessary to assure safety. In a recent reexamination of its regulations on packaging and transportation of radioactive materials, the NRC staff concluded that the environmental impacts of normal transportation and the risks attendant to accidents involving radioactive material shipments are sufficiently small to allow continued shipments by all modes and that no changes to the regulations are needed at this time. A supplemental study is being prepared which focuses on transportation impacts peculiar to urban areas. It will consider facets unique to the urban setting such as high population density, diurnal variation in population, shielding effects of buildings, and effects of local meteorology on accident consequences.

At present, six power reactor spent fuel cask designs are certified by NRC. These six designs include four truck casks and two rail casks. Two other rail cask designs are now being reviewed for certification.

The transportation safety regulations of NRC and DOT are consistent with those of the IAEA. Imports of spent fuel to the U. S. are subject to revalidation by the DOT, as the U. S. National Competent Authority, of

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the cask design approval certificate which the foreign shipper has obtained from his national competent authority. Under our present "Memorandum of Understanding" with DOT, the cask design would be reviewed by the NRC engineering staff before DOT provides that revalidation. We are presently considering a change to that Memorandum of Understanding which would eliminate the cask review by NRC for most import shipments because it is essentially a duplicate of that done by the foreign national competent authority, using the same package standards. Under this changed procedure, DOT would, for import shipments, screen the cask design as described in the approval certificate. If that screening raises any question about the safety of the cask design, an NRC detailed review would be provided. In the absence of questions however, DOT would revalidate the cask design approval certificate on the basis of its screening of the foreign safety review, but limiting the revalidation to import and export shipments.

Imports of spent fuel to the United States are subject to NRC import licensing. NRC has thus far licensed only relatively minor imports of foreign research reactor spent fuel for reprocessing and extraction of highly enriched uranium by the Department of Energy (DOE). In October 1977, the United States announced that, in conjunction with a program for the storage of domestic power reactor spent fuel, it was prepared

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to accept on Congressional approval limited quantities of foreign spent fuel for storage in the United States, if such action was necessary and if Federal nonproliferation goals would be advanced.

One additional matter that relates to transportation involves the Price-Anderson coverage for spent fuel. Irradiated fuel going to a storage facility from an indemnified licensed reactor is covered by the insurance and indemnity protection of the reactor from which the transportation originated. Under the current regulations, however, in a situation such as the shipment of foreign spent fuel to an independent spent fuel storage installation that is not indemnified, there would be no transportation coverage under the Price-Anderson Act. Although nuclear liability insurance for up to $160 million can now be purchased, government indemnity would not apply to this shipment unless the Commission were to extend Price-Anderson coverage to the storage facility, or some other method was devised to provide for public liability claims in the United States pertaining to shipments of foreign fuel. This is an area that will require further review as the policy of domestic storage of foreign spent fuel is developed.

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AWAY-FROM-REACTOR STORAGE

The NRC staff has evaluated the environmental impacts of the accumulation of spent fuel, and recently published a draft Generic Environmental Impact Statement (GEIS), NUREG-0404. The draft GEIS concludes that there will be a need in the early 1980s for independent spent fuel storage installations or, as these are sometimes called, away-from-reactor storage installations to accommodate some of the accumulating spent fuel. We have also published a proposed new regulation covering the requirements for extended spent fuel storage at installations built specifically for this purpose, which are not coupled to either a nuclear power plant or a fuel reprocessing plant, but possibly on the site of such plants.

We do not perceive any significant difference in safety considerations between storage of "aged" spent fuel at reactors or at away-from-reactor sites. Similar safety systems are provided at either site which are designed to minimize risk to the public. Personnel at either type of facility have comparable duties and training. Differences in site-related hazards can be and are designed to preclude these hazards from contributing significantly to the risk. Use of transportation to move spent fuel to an away-from-reactor storage facility is also a small contributor to risk. The increase in risk by expanding reactor storage capacity or extending storage time is very small relative to the risk resulting from handling and storing newly discharged fuel - - a risk that exists regardless of the number of fuel assemblies stored in the spent fuel pool.

Transportation to a storage pool at another reactor would present about the same risk as shipment to a centralized facility. If storage at another reactor is an interim measure with subsequent planned shipment to a centralized away-from-reactor storage facility, the interim step would increase the transportation risk.

The spent fuel pool and related access is considered to be a vital area for implementation of NRC requirements for physical protection against sabotage and theft of special nuclear material. The design of the spent fuel pool to maintain its function under severe adverse natural conditions provides substantial barriers against intruders. Administrative controls are applied where needed to augment physical protection. The radiation level of the spent fuel provides an effective deterrent against theft of this material. As long as the fuel elements are stored in the spent fuel pool, additional compaction of the fuel array does not change the required level of protection.

The storage of spent fuel at locations other than reactors raises related Price-Anderson questions. In this situation, where storage of irradiated fuel is not at the site of either an operating reactor or a reprocessing facility, the Commission has not exercised to date its discretionary authority to extend Price-Anderson coverage to such a storage facility. The NRC staff is conducting a study, to be completed in 1979, to determine if storage of spent fuel away from a reactor site should be indemnified under the Commission's discretionary authority.

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RESPONSES TO QUESTIONS ASKED IN LETTER FROM
MORRIS K. UDALL TO JOSEPH HENDRIE
JANUARY 11, 1979

QUESTION 1:

What regulatory constraints affect a reactor operator's ability to store quantities of fuel at the reactor site, increase at-reactor storage capacity, or transfer excess spent fuel to another site?

RESPONSE:

There are no regulatory constraints that limit the quantity of spent fuel that can be stored or transferred. The regulations, primarily 10 CFR Part 50, "Licensing of Production and Utilization Facilities", specify the safety requirements to be followed for the storage of spent fuel. 10 CFR Part 51, "Licensing and Regulatory Policy and Procedures for Environmental Protection" and the Commission Policy Statement of September 16, 1975, state the environmental considerations that need to be included for spent fuel storage. The regulations controlling transportation are covered in response to Question 4.

When a reactor facility is licensed to operate, the spent fuel storage capability proposed by the licensee is reviewed and approved as one part of the facility. The regulations do not require any particular storage capability. Most facility designs have provided capability for storage of at least 1-1/3 cores. Pool design and accident considerations assume that the pool contains one core of recently discharged fuel plus sufficient old fuel to fill the pool. The gaseous fission product inventory and decay heat associated with the

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recently discharged fuel are much greater than those associated with the old fuel. When the spent fuel storage capability is increased, more old fuel is stored. Safety analyses to date for the proposed increases in storage capacity have shown that the proposed increases have only a small impact on the design or accident considerations. The maximum increase in storage capability is limited by the available space in the spent fuel pool. Spent fuel has been stored safely in a water environment for 20 years and reasonable extrapolations indicate that it can be stored safely for the life of the facility.

Spent fuel can also be shipped by a reactor licensee to away-from-reactor facilities, provided that the recipient is licensed to receive and possess the spent fuel. The General Electric Morris plant is the only licensed facility that is accepting spent fuel today. As explained in the response to question number 2, a new regulation has been proposed to specify the requirements that must be followed for any additional away-from-reactor storage facilities. Until such time as that regulation may be adopted, licensing of spent fuel storage at away-from-reactor facilities continues pursuant to 10 CFR Part 70, "Domestic Licensing of Special Nuclear Materials."

QUESTION 2:

What modifications of this regulatory situation if any, are under way or under consideration?

RESPONSE:

The NRC staff has evaluated the environmental impact associated with the accumulation of spent fuel and recently published a draft Generic Environmental Impact Statement (GEIS) on this subject. The purpose of the evaluation was to analyze alternatives for the handling and storage of spent light water power reactor fuel with particular emphasis on developing long-range policy. The significant findings stated in the draft GEIS are:

1. The lack of spent fuel storage capacity at nuclear power plants has been alleviated by modification of the spent fuel storage facility in operating plants.

2. Additional away-from-reactor storage facilities are needed.

3. Storage of spent fuel in water pools at operating plants or at away-from-reactor facilities has an insignificant environmental impact.

4. There is a need for a more definitive regulatory basis for licensing additional away-from-reactor storage facilities.

5. Curtailment of the generation of spent fuel by ceasing operation of existing power plants when their spent fuel pools became filled is found to be unjustified on a cost-benefit basis, and the prohibition of construction of new plants is unrealistic.

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The NRC has published a proposed new regulation, 10 CFR Part 72, "Storage of Spent Fuel in an Independent Spent Fuel Storage Installation (ISFSI)," covering the requirements for extended spent fuel storage at installations built specifically for this purpose that are not coupled to either a nuclear power plant or a fuel reprocessing plant but may be located on the site of such plants. The proposed new regulation specifies procedures and requirements for the issuance of licenses to store spent fuel in an independent spent fuel storage installation. To ensure adequate protection of the public health and safety, the proposed regulation would establish siting, design, operation and records requirements for away-from-reactor spent fuel storage. In addition to this proposed new rule, the staff has issued Regulatory Guide 3.44, "Standard Format and Content for the Safety Analysis Report to be Included in a License Application for the Storage of Spent Fuel in an Independent Spent Fuel Storage Installation (Water-Based Type)." However, present regulations in 10 CFR 50 and 10 CFR Part 70 can be used as a basis for review and approval of additional storage pools located at power reactor sites.

No further modifications to NRC regulations are needed to deal with the short-term handling of spent fuel. However, the long-term solution may require additional regulatory actions. Any necessary action will be determined following publication of the Interagency Review Group report.

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QUESTION 3:

To what extent and in what manner is a growing shortage of spent fuel storage capacity being reflected in license modifications and license applications?

RESPONSE:

In 1974, licensees began to discuss several options for improving the capability for storing spent fuel with the regulatory staff. At that time, the most viable option was increasing the capacity of the onsite storage pool.

The first formal proposal by a reactor licensee for increasing onsite spent fuel storage capability was in late 1974. The proposal added new racks of a different design to the spent fuel storage pool in "free" or "unused" space. The initially installed racks were retained. Since that first proposal was made, the approaches to storage design have become more sophisticated with time. They vary from more racks of the same design to new racks with a decrease in spacing between fuel assemblies; from racks without neutron absorbers to deliberate use of boron materials; and from fuel storage racks that cover the spent fuel storage pool floor to a second tier of fuel storage racks.

Including the first proposals made in 1974, there have been 50 applications to modify the onsite storage capability for spent fuel. The 50 applications include 6 applications that are for second-time modifications. The 44 first time applications provide for increased storage capability for 60 of the 67 light water reactors actively operating today. In 1977, the NRC began maintaining a status summary of spent fuel storage capacity at each operating facility. Information is received monthly from licensees. This is reported monthly in the NRC publication, "Operating Units Status Report", NUREG-0020. The attached Table 1, entitled "Status of Spent Fuel Storage Capability," is a revision of that taken from the December 1978 NUREG-0020 report. The table shows that the pools at LaCrosse and Surry are now filled, and the pool at Kewaunee will be filled in 1979. Pools at Oconee, Point Beach and Big Rock will be filled in 1980. These fill dates were estimated based on the discharge rate of about 1/3 to 1/4 of the core into the pool at each refueling. The projected pool fill dates change as licensees foresee approaching problems and then select an available option to increase storage capacity. For the above-mentioned reactors, proposals have been made for all plants, except Big Rock, to either increase on-site storage or ship fuel off-site for storage (such as Oconee to McGuire). We understand that Big Rock intends to increase the on-site storage, but we have not received a proposal. If all proposals to provide additional storage are carried out, only Big Rock is shown to have a spent fuel storage problem within the next 3 years. For the cases cited above, only the storage of Oconee fuel at McGuire involves pending approval of storage of spent fuel shipped from one reactor site to another reactor site. However, we have previously approved storage of spent fuel from the H. B. Robinson facility at the Brunswick facility and have applications under review involving the Dresden and Quad Cities facilities.

Most nuclear plants that are currently being reviewed for operating licenses are proposing to increase the storage capability of their fuel pools by redesign for the spent fuel storage racks. Of the 19 facilities currently under review, 15 have submitted requests for approval to expand storage capacity. The increase in storage capacity is sufficient to store fuel for about 2 to 6 cores. This corresponds to sufficient storage capacity to accommodate about 6 to 18 years of operation without the need to transfer fuel off site.

TABLE 1

STATUS OF SPENT FUEL STORAGE CAPABILITY

DATA AS OF JANUARY 20, 1979

This table is an update of the information contained in NUREG 0020 Vol. 2 NO. 12

No. of Assemblies Stored	Remaining Capacity (No. of Assemblies)	Remaining Capacity If Pending Request Approved (No. of Assemblies)	Scheduled Date For Next Refueling	Will Fill Present Authorized Capacity [b]
112	478	–	2 79	1988
0	486	–	5 80	1990
0	833	–	4 79	1995
228(c)	828(c)	–	4 79	1984
		–	10 79	–
129	371	1921	N/S	1985
		–	–	–
4	252	1159	4 79	1982
0	260	1206	– 79	1983
0	675	–	3 79	1990
157	326	–	1 80	1985
156	439	–	3 79	1987
288	880	–	2 79	1994
160	668 128	–	N/S	
112	350	–	79	1984
64	773	–	N/S	1299
120	48	870	5 79	1979
433	520	–	N/S	1986
77	595	–	3 79	1986
0	40?	966	11 79	1984
0	400	–	N/S	
152(c)	154	–	N/S	1980
		–	N/S	1980
337	128	–	7 79	1980
273	525	–	N/S	1985
1800(c)	171(c)	1322	9 79	1980
		–	3 79	1980
2800(c)	487(c)	–	4 79	1984
		–	11 78	1984
112	167	–	3 80	1987
171	99(e)	–	N/S	1980(g)
0	264	1170	3 79	1982
58	158	–	5 80	1983
60	668	–	N/S	1982
436(c)	78(c)	808(c)	N/S	NOW
		–	12 78	–
158	682	–	2 79	
0	442	–	9 78	1988
64	587	–	9 79	1982
346(c)	275(c)	–	1 79	1987
		–	4 79	1987
149	242	572	10 78	1985
308(c)	560(c)	1804	9 79	1983
		–	2 79	1983

Facility	Core Size [a] (No. of Assemblies)	Present Authorized Storage Pool Capacity (Fuel Assemblies)	No. of Assemblies Stored	Remaining Capacity (No. of Assemblies)	Remaining Capacity If Pending Request Approved (No. of Assemblies)	Scheduled Date For Next Refueling	Will Fill Pr[esent] Authorized C[apacity]
II. Boiling Water Reactors							
Big Rock Point	84	193	62	131	–	1 79	1980
Browns Ferry 1	764	3471	324	3147	–		1995
Browns Ferry 2	764	3471	132	3339	–	4 79	1995
Browns Ferry 3	764	3471	208	3269	–	8 79	1995
Brunswick 1	560	(f)	(k)	–	–	1 79	1996
Brunswick 2	560	(f)	0	–	–	3 79	1986
Cooper	548	2366	284	2082	–	N/S	199[illegible]
Dresden 1	484	672	221	451	–	–	198[illegible]
Dresden 2	724	1420	509	911	3271	3 79	198[illegible]
Dresden 3	724	1420	560	860	3220	9 79	1984
Duane Arnold	368	2050	276	1774	–	N/S	199[illegible]
Fitzpatrick	560	760	268	492	1752	3 80	198[illegible]
Hatch 1	560	840	260	580	–	3 79	198[illegible]
Hatch 2	560	1120	0	1120	–	3 80	1981
Humboldt Bay	172	487	251	236	–	N/S	
LaCrosse	72	134	113	21	327	3 79	NOW
Millstone 1	580	2184	629	1555	–	4 79	199[illegible]
Monticello	484	2237	616	1621	–	N/S	199[illegible]
Nine Mile Point	532	1984	660	1324	2349	3 79	199[illegible]
Oyster Creek	560	1800	620	1180	–	N/S	198[illegible]
Peach Bottom 2	764	2816	618	2198	–	3 80	199[illegible]
Peach Bottom 3	764	2816	440	2376	–	9 79	199[illegible]
Pilgrim	580	2320	580	1740	–	1 80	198[illegible]
Quad Cities 1	724	1460	151	1309	–	1 79	19[illegible]
Quad Cities 2	724	1460	745	715	–	9 79	19[illegible]
Vermont Yankee	368	2000	894	1106	–	10 79	19[illegible]
III. Independent Spent Fuel Storage Installations (h)							
Morris Operations		750 MTU (j)	310	390 MTU (j)	1400 MTU (j)		
NFS(i)		250 MTU	170 MTU	80 MTU			

(a) At each refueling outage approximately 1/3 of a PWR core and 1/4 of a BWR core is off loaded.
(b) Some of these dates have been adjusted by staff assumptions.
(c) This is the total for both units.
(d) Plant not in commercial operation.
(e) Some spent fuel stored at Brunswick.
(f) Authorized a total 2088 BWR and 304 PWR assemblies for both pools.
(g) Robinson 2 assemblies being shipped to Brunswick for storage.
(h) Capacity is in metric tons of uranium; 1 MTU = 2 PWR assemblies or 5 BWR assemblies.
(i) No longer accepting spent fuel.
(j) Racked for 700 MTU.
(k) 144 BWR and 140 PWR assemblies stored.

N/S = Not Scheduled Yet

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POOR ORIGINAL

QUESTION 4:

Please describe regulations affecting spent fuel transportation, including those applicable to casks and rail cars.

RESPONSE:

The transportation of nuclear fuel and waste is regulated primarily by the Department of Transportation (DOT) and by the Nuclear Regulatory Commission (NRC). The regulations of the NRC are contained in Title 10 of the Code of Federal Regulations, primarily in 10 CFR Part 71, "Packaging of Radioactive Material of Transport and Transportation of Radioactive material Under Certain Conditions". The regulations of the DOT are contained in 49 CFR Part 170189, "Transportation" (for shippers and road, rail, water, and air carriers). These regulations are applicable both to persons who ship radioactive materials, as they package and offer such materials for transportation, and to carriers of radioactive material, as they load and transport such materials in their vehicles. The regulations provide protection from the hazards of radiation to transport workers and the general public and protection from radiation damage to undeveloped film.

The jurisdiction of the NRC and the DOT overlap with respect to safety in the transportation of radioactive materials. To develop and implement consistent, comprehensive, and effective regulations and to avoid duplication of effort, the DOT and the NRC partition their regulatory responsibilities under a Memorandum of Understanding between the two agencies.

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In general, the DOT is responsible for regulating safety in transportation of all hazardous materials, including radioactive materials, and the NRC is responsible for regulating safety in receipt, possession, use, and transfer of byproduct, source, and special nuclear materials. The DOT is primarily concerned with the conditions of carriage and the NRC is primarily concerned with evaluation of package designs for fissile materials and for larger quantities of other radioactive materials.

Primary reliance for safety in transportation of radioactive material is placed on the packaging. The DOT regulations prescribe general standards and requirements for all packages of radioactive material, and for handling and storage of those packages by carriers. The standards that have been established in the DOT and NRC regulations provide that the packaging shall prevent the loss or dispersion of the radioactive contents, provide adequate shielding and heat dissipation, and prevent nuclear criticality under both normal and accident conditions of transportation. The normal conditions of transportation which must be considered are specified in the regulations in terms of hot and cold environments, pressure differential, vibration, water spray, impact, puncture, and compression tests. Accident conditions that must be considered are specified in terms of impact, puncture, fire conditions and water emersion.

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For packages containing no significant fissile radioactive material and only small quantities of other radioactive materials, the DOT standards and requirements provide adequate assurance of containment and shielding of the radioactive material under normal conditions of transportation. Although these small quantity packages, termed Type A packages, may fail in an accident situation, the radiological consequences would be limited because of the limited package contents.

When the radioactive content of a package exceeds the small Type A quantity limit, it may only be transported in a Type B package, one that is designed to survive both normal conditions of transportation and transportation accidents. The Type B package must be designed to withstand specified impact, puncture, fire environments, and water emersion, which provide protection against severe transportation accidents, and its design must be independently reviewed by the NRC engineering staff to verify its conformance to regulatory requirements. Finally, a certificate must be issued by the NRC before a Type B package can be used to transport radioactive material. Spent fuel casks are classified as Type B packages.

Procedures applicable to the shipment of packages of radioactive material require that a package be labeled with a unique radioactive materials label. In transportation, the carrier is required to exercise control over radioactive material packages, including loading and storage in areas separated from persons, and to limit the aggregation of packages

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to limit the exposures of persons. The procedures that the carrier must follow in case of an accident include notifying of the shipper and the DOT, isolating any spilled radioactive material from personnel contact, pending disposal instructions from qualified persons, and holding vehicles, buildings, areas, or equipment from service or routine occupancy until they are cleaned to specified values.

Within the limitations of the regulatory standards, radioactive materials may be transported in routine commerce using conventional transportation equipment. No special restrictions on the speed or routing of a vehicle are considered necessary to assure safety.[1] In its recent reexamination of its regulations on packaging and transportation of radioactive materials, the NRC staff concluded that the environmental impacts of normal transportation and the risks attendant to accidents involving radioactive material shipments are sufficiently small to allow continued shipments by all modes and that no changes to the regulations are needed at this time. Two documents, "Environmental Survey of Transportation of Radioactive Materials To and From Nuclear Power Plants," WASH-1238, and "Final Environmental Statement on the Transportation of Radioactive Materials by Air and Other Modes," NUREG-0170, provide additional information on this topic.

1. According to DOT, of the more than 32,000 hazardous material incident reports submitted to the DOT during the five-year period 1971-1975, only 144 were noted to involve radioactive materials. Of these 144 incidents, only 36 showed any release of contents or excess radiation levels. In most cases, releases involved minor contamination from low specific activity, exempt, or Type A packages.

QUESTION 5:

Are there at this time any licensed spent fuel shipping casks, or rail cars, or any license applications for these?

RESPONSE:

Six spent fuel cask designs are currently authorized for shipment of spent fuel from pressurized water reactors (PWRs) or boiling water reactors (BWRs). These six designs include four truck casks, each of which can carry a small number of spent fuel assemblies, and two rail casks, each of which can carry a larger number of spent fuel assemblies. These designs are described in the recently issued, "Directory of NRC Certificates of Compliance," NUREG-0383, Revision 1. Details regarding these six designs are tabulated below:

Cask Design Model No.	Certificate of Compliance No.	Transportation Mode(s)	Capacity (assemblies) PWR/BWR	No. Built	No. Under Construction
NFS-4	6698	Truck	1/2	6	1
NLI-1/2	9010	Truck	1/2	5	0
TN-8	9015	Overwt Truck	3/0	2	2
TN-9	9016	Overwt Truck	0/7	1	3
IF-300	9001	Rail, Overwt Truck	7/18	4	0
NLI-10/24	9023	Rail	10/24	2	0

At present, two other cask designs are under review for certification, Model Nos. TN-12 and NAC-3K. Both casks are designed to be rail casks with capacities for 12 PWR assemblies each.

Adoption of AFR storage would require a significant increase in the number of casks available. This would also require an increase in the cask manufacturing capacity which is currently limited.

QUESTION 6:

What type of domestic or international regulations would affect spent fuel being shipped to this country? How do they differ, if at all?

RESPONSE:

As indicated in the response to question 4, transportation of radioactive material is regulated by the Nuclear Regulatory Commission (NRC) and the Department of Transportation (DOT), and responsibilities are partitioned under a Memorandum of Understanding. The transportation safety regulations of NRC and DOT are consistent with those of the IAEA. Imports of spent fuel to the U. S. are subject to revalidation by the DOT, as the U. S. National Competent Authority, of the cask design approval certificate which the foreign shipper has obtained from his national competent authority. Under our present "Memorandum of Understanding" (MOU) with DOT, the cask design would be reviewed by the NRC engineering staff before DOT provides that revalidation. We are presently considering a change to that MOU which would eliminate the cask review by NRC for most import shipments because it is essentially a duplicate of that done by the foreign national competent authority, using the same package standards. Under this changed procedure, DOT would, for import shipments, screen the cask design as described in the approval certificate. If that screening raises any question about the safety of the cask design, an NRC detailed review would be provided. In the absence of questions however, DOT would revalidate the cask design approval certificate on the basis of its screening of the foreign safety review, but limiting the revalidation to import and export shipments.

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The statutory criterion for approving NRC import licenses involving spent fuel is that a determination be made that the import would not be "inimical to the common defense and security" of the United States, and would not "constitute an unreasonable risk to the health and safety of the public." The Commission has not licensed any spent fuel imports to date other than relatively minor imports of foreign spent research reactor fuel for reprocessing and extraction of highly enriched uranium by the Department of Energy (DOE). In October 1977, the United States government announced that, in conjunction with a program for the storage of domestic spent power reactor fuel, it was prepared to accept limited quantities of foreign spent power reactor fuel for storage in this country. Such acceptance would be limited to instances in which U. S. nonproliferation goals would be advanced, and if a need for such services existed. Congressional approval would be required.

With respect to health and safety impacts, the DOE is currently preparing generic environmental impact statements for both the domestic storage program and the storage of foreign spent fuel. The NRC will submit comments, as appropriate, to the DOE regarding the impact statements, and it is anticipated that the NRC will draw heavily upon the findings in the final statements' in connection with its review of spent fuel import license applications.

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QUESTION 7:

What if any difference in safety risk exists between storage of spent fuel at reactor sites and storage of the fuel at centralized facilities away from the reactors? Please answer this both in terms of the storage means themselves and in terms of the related management systems.

RESPONSE:

There are no significant differences in health and safety risks between storage of spent fuel at reactors and storage of the same spent fuel at centralized away-from-reactors (AFR) storage facilities. Fuel stored at reactors would normally include fuel with less decay time, but this difference is accounted for in facility design. Fuel handling systems, components, etc., may differ in design and manufacture somewhat, but all are required to meet comparable seismic, manufacturing, and reliability standards. Personnel attendant at the storage facility area and equipment of either type of facility would have comparable duties and training. Differences in risk related to siting factors are accommodated in design. While preliminary results, with attendent large uncertainties, suggest that transportation may be a significant factor in contributing to risk in the post irradiation part of the fuel cycle, use of transportation to move spent fuel to an AFR storage facility is a small contributor to overall fuel cycle risk. Only aged spent fuel ($\geq$120 days) is shipped, and the shipping casks used to transport the spent fuel are designed to maintain integrity following impact and fire due to a postulated traffic accident. Overall, the increase in risk by expanding AFR storage capability or storage time is very small compared to the risk from handling and storing newly discharged fuel.

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QUESTION 8:

Will the absence of substantial newly constructed storage capacity in 1984 be likely to result in a significant risk to the public health and safety, if present trends in reactor operators' activities continue? If so, why?

RESPONSE:

The absence of substantial additional storage capacity in 1984 will not result in a significant risk to public health and safety from radiological hazards in that utilities will find it necessary to: (1) accomplish physical modifications that increase the capacity of existing pools or construct new at-reactor storage pools; or (2) transport their spent fuel to existing pools at GE Morris, Barnwell, or at under-utilized reactors, or (3) cease power generation. Strong economic incentives would likely exist to avoid a reactor shutdown for a lack of storage capacity. As of July 31, 1978, for example, 69 nuclear plants capable of producing approximately 50,000 megawatts of electrical power were licensed for commercial operation. This is approximately 9% of the total electrical generation capacity for the contiguous United States. In 1978, these nuclear units were expected to generate a net of nearly 25 billion kilowatt hours (kwh) per month or 13% of the total electricity production in the United States.* To the extent that curtailment of operations were necessary, and electrical demands were met by other fuels, society would be exposed to the public health and safety risks associated with the other fuel cycles.

*8th Annual Review of Overall Reliability and Adequacy of the North American Bulk Power Systems, National Reliability Council, August 1978.

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