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Docket No. 50-255

June 30, 1977

Consumers Power Company
ATTN: Mr. Dave Bixel
Nuclear Licensing Administrator
212 West Michigan Avenue
Jackson, Michigan 49201

Gentlemen:

The Commission has issued the enclosed Amendment No. 29 to Provisional Operating License No. DPR-20 for the Palisades Plant. The amendment consists of changes to the Technical Specifications in response to your request dated November 16, 1976, as supplemented November 1, 1976, January 11 and February 8, 1977.

This amendment permits the installation of new, higher capacity fuel storage racks in the Palisades Plant spent fuel pool which results in an increased storage capacity of from 276 to 798 fuel assemblies. This amendment also increases the amount of Uranium-235 that you are allowed to receive, possess and use, to reflect this expanded fuel storage capacity.

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

Sincerely,

Original signed by
TVWambach/for

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

Enclosures:
1. Amendment No. 29 to DPR-20
2. Safety Evaluation
3. Environmental Impact Appraisal
4. Notice/Negative Declaration

cc w/enclosures:
See next page

Construc. Permit

BCB 5/26/77

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NRC FORM 318 (9-76) NRCM 0240

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

CONSUMERS POWER COMPANY

DOCKET NO. 50-255

PALISADES PLANT

AMENDMENT TO PROVISIONAL OPERATING LICENSE

Amendment No. 29
License No. DPR-20

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

   A. The application for amendment by Consumers Power Company (the licensee) dated November 16, 1976, as supplemented November 1, 1976, January 11 and February 8, 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.

ATTACHMENT TO LICENSE AMENDMENT NO. 29

PROVISIONAL OPERATING LICENSE NO. DPR-20

DOCKET NO. 50-255

. Revise Appendix A as follows:

Remove Pages	Insert Revised Pages
3-47	3-47
5-4	5-4
4-14a	4-14a
4-14b	4-14b

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 and 3.B of Provisional Operating License No. DPR-20 are hereby amended to read as follows:

   2.B Pursuant to the Act and 10 CFR Part 70, "Special Nuclear Material" to receive, possess and use 15,000 kilograms of Uranium-235 and 96 grams of encapsulated plutonium-beryllium in connection with operation of the facility.

   3.B Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 29 , 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

for George Lear

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

Attachment:
Changes to the Technical
Specifications

Date of Issuance: June 30, 1977

f. During reactor vessel head removal and while refueling operations are being performed in the reactor, the refueling boron concentration shall be maintained in the primary coolant system and shall be checked by sampling on each shift.

g. Direct communication between personnel in the control room and at the refueling machine shall be available whenever changes in core geometry are taking place.

3.8.2 If any of the conditions in 3.8.1 are not met, all refueling operations shall cease immediately, work shall be initiated to satisfy the required conditions, and no operations that may change the reactivity of the core shall be made.

3.8.3 Refueling operation shall not be initiated before the reactor core has decayed for a minimum of 48 hours if the reactor has been operated at power levels in excess of 2% rated power.

3.8.4 The ventilating system and charcoal filter in the fuel storage building shall be operating whenever refueling operations are in process with the equipment door open, or whenever irradiated fuel is being handled in the fuel storage building.

3.8.5 When spent fuel which has decayed less than one year is placed in the tilt pit storage racks, the bulk water temperature in the tilt pit storage area must be monitored continuously to assure that the water temperature does not exceed 150°F. Monitoring will continue for 24 hours after any addition of fuel to the main pool or the tilt pit or when a failure of the spent fuel pool cooling system occurs.

Basis

The equipment and general procedures to be utilized during refueling are discussed in the FSAR. Detailed instructions, the above specifications, and the design of the fuel handling equipment incorporating built-in interlocks and safety features provide assurance that no incident could occur during the refueling operations that would result in a hazard to public health and safety.[1] Whenever changes are not being made in core geometry, one flux monitor is sufficient. This permits maintenance of the instrumentation. Continuous monitoring of radiation levels and neutron flux provides immediate indication of an unsafe condition. The shutdown cooling pump is used to maintain a uniform boron concentration.

The shutdown margin as indicated will keep the core subcritical, even if all control rods were withdrawn from the core. During refueling, the reactor refueling cavity is filled with approximately 250,000 gallons of borated water. The boron concentration of this water

5.4 FUEL STORAGE (Contd)

than 0.7. The open grating floor below the rack and the covers above the racks, along with generous provisions for drainage, precludes flooding of the new fuel storage rack.

b. New fuel may also be stored in shipping containers,

c. New fuel may be stored in the spent fuel pool racks which are designed to insure an effective multiplication factor of less than 0.95 when flooded with unborated water.

d. The new fuel storage racks are designed as a Class I structure.

5.4.2 Spent Fuel Storage

a. Irradiated fuel bundles will be stored, prior to off-site shipment in the stainless steel-lined spent fuel pool.

b. The spent fuel racks are designed to maintain fuel in a geometry which insures an effective multiplication factor of 0.95 or less with new fuel flooded with unborated water.

c. The spent fuel pool water boron concentration shall be verified at least once monthly to be equal to or greater than 1720 ppm.

d. The spent fuel racks are designed as a Class I structure.

e. The fuel placed in the spent fuel pool shall not contain more than 38.3 grams of U-235 per axial centimeter of active fuel assembly, subject to a maximum assembly average loading of 3.05 w/o U-235.

f. Shielded shipping casks shall not be moved in the fuel storage building until such time as the NRC has reviewed and approved the spent fuel cask drop evaluation.

g. Fuel stored in the higher capacity storage racks as described in the SER supporting Amendment No. 28, shall have decayed for a minimum of 12 months if the storage racks are not supported by similarly designed, adjacent racks and the spent fuel pool wall. or the cask anti-tipping device.[1]

References

[1] Until needed for fuel storage, two A-type racks in the northeast corner of the spent fuel pool will be removed and replaced with the cask anti-tipping device to provide necessary seismic restraint.

FSAR, Appendix A.

FSAR, Appendix B.

Table 4.2.1

Minimum Frequencies for Sampling Tests

		Test	Frequency	FSAR Section Reference
6.	Spent Fuel Pool	Boron Concentration	Monthly(7)	9.4
7.	Secondary Coolant	Bulk Water Temperature	Continuously when bundles are stored in tilt pit racks with less than one year decay(6)	None
		Gas Radioactivity by Air Ejector Gas Monitor	Continuous(5) during power operation	None
		Coolant Gross Radio-activity	3 times/7 days with a maximum of 72 hours between samples	None
		pH and specific conductivity	Once/24 hours during power operation	None
		Sodium	3 times/7 days during power operation, with a maximum of 72 hours between samples	None
		Isotopic Analysis for Dose Equivalent I-131 Concentration	a) 1 per 31 days, whenever the gross activity determination indicates iodine concentrations greater than 10% of the allowable limit b) 1 per 6 months, whenever the gross activity determination indicates iodine concentrations below 10% of the allowable limit	
8.	Liquid Radwaste	Radioactivity Analysis	Prior to release of each batch	11.1
9.	Radioactive Gas Decay	Radioactivity Analysis	Prior to release of each batch	11.1
10.	Stact-Gas Monitor Particulate Samples	Iodine 131 and Particulate Radioactivity	Weekly(4)	11.1

Amendment No. 29

Table 4.2.1

Minimum Frequencies for Sampling Tests

(1) A daily sample shall be obtained and analyzed if fission product monitor is out of service

(2) After at least 2 EFPD and at least 20 days since the last shutdown of longer than 48 hours.

(4) When iodine or particulate radioactivity levels exceed 10 percent of limit in Specification 3.9.6 and 3.9.9, the sampling frequency shall be increased to a minimum of once each day.

(5) If the air ejector gas monitor is out of service, the secondary coolant gross radioactivity shall be measured once per day to evaluate steam generator leak tightness.

(6) Reference Specification 3.8.5 for maximum bulk water temperature and monitoring requirements.

(7) Reference Bases section of Specification 3.8 for minimum boron concentration. ($\geq$1720ppm)

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 29 TO PROVISIONAL OPERATING LICENSE NO. DPR-20

CONSUMERS POWER COMPANY

PALISADES PLANT

DOCKET NO. 50-255

Introduction

By letter dated November 1, 1976, and as supplemented November 16, 1976, January 11 and February 8, 1977, Consumers Power Company (the licensee) proposed an amendment to Provisional Operating License No. DPR-20 for operation of the Palisades Plant in Van Buren County, Michigan. The proposed amendment would allow the installation of new, higher capacity fuel storage racks in the Palisades Plant spent fuel pool. The proposed rack modification would increase the spent fuel pool storage capacity from 276 to 798 fuel assemblies. The proposed amendment would also increase the amount of Uranium-235 that the licensee would be allowed to possess to reflect the total that would exist as a result of the expanded storage capacity.

Discussion

A. Existing Facilities

The existing spent fuel pool at the Palisades Plant has permanent storage capacity for 276 fuel assemblies. These existing racks are stainless steel with a center-to-center spacing of 11.25 inches. There are two 1/4 inch stainless steel plates between each pair of fuel assemblies. Borated water fills the spent fuel storage pool and surrounds the spent fuel storage racks. The existing center-to-center distance of the storage racks is such that the maximum neutron multiplication factor K_{eff}, is less than 0.95, with no credit taken for soluble boron in the pool water.

This cooling system was designed to maintain the pool average temperature at 125°F or less with 1/3 core of fully burned up fuel in the pool, 36 hours after reactor shutdown.

B. Proposed Facilities

The licensee proposes to increase the capacity of the spent fuel pool by replacing the present fuel storage racks with new racks with smaller center-to-center spacing between storage locations. Each individual storage location will consist of two concentric 1/8 inch austenitic type 304 stainless steel cans with the annular space occupied by boron carbide (B_4C) neutron absorber plates to ensure subcriticality. A rack assembly is formed by combining a number of storage cans into a rectangular array with a minimum center-to-center spacing of 10.25 inches between storage locations. The array size of each rack assembly will optimize the use of space in the spent fuel pool.

The present spent fuel cask laydown area will be used to accommodate two 50-element rack assemblies which will normally be used to store fuel during fuel core off-loads. These two racks will be removed to allow placement of the spent fuel cask when fuel shipments resume to allow fuel inspection or repairs.

The Palisades spent fuel storage facility includes two fuel tilt pits, only one of which is used during refueling operations. The presently unused tilt pit will be used for spent fuel and control rod storage and as an alternate cask laydown area.

The new storage racks will be restrained to the pool wall at the top and bottom of each rack to prevent excessive rack movement under postulated seismic accelerations. A maximum gap between the restraints and the pool wall of approximately 0.3 inches is provided to accommodate thermal expansion.

The proposed modification will not alter the external physical geometry of the spent fuel pool or require modifications to the spent fuel pool cooling system except for the addition of a direct cooling water supply to the presently unused tilt pit which will be used as a storage area, as discussed above.

Evaluation

A. Criticality Considerations of New Rack Design

The proposed spent fuel assembly racks are to be made up of individual containers which will be over twelve feet long and which are to have square cross sections. The walls for these containers are to consist of two plates which are to be fabricated from 0.125 inch thick type 304 stainless steel with 0.25 inch space between them in which 0.21 inch thick carbon plates with a minimum of fifty volume percent boron carbide are to be installed. This is to provide a minimum of 0.0959 grams of the boron-ten isotope per square centimeter of carbon plate which is equivalent to 11.55×10^{21} atoms of the boron-ten nuclide per cm^2 of area between any two stored fuel assemblies.

The majority of the racks will be made with the containers held on a 10.25 inch center-to-center spacing. These are designed to have 0.155 inches of water between the 8.25 inch square fuel assembly and the inner stainless steel plate. The fuel region volume fraction in this configuration will be 0.65.

Several of the racks, designated as type "E", will be larger than those described above to allow the storage of control rods as well as fuel assemblies. These type "E" racks are designed to have 0.375 inches of water between the 8.25 inch square fuel assembly and the inner stainless steel plate. These containers are to be held on a 10.25 by 11.25 inch center-to-center spacing. The fuel region volume fraction in this configuration will be 0.59.

The licensee states that the criticality calculations are based on a nominal fuel loading of 37.55 grams of uranium-235 per axial centimeter of fuel assembly and a maximum loading of 38.3 grams of Uranium-235 per axial centimeter of assembly.

For the neutron multiplication factor calculations, the licensee states that the NUMICE computer program was used to obtain four energy group cross sections for use in PDQ-07 diffusion theory calculations and GAM-THERMOS cross sections were used in the XSDRN program to obtain 123 group cross sections for use in the KENO Monte Carlo calculations. These calculational methods were verified by comparing the results of their use in analyses of experiments with experimentally measured results.

Ten shipping cask configuration experiments and one reactor critical experiment were calculated with the KENO Monte Carlo program. Based on this verification review, the neutron multiplication factor calculated by these methods was determined to have an uncertainty of ± 0.008. This uncertainty is in addition to the statistical uncertainty for the finite number of case histories which were calculated.

These computer programs were first used to calculate the neutron multiplication factors, k_∞, for infinite arrays of fuel assemblies in the two nominal storage lattices. The calculations for the lattice with the 10.25 inch center-to-center spacing resulted in a k_∞ of 0.872, and the calculations for the lattice with the 10.25 x 11.25 inch center-to-center spacing resulted in a k_∞ of 0.883.

Determinations of the maximum k_∞s were then made by (1) calculating the uncertainty in the self-shielding of the boron carbide particles, (2) the change for tolerance in the uranium-235 enrichment, (3) assuming that one absorber plate is missing from one side of one can in a group of 25 storage cells, (4) the change for the worst mechanical tolerances, and (5) the maximum increase in k_∞s with a change in water temperature. When these uncertainties and tolerances were all added together along with the KENO program uncertainty of 0.008 and an additional statistical uncertainty of 0.008, the result was a total uncertainty of Δk_∞ = 0.052. When this is added to the maximum nominal k_∞ of 0.883 the result is a maximum k_∞ of 0.935 for these storage racks.

Conclusions

The results of calculations of ten shipping cask configuration experiments with errors of less than ± 0.008 in k_∞ support the licensee's statement on the uncertainty of these results, since these were obtained with the same programs and methods. Also, the use of these programs gave results which compared very favorably with results of calculations, made by other licensees for Pressurized Water Reactor spent fuel pools which were reviewed and approved by us.

We have concluded that when any number of fuel assemblies, which have no more than 38.3 grams of Uranium-235 per axial centimeter of fuel assembly, are loaded into the proposed racks, the neutron multiplication factor will be < 0.935, when it is assumed that one out of every one hundred boron cabride plates are randomly missing from the storage racks. Since this factor is less than our acceptance criterion of 0.95, we find the proposed design acceptable. On this basis, we have concluded that the Palisades Technical Specifications should be modified to prohibit the storage of fuel assemblies that contain more than 38.3 grams Uranium per longitudinal centimeter of assembly. In addition, since the licensee's criticality analysis was based on a nominal fuel enrichment of 3.05 w/o Uranium-235, we have concluded that the Technical Specifications should reflect this limit also. The licensee has agreed to these Technical Specification changes.

B. Thermal Considerations

The spent fuel pool cooling system was designed for a heat removal capability of 23 x 10^6 BTU/hr. The system was conservatively designed to maintain pool average temperature at less than 125°F with 1/3 core of fully burned up fuel in the pool, 36 hours after reactor shutdown. (normal refueling) This was based on a normal refueling heat load of 20 x 10^6 BTU/hr, as discussed in the Palisades Plant FSAR. Revised calculations using more advanced techniques to calculate decay heat generation have shown that the normal refueling heat load following the proposed modification would be 16.9 x 10^6 BTU/hr (5 MW) while maintaining the pool outlet water temperature at no more than 116°F. For a full core off-load following the proposed modification, a decay heat rate of 26.4 x 10^6 BTU/hr (7.7 MW) would occur and the pool outlet temperature would rise to 134°F. The licensee states that connections are provided for a temporary tie-in of the shutdown cooling system to the spent fuel pool cooling system in the event a full core need be rapidly unloaded or if backup cooling capacity is needed. With the shutdown cooling system connected to the spent fuel pool cooling system, and a full core off-loaded, the maximum temperature expected under conditions which assume a single failure (loss of one spent fuel pool cooling system pump) would be 103°F.

The licensee states that its cooling analyses treated the main pool and the tilt pit as one pool. It should be noted that this refers to the total heat load on the spent fuel cooling system rather than an assumption that the tilt pit and main pool formed a single pool. As indicated in the licensee's submittal, the bulk water temperatures would be different for the two pools following a normal refueling off-load of spent fuel assemblies.

One hundred and ten of the new total of 798 storage spaces would be in a presently unused tilt pit, which was initially provided for a possible second reactor. The bulk water temperature in this tilt pit will be higher than that in the main pool because the amount of cooling water flow into it will be lower than for the same number of fuel assemblies in the main pool and because the coolant water for the tilt pit is to be taken directly from the spent fuel cooling pump discharge prior to its passage through the heat exchanger. For these reasons, the licensee has proposed to limit storage in these 110 spaces to fuel that has decayed for at least one year. With this restriction, the licensee indicates that, assuming a single failure, the bulk temperature of the tilt pit water will be 145°F for normal refueling conditions, i.e., an inlet water temperature of 118°F.

In a response to our request for additional information, the licensee stated that there will be approximately 2.5 x 10^4 cubic feet of water in the spent fuel pool.

Comparisons of the above cited licensee's calculated spent fuel cooling heat loads with those obtained by using the total decay energy curve of the NRC Standard Review Plan, "Technical Position APCSB 9-2" shows the licensee's analyses to be adequately conservative without manually connecting the shutdown cooling system, if 150 hours of post shutdown cooling in the reactor vessel is provided prior to transferring a full core to the main spent fuel pool. However, should it become necessary to use the shutdown cooling system after a full core is removed to the spent fuel pool, that system would be available for this purpose because, with the core completely off-loaded, the requirement for shutdown cooling no longer would exist.

To prevent the water in the tilt pit from possibly exceeding 150°F, the licensee has agreed to a Technical Specification to prohibit tilt pit storage of spent fuel assemblies which have been decayed for less than one year, unless the tilt pit bulk water temperature is monitored continuously to assure that it does not exceed 150°F. Monitoring would continue for 24 hours after an addition of fuel to the main pool or the tilt pit, or when a failure of the spent fuel pool cooling system occurs.

If after a full core off-load, a complete loss (i.e., a double failure) of the spent fuel cooling system is postulated to occur, it would take about 4.6 hours to heat the 2.5×10^4 cubic feet of water in the spent fuel pool from 134°F to 212°F. This would provide sufficient time to manually connect the shutdown cooling system to the spent fuel pool.

We have considered the potential of foreign material blocking cooling flow in one or more fuel assemblies. First, the spent fuel pool cooling system additionally serves as a cleanup system which filters out debris and impurities in the system filter and demineralizer. Secondly, the design of the new storage racks and rack assemblies is such that natural circulation of water up through each stored fuel assembly is provided. Finally, the design of a fuel assembly, which consists of fuel rods in a 15 x 15 lattice array, makes it extremely unlikely that coolant flow could be blocked. Nevertheless, we requested that the licensee perform an analysis to determine what the maximum temperature attained would be should the inlet port of a fuel assembly become blocked. The results of this analysis shows that the maximum fuel clad temperature would be less than 250°F. This is considerably less than the minimum fuel clad failure temperature of over 1000°F. We additionally requested the effects on the boron carbide absorber plates should a coolant blockage occur in a stored fuel assembly. The licensee provided information which showed that the boron carbide had been tested to 350°F with no significant changes in properties. Since the plates would be cooler than the fuel clad surface maximum temperature of 250°F under these postulated conditions, it is concluded that the boron carbide plates would not be adversely affected.

Conclusion

We have calculated that the incremental heat load due to older fuel, as the pool as filled to its enlarged storage capacity, to be approximately 1.07×10^6 BTU/hr. We have concluded that this additional heat load, assuming it is all discharged to the environment, is negligible compared to the present total heat rejection rate of 4.78×10^9 BTU/hr, based on operation at a power level of 2200 MWt.

We have concluded that the cooling water capacity of the spent fuel pool cooling system will be sufficient to maintain the tilt pit water temperature at or below 145°F. In addition, we have concluded that the spent fuel bulk water temperature for both the normal refueling condition and the full-core off-load will be maintained below the maximum temperature of 125°F, as was analyzed in the Palisades FSAR. We also find that, in the extremely unlikely event of a double failure causing the complete loss of the spent fuel cooling system, 4.6 hours would be sufficient time to manually connect the shutdown cooling system and thus prevent the spent fuel pool bulk water temperature from reaching 212°F. In view of the above, we therefore conclude that the heat removal capability of the spent fuel pool cooling system will be adequate following installation of the new storage racks.

C. Structural and Material Considerations

We reviewed the supporting arrangements for the proposed racks including their restraints, in accordance with the criteria described in Sections 3.7 and 3.8 of the Standard Review Plan. The scope of our review included the design, fabrication and installation procedures; the structural analysis for all loads on the racks and pool, including seismic and impact loadings; load combination; structural acceptance criteria; quality assurance requirements for design, fabrication and installation; and applicable industry codes.

The seismic loading of a typical fuel rack was determined by the licensee from a response spectrum modal analysis using floor response spectra approved for the Palisades FSAR with a 2% increase in structural damping to account for the effects of the surrounding water. In addition because of the gap that exists between the sides of a fuel assembly and the storage can, a nonlinear dynamic analysis was performed to determine the maximum shear force and bending moment resulting from the fuel assembly impacting the can at maximum velocity.

The use of 300 series stainless steel materials for the fabrication of the spent fuel racks, and its performance requirements during the service life, were reviewed for consistency with the requirements identified in Section 9.1.2 of the Standard Review Plan and were found to be acceptable.

Conclusion

Based on our review of the structural and material aspects of the proposed high capacity fuel storage racks, we have determined that the analysis, design, fabrication and installation will be in accordance with accepted criteria for seismic Category I equipment and that the structural and material aspects of the modification proposed by the licensee are therefore acceptable.

D. Installation Considerations

The installation of the new spent fuel storage racks will involve the movement of fuel assemblies presently stored in the pool. New fuel racks will first be installed in the present cask laydown area and in the tilt pool. The fuel now stored in the pool will then be transferred to these new racks. The old racks will then be removed and replaced by new racks using detailed written procedures to preclude the possibility of dropping a rack on the stored fuel elements. The licensee has agreed to provide us with a copy of the procedures for our review prior to commencement of any movement of racks in the spent fuel pool. We have, however, considered the potential of an old rack accidently dropping on the fuel now stored in the pool during the installation procedures. In view of the fact that all the fuel now stored in the pool has decayed for greater than one year, we have concluded that the consequences of such an accident would be significantly less than the guidelines of 10 CFR Part 100 and that therefore a significant threat to the public health and safety does not exist.

The next refueling outage for Palisades is now scheduled to commence on August 6, 1977. This date is based on present Technical Specification requirements to conduct steam generator tube inspection by that date. By letter dated April 1, 1977, the licensee requested a 5 month extension to the steam generator tube inspection interval which, if approved, will delay the commencement date of the August 6, 1977 outage until January 1978. If the request is not approved, the licensee would not have sufficient time to complete the spent fuel rack modification and a number of the racks (up to 11 of the 15 racks to be installed) would not be installed until after the refueling outage. Those racks that would be installed in the main pool (two A racks and one B rack) would not be supported by other new racks and therefore would not meet the assumptions made in the seismic analysis. The existing racks individually meet the required seismic criteria and adjacent racks are not required for support. This is also the case for the two D racks and the one E rack that will be installed in the tilt pit pool.

In the event the extension for the steam generator tube inspection interval is not granted we will therefore require a Technical Specification change that limits the number of spent fuel assemblies that can be stored in the unsupported, new racks that are installed before the August refueling outage. The licensee has indicated that 205 assemblies is the maximum number that they may be required to store in the unsupported racks. These assemblies would have decayed by over 12 months at the time of the next outage. We have concluded that if no more than 205 assemblies, all of which have decayed by 12 months should become damaged, the resultant dose to the public would be insignificant with respect to the limits of 10 CFR Part 100. The licensee has agreed to this Technical Specification change.

E. Postulated Spent Fuel Shipping Cask Drop and Fuel Handling Accidents

By letter dated March 6, 1974, we requested that the licensee submit an evaluation of a postulated tip or eccentric drop of a spent fuel shipping cask. On August 9, 1974 and as supplemented March 6, 1975; the licensee filed Appendix J to the Palisades FSAR in which several modifications to plant procedures and equipment were identified which, once accomplished, would increase the margin of safety when handling a spent fuel cask. By letter dated January 9, 1976, the licensee provided additional information pertaining to the postulated dropped fuel cask accident and by letter dated April 14, 1977, Technical Specification changes were proposed which would govern the movement of all heavy loads (up to 25 tons) over the spent fuel pool. We are presently reviewing these submittals.

For the interim period until our review of the postulated cask tip is completed, the licensee has agreed to a Technical Specification change which prohibits the movement of any shielded cask inside the fuel storage facility. Upon completion of our review of the consequences of a postulated fuel cask drop and the implementation of the Technical Specifications proposed in the licensee's letter of April 14, 1977, and any other measures found appropriate, this restriction will be removed.

We have examined the offsite consequences of postulated fuel damage resulting from the drop of fuel bundles and have determined that the consequences of this accident would not be increased above those presented in our safety evaluation dated February 7, 1967.

The licensee has also calculated the maximum neutron multiplication factor, k_{eff}, that could be obtained by the dropping or tipping of a fuel cask or fuel rack on stored fuel assemblies. This calculation was made assuming that a nominal concentration of 1720 ppm boron exists in the fuel pool water. Credit is taken for this concentration of boron in the pool water because of the low probability of an accident occurring and because of other conservative assumptions made in the analysis. The analyses performed to determine the maximum k_{eff} in a normal loading condition such as described in Section A above, Criticality Considerations of New Rack Design, assume no boron concentration in the pool water as a conservative condition in the analyses. The results of the licensee's dropped fuel cask analysis show that the k_{eff} would be less than 0.87. The presence of the nominal refueling concentration of boron in the fuel pool water removes any possibility of achieving criticality in the fuel pool. The licensee has therefore agreed to a Technical Specification change which would require that the spent fuel/tilt pit pool water boron concentration be tested at least once monthly to verify that the boron concentration is equal to or greater than 1720 ppm.

Conclusion

We conclude that the proposed increase in spent fuel storage capacity is not affected by considerations of a postulated cask drop accident since cask movement inside the fuel storage facility will be prohibited and since the pool water boration will be periodically verified by test. In addition, the consequences of fuel handling accidents are not increased by this modification.

F. Verification of B_4C Loading

To assure that the B_4C loading in the spent fuel storage racks is consistent with the loading value assumed in the safety analysis, the licensee has developed quality assurance (QA) procedures including weight verification for the spent fuel storage racks.

QA measures will verify and document that the required quantity of poison plates has been installed in each fuel box assembly. Further, verification will be made by weighing the box assembly before and after the B_4C plates are installed.

In addition, the licensee will conduct a test program at the Palisades Plant to show that the racks actually contain the B_4C material prior to storing spent fuel assemblies in the new racks. The test program will be submitted to us and approved by us prior to completing the installation of the racks.

Conclusion

We conclude that the above measures provide reasonable assurance that the proper loading of B_4C has been made.

G. Radiation Levels Following Modification

We have evaluated the increment in onsite occupational doses that could result from the proposed increase in the number of stored fuel assemblies. Our evaluation was based on information supplied by the licensee and was based on realistic assumptions for water cleanup periods and occupancy times. Our evaluation determined that the increase in occupational radiation exposure that could result from the facility modification represents less than one percent of the present total annual occupational burden at the facility. This small increase in radiation exposure will not affect the licensee's ability to maintain individual occupational doses as low as reasonably achievable (ALARA) and within the limits of 10 CFR Part 20.

We also evaluated the offsite doses associated with the increased storage capability of the spent fuel storage pool. Offsite doses are affected primarily by the release of radioactive noble gases from the surface of the spent fuel storage pool. The only significant noble gas released from the surface of the spent fuel pool is krypton 85 since other radioactive noble gases will have decayed to negligible amounts prior to release from the pool surface. We estimate that an additional 46 curies of krypton 85 will be released each year from the modified storage pool when it is completely filled with spent fuel assemblies. The release of an additional 46 curies of krypton 85 per year would result in an additional offsite dose of less than .001 millirem per year. This dose is insignificant when compared with the approximately 100 millirem per year that an individual receives from natural background radiation. This additional dose contributes insignificantly to the Palisades Plant offsite dose and does not jeopardize the ability of the licensee to maintain the offsite dose within the limits of 10 CFR Part 20. For further details on radiation levels following pool modification see the Commission's Environmental Impact Appraisal regarding this action.

Conclusion

On the basis of our evaluation, we conclude that storing additional fuel in the spent fuel storage pool will not result in a significant increase in doses received by occupational workers. Further, we conclude that there will be no significant impact on offsite radiation levels or personnel exposure due to facility operation following installation of the new spent fuel storage racks.

Summary

Our evaluation supports the conclusion that the proposed modifications to the spent fuel storage pool at Palisades Plant is acceptable because: (1) the physical design of the new storage racks will preclude criticality for any moderating condition, (2) the spent fuel pool and tilt pit can be adequately cooled, (3) the increase in the spent fuel pool storage capacity is not affected by considerations of a postulated cask drop accident because cask movement over the pool will be prohibited by Technical Specifications until our review of the postulated cask drop accident is complete, (4) the structural design and materials of construction are adequate, (5) installation can be accomplished safely, and (6) the increase in onsite and offsite radiation levels will be negligible.

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

Date: June 30, 1977

UNITED STATES NUCLEAR REGULATORY COMMISSION

DOCKET NO. 50-255

CONSUMERS POWER COMPANY

NOTICE OF ISSUANCE OF AMENDMENT TO PROVISIONAL OPERATING LICENSE

AND NEGATIVE DECLARATION

The U. S. Nuclear Regulatory Commission (the Commission) has issued Amendment No. 29 to Provisional Operating License No. DPR-20 issued to Consumers Power Company which revised Technical Specifications for operation of the Palisades Plant, located in Covert Township, Van Buren County, Michigan. The amendment is effective as of the date of issuance.

This amendment permits the installation of new, higher capacity fuel storage racks in the Palisades Plant spent fuel pool which results in an increased storage capacity of from 276 to 798 fuel assemblies. This amendment also increases the amount of Uranium-235 that Consumers Power Company is allowed to receive, possess and use, to reflect the increased amount of Uranium-235 that will be stored in the Palisades spent fuel pool.

The application for the amendment 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 amendment. Notice of Proposed Issuance of Amendment to Provisional Operating License in connection with this action was published in the FEDERAL REGISTER on

December 13, 1976, (41 FR 54260). 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 this action.

For further details with respect to this action, see (1) the application for amendment dated November 16, 1976, as supplemented November 1, 1976, January 11 and February 8, 1977, (2) Amendment No. 29 to License No. DPR-20, (3) The Commission's related Safety Evaluation and (4) the Commission's Environmental Impact Appraisal. All of these items are available for public inspection at the Commission's Public Document Room, 1717 H Street, N. W., Washington, D. C. and at the Kalamazoo Public Library, 315 South Rose Street, Kalamazoo, Michigan 49006. A copy of items (2), (3) and (4) 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

FOR THE NUCLEAR REGULATORY COMMISSION

T. V. Wambach

T. V. Wambach, Acting Chief
Operating Reactors Branch #1
Division of Operating Reactors

ENVIRONMENTAL IMPACT APPRAISAL

BY

OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING

AMENDMENT NO. 29 TO

PROVISIONAL OPERATING LICENSE NO. DPR-20

CONSUMERS POWER COMPANY

PALISADES NUCLEAR GENERATING PLANT

DOCKET NO. 50-255

DATE: June 30, 1977

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1.0 Description of Proposed Action

By letter dated November 1, 1976 and as supplemented November 16, 1976, January 11 and February 5, 1977, Consumers Power Company (the licensee) proposed an amendment to Provisional Operating License No. DPR-20 for operation of the Palisades Plant in Van Buren County, Michigan. The proposed amendment would allow the installation of new, higher capacity fuel storage racks in the Palisades Plant spent fuel pool (SFP). The proposed rack modification would increase the SFP storage capacity from 276 to 798 fuel assemblies. The proposed amendment would also increase the amount of Uranium-235 that the licensee would be allowed to posses to reflect the total that would exist as a result of the expanded storage capacity.

The modification evaluated in this environmental impact appraisal is the proposal by the licensee to replace the existing spent fuel storage racks with closer spaced racks. The rack spacing would be changed from 11.25 inches center-to-center spacing to 10.25 inches center-to-center spacing of the individual spent fuel cavities. The new racks would increase the storage capacity of the spent fuel storage facility from 276 to 798 fuel assemblies. A presently unused tilt pit that had originally been included for a possible second unit at Palisades, would be used for spent fuel and control rod storage and as an alternate cask laydown area. The present spent fuel cask laydown area will be used to accommodate two 50-element rack assemblies which will normally be used to store fuel during full-core offloads. These two racks would be removed to allow placement of the spent fuel cask when fuel shipments resume or to allow fuel inspections or repairs.

2.0 Need for Storage Capacity

The Palisades Plant achieved initial criticality on May 24, 1971. The facility's first refueling shutdown was on December 20, 1975. At that time the entire core of 204 fuel assemblies was removed and replaced with prepressurized fuel. The second refueling is presently scheduled to begin in the fall of 1977 at which time an additional 68 fuel assemblies will be removed to the SFP. Since the current storage capacity of the SFP is 276 fuel assemblies, there is not room in the SFP to off-load a full core from the reactor should inspection or repair of core internals become a prerequisite for continued operation. During a normal refueling, 1/3 of the core (68 assemblies) is replaced. Under the licensee's current fuel management plan, the reactor is projected to be refueled with 68 assemblies every 12 to 18 months. With the present storage capacity of the SFP, the unfilled spaces (72) would only accommodate the upcoming fall 1977 refueling. If additional storage space for spent fuel from Palisades cannot be located, the licensee will have to shut down Palisades in 1979.

The need to expand the storage capacity of the SFP or to locate alternate storage exists now. It is prudent engineering practice to reserve room in a SFP to off-load a full core should this be necessary to inspect or repair core internals. At present, the licensee does not have room in the SFP to off-load a full core.

The proposed expanded storage capacity of 522 additional assemblies would provide room for somewhat over 7 refuelings. The total capacity of 798 assemblies is based on the physical layout of the SFP and is not related to a specific refueling schedule.

The proposed modification would extend the spent fuel storage capacity of the pool through to 1985 and leave room for a complete core discharge up to that time (assuming a refueling occurs once every 18 months). In our evaluation, we considered the impacts which may result from storing up to an additional 522 spent fuel assemblies in the SFP for up to an additional 10 years.

The proposed modification will not alter the external physical geometry of the spent fuel pool or require additional modifications to the SFP cooling or purification systems. The proposed modification does not affect in any manner the quantity of uranium fuel to be burned in the reactor over the anticipated operating life of the facility and thus in no way affects the generation of spent uranium fuel by the facility. The rate of spent fuel generation and the total quantity of spent fuel generated during the anticipated operating lifetime of the facility and stored in the SFP remains unchanged as a result of the proposed expansion. The modification will increase the number of spent fuel assemblies stored in the SFP and the length of time that some of the fuel assemblies will be stored in the pool.

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 they were 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 Facility

The Palisades Plant is more fully described in a June 1972 Final Environmental Statement (FES) related to operation of the facility. It has a pressurized water reactor (PWR), which produces 2200 Megawatts thermal (MWt) and has a gross electrical output of 812 Megawatts (MWe). Pertinent descriptions of principal features are summarized below.

4.1 Fuel Inventory

The reactor contains 204 fuel assemblies. Each of these assemblies is in a cluster of 208 fuel rods or sealed tubes arranged in a 15 x 15 array. The weight of the fuel, as UO_2, is approximately 211,000 pounds.

4.2 Cooling Water Systems

During operation, the maximum flow rate of the condenser cooling system water is 297,000 gal/min or 885 cu. ft./sec with a rise in water temperature across the condenser of about 24°F. This cooling rate is equal to 4.78×10^9 BTU/hr at a power level of 2200 MWt. Normally the condenser cooling system is operated in a closed cycle mode using mechanical draft cooling towers to dissipate the heat. The Technical Specifications restrict thermal discharges to Lake Michigan to no more than 5°F above the ambient temperature of the receiving water.

The component cooling water system is designed to remove heat from major components in the Nuclear Steam Supply System under normal conditions and from all components associated with removal of reactor core decay heat under accident conditions. The maximum heat load on this system is during facility shutdown at which time a total heat load of 190×10^6 BTU/hr exists. The component cooling water system heat exchangers are cooled by the service water system which discharges into the cooling tower make-up basin.

4.3 Radioactive Wastes

The facility 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 is no change in this Section as a result of modification of the SFP.

4.4 Purpose of SFP

The SFP was designed to store spent fuel assemblies prior to shipment to a reprocessing facility. These assemblies may be transferred from the reactor core to the SFP to accomplish a core refueling, or to allow for inspection or modification of core internals, which may require the removal and storage of up to a full core. The assemblies are initially intensely radioactive (due to their fresh fission product content) and have a high thermal output. They are stored in the SFP to allow for radioactive and thermal decay.

The major portion of decay occurs in the first 150-days 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

The SFP is provided with a cooling loop which removes residual heat from fuel stored in the SFP. The SFP cooling and cleanup system (SFPCCS) was designed to maintain the SFP water temperature less than or equal to 125°F during normal refueling operations. The cooling and cleanup system is described in Section 9.4 of the FSAR.

The existing SFP cooling and cleanup system consists of two 1700 gpm circulating pumps, two heat exchangers, a filter and demineralizer, and the required piping, valves and instrumentation. The pumps draw water from the pool, circulate it through a heat exchanger and return it to the pool. Component cooling water cools the heat exchanger. The pumps have suction lines to the surface of the SFP and the refueling cavity. The clarity and purity of the spent fuel pool water is maintained by passing approximately 150 gpm of the system flow through a replaceable cartridge type filter (approximately 5 ft^3) and a 50 ft^3 flushable, mixed bed demineralizer to remove radioactive nuclides and chemical impurities in the water. There is also a separate skimmer system to remove surface dust and debris from the SFP; the system consists of 4 skimmers which are connected to the SFP circulating pumps.

The system design incorporates two half-capacity SFP pumps and a full capacity heat exchanger consisting of two heat exchangers in series.

5.0 Environmental Impacts of Proposed Action

5.1 Land Use

The proposed modification will not alter the external physical geometry of the SFP. The SFP was designed to store spent fuel assemblies under water for a period of time to allow shorter lived radioactive isotopes to decay and to reduce the associated thermal heat output. The Commission has never set a limit on how long spent fuel assemblies could be stored on-site. The longer the fuel assemblies decay, the less radioactivity they contain. The proposed modification will not change the basic land use of the SFP. The pool was designed to store the spent fuel assemblies for up to 4 normal refuelings. The modification would provide storage for up to 11 normal refuelings. The pool was intended to store spent fuel. This use will remain unchanged by the proposed modification.

5.2 Water Use

There will be no significant change in plant water usage as a result of the proposed modification. As discussed subsequently, storing additional spent fuel in the SFP will increase the heat load on the SFP cooling system, which is transferred to the component cooling water system and to the emergency cooling water system. The modification will not change the flow rate within these cooling systems. Since the temperature of the SFP water during normal refueling operations will remain below the 125^{o}F (145^{o} in the tilt pit) evaluated in the FES, the rate of evaporation and thus the need for makeup water will not be significantly changed by the proposed modification.

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 SFP will allow spent fuel to be stored for an additional 8 years without shipment offsite. The additional spent fuel which would be stored is fuel which has decayed at least 4 years. 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 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 becomes 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 at reactor operating conditions of approximately 800°F. A few weeks after refueling, the spent fuel cools in the SFP so that the fuel rod temperature is relatively cool, approximately 180°F. This substantial temperature reduction should reduce the rate of 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 licensees and discussions with the operators, there has never been indication of significant leakage of fission products from spent light water reactor fuel stored in the Midwest Fuel Recovery Plant (MFRP) 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 SFP, this fuel was later shipped to either MFRP or NFS for extended storage. Although the fuel exhibited significant leakage at reactor operating conditions, 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 the SFP will accommodate the spent fuel from 4 refuelings. Thus, spent fuel could be stored for up to 4 years with the present racks. The additional fuel that would be stored as a result of the proposed modification is fuel that will have decayed for at least 4 years.

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. Based on operating experience for Zircaloy clad fuel (see NUREG-0017)[1], we have assumed that 0.12% of all fuel rods 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 defected fuel. However, to upper bound 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 46 curies per year of krypton-85 may be released from the SFP when the modified pool is completely filled. The fuel storage pool area is continuously ventilated. This air is normally released through the main vent stack as described in Section 9.8 of the FSAR. If the facility does eventually release an additional 46 curies per year of krypton-85 as a result of the proposed modifications, the increase would result in an additional total body dose at the site boundary 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 0.001 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 a 0.5% increase in the exposures evaluated in the FES for the individual (Table V-6) and the population (Table V-7). Thus, we conclude that the proposed modification will not have any significant impact on radiation levels or personnel exposure offsite.

Assuming that the spent fuel will be stored onsite for several years (rather than shipped offsite after 6 to 12 months storage as originally planned), 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 refueling. The iodines are removed from the SFP water by the SFP cleanup system and by their relative short half lives. Storing additional spent fuel assemblies is not expected to increase the bulk water temperature above the 125°F used in the design analysis during normal refuelings (removal of 1/3 core every 12 to 18 months).

[1]Calculations of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Pressurized Water Reactors (PWR Gale Code), Nuclear Regulatory Commission, April 1976, p.2-19.

Although the heat load for a full core off-load was not considered in the FSAR, the licensee has determined that the maximum heat load would be 26.4 x 10^6 BTU/hr. Should a full core off-load be necessary, the shutdown cooling system would be tied into the SFP cooling system and would limit the temperature increase to 103°F.

Since the temperature of the pool water will normally be maintained below 125°F, it is not expected that there will be any significant change in evaporation rates and the release of tritium as a result of the proposed modification. Most radioactive airborne releases from the facility result from leakage of reactor coolant which contains tritium and iodine in higher concentrations than the SFP. Therefore, even if there were a slightly higher evaporation rate from the SFP, the increase in tritium and iodine released from the facility as a result of the increase in stored spent fuel would be small compared to the amount normally released from the facility and that which was previously evaluated.

The storage of spent fuel in the tilt pit pool may increase the bulk water temperature above the 125°F used in the FSAR design analysis. The bulk temperature in the tilt pit pool will be higher than that in the main pool because the cooling water flow entering the tilt pit pool is at the bulk water temperature of the main pool. With both cooling pumps running, this temperature would be 116°F. Based on this temperature, 100 gpm of cooling water flow, and 179 spent fuel assemblies in the tilt pit pool which have decayed for at least one year, the bulk temperature of the tilt pit pool may be as high as 145°F. This would be 20°F above the design analysis temperature of 125°F.

This increase in the tilt pool bulk water temperature is a design valve, not an expected one. The increase will depend on the actual number and age of the spent fuel in the tilt pool and the actual bulk temperature of the main pool. The bulk water temperature of the main pool is expected to be lower than the design valves of 116°F (both cooling pumps operating) and 118°F (one cooling pump operating). An increase in the tilt pool temperature will result in a higher evaporation rate from this pool as compared to the design analysis temperature. This should increase the release of tritium and radioiodines from the tilt pool. However, we do not anticipate a significant increase overall from the SFP area because the main pool bulk temperature is lower than the design analysis temperature. The overall evaporation rate from the two pools should not be significantly greater than that expected at the design analysis temperature. The licensee is required to monitor the release of gaseous radioactivity from the plant including the SFP area. As a matter of normal operating procedure, the licensee samples the air in the vicinity of the pools. The licensee will be able to monitor the temperature of the tilt pool. If gaseous iodine and tritium releases are greater than the design objectives of the plant to be "as low as reasonably achievable," the licensee will be asked to determine if these releases are coming from the SFP area and to take corrective action to reduce the releases.

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. During operating service, the demineralizer and filter have been demonstrated to be effective in maintaining water purity and low radionuclide concentrations. The concentration of radionuclides in the pool is controlled primarily by the removal of the activity from the pool water by the demineralizer and the filter. The activity is highest during refueling where reactor coolant water is introduced into the pool and decreases as the pool water is processed through the demineralizer and the filter. Additional activity that may be released to the SFP water by the accumulative storage of the spent fuel assemblies in the pool may require some additional pool water to be processed through the demineralizer and filter to keep concentrations of activity in the pool as low as they were prior to the modification of the SFP. It is expected that such additional processing of SFP water could result in more frequent replacement of the demineralizer resins and filter cartridges and, possibly, an increase in the amount of radioactivity accumulated in the demineralizer resins and filters before disposal as solid waste. The increase in the amount of radioactive waste from such additional processing of the SFP water should be minor because the accumulation of spent fuel will be relatively cool, thermally, and the radionuclides will have already decayed significantly, so that further releases of activity should be very small when compared to the radioactivity of solid wastes normally generated by the reactor. The licensee currently replaces the cartridge filter and mounting frame in the purification system about four times every 18 months. The replacement frequency for the demineralizer resin is about twice every 18 months. These replacements resulted from following a maintenance schedule and from monitoring pressure drops across the filter and demineralizer. The demineralizer resins are transferred to the waste drumming station.

The licensee does not expect any increase in the amount of solid waste generated from the spent fuel cleanup system due to the proposed modification. We generally agree with the licensee's conclusion. However, as a conservative estimate, we have assumed that the amount of solid radwaste may be increased by half an additional resin bed and an additional cartridge filter a year due to the increased operation of the spent fuel pool purification system. The annual average volume of solid waste shipped from Palisades from 1972 through

1976 was 25,000 cubic feet. If the storage of additional spent fuel does increase the amount of solid waste from the SFP purification system by about 30 cubic feet per year from the facility, the increase in total waste volume shipped would be less than 1% and would not have any significant additional environmental impact.

In addition to the solid wastes generated by operations in the SFP area as discussed above, the present spent fuel racks in the SFP will probably be disposed of as low activity waste. If the existing racks are disposed of as solid waste, the volume would be approximately 200 cubic feet and would be a one time event. Averaged over the lifetime of the facility, this would increase the total waste volume shipped by less than 0.1%. This would not have any significant additional environmental impact.

5.3.4 Radioactivity Released to Receiving Waters

There should not be an increase in the liquid release of radionuclides from the facility as a result of the modification. The amount of radioactivity accumulated on the SFP filter and demineralizer resin might slightly increase due to the additional spent fuel in the pool, but this increase of radioactivity should not be released in liquid effluents from the facility. The cartridge filter will remove the insoluable radioactive contaminants and the demineralizer resin will remove the soluable contaminants. The filter cartridges will be periodically removed, placed in a shipping container, and be disposed as radioactive waste without generating radioactive liquids. The resins will be periodically flushed with water to the spent resin tank in the radioactive solid waste system. The spent resins will then be transferred to a shipping container and disposed as radioactive waste. The flush water used to transfer the resins is returned to radwaste. This water is essentially non-radioactive because the soluable radioactive contaminants are retained on the resins. If any of the radioactivity should be transferred from the resins to the flush water, it would be removed by the liquid radwaste system.

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 applying realistic assumptions for occupancy times and for dose rates in the SFP area for 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. We have also reviewed the licensee's plans for increasing the shielding for those areas where preliminary analyses show that gamma dose rates would exceed the Palisades FSAR radiation zoning criteria. The calculated dose rates are conservative and are based on actual concrete thicknesses of the SFP walls and floor. We conclude that the licensee is taking appropriate steps to ensure compliance with the FSAR radiation zoning criteria.

Our analysis indicates that the occupational radiation exposure resulting from the proposed action represents a negligible burden. Based on present and projected operations in the SFP area the proposed modification will add less than 1% to the total annual occupational radiation exposure burden at this facility. The small increase in radiation exposure will not affect the licensee's ability to maintain individual occupational doses to as low as is reasonably achievable and within the limits of 10 CFR 20. Thus, we conclude that storing additional fuel in the SFP will not result in any significant increase in doses received by occupational workers.

We have reviewed the licensee's plan for removal, disassembly and offsite shipment of the old racks and installation of the new racks. The racks will be installed over a short period of time, that is weeks rather than years. The total occupational radiation exposure for this operation is estimated to be about 7 man-rem. We consider this to be a reasonable estimate, and to result in exposures less than or comparable to special maintenance activities such as primary system maintenance. Since this is a one-time exposure it is not directly comparable to the annual dose during normal operation in the SFP.

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 atmosphere or to Lake Michigan. The SFP cooling system was designed for a heat removal capability of 23×10^6 BTU/hr. The system was conservatively designed to maintain pool average temperature at less than 125°F with 1/3 core of fully burned up fuel assemblies placed in the pool 36 hours after reactor shutdown. This was based on a normal refueling heat load of 20×10^6 BTU/hr, as discussed in the Palisades Plant FSAR. The licensee states that revised calculations using more advanced techniques to calculate decay heat generation show that the normal refueling heat load, following the proposed modifications, would actually be 16.9×10^6 BTU/hr (5MW), thus permitting the pool outlet temperature to be maintained at no more than 116°F. For a normal refueling then, the heat rejection rate to the SFP cooling system would actually be less than that originally considered in the Palisades FSAR.

The licensee also indicated that the incremental increase in heat load due to older fuel as the pool is filled to its enlarged storage capacity would be 0.19 x 10^6 BTU/hr. We also calculated this increase in heat load using somewhat more conservative assumptions and arrived at a figure of 1.07 x 10^6 BTU/hr. As indicated above in Section 4.2, the maximum heat rejection rate from the plant to the cooling tower water is 4.78 x 10^9 BTU/hr at 2200 MWt. Assuming no heat losses, i.e., that all 1.07 x 10^6 BTU/hr of the increased heat load in the SFP reaches the cooling tower water, the heat rejection to the cooling tower water would be increased by only 0.02%. After heat rejection to the atmosphere from the cooling towers and through surface evaporation this increase should not be detectable compared to the existing heat load on the plant cooling water system and the total heat load rejected to Lake Michigan and to the atmosphere by the cooling towers. The small additional heat load from the SFP cooling system would be negligible.

5.5 Impacts on the Community

The new storage racks will be fabricated offsite and shipped to the facility. 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 SFP.

6.0 Environmental Impact of Postulated Accident

In order to ensure that no offsite exposures due to possible cask handling accidents in the SFP area are in excess of those calculated for the fuel handling accident in the Final Environmental Statement of June 1972, the licensee has agreed to a Technical Specification change that will prohibit any movement of a shielded cask in the Fuel Building until we have completed our review of the postulated dropped fuel cask accident. This review is expected to be completed in the summer of 1977.

The consequences of postulated accidents resulting from fuel handling are unchanged from those considered in the FES dated June 1972.

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 and (4) ceasing operation of the facility. These alternatives are considered in turn.

The total construction cost associated with the proposed modification is estimated to be about $2,520,000 or approximately $4800 for each of the 422 additional fuel assemblies that the increased storage capacity will accommodate. While this is costly, as discussed below, the alternatives are more costly.

7.1 Reprocessing of Spent Fuel

As discussed earlier, none of the three commercial reprocessing facilities in the U. S. are currently operating. The Morris Operation is in a decommissioned condition. On September 22, 1976, NFS informed the Nuclear Regulatory Commission that they were "withdrawing from the nuclear fuel processing business." The 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 are expected to be completed on the materials license application by mid 1977. However, the AGNS separations 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 7000 MTU in spent fuel. The application for a construction permit is under reivew.

The licensee had originally planned to ship the spent fuel from the Palisades Plant to NFS for reprocessing. However, in view of the above, reprocessing of the spent fuel is not an available alternative in the foreseeable future.

In addition, 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."

7.2 <u>Independent Spent Fuel Storage Facility</u>

An alternative to expansion of onsite SFP 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 MO 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 license for MO was amended on December 3, 1975 to increase the storage capacity to about 750 MTU; approximately 200 MTU is now stored in the pool. 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, they are not at present accepting additional spent fuel for storage even from these reactor facilities with which they had contracts. The licensee had a contract with NFS for storage and processing of spent fuel from Palisades Plant which was voided by NFS's decision to leave the fuel reprocessing business. The licensee reported that as of the date of the subject request to amend the license for Palisades, they had not been able to arrange firm contractual commitments from MO or AGNS to accept fuel. Even if a contract with AGNS could be arranged, AGNS cannot accept spent fuel unless the pending license action is approved. Since the Palisades Plant SFP presently has only space for 71 additional spent fuel assemblies, there is an immediate need for a solution to the spent fuel storage problem or the facility will be forced to shutdown in 1979. Even if storage space at an ISFSI becomes available in the near future, the present worth costs associated with this alternative have been reviewed by the licensee and determined to be in the range of $15,000 to $19,000 per storage location, which does not include the cost of shipping the fuel to the storage facility.

The licensee has also investigated the economic and technical feasibility of an independent Consumers Power Company reprocessing facility in which other utility companies would be participants. The licensee states that the estimated cost of a 500-1500 MTU capacity spent fuel receiving pool for such a facility would be $20-$50 million with each increment of 1000 MTU of storage capacity adding about $30-$40 million to the cost. The licensee estimates the cost to be $14,000 for each spent fuel assembly thus stored. Aside from economic considerations, an independent storage facility could not be completed and licensed in time to meet the needs at Palisades Plant.

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 their construction cost at approximately $9000 per spent fuel assembly. At this rate it would cost the licensee over $4.7 million to store the additional 522 spent fuel assemblies that the proposed modification would accommodate, plus additional costs for shipment and safeguarding the fuel.

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 siting it near a nuclear power facility. No estimated costs for fuel storage were included in the topical report.

On a short term basis (i.e., prior to 1985) 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, ERDA is modifying its program for nuclear waste management to include design and evaluation of a retrievable storage facility to increase government storage at central locations for un-reprocessed spent fuel rods. As announced in a Presidential energy policy statement on October 28, 1976, the government is committed to provide a retrievable, long-term storage facility for spent fuel by 1985. Even if the 1985 date is met, it would be 6 years after Palisades Plant would have to shut down because the unmodified SFP would be full.

7.3 Storage at Another Reactor Site

The licensee owns and operates Big Rock Point. This facility is a Boiling Water Reactor (BWR) whereas Palisades Plant is a Pressurized Water Reactor (PWR). PWR fuel will not physically fit in the standard BWR 20 element storage racks at Big Rock Point. Therefore, the spent fuel storage pool at Big Rock Point could not be used to store spent fuel from the Palisades Plant reactor.

According to a survey conducted and documented by the Energy Research and Development Agency, up to 46% 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. The licensee estimated that the transportation costs above could be $1,000-$3,000 per fuel assembly.

7.4 Shutdown of Facility

Storage of additional spent fuel from Palisades Plant in the existing racks is possible for only a short period of time. As discussed above, if expansion of the SFP capacity is not approved and if alternate storage space is not located, the licensee would be unable to unload further spent fuel after the fall of 1977 and would have to shut down Palisades in 1979 or earlier. This would halt the generation of 668 Megawatts net of electrical energy. The licensee has estimated that a shutdown of the Palisades Plant would result in a levelized annual cost of replacement power of $176.6 million. This cost is based on today's dollar and would continue over a ten year period corresponding to the few years additional storage time that the proposed modification would provide. The $176.6 million annual cost would consist of additional fuel, increased purchased power and capacity changes.

7.5 Summary of Alternatives

In summary, the alternatives (1) to (3) described above are either 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) would be more expensive then the proposed modification and would not provide the operating flexibility of the proposed action or might preempt storage space needed by another utility. 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

SFP for the Palisades Plant 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 would not create any significant additional adverse 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/yr, 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 7 man-rem. Operation of the facility with additional spent fuel in the SFP is not expected to increase the occupational radiation exposure by more than 1% of the present total annual operational burden 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 SFP, which would permit the facility to continue to operate until offsite storage facilities are available for long term storage of spent fuel, would allow the short-term economic advantages and electrical needs of the county and State to be realized without affecting the long term productivity of the Palisades Plant site. The proposed modification would therefore not change the evaluation previously made in the Palisades FES.

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 that will increase the storage capacity of the SFP by 522 fuel assemblies. Each individual storage location consists of two concentric 1/8" austenitic type 304 stainless steel square cans with the annular space occupied by B_4C neutron absorber plates to assure subcriticality. Each concentric can is approximately 12 feet long with an inside square cross sectional length of 8.56". The top and bottom of the two concentric cans will be closed with spacers and seal welded to provide a water tight annulus within which the neutron absorber will be held. A 1/4" diameter rod will be run the length of each corner of the annulus and welded in place to maintain the spacing between cans and to provide lateral support for the absorber plate. A 3/8" thick fuel support plate will be welded at the bottom of the can to provide support for the fuel. The plate will contain a 5" diameter hole to allow cooling water to flow upward through the fuel assembly to provide removal of the decay heat from the fuel element. The top of each can will be flared to facilitate fuel assembly insertion.

The neutron absorber plate is B_4C power bonded together in a carton matrix. The absorber is 50% B_4C by volume with the remainder being carbon and voids. The absorber is fabricated in 0.21" (minimum) thick plates. The B_4C plate is chemically inert in borated water and is thermally stable under all temperatures expected in the SFP.

The assembled cans are formed into rack assemblies by attachment to rectangular stainless steel bars. The bars run horizontally near the top and bottom of the rack assembly forming a unitized lattice arrangement. Each can is continuously welded on all four sides to the lattice forming a single rigid structure called the rack assembly. Each of the racks is supported by four legs which can be adjusted to compensate for any tilt in the floor.

The licensee proposes to install five different sizes of rack assemblies. Three of the types (A, B and C) which will be installed in the main pool are similar, having 8.56" square inner cans and a 10 1/4" center-to-center spacing. The capacities of each of these types are 50, 60 and 64 assemblies, respectively. The two remaining types, D and E, will be used in the tilt pit pool. The type E rack is designed for storage of control rods as well as fuel and has a 9" square inner can and is arranged on a 10.25" by 11.25" center-to-center spacing. The two D racks in the tilt pit pool are similar to racks in the main pool. The capacities of the type D and E type racks are 30 and 50 assemblies respectively.

The commitment of resources to the fabrication the new spent fuel storage racks would total approximately 350,000 pounds of stainless steel and 30,700 pounds of Boron Carbide (B_4C) in the form of poison plates. The amount of stainless steel used annually in the United States is about 2.82 x 10" pounds and the amount of B_4C is 900,000 pounds. The amount of stainless steel required for fabrication of the new racks is a small amount of this resource consumed annually in the United States. The amount of B_4C required for fabrication of the Palisades spent fuel pool racks represents approximately 3.4% of the current annual consumption of 900,000 pounds. These consumption rates however, do not represent the actual capacity for the production of these materials. Should the demand increase, additional amounts could readily be produced and the percentage that the spent fuel pool modification represents would decrease accordingly.

It is additionally noted that the materials required for the fabrication of the spent fuel racks represent a one-time use and would not be an annual requirement. In view of the above, we conclude that the amounts of material required for the new racks are insignificant and do not represent a significant irreversible commitment of material resources.

Storage of spent fuel assemblies for a longer term would prolong the fuel cycle of the stored fuel beyond that originally envisioned. Its usefulness as a resource in the future, however, would not be changed. The provision of longer onsite storage does not result in any cumulative effects due to facility 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 facility. This licensing action would not constitute a commitment of resources that would affect the alternatives available to other nuclear power facilities or other actions that might be taken by the industry in the future to alleviate fuel storage problems. No other resources would need to be allocated because the other design characteristics of the SFP would remain unchanged.

We conclude that the proposed expansion of the SFP at the Palisades Plant facility 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 action 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 generic 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?

With the existing storage racks, the SFP does not have sufficient storage capacity to accommodate a full core discharge although 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. If 68 fuel assemblies are discharged each year, the SFP will be full after the refueling scheduled for the fall of 1977. The spent fuel must be stored onsite or elsewhere if the facility is to be refueled. If expansion of the SFP capacity is not approved or if an alternate storage facility is not located, the licensee would have to shutdown in mid-1979. As discussed under alternatives, an alternate storage facility is not now available. Storage onsite is an interim solution to allow the plant to continue to operate. As a long term solution, the government is committed to providing a retrievable, repository for spent fuel by 1985.

The proposed licensing action (i.e., installing new racks of a design that permits storing more assemblies in the same space) would provide the licensee with additional flexibility which is desireable even if adequate offsite storage facilities hereafter become available to the licensee.

We have concluded that a need for additional spent fuel storage capacity exists at Palisades Plant which is independent of the utility of other licensing actions designed to ameliorate a possible shortage of spent fuel 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 SFP.

The increased storage capacity at the Palisades Plant SFP 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 SFP is only a measure to allow for continued operation and to provide operational flexibility at the facility, 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 1985.

We conclude that the expansion of the SFP at the Palisades Plant facility, 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 SFP at this facility were considered by the staff.

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 and to the occupational radiation exposure to the personnel involved.

The potential non-radiological environmental impact attributable to the additional heat load in the SFP 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 SFP and have concluded that they would not result in radioactive effluent releases that significantly affect the quality of the human environment during either normal operation of the expanded SFP 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 questions 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 plant when the existing SFP is full. We have determined that there are significant economic advantages associated with the proposed action and that expansion of the storage capacity of the SFP will have a negligible environmental impact. Should the proposed modification be deferred or severely restricted, Palisades would have to shutdown as early as 1979 due to an inability to refuel the core. As discussed in Section 7.4, such a shutdown would result in considerable additional costs to the licensee which would result in higher energy cost for the public. 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 benefits and cost 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. The benefit that would be derived from three of these alternatives is the continued operation of the facility and its production of electrical energy. As shown in the table, the reactor shutdown and subsequent storage of fuel in the reactor vessel would result in the cessation of this electrical energy production. The remaining alternatives, storage at other nuclear power facilities or at a reprocessor's facility are not possible at this time 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 SFP 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 Palisades Plant issued in June 1972.

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 license amendment will not significantly affect the quality of the human environment. 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.

SUMMARY OF COST-BENEFITS

Alternative	Cost	Benefit
Increase storage capacity of Spent Fuel Pool	$3,800 per assembly	Continued Operation and production of electrical energy.
Storage at Independent Commercial Facility	$15,000 to $19,000 per assembly	Continued operation and production of electrical energy
Storage at Independent Consumers Power Company Facility	$14,000 per assembly	Continued operation and production of electrical energy
Storage at other nuclear power facilities	This alternative is not available at this time.	
Storage at Reprocessors' Facility	This alternative is not available at this time.	
Reactor Shutdown	$176.6 million a year over a ten year period	None - No production of electrical energy