Docket Files

AUG 26 1977

Docket Nos. 50-325
and 50-324

Carolina Power & Light Company
ATTN: Mr. J. A. Jones
Executive Vice President
336 Fayetteville Street
Raleigh, North Carolina 27602

Gentlemen:

The Commission has issued the enclosed Amendment No. 8 to Facility Operating License No. DPR-71 and Amendment No. 30 to Facility Operating License No. DPR-62 for the Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2. The amendments consist of changes to the licenses and their appended Technical Specifications in response to your application dated September 23, 1976, and supplements thereto dated January 7, March 3, April 7, and April 26, 1977.

The amendments authorize modification of both spent fuel pools at BSEP to accommodate increased storage of spent fuel discharged from the Brunswick Units and to accommodate storage of spent fuel from CP&L's H. B. Robinson Unit No. 2. In addition, the amendments authorize the storage of spent fuel discharged from either Brunswick Unit to be stored in either BSEP spent fuel storage pool.

The remainder of the CP&L request will be the subject of a future Commission action.

Copies of the Safety Evaluation, Environmental Impact Appraisal, and Notice of Issuance and Negative Declaration are also enclosed.

Sincerely,

/S/

A. Schwencer, Chief
Operating Reactors Branch #1
Division of Operating Reactors

Enclosures and cc:
See next page

Const. 1

GD

OFFICE➤						
SURNAME➤						
DATE➤						

Enclosures:
1. Amendment No. 8 to DPR-71
2. Amendment No. 30 to DPR-62
3. Safety Evaluation
4. Environmental Impact Appraisal
5. Notice of Issuance/Negative Declaration

cc w/encl:

Richard E. Jones, Esquire
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336 Fayetteville Street
Raleigh, North Carolina 27602

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Shaw, Pittman, Potts & Trowbridge
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Analyses Branch (AW-459)
Office of Radiation Programs
U.S. Environmental Protection Agency
Room 645, East Tower
401 M Street, SW.
Washington, D.C. 20460

U.S. Environmental Protection Agency
Region IV Office
ATTN: EIS COORDINATOR
345 Courtland Street, NW.
Atlanta, Georgia 30308

Mr. Steve J. Varnam
Chairman, Board of County
Commissioners of Brunswick County
Southport, North Carolina 28461

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We are currently examining the desirability of imposing the preferred spent fuel storage configurations in the pool for the purpose of minimizing the potential radiological consequences from handling any heavy loads in the pool area. However, we have concluded that the probability of a load-handling accident is sufficiently small that cask handling operations may proceed while this examination is underway.

	DOR:OT	DOR:EB	DOR:EEB	DOR:PSB	
				W. Butler	
				5/27/77	
OFFICE	DOR:ORB#1	OELD	DOR:ORB#1		
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DATE	5/9/77	8/24/77	8/26/77	8/26/77	

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Docket Nos. 50-325
and 50-324

August 26, 1977

Carolina Power & Light Company
ATTN: Mr. J. A. Jones
Executive Vice President
336 Fayetteville Street
Raleigh, North Carolina 27602

Gentlemen:

The Commission has issued the enclosed Amendment No. 8 to Facility Operating License No. DPR-71 and Amendment No. 30 to Facility Operating License No. DPR-62 for the Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2. The amendments consist of changes to the licenses and their appended Technical Specifications in response to your application dated September 23, 1976, and supplements thereto dated January 7, March 3, April 7, and April 26, 1977.

The amendments authorize modification of both spent fuel pools at BSEP to accommodate increased storage of spent fuel discharged from the Brunswick Units and to accommodate storage of spent fuel from CP&L's H. B. Robinson Unit No. 2. In addition, the amendments authorize the storage of spent fuel discharged from either Brunswick Unit to be stored in either BSEP spent fuel storage pool.

The remainder of the CP&L request will be the subject of a future Commission action.

Copies of the Safety Evaluation, Environmental Impact Appraisal, and Notice of Issuance and Negative Declaration are also enclosed.

Sincerely,

A. Schwencer

A. Schwencer, Chief
Operating Reactors Branch #1
Division of Operating Reactors

Enclosures and cc:
See next page

Enclosures:
1. Amendment No. 8 to DPR-71
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3. Safety Evaluation
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Mr. Steve J. Varnam
Chairman, Board of County
Commissioners of Brunswick County
Southport, North Carolina 28461

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

CAROLINA POWER & LIGHT COMPANY

DOCKET NO. 50-325

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 8
License No. DPR-71

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Carolina Power & Light Company (the licensee) dated September 23, 1976, and supplements thereto dated January 7, March 3, April 7, and April 26, 1977, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraphs 2.B.(5) and 2.C.(2) of Facility Operating License No. DPR-71 are hereby amended to read as follows:

"2.B.(5) Pursuant to the Act and 10 CFR Parts 30 and 70 to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of Brunswick Steam Electric Plant, Unit Nos. 1 and 2.

2.C.(2) Technical Specifications

The Technical Specifications contained in Appendices A, A-Prime, and B, attached hereto, as revised through Amendment No. 8 , are hereby incorporated in this license. Appendix A shall be effective from the date of issuance of the Unit 1 operating license until the Appendix A-Prime becomes effective on or before the initial criticality of Brunswick Unit No. 2 following its initial refueling outage. Carolina Power & Light Company shall operate the facility in accordance with the Technical Specifications as indicated above. The licensee shall inform the Office of Inspection and Enforcement, Region II, of the date that the Appendix A-Prime becomes effective."

3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Karl R. Goller

Karl R. Goller, Assistant Director
for Operating Reactors
Division of Operating Reactors

Attachment:
Changes to the Technical
Specifications

Date of Issuance:

ATTACHMENT TO LICENSE AMENDMENT NO. 8

FACILITY OPERATING LICENSE NO. DPR-71

DOCKET NO. 50-325

Revise Appendix A and A-Prime Technical Specifications by removing the following pages and replacing with identically numbered revised pages.

Appendix A	Appendix A-Prime
5.0-1/5.0-2	5-5

5.0 Major Design Features

5.1 Site Features

The Brunswick Steam Electric Plant is located in the southeastern portion of North Carolina in Brunswick County, approximately 135 miles SSE of Raleigh, North Carolina, 175 miles due east of Colombia, South Carolina and 150 miles NE of Charleston, South Carolina. The site is 16 miles south of the nearest boundary of Wilmington, North Carolina, in adjacent New Hanover County, and 2½ miles north of Southport. Approximate coordinates of the Reactor Buildings are latitude 33°57.5'N and longitude 78°00.5'W. The site region is influenced by the Atlantic Ocean, which bounds the southern edge of Brunswick County, and the Cape Fear River, along the eastern border. The site is approximately five miles west and north of the Atlantic Ocean. Elevations range from sea level to about +30 feet mean sea level (MSL).

5.2 Reactor

A. The core shall consist of not more than 560 fuel assemblies of 49 fuel rods each.

B. The reactor core shall contain 137 cruciform-shaped control rods. The control material shall be boron carbide powder (B_4C) compacted to approximately 70 percent of theoretical density.

5.3 Reactor Vessel

The reactor vessel shall be as described in FSAR Table 4.2-2. The applicable design codes shall be as described in FSAR Section 4 and materials as described in FSAR Table 4.2-1.

5.4 Containment

A. The principal design parameters for the primary containment shall be as given in FSAR Table 5.2-1. The design and analysis shall be as described in FSAR Appendix C.

B. The secondary containment shall be as described in FSAR Subsection 5.3.

C. Penetrations to the primary containment and piping passing through such penetrations shall be designed in accordance with standards set forth in FSAR Subsection 5.2.3.5 and Appendix A.

5.5 Fuel Storage

A. The new fuel storage facility shall be such that the K_{eff} dry is less than 0.90 and flooded is less than 0.95.

B. The K_{eff} of the spent fuel storage pool shall be less than or equal to 0.95 with (1) new PWR fuel containing not more than 41 grams of U-235 per axial centimeter of active fuel assembly and a maximum assembly average loading of 3.2 w/o U-235; and (2) with new BWR fuel containing not more than 15.6 grams of U-235 per axial centimeter of active fuel assembly, subject to a maximum assembly average loading of 3.0 w/o U-235.

5.6 Seismic Design

The plant Class I structures and systems have been designed for ground accelerations of 0.08g (operating basis earthquake) and 0.16g (design basis earthquake).

VOLUME

5.4.2 The total water and steam volume of the reactor vessel and recirculation system is approximately 18,670 cubic feet.

5.5 FUEL STORAGE

5.5.1.1 The new fuel storage facility shall be designed and maintained such that K_{eff} dry is less than 0.90 and flooded is less than 0.95.

5.5.1.2 The K_{eff} of the spent fuel storage pool shall be less than or equal to 0.95 with:

a. New PWR fuel containing not more than 41 grams of U-235 per axial centimeter of active fuel assembly and a maximum assembly average loading of 3.2 w/o U-235, and

b. New BWR fuel containing not more than 15.6 grams of U-235 per axial centimeter of active fuel assembly and a maximum assembly average loading of 3.0 w/o U-235.

DRAINAGE

5.5.2 The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 116' 4".

5.6 METEOROLOGICAL TOWER LOCATION

5.6.1 The meteorological tower shall be located as shown on Figure 5.1-1.

5.7 COMPONENT CYCLIC OR TRANSIENT LIMIT

5.7.1 The components identified in Table 5.9-1 are designed and shall be maintained within the cycle or transient limits of Table 5.9-1.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

CAROLINA POWER & LIGHT COMPANY

DOCKET NO. 50-324

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 30
License No. DPR-62

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Carolina Power & Light Company (the licensee) dated September 23, 1976, and supplements thereto dated January 7, March 3, April 7, and April 26, 1977, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraphs 2.B.(6) and 2.C.(2) of Facility Operating License No. DPR-62 are hereby amended to read as follows:

"2.B.(6) Pursuant to the Act and 10 CFR Parts 30 and 70 to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of Brunswick Steam Electric Plant, Unit Nos. 1 and 2.

2.C.(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 30 , are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications."

3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Karl R. Goller

Karl R. Goller, Assistant Director
for Operating Reactors
Division of Operating Reactors

Attachment:
Changes to the Technical
Specifications

Date of Issuance:

ATTACHMENT TO LICENSE AMENDMENT NO. 30

FACILITY OPERATING LICENSE NO. DPR-62

DOCKET NO. 50-324

Revise Appendix A Technical Specifications by removing the following pages and replacing with identically numbered revised pages.

Remove	Insert
5.0-1/5.0-2	5.0-1/5.0-2

5.0 Major Design Features

5.1 Site Features

The Brunswick Steam Electric Plant is located in the southeastern portion of North Carolina in Brunswick County, approximately 135 miles SSE of Raleigh, North Carolina, 175 miles due east of Columbia, South Carolina and 150 miles NE of Charleston, South Carolina. The site is 16 miles south of the nearest boundary of Wilmington, North Carolina, in adjacent New Hanover County, and 2½ miles north of Southport. Approximate coordinates of the Reactor Buildings are latitude 33°57.5'N and longitude 78°00.5'W. The site region is influenced by the Atlantic Ocean, which bounds the southern edge of Brunswick County, and the Cape Fear River, along the eastern border. The site is approximately five miles west and north of the Atlantic Ocean. Elevations range from sea level to about +30 feet mean sea level (MSL).

5.2 Reactor

A. The core shall consist of not more than 560 fuel assemblies of 49 fuel rods each.

B. The reactor core shall contain 137 cruciform-shaped control rods. The control material shall be boron carbide powder (B_4C) compacted to approximately 70 percent of theoretical density.

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C. Penetrations to the primary containment and piping passing through such penetrations shall be designed in accordance with standards set forth in FSAR Subsection 5.2.3.5 and Appendix A.

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B. The K_{eff} of the spent fuel storage pool shall be less than or equal to 0.95 with (1) new PWR fuel containing not more than 41 grams of U-235 per axial centimeter of active fuel assembly and a maximum assembly average loading of 3.2 w/o U-235; and (2) with new BWR fuel containing not more than 15.6 grams of U-235 per axial centimeter of active fuel assembly, subject to a maximum assembly average loading of 3.0 w/o U-235.

5.6 Seismic Design

The plant Class I structures and systems have been designed for ground accelerations of 0.08g (operating basis earthquake) and 0.16g (design basis earthquake).

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 8 TO LICENSE NO. DPR-71

AMENDMENT NO. 30 TO LICENSE NO. DPR-62

CAROLINA POWER AND LIGHT COMPANY

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2

DOCKET NOS. 50-325 AND 50-324

1.0 Introduction

By letter dated September 23, 1976, and supplements thereto dated January 7, March 3, April 7, and April 26, 1977, Carolina Power & Light Company (CP&L) proposed amendments to Facility Operating License Nos. DPR-71 and DPR-62 for operation of Brunswick Steam Electric Plant, Unit Nos. 1 and 2. The proposed amendments would authorize CP&L to replace the existing spent fuel racks at Brunswick Steam Electric Plant (BSEP) Unit Nos. 1 and 2 with modular racks designed to store either spent BWR fuel or PWR fuel. The PWR fuel would be shipped from CP&L's H. B. Robinson Plant Unit No. 2 located near Hartsville, South Carolina.

The present spent fuel racks at BSEP have a capacity of 720 BWR fuel assemblies in each unit. Adopting the modular rack design would allow CP&L to store a maximum of either 616 PWR assemblies or 1386 BWR assemblies in each pool. The modular rack concept allows for the installation of both PWR and BWR rack modules in only the quantities required, and would permit CP&L the flexibility to store either fuel type in amounts as needed up to the storage limits stated above.

In addition, the amendments would permit CP&L to store spent fuel discharged from either Brunswick unit in either spent fuel storage pool at BSEP.

This Safety Evaluation and the accompanying Environmental Impact Appraisal address the safety and environmental aspects of the CP&L proposal. The amendments to the Facility Operating Licenses associated with these evaluations do not permit actual storage of H. B. Robinson fuel at the Brunswick site. This aspect of the CP&L proposal will be the subject of a future Commission action.

2.0 Discussion and Evaluation

2.1 Criticality Considerations

The proposed spent fuel racks are to be made up of two types of modules, one for BWR assemblies and another for PWR assemblies. Both of these modules will have the same overall dimensions. However, one type is designed to hold 36 BWR fuel assemblies while the other is designed to hold 16 PWR fuel assemblies. A few half modules will also be made so that all of the pool area can be used. The outside dimensions of the fuel modules will be 4.5 feet square by 14 feet high. Each pool will have the capacity for 38.5 modules.

The BWR modules are to be made up of 36 schedule 10 stainless steel pipes. These pipes have a nominal wall thickness of 0.148 inches and a minimum outer diameter of 8.625 inches (the minimum wall thickness is 0.129 inches). The diameter of these pipes is too small to accept a PWR fuel assembly. The resulting fuel region volume fraction is 0.35.

The PWR modules are to be made up of 16 stainless steel containers which will have square cross sections with an inside dimension of approximately 8.95 inches. The nominal wall thickness of these square containers is 0.25 inches, and the minimum thickness is 0.24 inches. The minimum distance between the centers of these square containers is 13.0 inches. This results in a fuel region volume fraction of 0.42 for the PWR fuel assemblies.

CP&L criticality calculations are based on fresh (i.e., unirradiated) fuel with 3.0 weight per cent uranium-235 for the BWR fuel assemblies and 3.2 weight per cent uranium-235 for the PWR fuel assemblies. For the fuel assemblies considered in the analysis, these enrichments correspond to 15.6 grams of uranium-235 per axial centimeter of BWR fuel assembly and 41 grams of uranium-235 per axial centimeter of PWR fuel assembly.

The criticality calculations were performed by CP&L and Nuclear Associates International (NAI). Four energy group cross sections were obtained from XPOSE, which is Exxon Nuclear's version of the LEOPARD computer program. These cross sections were used in the PDQ-07 diffusion theory program to perform sensitivity studies. The KENO-IV Monte Carlo program with 123 group cross sections from the AMPX system of programs was used to calculate the actual neutron multiplication factors. The accuracy of the AMPX/KENO-IV method was checked by using it to calculate two critical experiments.

One of these experiments had some stainless steel in it. Both of the neutron multiplication factors calculated by this method were within 0.2 percent (.002) of the experimental values. The AMPX/KENO-IV neutron multiplication factors for these racks, which were calculated to be within the 95 percent confidence limits, are 0.76 for the filled BWR racks and 0.90 for the filled PWR racks. The XPOSE/PDQ-07 method was then used to obtain the variation in the neutron multiplication factors with temperature, with the addition of the zircaloy channel in the BWR racks, and with changes in the PWR rack pitch. A stainless steel reactivity coefficient was also calculated for both the BWR and PWR modules. The maximum effect of temperature on reactivity was found to be +0.018 for the filled BWR racks. The effect of including a zircaloy channel in the BWR fuel bundle was found to be +0.006. Also, the difference in the neutron multiplication factor in 8 X 8 and 7 X 7 BWR assemblies could be as large as 0.01. These effects could increase the neutron multiplication factor in the BWR racks to 0.79. This is a higher neutron multiplication factor than would be obtained if BWR fuel assemblies were accidentally put into PWR racks.

For the PWR racks the maximum effect of temperature on reactivity was found to be +0.003 and an upper limit for the effect of eccentric positioning of PWR assemblies in the racks, which was taken from the calculated variation with pitch, was found to be +0.027. Thus, an upper limit for the neutron multiplication factor for fuel assemblies in the PWR racks is 0.93.

The above cited results for the BWR modules compare very favorably with results of calculations made for a similar fuel pool storage lattice.* The above cited results for the PWR modules are more conservative than the results of parametric calculations made with another method for a similar fuel pool storage lattice.

We find that when any number of BWR fuel assemblies, which have no more than 15.6 grams of U-235 per axial centimeter of fuel assembly and a maximum enrichment of 3.0 w/o U-235, and any number of PWR fuel assemblies, which have not more than 41 grams of U-235 per axial centimeter of fuel assembly and a maximum enrichment of 3.2 w/o U-235, are placed in their respective modules in the pool, the neutron multiplication factor will be <0.93. Since this factor is less than our acceptance criterion of 0.95, we find the proposed design acceptable with respect to criticality considerations. The Technical Specifications have been modified to implement these limitations.

---

* GE Morris Operation

2.2 Spent Fuel Cooling

In its submittal, CP&L states that the additional heat loads in the spent fuel pools due to the proposed modification, including heat loads from H. B. Robinson fuel, will not increase the water temperature above 150°F. The system has two pumps and two heat exchangers, and it is designed for a maximum water flow of 1000 gallons per minute. There is an alarm in the control room to alert the operator of low flow from either of these pumps, and there is also a pool water temperature indicator in the control room. CP&L's calculations show that when the usual Brunswick core reloads are considered (i.e., a full core off-load is excluded) the maximum heat generation rate in the completely filled pool, including the contribution from H. B. Robinson fuel, will be about 10.6 x 10^6 BTU/hr (3.1MW). Table 3.2-6 of the submittal states that for this heat generation rate the maximum temperature of the water in the pool will be 138°F.

As stated in Section 10.5 of the FSAR and in the September 23, 1976 submittal, the residual heat removal system (RHR) can be used to cool the fuel pool water when the reactor is in the refueling mode. The RHR system is a redundant, seismic Class I system which is designed to supply 3200 gallons of water per minute when it is used to cool the spent fuel pool. CP&L states that for the maximum heat load case, where a full core is moved into the pool about seven days after the reactor is shut down and where this completes the filling of all of the racks in the pool, the maximum heat generation rate will be about 24 x 10^6 BTU/hr (7 MW). Table 3.2-6 of the September 23, 1976 submittal indicates that for this maximum heat load, two thirds of the capacity of the RHR (i.e., 2000 gallons of coolant water per minute) can limit the maximum water temperature in the fuel pool to 143°F. CP&L states that since the RHR system is a redundant, seismic Class I Safety System, this temperature will not be exceeded even in the event of a single failure.

By using the total decay energy curve given in the NRC Standard Review Plan, "Technical Position APCSB 9-2", we find that the maximum heat load for the normal refueling case would be about 3.5 MW instead of the 3.1 MW calculated by CP&L. This would raise the maximum water temperature for this case from 138°F to 141°F. Using this same method for the full core off-load case we find that the maximum heat load would be about 8.3 MW instead of the 7 MW assumed by CP&L. This higher heat load would raise the maximum water temperature for this case from 143°F to 147°F.

Table 10.5-1 of the FSAR indicates that the total fuel pool volume is 4.3 x 10^4 cubic feet. If we assume the pool to be completely filled with BWR fuel bundles, approximately 18 percent of this volume would be taken up by the fuel elements. If we further assume that the heat capacity of the stainless steel racks is about the same as that of the water it displaces, the effective heat capacity of the spent fuel pool will be that of 3.5 x 10^4 cubic feet of water. Assuming the maximum heat load for the spent fuel cooling system to be 3.5 MW, this heat capacity would allow 2 hours after the postulated loss of all cooling before the water temperature would reach 150°F. This is a conservative estimate since it assumes that no heat is transferred to the surroundings.

We find that the cooling capacity will be sufficient to maintain the spent fuel pool water outlet temperature at or below 147°F. The cooling capacity analysis is sufficiently conservative that this thermal limit will be maintained for any combination of Brunswick or H. B. Robinson spent fuel. We also find that in the unlikely event of multiple failures causing the complete loss of the spent fuel pool cooling system, 2 hours would be sufficient time for the operator to align the RHR system after a low flow alarm is received in the control room. On this basis we conclude that the spent fuel cooling system is acceptable for the proposed modification.

2.3 Installation of Racks & Fuel Handling

CP&L is proposing to first install the modified racks in the Unit 1 pool, then transfer about 144 spent fuel assemblies in the Unit 2 pool to the new racks in the Unit 1 pool so the Unit 2 pool can then be drained and modified. The transfer of spent fuel assemblies from Unit 2 to Unit 1 and from H. B. Robinson to Brunswick will be accomplished with a shipping cask which is approved by the NRC for general shipment of spent fuel(General Electric IF 300).

The transfer of H. B. Robinson fuel assemblies from the shipping cask to the fuel storage racks is to be accomplished by using a standard Westinghouse PWR handling tool on the present BSEP refueling bridge, but it will be necessary to modify the bridge by adding a 2000 pound hoist to the present traveling trolley.

The Brunswick FSAR states that, "Redundancy has been incorporated in the design of the spent fuel cask lifting lugs, lifting rig and the 125 ton Reactor Building Class I crane." In their September 23, 1976 submittal, CP&L states that redundant yokes will be provided for the GE IF 300 cask. In their March 3, 1977 submittal, CP&L states that the fully loaded GE IF 300 cask with the redundant yoke weighs approximately 73 tons.

Section 9.1.5 of NRC's Brunswick 1 and 2 SER Supplement #4 dated September 1976 has the following conclusion:

> "Based on our evaluation of the data provided, and the commitments made by the applicant in the areas of crane reeving, control braking, and two blocking protection, we conclude that the overhead handling system for Brunswick Unit 1 as proposed is acceptable."

In regard to crane reeving, this would allow loads of sixty percent of the 125-ton design with the present wire rope. Since the weight of the fully loaded GE IF 300 cask with the redundant yoke is less than this, the present wire rope is acceptable. We conclude that when all of the other commitments stated in Section 9.1.5 of this SER are complied with for both Units 1 and 2, the GE IF 300 cask can be safely used to transfer fuel assemblies between the two units and to bring in fuel assemblies from H. B. Robinson.

We have previously determined that the overhead handling system provided for moving shielded casks in the SFP has a sufficiently high degree of redundancy so that the probability of a cask and/or heavy load handling accident which can damage the pool water-tight integrity is small enough to preclude consideration of that event (SER Supplement No. 4, Brunswick Steam Electric Plant, September 1976).

We have underway a generic review of load handling operations in the vicinity of spent fuel pools to determine the likelihood of a heavy load impacting fuel in the pool and if necessary, the radiological consequences of such an event. We have concluded that the likelihood of a heavy load handling accident is sufficiently small, that the acceptability of the proposed modification is not affected and that no additional restrictions on load handling operations in the vicinity of the SFP are necessary while our review is underway.

In regard to moving the fuel assemblies between the two Brunswick units, CP&L states in their April 7, 1977 submittal that current plans are to transport the GE IF 300 cask by rail on the tracks between the two units. They also state that if a truck cask is used for the transfer, the truck will follow the road which runs adjacent to the railroad tracks. We find this to be an acceptable path, and therefore conclude that CP&L's proposal to store spent fuel from either Brunswick unit in either pool is acceptable.

Since there will be no fuel assemblies in either fuel pool while it is undergoing modification it will not be possible during the modification of that pool for an accident to result in an increased neutron multiplication factor. The potential consequences of the postulated fuel handling accident presented in the Brunswick Units 1 and 2 SER dated November 1973 would not be changed as a result of the modification of the SFP. This is because the original analysis which assumes the fuel handling accident occurs over the core is still of the most limiting accident. However, the handling and storage of PWR spent fuel assemblies in the Brunswick SFPs was not addressed in the SER. Therefore, the staff has considered the impact of dropping a larger, heavier PWR spent fuel assembly onto BWR spent fuel assemblies in the SFP. The staff compared the potential consequences of this accident to those in the SER.

The licensee's analysis shows that the impact energy of a PWR fuel assembly dropped into the SFP would be dissipated by the failure of two storage tubes in a BWR spent fuel storage rack. We, therefore, postulate that the resulting damage would be the rupture of all the fuel pins in the PWR spent fuel assembly and the equivalent of all of the fuel pins in the BWR assemblies. This damage for BWR spent fuel assemblies is less than that postulated in the Brunswick SER. The contribution to the potential consequences from the damaged PWR assembly was negligible because this spent fuel has decayed at least 120 days before being transferred to a Brunswick SFP. Therefore, the estimated consequences from this postulated accident are less than those reported for the fuel handling accident in the SER even if the BWR spent fuel is assumed to have only 24 hours decay time which is very unlikely.

We conclude that the rack installation and fuel handling aspects of the CP&L proposal are acceptable.

2.4 Structural and Mechanical

The new racks are seismic Category I and fabricated from Type 304 stainless steel and 17-4 PH stainless steel. Each fuel rack will be approxiamtely 14'-0" in height and 4'-6" square with the exception of seven racks which are 4'-6" x 2'-3" to conform to the geometry of the fuel pool. The BWR assemblies will be stored within schedule 10 stainless steel pipes; PWR fuel assemblies within 1/4" thick stainless steel square tubes. The individual cells are connected to the bottom support plate by welding, to each other at mid-height by means of clip angles or a diaphram plate, and to a lead-in fabricated plate at the top. The fuel racks are supported from the floor of the spent fuel pool on a positioning grid consisting of a 1'-6" deep truss system. A general description of the racks is given in Section 2.1.1 of the report submitted by Carolina Power & Light Company dated September 23 , 1976. A review based on the applicable parts of Sections 3.7 and 3.8 of the Standard Review Plan was completed for the following items: supporting arrangements for the modules including their restraints; design, fabrication, installation procedures; structural design and analyses procedures for all loads including seismic and impact loadings; load combinations; the structural acceptance criteria; quality control for design, fabrication and installation; and the applicable industry codes. Seismic excitation in three orthogonal directions, acting simultaneously, has been imposed in the design of the new rack system. The same horizontal response spectrum was used for the two horizontal directions. The effects of the three components were combined by the SRSS method. There are no closely spaced modes as defined in Regulatory Guide 1.92, entitled "Combining Modal Responses and Spatial Components in Seismic Response Analysis." The existing pool structure has been examined for the effects of the increased load and seismic load.

The use of Type 304 and 17-4 PH stainless steels for the fabrication of the spent fuel racks and the performance requirements during the service life were reviewed for material compatibility in the spent fuel pool environment. The proposed modification of fuel racks does not involve the use of any poison material.

Analyses, design, fabrication and installation of the proposed racks are in accordance with accepted criteria, and are in conformance to the AISC Code and Section 3.8.4.II.3, 4, and 5 of the Standard Review Plan. The racks are designed as seismic Category I equipment.

The effects of the additional loads on the existing pool structure due to the high density of storage of fuel assemblies have been examined. It was found that the structural integrity and leak tightness of the spent fuel pool liner will be maintained. We conclude that the structural and mechanical aspects of the modification proposed by the licensee are acceptable. The effects of pool environment on the racks, fuel cladding and pool liner have been evaluated by us. We conclude that significant corrosion is highly unlikely to occur for periods up to 20 years. We are currently reviewing the need for material surveillance programs for extended periods of storage after 20 years and if a surveillance program is determined to be necessary, we will require Carolina Power & Light Company to implement it.

2.5 Radiation Levels

We have reviewed CP&L's plans for removal, disassembly and disposal of the old racks and installation of the new racks. The Unit 1 fuel pool is dry and has never contained spent fuel. Therefore no occupational radiation exposure is expected for the rack modification to this pool. The Unit 2 pool, which has stored spent fuel, will be decontaminated prior to starting work on the modification. The occupational exposure for this modification is estimated to be in the order of 10-25 man-rem. Because this is a one-time exposure it is not directly comparable to the annual doses during normal operation in the spent fuel pool (SFP). We consider this to be a reasonable estimate and comparable to other reactor operations such as primary system maintenance.

We have estimated the increment in onsite occupational dose resulting from the proposed increase in stored fuel assemblies (and associated fuel handling, including transfer of fuel between the Brunswick units when necessary) on the basis of information supplied by the licensee and by using realistic assumptions for radionuclide concentrations in the SFP water and for occupancy times.

This analysis indicates that the occupational radiation exposure resulting from this proposed action represents less than one percent of the present total annual occupational burden at this facility. The increase in radiation expousre is small and individual occupational doses will be maintained as low as reasonably achievable and within the limits of 10 CFR 20. The waste treatment system is adequate and the fuel integrity is not expected to deteriorate while stored in the pool as discussed in the EIA. Thus, we conclude that storing additional fuel for a longer period in the SFP and associated fuel handling operations will not result in any significant inc ease in doses received by occupational workers.

The only change in offsite dose would be that associated with the small incremental increase in effluents released from the facility. As is discussed in the accompanying Environmental Impact Appraisal, the effect of that increment would be negligible.

3.0 Summary

Our evaluation supports the conclusion that the proposed modification to the SFP at BSEP is acceptable because:

(1) The physical design of the new stroage racks will preclude criticality for any moderating condition with the limits imposed for both Brunswick and H. B. Robinson spent fuel.

(2) The SFP cooling system has adequate cooling capacity.

(3) The installation and use of the proposed fuel handling racks can be accomplished safely.

(4) The structural design and the materials of construction are adequate.

(5) The increase in radiation doses due to both the storage of additional fuel in the SFP and the associated fuel handling operations would be negligible.

4.0 Conclusion

We have concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations and the issuance of these amendments will not be inimical to the common defense and security or to the health and safety of the public.

Date: August 26, 1977

ENVIRONMENTAL IMPACT APPRAISAL

BY

OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING

AMENDMENT NOS. 8 AND 30 TO

FACILITY LICENSE NOS. DPR-71 AND DPR-62

CAROLINA POWER & LIGHT COMPANY

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2

DOCKET NOS. 50-325 AND 50-324

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1.0 Description of Proposed Action

In its submittal of September 23, 1976, supplemented by letters dated January 7, 1977, March 3, 1977, April 7, 1977 and April 26, 1977, Carolina Power & Light Company (CP&L) (the licensee) requested amendments to Facility Operating Licenses No. DPR-71 and DPR-62 for the Brunswick Steam Electric Plant (BSEP) Units 1 and 2. The proposed amendments would authorize CP&L to replace the existing spent fuel racks at Brunswick Steam Electric Plant (BSEP) Unit Nos. 1 and 2 with modular racks designed to store either BWR or PWR spent fuel. The PWR fuel would be shipped approximately 170 miles by rail from CP&L's H. B. Robinson Plant Unit No. 2 (Robinson) located near Hartsville, South Carolina.

The present spent fuel racks at BSEP have a capacity of 720 BWR fuel assemblies in each unit. Adopting the modular rack design would allow CP&L to store a maximum of either 616 PWR assemblies or 1,386 BWR assemblies in each pool. The modular rack concept allows for the installation of both PWR and BWR rack modules in only the quantities required, and would permit CP&L the flexibility to store either fuel type in amounts as needed up to the storage limits stated above.

In addition, the amendments would permit CP&L to store spent fuel discharged from either Brunswick unit in either spent fuel pool (SFP) at BSEP.

Although the maximum amounts of PWR and BWR spent fuel which could be stored are as described above, the mix of each fuel type selected by CP&L and the action evaluated in this environmental impact appraisal is the proposal by the licensee (1) to replace the 72 existing spent fuel storage racks in the two BSEP Units SFPs, with racks which will increase the total number of BSEP spent fuel assemblies stored in the two pools from 1,440 to about 2,088, (2) to store about 304 spent fuel assemblies from Robinson in the BSEP pools and (3) to intertransfer spent fuel stored at Brunswick Units 1 and 2 between the two SFPs at BSEP.

The environmental impacts of all activities as described above are addressed in this appraisal. However, the amendments to the operating licenses for the Brunswick units issued at this time only authorize items (1) and (3). Item (2) will be the subject of a future Commission action.

2.0 Need for Increased Storage Capacity

Brunswick Unit No. 1 achieved initial criticality on October 8, 1976. Unit 2 achieved initial criticality on March 20, 1975. Brunswick Units 1 and 2 are both in their first fuel cycle. The first refueling of Unit 2 is scheduled to begin about August 26, 1977; the first refueling of Unit 1 is scheduled for the fall of 1978. Robinson Unit 2 achieved initial criticality on September 20, 1970 and is now approaching the end of its fifth fuel cycle. Refueling of Robinson Unit 2 is currently scheduled to begin in February 1978.

A full core consists of 560 fuel assemblies for both Brunswick Units 1 and 2. During a normal refueling of a boiling water reactor (BWR), about one-fourth of the fuel assemblies are replaced.

In the case of Brunswick Units 1 and 2, CP&L presented their current fuel replacement schedule through the year 1984 in Table C3 of the March 3, 1977 submittal. The existing storage racks in both the Unit 1 and 2 SFPs are the standard 20 element BWR racks. During design of the SFP, provisions were made for 36 of these racks which would accommodate 720 spent fuel bundles in each pool. With the designed storage capacity for 720 spent BWR fuel assemblies, the SFPs at Brunswick Units 1 and 2 could accommodate the projected refueling of these facilities through 1981. However, it is prudent engineering practice to reserve space in a spent fuel pool to permit discharge of a full core should this be necessary to inspect or repair core internals. With the present design capacity of the SFPs, Brunswick Units 1 and 2 would not have space for a full core discharge after the scheduled 1978 refuelings of these units without transferring spent fuel between the two pools.

A full core for H. B. Robinson Unit 2 consists of 157 fuel assemblies. Typically, a pressurized water reactor (PWR) replaces about one-third of the core at each refueling outage. As shown in Table C3 referred to above, Robinson Unit 2 is scheduled to be refueled annually with 52 or 53 new fuel assemblies. CP&L has a contract with Allied General Nuclear Services (AGNS) for transportation and reprocessing services. As discussed in Section 7.0, AGNS is not licensed to accept spent fuel and it is unlikely that they will be licensed to accept fuel before the scheduled refueling of Robinson Unit 2 in February 1978. As a consequence of the delay and uncertainty in licensing AGNS and an early discharge of one batch of fuel in 1974, CP&L in 1975 requested approval to increase the storage capacity of the Robinson Unit 2 SFP from 240 to 276 assemblies (a 15% increase). This request was granted on February 9, 1976 and was issued as Amendment No. 19 to Facility Operating License DPR-23. This increase in storage capacity was completed in June 1976 and will allow the plant to continue to operate until the end of its fifth fuel cycle (February 1978). Prior to

February 1978, CP&L must find space to store the 53 spent fuel assemblies to be replaced in Robinson Unit 2 or shut down the facility. There is only space in the Robinson Unit 2 SFP to store 16 of the 53 assemblies due to the 260 spent fuel assemblies currently stored in the pool. As discussed in Section 7.0 under Alternatives, further expansion of the Robinson Unit 2 SFP is not feasible until or unless enough of the spent fuel assemblies now stored in the SFP can be moved out to make room to replace some or all of the existing racks with higher density racks. The alternative which is best suited to CP&L's needs is modification of the spent fuel pools at BSEP to store both BSEP and H. B. Robinson spent fuel.

The proposed modification of the Brunswick Units 1 and 2 SFPs to increase the storage capacity of the pools, the transfer of H. B. Robinson Unit 2 spent fuel to BSEP and the intertransfer of spent fuel between the two BSEP SFPs will allow H. B. Robinson Unit 2 to operate until the spring of 1984; Brunswick Unit 1 until the fall of 1984; and Brunswick Unit 2 until the fall of 1985. As discussed in Section 7.0, the Federal Government is expected to have a retrievable surface repository for spent fuel available in 1985. The staff concludes that there is an immediate need to increase the storage capacity of the BSEP SFPs to store spent fuel from H. B. Robinson Unit 2 and to provide space for a possible full core discharge from Brunswick Units 1 and 2 and Robinson Unit 2 after 1978. In the longer term, there is also the need to expand the storage capacity of the H. B. Robinson Unit 2 SFP or to find an alternate storage location for spent fuel from this facility to provide storage space for spent fuel from the three units until the Federal repository is in operation.

3.0 Fuel Reprocessing History

Currently, spent fuel is not being reprocessed on a commercial basis in the United States. The Nuclear Fuel Services (NFS) plant at West Valley, New York, was shut down in 1972 for alterations and expansions; on September 22, 1976, NFS informed the Commission that it was withdrawing from the nuclear fuel reprocessing business. The Allied General Nuclear Services (AGNS) proposed plant in Barnwell, South Carolina is not licensed to operate. The General Electric Company's (GE) Midwest Fuel Recovery Plant in Morris, Illinois, now referred to as Morris Operation (MO), is in a decommissioned condition. Although no plants are licensed for reprocessing fuel, the storage pool at Morris, Illinois and the storage pool at West Valley, New York (on land owned by the State of New York and leased to NFS thru 1980) are licensed to store spent fuel. The storage pool at West Valley is not full but NFS is presently not accepting any additional spent fuel for storage, even from those power generating facilities that had contractual arrangements with NFS. Construction of the AGNS receiving and storage station has been completed. AGNS has applied for - but has not been granted - a license to receive and store irradiated fuel assemblies in the storage pool at Barnwell prior to a decision on the licensing action relating to the separation facility.

4.0 The Plant

The Brunswick Steam Electric Plant Units 1 and 2 (Plant) is described in the Final Environmental Statement (FES) related to operation of the facilities issued by the Commission in January 1974. The Plant has two Boiling Water Reactors (BWRs), each of which has a licensed thermal power of 2436 thermal megawatts (MWt) and has a design electrical output of 821 megawatts (Net MWe). Pertinent descriptions of principal features are summarized below.

4.1 Fuel Inventory

Each of the two Brunswick reactors contains 560 fuel assemblies. Each fuel assembly contains either 49 or 63 fuel rods in the bundle, spaced and supported in a 7x7 or 8x8 array. An individual fuel rod consists of UO_2 fuel pellets stacked in a Zircaloy-2 cladding tube. The weight of the fuel, as UO_2, is approximately 262,400 pounds. About one-fourth of the assemblies are removed from the reactor and replaced with new fuel each year.

4.2 Plant Cooling Water Systems

When Units 1 and 2 are operating, the maximum flow rate of condenser cooling system water is approximately 1,300,000 gal/min or 2900 cu. ft./sec with a rise in water temperature across the condenser of 12°F to 18°F. At rated turbine loads and design operating conditions, about 11 x 10^9 BTU/hr are transferred from the condensers to the circulating water system.

The Service Water System, which is separate from the condenser circulating water system, removes heat from the reactor building and turbine building closed cooling water system. The Service Water System is described in Section 10.8 of the BSEP 1 & 2 Final Safety Analysis Report (FSAR). Under normal operating conditions, only three of the five 8,000 gpm pumps are operated. The Service Water is run in a common header for each unit after cooling the various heat exchangers and flows into the discharge canal. The nuclear portion of the Service Water System, which is used to cool the SFP, was designed for a maximum duty of 225 x 10^6 Btu/hr although the calculated normal heat load is only 64 x 10^6 Btu/hr.

The Reactor Building Closed Cooling Water System (RBCCWS) removes heat from the reactor auxiliary systems and their related accessories. In addition to cooling the SFP heat exchangers, the RBCCWS cools a number of other components as described in Section 10.6 of the FSAR. The RBCCWS for each unit contains three heat exchangers (cooled by the Service Water System) although only two are required; each heat exchanger was designed for a heat load of 16.0 x 10^6 Btu/hr.

4.3 Radioactive Wastes

The plant contains waste handling and treatment systems designed to collect and process gaseous, liquid and solid waste that might contain radioactive material. The waste handling and treatment systems are evaluated in Section III.D.2 of the FES; there will be no change in these systems or that evaluation as a result of the proposed modification.

4.4 Purpose of SFP

The SFPs at Brunswick are designed to store spent fuel assemblies prior to shipment to a reprocessing facility. Fuel assemblies are transferred from the reactor core to the unit SFP during a core refueling, or to allow for inspection and/or modification to core internals. The latter may require the removal and storage of up to a full core. The assemblies are initially intensely radioactive due to their fission product content and have a high thermal output. They are stored in the SFP to allow for radioactive decay and to provide adequate radiation shielding and cooling.

The major portion of decay occurs during the 150-day period following removal from the reactor core. After this period, the assemblies may be withdrawn and placed into a heavily shielded fuel cask for offsite shipment. Space permitting, the assemblies may be stored for an additional period allowing continued fission product decay and thermal cooling prior to shipment.

4.5 SFP Cooling and Cleanup System

Each BSEP spent fuel pool is provided with a cooling system which removes residual heat from fuel stored in the SFP. The Spent Fuel Pool Cooling and Cleanup System (SFPCCS) was designed to maintain the SFP water temperature less than or equal to 125°F during normal refueling operations and less than or equal to 150°F during full core discharge situations. The cooling and cleanup system is described in Section 10.5 of the FSAR.

The existing SFP pool cooling and cleanup system for each unit consists of two 500 gpm circulating pumps, two heat exchangers, two filter-demineralizers, two skimmer surge tanks and the required piping, valves and instrumentation. The pumps draw water from the pool, circulate it through the heat exchangers and the filter-demineralizer and return it to the pool. The Reactor Building Closed Cooling Water System cools the heat exchangers. At least one pump, heat exchanger and filter-demineralizer are continuously in operation while fuel is stored in a pool.

The filter-demineralizers are of the pressure precoat type in which a finely divided disposable filter medium is supported on permanent filter elements. The filter medium may consists of cellulose (Solka-floc), or a powered ion-exchange resin (Powdex). Each of the filter-demineralizers has a design capacity of 500 gpm. This system flow rate is larger than that required for two complete water changes per day of the fuel pool. The filter area of each unit is 270 sq. ft. Pool water clarity and purity are maintained by the combination of filtering and ion exchange processes. Approximately 4 ft^3 of spent filter media and resins are removed from the elements by backwashing with air and condensate when the pressure drop is excessive or the capacity of the resin is depleted. The spent filter media and resins are flushed to the waste sludge tank and processed in the radwaste system.

5.0 Environmental Impacts of Proposed Action

5.1 Land Use

The spent fuel pool for each unit is located next to the reactor vessel inside the reactor building. Since the proposed modification will not alter the external physical geometry of the SFP, no additional commitment of land is required.

5.2 Water Use

There will be no significant change in plant water usage as a result of the proposed modification. As discussed subsequently and in the accompanying safety evaluation, storing additional spent fuel in the SFP will slightly increase the heat load on the SFP cooling system, which is transferred to the Reactor Building Closed Cooling Water System and to the Plant Service Water System. The modification will not change the flow rates within these cooling systems.

As discussed in Section 3.2 of CP&L's submittal of September 23, 1976 and in Section 2.2 of the staff's safety evaluation, the maximum heat load for the normal refueling case could raise the bulk water temperature to 139°F in the Unit 1 SFP and to 141°F in the Unit 2 SFP. This assumes that the Service Water temperature is 90°F; it is not likely to be this warm if refuelings are conducted in the spring and fall as scheduled. This also assumes that the SFP cooling systems are not supplemented by the Residual Heat Removal System. Although it may not be necessary to use the RHR system from a safety or radiological standpoint, the staff is of the opinion that CP&L is likely to use the RHR system as needed to maintain the temperature of the pool water below 125°F during refueling operations from the standpoint of operator comfort. However, without use of the RHR system, the staff's analyses showed that the spent fuel pool cooling system will be capable of maintaining temperatures equal to or less than 125°F approximately 17 days following shutdown for BSEP Unit 1 and 20 days following shutdown for BSEP Unit 2. CP&L calculated these times as 8 and 11 days, respectively. This was the basis for CP&L's conclusion "that the cooling that is available to the spent fuel pool is sufficient to maintain the pool water temperature normally at or below 125°F."

Since the temperature of the SFP water will generally be below the 125°F evaluated in the FES, the rate of evaporation and thus the need for makeup water to the pool will not be significantly changed by the proposed modification. In any case, the amount of makeup water that will be required for the two spent fuel pools is a small fraction of the 300 to 600 gpm of fresh water which was evaluated in the FES as being drawn from the wells onsite for plant water uses.

5.3 Radiological

5.3.1 Introduction

The potential offsite radiological environmental impact associated with the expansion (resulting from an incremental addition in the long-lived radioactive effluents released from the facility) was evaluated and determined to be environmentally insignificant as addressed below.

The expansion of the SFPs will accommodate spent fuel from operation of Brunswick Units 1 and 2 for an additional two to three years without shipment offsite as well as providing space for up to six annual reloads from Robinson Unit 2. During the storage of the spent fuel under water, both volatile and nonvolatile radioactive nuclides may be released to the water from the surface of the assemblies or from defects in the fuel cladding. Most of the material released from the surface of the assemblies consists of activated corrosion products such as Co-58, Co-60, Fe-59 and Mn-54 which are not volatile. The radionuclides that might be released to the water through defects in the cladding, such as Cs-134, Cs-137, Sr-89 and Sr-90, are also predominantly nonvolatile. The primary impact of such nonvolatile radioactive nuclides is their contribution to radiation levels to which workers in and near the SFP would be exposed. The volatile fission product nuclides of most concern that might be released through defects in the fuel cladding are the noble gases (xenon and krypton), tritium and the iodine isotopes.

Experience indicates that there is little radionuclide leakage from spent fuel stored in pools after the fuel has cooled for several months. The predominance of radionuclides in the spent fuel pool water appears to be radionuclides that were present in the reactor coolant system prior to refueling (which become mixed with the water in the spent fuel pool during refueling operations) or crud dislodged from the surface of the spent fuel during transfer. During and after refueling, the spent fuel pool cleanup system reduces the radioactivity concentrations considerably. It is theorized that most failed fuel contains small, pinhole-like perforations in the fuel cladding which allow leakage during reactor operating conditions of approximately

600°F. A few weeks after refueling, the spent fuel cools in the spent fuel pool so that the fuel rod temperature is relatively cool, approximately 180°F. This substantial temperature reduction should reduce the rate of the release of fission products from the fuel pellets and decrease the gas pressure in the gap between pellets and clad, thereby tending to retain the fission products within the cladding. In addition, most of the gaseous fission products have short half-lives and decay to insignificant levels within a few months. Based on the operational reports submitted by the licensees and discussions with the operators, there has been very little leakage of fission products from spent light water reactor fuel stored at the Morris Operation (MO) at Morris, Illinois, or at Nuclear Fuel Services (NFS) storage pool at West Valley, New York. Spent fuel has been stored in these two pools which, while it was in a reactor, was determined to have significant leakage and was therefore removed from the core. After storage in the onsite spent fuel pool, this fuel was later shipped to either MO or NFS for extended storage. Although the fuel exhibited significant leakage during reactor operation, there was no detectable leakage from this fuel in the offsite storage facility.

5.3.2 Radioactive Material Released to Atmosphere

The present storage capacity of each BSEP SFP will accommodate the spent fuel from five refuelings from the respective unit. Thus, spent fuel from five years' operation could be stored with the present racks. The proposed modification will accommodate two additional reloads of Brunswick Unit 1 (the scheduled refueling of Unit 1 in the fall of 1982 and 1983), three additional reloads of Brunswick Unit 2 (the scheduled refueling of Unit 2 in the fall of 1983 and 1984) and about six reloads from Robinson Unit 2 (permitting Robinson Unit 2 to refuel through 1983).

With respect to gaseous releases, since short-lived noble gases in the spent fuel will have decayed to negligible amounts after a year of storage, the only significant noble gas isotope remaining in the SFP and attributable to storing additional assemblies for a longer period of time would be Krypton-85.

CP&L calculated the maximum airborne concentrations of radionuclides that might be released from the SFPs when the pools are completely filled with the projected number of BWR and PWR assemblies. The analysis was performed by the use of the radiation transport computer code HDOSE, considering the noble gases released as a result of 1% failed fuel, noble gases from iodines in the pool water and tritium as a result of evaporation. CP&L's analysis showed that even if the maximum concentration of radionuclides were to be released to the environment without treatment, the total noble gas release rate would be less than 2% of that exhausted through the gland seal and air ejector system. However, the airborne radioactivity level from the SFP is continually monitored and if the level is abnormally high, the reactor building atmosphere would automatically be exhausted through the standby gas treatment system.

Based on operating experience with Zircaloy clad fuel in pressurized water reactors* we have assumed that up to 0.12% of all fuel rods from Robinson Unit 2 may have cladding defects which permit the escape of fission product gases. On a similar basis, we have assumed that 0.36% of the Brunswick Unit 1 and 2 fuel rods may have cladding defects which permit the escape of fission product gases. As discussed previously, experience has demonstrated that after spent fuel has decayed for 4 to 6 months, there is no measurable release of fission products from defective fuel. However, to place an upper bound on any potential releases, we assumed that the fission product gases escape on a relatively linear basis with time. On this basis, we have conservatively estimated that an additional 152 curies per year of Krypton-85 may be released from the Brunswick SFPs when the modified pools are completely filled. The fuel storage pool area is continuously ventilated. This air is normally released through the plant stack. If the SFPs do eventually release an additional 152 curies per year of Kr-85 as a result of the proposed modifications, the increase would result in an additional total body dose at the site boundary (northwest) to an individual of less than 0.001 mrem/year. This dose is insignificant when compared to the approximately 100 mrem/year that an individual receives from natural background radiation. The calculated total body dose to the estimated population within a 50-mile radius of the plant is less than 0.01 man-rem/year, which is less than the natural fluctuations in the dose this population would receive from background radiation. Under our conservative assumptions, these exposures would represent less than 1% increase in the exposures from the plant evaluated in the FES for the individual (Table V-2) and the population (Table V-4).

Assuming that the spent fuel will be stored onsite for several years, Iodine-131 releases from spent fuel assemblies will not be significantly increased by the expansion of the fuel storage capacity since the Iodine-131 inventory in the fuel will decay to negligible levels between each annual refueling. The iodines are removed from the SFP water by the SFP cleanup system and by their relative short half lives.

*Calculations of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Pressurized Water Reactors (PWR Gale Code), U.S. Nuclear Regulatory Commission, NUREG-0017, April 1976, p. 2-19.

As discussed in Section 5.2, storing additional spent fuel in the pool is expected to raise the temperature of the water above the 125°F used in the FSAR design analysis. When the pools are completely filled according to the normal projected refueling schedule (annual refueling of BSEP and Robinson), we estimate that the bulk water temperature in the BSEP Unit 2 pool may be as high as 141°F for a relatively short period of time. This is a conservatively calculated maximum value based on a service water temperature of 90°F and without use of the RHR system to supplement the spent fuel pool cooling system. Using the decay heat curves (Figures 3.2-4 and 3.2-5) in CP&L's submittal of September 23, 1976, we estimate that the temperature of the pool water may remain above 125°F for 17 days in the BSEP Unit 1 pool and above 125°F for 20 days in the Unit 2 pool. An increase in the bulk water temperature will result in a higher evaporation rate from the pool as compared to the design analysis temperature. The higher evaporation rate will increase the release of tritium and radioiodines from the pool. However, we do not anticipate a significant increase in the average annual releases from the pools because of conservatism in the calculated temperatures. The maximum temperature of 141°F would only occur when the Unit 2 pool is completely filled and the condition would not exist for more than 20 days. The overall evaporation rate from the pool for the year should not be significantly greater than that expected if the pool remained at 125°F for the entire year.

CP&L is required to monitor the release of gaseous radioactivity from the plant, including the SFP area. If the gaseous iodine and tritium releases are greater than the "as low as reasonably achievable" design objectives for radiological effluents as stated in the unit Technical Specifications, CP&L will have to take corrective action to reduce these releases. Corrective action could be to reduce the temperature of the pool water by use of the RHR system, to operate the charcoal filters in the ventilation exhaust system or to reduce evaporation from the pool.

Thus, we conclude that the proposed modification will not have any significant impact on radiation levels or personnel exposures offsite.

5.3.3 Solid Radioactive Wastes

Storing additional spent fuel in the SFP may require additional reshuffling of the assemblies, which could result in additional crud (corrosion product oxides) being dislodged from the surface. While we consider it unlikely, for the reasons discussed previously, storing additional decayed spent fuel could result in some additional fission products being introduced into the SFP water.

The purification systems for the Brunswick Units 1 and 2 SFPs are capable of removing any increased radioactivity resulting from the expanded storage of spent fuel to maintain acceptable radiation levels above and in the vicinity of the pools. The concentration of radionuclides in the pool is controlled by the filter-demineralizer and by decay of short-lived isotopes. The activity is expected to be high during refueling operations while reactor coolant water is introduced into the pool and to decrease as the pool water is processed through the filter-demineralizer and the short-lived isotopes decay. The additional radioactivity that may be released to the SFP water by storing more spent fuel assemblies in the pool may result in more frequent replacement of the filter-demineralizer or an increased amount of radioactivity accumulated on the filter-demineralizer or both. This increase in radioactivity to the SFP, if any, should be minor because the additional spent fuel to be stored is relatively cool, thermally, and radionuclides in the fuel will have decayed significantly. The additional amount of radioactivity accumulated on the filter-demineralizer should be insignificant compared to the radioactivity in solid wastes normally generated at the site.

The filter-demineralizer resin may be changed on the basis of pressure drop, chemical exhaustion or breakthrough. The filter-demineralizer resins are transferred to the waste sludge tank of the solid waste system, dewatered, and packaged in 55-gallon drums. The licensee does not have any experience with which to estimate an expected replacement frequency for the resin. Based on experience at another BWR which has a filter demineralizer and which replaces the resin on a similar basis, we would expect a replacement frequency of once per month before the modification. CP&L does not expect any increase in the amount of solid waste generated from the spent fuel cleanup system due to the proposed modification. Although we generally agree with this conclusion, we have assumed as a conservative estimate that the amount of solid radwaste may be increased by six additional resin beds per year due to the increased amount of spent fuel stored in the SFP. The annual average volume of solid waste shipped from the Brunswick facility during 1975 and 1976 was about 46,000 cubic feet. If the storage of additional spent fuel does increase the amount of solid waste generated by the SFP purification system as assumed above (4 cubic feet per resin change or 24 cubic feet per year), the increase in total waste volume shipped would be less than 1% and would not have a significant environmental impact.

In addition to the solid wastes generated by operations in the SFP area discussed above, the present storage racks and seismic supports in the Brunswick Unit 2 SFP may have to be disposed of as low activity waste. The racks and supports have become contaminated because there are four spent fuel assemblies in the Unit 2 SFP (removed from the reactor in 1976) and there are irradiated core components stored in the pool.

There are 36 aluminum spent fuel racks in each pool. Each rack weighs 2,020 pounds. The total weight of racks of both units is 145,440 pounds (2x36x2020). Adding 5% for miscellaneous material yields a total amount of aluminum of 153,000 pounds. There is also a system of aluminum framing (columns and beams) provided for seismic stability of the present racks which will be removed. This total weight is approximately 7,000 pounds. In addition, an estimated 1,000 pounds of miscellaneous stainless steel used in the rack support system will have to be removed. Thus, the total amount of material to be removed is 160,000 pounds of aluminum and 1,000 pounds stainless steel.

The uncontaminated Unit 1 racks will be removed and sold to another licensee or for scrap. The Unit 2 racks will be surveyed by radiation control personnel to determine if decontamination of any or all of the racks can be accomplished. Those racks that cannot be decontaminated will be packaged and shipped to a licensed burial site. Those which can be decontaminated will be sold for scrap. If the existing storage racks and seismic supports in the Unit 2 pool are disposed of as solid waste, the volume would be approximately 600 cubic feet, phased over a period of up to ten years. Averaged over the lifetime of the plant, this would increase the total waste volume shipped from the facility by less than 0.2%. This would not have any significant additional environmental impact.

5.3.4 Radioactivity Released to Receiving Waters

The amount of radioactivity in the SFP cleanup filter-demineralizer might increase slightly due to the additional spent fuel in the pool, but this increase in radioactivity should not be released in liquid effluents from the station. The filter-demineralizer will remove insoluble and soluble radioactive material from the SFP water. The resins are periodically flushed with water to the waste sludge tank of the solid waste system and are not regenerated. The water used to transfer the spent resin is decanted from the tank and is returned to the liquid radwaste system for processing. The soluble radioactivity will be retained on the resins. The insoluble radioactive matter should settle to the bottom of the tank. If any additional activity should be transferred from the spent resin to the flush water, it would be removed by the liquid radwaste system.

No significant increase in the liquid release of radionuclides from the station is expected as a result of the proposed modification.

5.3.5 Occupational Exposures

We have estimated the increment in onsite occupational dose resulting from the proposed increase in stored fuel assemblies on the basis of information supplied by the licensee and by utilizing realistic assumptions for occupancy times and for dose rates in the spent fuel area from radionuclide concentrations in the SFP water. The spent fuel assemblies themselves contribute a negligible amount to dose rates in the pool area because of the depth of water shielding the fuel. The occupational radiation exposure resulting from the proposed action represents a negligible burden. Based on present and projected operations in the spent fuel pool area, we estimate that the proposed modification will add less than one percent to the total annual occupational radiation exposure burden at this facility. The increase in radiation exposure is small and individual occupational doses will be maintained as low as reasonably achievable and within the limits of 10 CFR 20. Thus, we conclude that storing additional fuel in the SFPs will not result in any significant increase in doses received by occupational workers.

The racks will be installed over a period of time of up to six years on an as-needed basis. In its submittal of April 7, 1977, CP&L estimated that the total exposure for the proposed modification was expected to be in the range of 10 to 25 man-rem. The Unit 1 SFP does not have any spent fuel in the pool. Removal of the 36 existing racks and seismic supports, which are not contaminated, should result in almost no measurable exposure. The Unit 2 SFP has four fuel elements in the pool removed from the reactor in 1976. Due to the mixing of reactor coolant with water in the SFP, the racks and structural materials which have to be removed to install the new racks are contaminated. The pool also contains a number of fuel channels and core internals which were removed from the reactor. These items have been stored in the SFP under water for shielding purposes until they can be disposed of as radioactive waste. We believe that CP&L can accomplish the removal of the existing racks, installation of part of the new racks and transfer of fuel assemblies between the two pools well within the 10 to 25 man-rem estimated total exposure. This would result in exposures comparable to special maintenance activities such as those involving the reactor coolant system.

5.3.6 Evaluation of Radiological Impact

As discussed above, the proposed modification does not significantly change the radiological impact evaluated in the FES.

5.4 Nonradiological Effluents

There will be no change in the chemical or biocidal effluents from the plant as a result of the proposed modification.

The only potential offsite nonradiological environmental impact that could arise from this proposed action would be an additional discharge of heat to the discharge canal and to the Atlantic Ocean. Storing spent fuel in the SFPs for a longer period of time will add more heat to the SFP water. The spent fuel pool heat exchangers are cooled by the Reactor Building Closed Cooling Water System which in turn is cooled by the plant Service Water System. An evaluation of the augmented spent fuel storage facility was made to determine the effects of the increased heat generation on the plant cooling water systems, and ultimately, on the environment. As discussed in the accompanying safety evaluation, our calculated heat loads were slightly higher than those calculated by the licensee. We estimate that the maximum incremental heat load (a full core offload that fills the pool) will be 2.9×10^6 Btu/hr. Compared to the existing heat load on the Service Water System and the heat discharged to the once-through circulating water system by the condensers in the two units, this incremental heat load would represent less than 0.1% of the total heat load. We conclude that proposed modification will have a negligible effect on thermal discharges from the BSEP and that there will be no detectable effect on the environment.

5.5 Impacts on the Community

The new storage racks will be fabricated offsite and shipped to the plant. No environmental impacts on the environs outside the spent fuel storage building are expected during removal of the existing racks and installation of the new racks. The impacts within this building are expected to be limited to those normally associated with metal working activities. No significant environmental impact on the community is expected to result from the fuel rack conversion or from subsequent operation with the increased storage of spent fuel in the SFPs.

5.6 Transportation of Spent Fuel

H. B. Robinson Unit 2 is located on the southern end of Lake Robinson, five miles west-northwest of Hartsville, S.C. A spur track of the Seaboard Coast Line Railroad branches from the main line between McBee and Hartsville, passes through the plant site and connects with another main line of the railroad in Florence, S.C. A siding from this spur is used for coal delivery to fossil-fueled Robinson Unit 1. No passenger traffic is accommodated on this spur track.

Access to Robinson Unit 2 by road is via State Road 23 at the south border of the site, which intersects primary State Highway 151 about one mile from the site. The latter runs in a general northwest direction from Darlington to McBee, S.C. McBee, S.C. is on U.S.

Highway No. 1 and is about eight miles northwest of the site. In the other direction, Interstate 95 is about 26 miles southwest of the site; a truck traveling between the site and I-95 would not have to go through any listed towns or cities.

The Brunswick Steam Electric Plant is located in Brunswick County near Southport, North Carolina near the mouth of the Cape Fear River. The plant is about 16 miles south of Wilmington, N.C. Rail service is available at BSEP over the Seaboard Coastline Railroad.

CP&L has purchased a GE IF 300 rail cask. In its April 7, 1977 submittal, CP&L stated that its current plans are to transfer the Robinson spent fuel to Brunswick by rail over the Seaboard Coastline Railroad. The IF-300 cask will accommodate up to seven PWR spent fuel assemblies or 18 BWR assemblies. The Brunswick and Robinson facilities are about 170 miles apart by rail. In the Commission's Final Environmental Statement (FES) related to operation of H. B. Robinson Nuclear Steam Electric Plant Unit 2 issued April 1975, the environmental impacts of the transportation of radioactive material were discussed in Section 5.4.4.2. The environmental impacts of transporting irradiated fuel from BSEP were covered in Section V.E.2 of the Commission's FES related to operation of this facility issued January 1974. In the latter, it was assumed that spent fuel would be shipped to the AGNS reprocessing plant in Barnwell, S.C., a distance of 234 miles, which would require approximately 49 hours via direct movement over the Seabrook Coastline Railroad. For shipment of spent fuel from Robinson, the environmental impacts of transporting the spent fuel to either AGNS or NFS at West Valley, N.Y. were within the scope of the Commission's report, "Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Plants," WASH-1238 dated December 1972. CP&L has contracted with AGNS for transportation and reprocessing of services; however, as discussed in Section 7.0, AGNS is not at present licensed to receive or reprocess spent fuel.

The action proposed by CP&L is to ship Robinson spent fuel to Brunswick for interim storage until the fuel can be shipped to a reprocessing facility (for separation of the uranium and plutonium for recycle) or shipped to a long-term storage facility such as the Federal repository which is planned to be in operation by 1985. In the time frame of interest in this case (i.e., 1982 to 1985), Barnwell would be the most likely location of a reprocessing facility if this option is available. The possible location(s) of a long-term storage facility is speculative at this time. To bound the shipping distances, the staff assumed that the storage facility might be on Federally owned property at Oak Ridge, Tenn. or the Savannah River Plant at Aiken, S.C. The farthest distance the facility is likely to be located from the Brunswick site would be a location in far southwest U.S. (e.g., southern New Mexico).

If the Robinson spent fuel is shipped to Brunswick for interim storage and then shipped to Barnwell, S.C., the total shipping distance would be in the order of 400 miles. If the spent fuel is shipped from Brunswick to a location in southwestern U.S., the total shipping distance would be in the order of 2,000 miles.

The basis for our evaluation of the proposal is the data in the generic report, "Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants", WASH-1238, December 1972 and Supplement 1, NUREG-75/038, April 1975. In this report, the number of shipments of fuel was estimated on the basis of those anticipated from a typical 1,100 MWe light water cooled nuclear reactor; the amount of spent fuel generated by the 750 MWe Robinson plant and the 850 MWe Brunswick plants would be less than the typical plant. In WASH-1238, it was estimated that the average distance from the nuclear power plant site to the ultimate location (reprocessing facility) over which the irradiated fuel would be transported would be 1,000 miles (Section V.C).

Since the spent fuel which would eventually be shipped from Brunswick would have decayed for over a year, the rate of heat release to the air from each cask was estimated to be less than 250,000 Btu/hr, which is negligible; this could be compared to the rate at which waste heat is rejected from a 100 horsepower truck engine operating at full power. The cumulative radiation dose to the exposed population per reactor year was estimated to be about 4 man-rem to transportation workers and 3 man-rem to the general public. For purposes of comparison, the dose due to the average normal background radiation for the approximately 600,000 members of the general public assumed to be exposed during the above shipments would be about 78,000 man-rem per year. The environmental risk of radiological effects stemming from transportation accidents in the shipment of spent fuel from Robinson and Brunswick is small when both the probability of occurrence and extent of the consequences are taken into account.

We have considered the potential cumulative environmental impacts associated with the expansion of the SFPs at Brunswick Units 1 and 2, the transfer and storage of spent fuel from Robinson Unit 2 to the BSEP spent fuel pools and the eventual shipment of the aged spent fuel to a reprocessing facility or long term storage facility. We have concluded that these actions will not significantly affect the quality of the human environment during either normal operation of the expanded spent fuel pools, the transfer of spent fuel between the facilities or under postulated fuel handling accident conditions.

6.0 Environmental Impact of Postulated Accidents

The overhead handling system for moving shielded casks in the area of the SFP is provided with a sufficiently high degree of redundancy that the probability of a cask or other heavy load handling accident which can damage the pool water-tight integrity is small enough to preclude consideration of that event (SER Supplement No. 4, Brunswick Steam Electric Plant, September 1974). We have examined the consequences of dropping a PWR fuel element from H. B. Robinson in the SFP at Brunswick, and find that the potential environmental consequences are neglible because this spent fuel will have decayed at least 120 days before being transferred to the Brunswick SFP.

7.0 Alternatives

In regard to this licensing action, the staff has considered the following alternatives: (1) shipment of spent fuel to a fuel reprocessing facility, (2) shipment of spent fuel to a separate fuel storage facility, (3) shipment of spent fuel to another reactor site, (4) expansion of the H. B. Robinson spent fuel storage capacity, and (5) ceasing operation of the Robinson facility. These alternatives are considered in turn.

The total projected cost for the project is $6,102,000. This includes direct material costs of $4,350,000 and direct labor cost of $90,000. The indirect costs, including contractor's indirect costs, CP&L Administrative and Engineering costs, and construction equipment, facilities and office expense, are $649,000. Included in the total cost is $156,000 as allowance for funds during construction. While this is costly, the alternatives are more expensive.

7.1 Reprocessing of Spent Fuel

As discussed earlier, none of the three commercial reprocessing facilities in the U.S. are currently operating. The General Electric Company's Midwest Fuel Recovery Plant (MFRP) at Morris, Illinois is in a decommissioned condition. On September 22, 1976, Nuclear Fuel Services, Inc. (NFS) informed the Nuclear Regulatory Commission that they were "withdrawing from the nuclear fuel reprocessing business." The Allied General Nuclear Services (AGNS) reprocessing plant received a construction permit on December 18, 1970. In October 1973, AGNS applied for an operating license for the separation facility; construction of the separation facility is essentially complete. On July 3, 1974, AGNS applied for a materials license to receive and store up to 400 MTU in spent fuel in the on-site storage pool, on which construction has been completed. Hearings may be completed on the materials license application by late 1977. However, even if AGNS decides to proceed with operation of the Barnwell facility in light of the President's policy statement of April 29, 1977, the separation plant will not be licensed until the issues presently being considered in the GESMO proceedings are resolved and the GESMO proceedings are completed.

In 1976, Exxon Nuclear Company, Inc. submitted an application for a proposed Nuclear Fuel Recovery and Recycling Center (NFRRC) to be located at Oak Ridge, Tennessee. The plant would include a storage pool that could store up to 7,000 MTU in spent fuel. The application for a construction permit is under review.

On April 7, 1977, the President issued a statement outlining his policy on continued development of nuclear energy in the U.S. The President stated that: "We will defer indefinitely the commercial reprocessing and recycling of the plutonium produced in the U.S. nuclear power programs. From our own experience, we have concluded that a viable and economic nuclear power program can be sustained without such reprocessing and recycling."

CP&L has a contract with AGNS for transportation and reprocessing services. As discussed above, AGNS has not to date been able to obtain either a plant operating license or a license to receive and store spent fuel. Shipping spent fuel to AGNS is therefore not legally possible at this time and is not a sufficiently dependable option for CP&L to rely on prior to the scheduled refueling of H. B. Robinson Unit 2 on November 4, 1977. If space for the spent fuel from Robinson Unit 2 cannot be made available, the facility will have to cease operation, since the Robinson Unit 2 SFP only has room for 16 of the 53 fuel assemblies to be replaced.

7.2 Independent Spent Fuel Storage Facility

An alternative to expansion of onsite spent fuel pool storage is the construction of new "independent spent fuel storage installations" (ISFSI). Such installations could provide storage space in excess of 1000 MTU of spent fuel. This is far greater than the capacities of onsite storage pools. Fuel storage pools at GE Morris and NFS are functioning as ISFSIs although this was not the original design intent. Likewise, if the receiving and storage station at AGNS is licensed to accept spent fuel, it would be functioning as an ISFSI until the separations facility is licensed to operate. The licensee for the GE facility at Morris, Ill. was amended on December 3, 1975 to increase the storage capacity to about 750 MTU; as of April 1, 1977, approximately 259 MTU was stored in the pool in the form of 1,055 assemblies. The NFS facility has capacity for about 260 MTU, with approximately 170 MTU presently stored in the pool. The storage pool at West Valley, New York is on land owned by the State of New York and leased to NFS thru 1980. Although the storage pool at West Valley is not full, since NFS withdrew from the fuel reprocessing business, correspondence we have received indicates that they are not at present accepting additional spent fuel for storage even from those reactor facilities with which they had contracts. The status of the storage pool at AGNS was discussed above.

With respect to construction of new ISFSIs, Regulatory Guide 3.24, "Guidance on the License Application, Siting, Design, and Plant Protection for an Independent Spent Fuel Storage Installation," issued in December 1974, recognizes the possible need for ISFSIs and provides recommended criteria and requirements for water-cooled ISFSIs. Pertinent sections of 10 CFR Parts 19, 20, 30, 40, 51, 70, 71 and 73 would also apply.

The staff has estimated that at least five years would be required for completion of an independent fuel storage facility. This estimate assumes one year for preliminary design; one year for preparation of the license application, Environmental Report, and licensing review in parallel with one year for detail design; two and one-half years for construction and receipt of an operating license; and one-half year for plant and equipment testing and startup.

Industry proposals for independent spent fuel storage facilities are scarce to date. In late 1974, E. R. Johnson Associates, Inc. and Merrill Lynch, Pierce, Fenner and Smith, Inc. issued a series of joint proposals to a number of electric utility companies having nuclear plants in operation or contemplated for operation, offering to provide independent storage services for spent nuclear fuel. A paper on this proposed project was presented at the American Nuclear Society meeting in November 1975. In 1974, E. R. Johnson Associates estimated the construction cost at approximately $9,000 per spent fuel assembly.

Several licensees have evaluated construction of a separate independent spent fuel storage facility and have provided cost estimates. Connecticut Yankee, for example, estimated that to build an independent facility with a storage capacity of 1,000 MTU (BWR and/or PWR assemblies) would cost approximately $54 million and take about five years to put into operation. Commonwealth Edison estimated the construction cost to build a fuel storage facility at about $10,000 per fuel assembly. To this would be added the costs for maintenance, operation, safeguards, security, interest on investment, overhead, transportation and other costs.

On December 2, 1976, Stone and Webster Corporation submitted a topical report requesting approval for a standard design for an independent spent fuel storage facility. No specific locations were proposed, although the design is based on location near a nuclear power facility. No estimated costs for fuel storage were included in the topical report.

CP&L considered a spent fuel storage facility which could be built at an existing CP&L nuclear site for receipt of spent fuel beginning in 1981. This alternative was judged undesirable for adding BWR storage capability because of the large commitment of resources required. It is not viable for solving H. B. Robinson's spent fuel storage problem because it could not be designed, licensed, and built by February 1978 when Robinson is scheduled to be refueled.

On a short term basis (i.e., prior to 1983) an independent spent fuel storage installation is not a viable alternative based on cost or availability in time to meet the licensee's needs. It is also unlikely that the total environmental impacts of constructing an independent facility and shipment of spent fuel would be less than the minor impacts associated with the proposed action.

In the long term, the Energy Research and Development Administration (ERDA) is modifying its program for nuclear waste management to include design and evaluation of a retrievable storage facility to provide government storage at central locations for unreprocessed spent fuel. As announced in the President's energy policy statement of April 29, 1977, the government is committed to provide a retrievable, long-term storage facility for spent fuel by 1985. The proposed increase in storage capacity of the BSEP SFP's will allow H.B. Robinson Unit 2 to operate until the spring of 1984, Brunswick Unit 1 until the fall of 1984 and Brunswick Unit 2 until the fall of 1985. Thus, there is a period of at least a year between the time the proposed modification will accommodate spent fuel from the three units and the time the government is committed to providing a spent fuel storage facility. An independent spent fuel storage facility, either at a CP&L site or a shared facility at another reactor site, is a viable alternative for providing storage space after 1984 but is not a viable alternative for the next several years.

7.3 Storage at Another Reactor Site

CP&L has only two operating nuclear power plants: Robinson and Brunswick. CP&L has proposed to build Shearon Harris Units 1, 2, 3 and 4, on which a construction permit application is pending. The earliest scheduled fuel loading date for Harris Unit 1 is June 1983. Thus, CP&L does not have another facility within their system other than the BSEP to which they can ship spent fuel from Robinson. The proposed Harris Plant, however, is another possible alternative to providing storage for spent fuel from Robinson Unit 2 after 1984.

According to a survey conducted and documented by the Energy Research and Development Administration, up to 46 percent of the operating nuclear power plants will lose the ability to refuel during the period 1975-1984 without additional spent fuel storage pool expansions or access to offsite storage facilities. Thus, the licensee cannot assuredly rely on any other power facility to provide additional storage capability except on a short-term emergency basis. If space were available in another reactor facility, the cost would probably be comparable to the cost of storage at a commercial storage facility.

7.4 Expansion of H. B. Robinson Spent Fuel Storage Capacity

Consideration was given by CP&L to providing additional storage at H. B. Robinson so that transportation of spent fuel to another storage location would not be required. The recent addition of storage racks at H. B. Robinson (Amendment 19 to Facility Operating License No. DRP-23) exhausted the empty space in that unit's fuel storage pool. Thus, further expansion of that unit's storage capacity would require use of high density storage racks. To accomplish this, at least some of the spent fuel assemblies now stored in the Robinson SFP would have to be moved elsewhere to make room for several new racks. Preferably, to minimize radiation exposures and potential safety considerations, it is desirable to remove all spent fuel from a pool if replacement racks are to be installed. Until or unless CP&L can ship enough of the spent fuel now stored in the Robinson SFP to another facility to permit installation of high density racks, expansion of the H. B. Robinson spent fuel storage capacity is not a viable alternative. If the proposed action is approved, CP&L could transfer the 260 assemblies now stored in the Robinson SFP to BSEP and install high density storage racks in the Robinson SFP prior to the 1978 or 1979 refeuling of the unit. This is another possible alternative for providing storage of Robinson spent fuel after 1984 and until the government storage facility is available.

7.5 Shutdown of Facilities

The present storage capacity of the Brunswick Units 1 and 2 SFPs (720 spaces each) is adequate to accommodate the project refueling of these facilities through 1981. However, Robinson Unit 2 only has 16 storage spaces in its SFP and is scheduled to replace 53 fuel assemblies in February 1978. If Robinson Unit 2 is not authorized to transfer spent fuel to BSEP prior to February 1978, or if alternate storage space for 37 of the assemblies is not available, Robinson Unit 2 will not be able to refuel in February 1978 and the facility will have to be shut down.

CP&L has estimated that the cost of replacement power by fossil plants on their system is several hundred thousand dollars per week - if the power is available. If purchased outside their system, the cost would be even greater. This would be the cost of purchased power and the substitution of some fossil-fired power generating facilities for Robinson. However, this does not consider that the $472 million investment would be idle and that the Robinson plant would have to be maintained in standby or decommissioned.

While the existing storage capacity of the BSEP SFPs may be adequate to accommodate normal refuelings of Brunswick Units 1 and 2 until 1981, it is prudent engineering practice to reserve space in a SFP to permit discharge of a full core should this be necessary to inspect or repair core internals. The Robinson Unit 2 SFP is essentially full and does not have this capability. With the present design capacity of their pools, Brunswick Units 1 and 2 will not have space for a full core discharge after the scheduled 1978 refuelings of these units without transferring spent fuel between the two pools.

7.6 Summary of Alternatives

In summary, the alternatives (1) to (4) described above are presently not available to the licensee or could not be made available in time to meet the licensee's need. Even if available, alternatives (2) and (3) do not provide the operating flexibility of the proposed action. Alternative (3) might preempt storage space needed by another utility. All alternatives would likely be more expensive than the proposed modification. The alternative of ceasing operation of the facility would be much more expensive than the proposed action because of the need to provide replacement power. In addition to the economic advantages of the proposed action, we have determined that the expansion of the storage capacities of the spent fuel pools for Brunswick Units 1 and 2 would have a negligible environmental impact. Accordingly, deferral or severe restriction of the action here proposed would result in substantial harm to the public interest.

8.0 Evaluation of Proposed Action

8.1 Unavoidable Adverse Environmental Impacts

8.1.1 Physical Impacts

As discussed above, expansion of the storage capacity of the SFP would not result in any significant unavoidable adverse environmental impacts on the land, water, air or biota of the area.

8.1.2 Radiological Impacts

Expansion of the storage capacity of the SFP will not create any significant additional radiological effects. As discussed in Section 5.3, the additional total body dose that might be received by an individual or the estimated population within a 50 mile radius is less than 0.001 mrem/yr and 0.01 man-rem, respectively, and is less than the natural fluctuations in the dose this population would receive from background radiation. The total dose to workers during removal of the present storage racks and installation of the new racks is estimated to be about 10 to 25 man-rem. Operation of the units with additional spent fuel in the SFPs is not expected to increase the occupational radiation exposure by more than one percent of the present total annual occupational exposure at this facility.

8.2 Relationships Between Local Short-Term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

Expansion of the storage capacity of the BSEP SFPs, which would permit BSEP and Robinson to continue to operate until 1984 and 1985, would not change the evaluation in the FES. Continued operation of the facilities will allow the expected short-term benefits (i.e., production of electrical energy) to be realized.

8.3 Irreversible and Irretrievable Commitments of Resources

8.3.1 Water, Land and Air Resources

The proposed action would not result in any significant change in the commitments of water, land and air resources as identified in the FES. No additional allocation of land would be made; the land area now used for the SFP would be used more efficiently by reducing the spacings between fuel assemblies.

8.3.2 Material Resources

Under the proposed modification, the present spent fuel storage racks would be replaced by new racks to increase the storage capacity of the SFPs by about 952 spent fuel assemblies.

Each fuel rack to be installed in the BSEP SFPs will be approximately 14'-0" in height, and 4'-6" square with the exception of seven (7) racks in each pool which are 4'-6" x 2'-3" to conform to the geometry of the spent fuel pool. Each 4'-6" BWR rack will provide for the storage of 36 spent fuel assemblies in a 6x6 array with a minimum center-to-center spacing (pitch) of 8.625 inches. Each half-size BWR rack will store 18 assemblies. The PWR racks will contain 16 assemblies each in a 4x4 array with a minimum pitch of 13.0 inches. The BWR assemblies will be stored within Schedule 10 stainless steel pipes; PWR fuel assemblies will be stored within 1/4" thick stainless steel square tubes. Based on the currently proposed storage arrangement, the two spent fuel pools, when full, would probably contain 19 PWR racks, 51 full size BWR racks and 14 half-sized BWR racks.

The fuel racks are supported from the floor of the spent fuel pool on a positioning grid consisting of a 1'-6" deep truss system. The racks and truss system will be constructed of Type 304 stainless steel to insure a very low susceptibility to corrosion and compatibility with the existing Type 304 stainless steel pool liner. In addition, 17-4 PH stainless steel will be utilized in any areas where galling could be a problem.

The amount of material to be used to fabricate the new racks and grid structure is approximately 555,000 pounds of stainless steel, 400 pounds of aluminum and 2,000 pounds of miscellaneous material (welding rods, nuts, bolts, etc.). As discussed in Section 5.3.3, a total of about 160,000 pounds of aluminum and 1,000 pounds of stainless steel would be removed from the two SFPs consisting of the present racks and rack support system. Brunswick Unit 1 does not have any spent fuel stored in its SFP. The racks and support system are not contaminated and may be sold as is to another licensee or sold as scrap. Brunswick Unit 2 SFP only contains four spent fuel assemblies at this time; however, according to CP&L's schedule, 140 additional spent fuel assemblies will be added to the pool during the August 1977 refueling. In 1978, after sufficient new racks are installed in BSEP Unit 1, the 144 spent fuel assemblies in the BSEP Unit 2 pool would be transferred to the Unit 1 SFP so the new racks could be installed in the Brunswick Unit 2 SFP without any spent fuel assemblies in the pool. If CP&L can adequately decontaminate the racks in the Unit 2 SFP, these racks will also be transferred to another licensee or sold as scrap. In any case, at least half the material used to fabricate the existing racks will be salvaged, offsetting the material resources used to fabricate the new racks.

The new racks do not use a poison material such as boron impregnated stainless steel, B_4C plates or boral. The amount of stainless steel used annually in the U.S. is about 2.82×10^{11} lbs. The material is readily available in abundant supply. The amount of stainless steel required for fabrication of the new racks is a small fraction of this resource consumed annually in the United States. We conclude that the amount of material required for the new racks at Brunswick Units 1 and 2 is insignificant and does not represent a significant irreversible commitment of material resources.

The longer term storage of spent fuel assemblies withdraws the unburned uranium from the fuel cycle for a longer period of time. Its usefulness as a resource in the future, however, is not changed. The provision of longer onsite storage does not result in any cumulative effects due to plant operation since the throughput of materials does not change. Thus the same quantity of radioactive material will have been produced when averaged over the life of the plant. This licensing action would not constitute a commitment of resources that would affect the alternatives available to other nuclear power plants or other actions that might be taken by the industry in the future to alleviate fuel storage problems. No other resources need be allocated because the other design characteristics of the SFPs remain unchanged.

We conclude that the expansion of the SFPs at Brunswick Units 1 and 2 does not constitute a commitment of either material or nonmaterial resources that would tend to significantly foreclose the alternatives available with respect to any other individual licensing actions designed to ameliorate a possible shortage of spent fuel storage capacity.

8.4 Commission Policy Statement Regarding Spent Fuel Storage

On September 16, 1975, the Commission announced (40 F. R. 42801) its intent to prepare a generic environmental impact statement on handling the storage of spent fuel from light water reactors. In this notice, the Commission also announced its conclusion that it would not be in the public interest to defer all licensing actions intended to ameliorate a possible shortage of spent fuel storage capacity pending completion of the generic environmental impact statement. The statement is expected to be completed by the fall of 1977.

The Commission directed that in the consideration of any such proposed licensing action, among other things, the following five specific factors should be applied, balanced, and weighed in the context of the required environmental statement or appraisal.

1. Is it likely that the licensing action here proposed would have a utility that is independent of the utility of other licensing actions designed to ameliorate a possible shortage of spent fuel capacity?

The reactor core for Brunswick Units 1 and 2 each contain 560 fuel assemblies. The refueling of each of the two units, which consists of replacing about 140 of the 560 fuel assemblies, is done annually. The refuelings of the two units are both scheduled for the fall of each year based on the current fuel management plan. The spent fuel pools for these two units were designed on the basis that a fuel cycle would be in existence that would only require storage of spent fuel for a year or two prior to shipment to a reprocessing facility. Therefore, a pool storage capacity for 720 assemblies (about 130% of the full core load) was considered adequate. This provided for complete unloading of the reactor even if the spent fuel from the previous refueling was in the pool. It is prudent engineering practice to reserve space in the SFP to receive an entire reactor core, should this be necessary to inspect or repair core internals or because of other operational considerations. With the present spent fuel storage racks, BSEP will not have space for a full core discharge after the scheduled 1978 refuelings of these units.

A full core for Robinson Unit 2 consists of 157 fuel assemblies. One third (52 or 53) of the fuel assemblies are replaced each year. The spent fuel pool for this unit was originally intended to store 236 spent fuel assemblies (about 1 1/2 cores). This was subsequently changed to 240 storage spaces and in 1976 was increased to 276 storage spaces. Like all PWR spent fuel pools, storage capacity for at least 1-1/3 cores was considered adequate to provide capability for a full core offload if the fuel from the previous refueling were still in the pool. However, CP&L has not been able to ship their Robinson spent fuel to AGNS, the intended reprocessor. Consequently, Robinson Unit 2 now has 260 spent fuel assemblies stored in its SFP from the four previous refuelings and is scheduled to replace 53 fuel assemblies starting about February 1978. If expansion of at least one of the Brunswick SFPs is not approved or if an alternate storage facility is not located, CP&L will have to shutdown Robinson Unit 2 this fall. As discussed under alternatives (Section 7.0), an alternate storage facility is not now available. Storage of the Robinson spent fuel in the BSEP SFPs along with increased storage capacity in these two pools for spent fuel from Brunswick Units 1 and 2 is required as an interim solution to allow these three units to continue to operate until 1984 and 1985. As a long term solution for spent fuel storage, the government is committed to providing a retrievable repository for spent fuel by 1985. While the proposed actions will not completely cover the time period until the long-term repository is expected to be available, there are a number of alternatives available to CP&L to cover the intervening time period of one or two years. These include stretch-out of the fuel cycles, increasing the storage capacity of the Robinson Unit 2 SFP, storage of spent fuel at AGNS or another independent, offsite spent fuel storage facility, storage at the proposed Harris plant or, possibly, the resumption of fuel reprocessing in the United States or another country.

The proposed licensing action (i.e., installing new racks of a design that permits storing more assemblies in the same space) would allow Robinson Unit 2 to continue to operate beyond February 1978 and will provide the licensee with additional flexibility which is desirable even if adequate offsite storage facilities hereafter become available.

We have concluded that a need for additional spent fuel storage capacity exists at Brunswick Units 1 and 2 which is independent of the utility of other licensing actions designed to ameliorate a possible shortage of spent fuel storage capacity.

2. Is it likely that the taking of the action here proposed prior to the preparation of the generic statement would constitute a commitment of resources that would tend to significantly foreclose the alternatives available with respect to any other licensing actions designed to ameliorate a possible shortage of spent fuel storage capacity?

With respect to this proposed licensing action, we have considered commitment of both material and nonmaterial resources. The material resources considered are those to be utilized in the expansion of the SFPs.

The increased storage capacity of Brunswick Units 1 and 2 spent fuel pools was considered as a nonmaterial resource and was evaluated relative to proposed similar licensing actions within a one year period (the time we estimate is necessary to complete the generic environmental statement) at other nuclear power plants, fuel reprocessing facilities and fuel storage facilities. We have determined that the proposed expansion in the storage capacity of the SFPs is only a measure to allow for continued operation and to provide operational flexibility at BSEP and Robinson, and will not affect similar licensing actions at other nuclear power plants. Similarly, taking this action would not necessarily commit the NRC to repeat this action or a related action in 1984.

We conclude that the proposed expansion of the SFP at the Brunswick Units 1 and 2 facility, including the capability to store Robinson spent fuel, prior to the preparation of the generic statement, does not constitute a commitment of either material or nonmaterial resources that would tend to significantly foreclose the alternatives available with respect to any other individual licensing actions designed to ameliorate a possible shortage of spent fuel storage capacity.

3. Can the environmental impacts associated with the licensing action here proposed be adequately addressed within the context of the present application without overlooking any cumulative environmental impacts?

Potential non-radiological and radiological impacts resulting from the fuel rack conversion and subsequent operation of the expanded SFPs at this facility were considered by the Staff.

No environmental impacts on the environs outside the spent fuel storage buildings are expected during removal of the existing racks and installation of the new racks. The impacts within this building are expected to be limited to those normally associated with metal working activities and to the occupational radiation exposure to the personnel involved.

The potential non-radiological environmental impact attributable to the additional heat load in the SFPs was determined to be negligible compared to the existing thermal effluents from the facility.

We have considered the potential radiological environmental impacts associated with the expansion of the SFPs and have concluded that they would not result in radioactive effluent releases, occupational exposures or offsite personnel exposures that significantly affect the quality of the human environment during either normal operation of the expanded SFPs or under postulated fuel handling accident conditions.

4. Have the technical issues which have arisen during the review of this application been resolved within that context?

This Environmental Impact Appraisal and the accompanying Safety Evaluation respond to the issues concerning health, safety and environmental concerns.

5. Would a deferral or severe restriction on this licensing action result in substantial harm to the public interest?

We have evaluated the alternatives to the proposed action, including storage of the additional spent fuel offsite and ceasing power generation from the three plants when the existing SFPs are full. We have determined that there are significant economic advantages associated with the proposed action and that expansion of the storage capacity of the SFPs will have a negligible environmental impact. Accordingly, deferral or severe restriction of the action here proposed would result in substantial harm to the public interest.

9.0 Benefit-Cost Balance

This section summarizes and compares the costs and the benefits resulting from the proposed modification to those that would be derived from the selection and implementation of each alternative. The table below presents a tabular comparison of these costs and benefits. The benefit that is derived from four of these alternatives is the continued operation of Robinson Unit 2 and Brunswick Units 1 and 2 and production of electrical energy. As shown in the table, the shutdown of these reactors and subsequent storage of fuel in the reactor vessel would result in the cessation of electrical energy production. The remaining alternatives (i.e., reprocessing of the spent fuel or storage at other nuclear plants) are not possible at this time or in the foreseeable future except on a short term emergency basis and, therefore, have no associated cost or benefit.

From examination of the table, it can be seen that the most cost-effective alternative is the proposed spent fuel pool modification. As evaluated in the proceeding sections, the environmental impacts associated with the proposed modification would not be significantly changed from those analyzed in the Final Environmental Statement for Brunswick Units 1 and 2 issued in January 1974.

10.0 Basis and Conclusion for not Preparing an Environmental Impact Statement

We have reviewed this proposed facility modification relative to the requirements set forth in 10 CFR Part 51 and the Council of Environmental Quality's Guidelines, 40 CFR 1500.6 and have applied, weighed, and balanced the five factors specified by the Nuclear Regulatory Commission in 40 FR 42801. We have determined that the proposed license amendment will not significantly affect the quality of the human environment and that there will be no significant environmental impact attributable to the proposed action other than that which has already been predicted and described in the Commission's Final Environmental Statement for the facilities dated January 1974. Therefore, the Commission has found that an environmental impact statement need not be prepared, and that pursuant to 10 CFR 51.5(c), the issuance of a negative declaration to this effect is appropriate.

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SUMMARY OF COST-BENEFITS

Alternative	Cost	Benefit
Reprocessing of Spent Fuel	-	None-This alternative is not available either now or in the foreseeable future.
Increase storage capacity of BSEP SFP's	$6400/assembly plus shipping cost for Robinson fuel	Continued operation of Robinson-2 and BSEP 1 & 2 and production of electrical energy.
Storage at Independent Facility	$10,000/assembly plus shipping costs for PWR fuel	Continued operation of Robinson 2 and BSEP 1 and 2 and production of electrical energy. This alternative is not available for several years.
Storage at Reprocessor's Facility	$3000 to 5000/yr. per assembly* plus shipping costs	Continued operation of Robinson 2 and BSEP 1 and 2 and production of electrical energy.
Storage at Other Nuclear Plants	-	None - This alternative is not likely to be available.
Expansion of Robinson SFP	Similar to 2 above	This alternative is not feasible unless some fuel can removed from SFP to make room for a new rack.
Reactor Shutdown	about $10 million/yr**	None - No production of electrical energy.

* In order to use this alternative a minimum commitment of seven to ten years of storage is required.

** This does not include costs of maintaining the plant in a standby condition, decommissioning costs etc.

The application for the amendments complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations. The Commission has made appropriate findings as required by the Act and the Commission's rules and regulations in 10 CFR Chapter I, which are set forth in the license amendments. Notice of Proposed Issuance of Amendments to Facility Operating Licenses in connection with this action was published in the FEDERAL REGISTER on November 26, 1976 (41FR 52113). No request for a hearing or petition for leave to intervene was filed following notice of the proposed action.

The Commission has prepared an environmental impact appraisal for the revised Technical Specifications and has concluded that an environmental impact statement for this particular action is not warranted because there will be no significant environmental impact attributable to the action. A negative declaration to this effect is appropriate.

For further details with respect to this action, see (1) the application for amendments dated September 23, 1976 as supplemented January 7, March 3, April 7, April 26, 1977, (2) Amendment No. 8 to License No. DPR-71, (3) Amendment No. 30 to License No. DPR-62, (4) the Commission's related Safety Evaluation and (5) the Commission's related Environmental Impact Appraisal. All of these items are available for public inspection at the Commission's Public Document Room 1717 H Street, NW., Washington, D.C. and at the Southport-Brunswick County Library, 109 W. Moore Street, Southport, North Carolina 28461. A copy of items (2), (3), (4) and (5) may be obtained upon request addressed to the U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Director, Division of Operating Reactors.

Dated at Bethesda, Maryland, this 26th day of August 1977.

FOR THE NUCLEAR REGULATORY COMMISSION

A. Schwencer, Chief
Operating Reactors Branch #1
Division of Operating Reactors