APRIL 14 1978

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Docket No. 50-263

Northern States Power Company
ATTN: Mr. L. O. Mayer, Manager
Nuclear Support Services
414 Nicollet Mall - Eighth Floor
Minneapolis, Minnesota 55401

Gentlemen:

The Commission has issued the enclosed Amendment No. 34 to Provisional Operating License No. DPR-22 for the Monticello Nuclear Generating Plant. This amendment modifies the license and is in response to your submittal dated August 17, 1977, as supplemented by letters dated September 12, December 8, December 14, 1977, January 3, January 30, March 10, March 16, and March 28, 1978.

The amendment increases the capacity of the spent fuel storage pool from 740 to 2237 fuel assemblies.

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

Sincerely,

Original signed by
George Lear, Chief
Operating Reactors Branch #3
Division of Operating Reactors

Enclosures:
1. Amendment No. 34 to License No. DPR-22
2. Safety Evaluation
3. Environmental Impact Appraisal
4. Notice of Issuance and Negative Declaration

cc w/enclosures:
See page 2

Concurred subject to changes in EIA as discussed with Roby Bevan

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

April 14, 1978

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Sincerely,

George Lear

George Lear, Chief
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Division of Operating Reactors

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cc w/enclosures:
See page 2

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

NORTHERN STATES POWER COMPANY

DOCKET NO. 50-263

MONTICELLO NUCLEAR GENERATING PLANT

AMENDMENT TO PROVISIONAL OPERATING LICENSE

Amendment No. 34
License No. DPR-22

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

   A. The submittal by Northern States Power Company (the licensee) dated August 17, 1977, as supplemented by letters dated September 12 (application for amendment), December 8, December 14, 1977, January 3, January 30, March 10, March 16, and March 28, 1978, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

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

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

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

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

2. Accordingly, the license is amended by revising paragraph 2.B. of Provisional Operating License No. DPR-22 to read as follows:

   "B. Pursuant to the Act and 10 CFR Part 70, to receive, possess and use at any time special nuclear material as reactor fuel, in accordance with the limitations for storage and amounts required for reactor operation, as described in the Final Safety Analysis Report, as supplemented and amended, and the licensee's filings dated August 16, 1974 (those portions dealing with handling of reactor fuel) and August 17, 1977 (those portions dealing with fuel assembly storage capacity);"

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

FOR THE NUCLEAR REGULATORY COMMISSION

Brian Grimes

Brian K. Grimes, Assistant Director
for Engineering and Projects
Division of Operating Reactors

Date of Issuance: April 14, 1978

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. TO LICENSE NO. DPR-22

NORTHERN STATES POWER COMPANY

MONTICELLO NUCLEAR GENERATING PLANT

DOCKET NO. 50-263

Introduction

By submittal dated August 17, 1977, as supplemented by letters dated September 12 (license amendment request), December 8, December 14, 1977, January 3, January 30, March 10, March 16, and March 28, 1978, Northern States Power Company (NSP or licensee) requested NRC approval of a proposed increase in the spent fuel pool (SFP) storage capacity at the Monticello Nuclear Generating Plant from 740 to 2237 fuel assemblies. Notice of Consideration of Proposed Modification to Facility Spent Fuel Storage Pool issued to Northern States Power Company was published in the FEDERAL REGISTER on September 19, 1977 (42 FR 46963).

Discussion

The proposed amendment would modify paragraph 2.B of the license to delete extraneous or superseded information and to incorporate information related to this licensing action to increase the spent fuel storage capacity. Specifically, the reference to NSP letters dated May 30, 1975 and July 1, 1975 has been deleted. The May 30, 1975 letter, which dealt with an increase in the storage of special nuclear material from 2300 to 3200 kilograms was addressed in Amendment 10 of July 8, 1975 but has been superseded by this latest action. The letter of July 1, 1975, which was addressed by License Amendment No. 11 dated September 17, 1975, only concerned sealed radioactive source leak testing and is not pertinent to the use of special nuclear material as fuel. Source leak testing is addressed as Technical Specifications 3.11 and 4.11. The proposed change to the Specification deletes references which are no longer applicable and adds references to reflect the latest licensing action.

We also have reviewed in detail the engineering and environmental aspects of this proposed action. The remainder of this evaluation, and the Environmental Impact Appraisal which follows, deals with these aspects.

The SFP at the Monticello facility contains 616 spent fuel assemblies at the present time. Spent fuel has been stored in the pool since the first core refueling. Since there is storage space for only 740 spent fuel assemblies and since the core contains 484 fuel assemblies, Monticello cannot, with the existing spent fuel storage racks, accommodate removal and storage in the SFP of all the fuel assemblies in the core.

The proposed increase in spent fuel storage capacity from 740 fuel assemblies will (1) provide storage for all spent fuel assemblies removed from the core between the present time and 1990, (2) provide sufficient additional fuel assembly storage capacity so that the entire core (484 fuel assemblies) can be removed from the reactor vessel and stored in the SFP to about 1987, and (3) continue to accommodate one fuel assembly shipping cask for offsite shipping of spent fuel assemblies from the Monticello SFP when offsite spent fuel shipment is resumed at some indefinite future date within the next 12 years.

Our review and evaluation considered the following:

1. Structural adequacy of the proposed spent fuel racks and pool

2. Criticality considerations

3. Spent fuel pool cooling capacity

4. Fuel handling and installation of the modified spent fuel racks

5. Occupational radiation exposure and radioactive waste treatment

Evaluation

1. Structural Adequacy of the Proposed Spent Fuel Racks and Pool

   The current fuel storage racks have a storage capacity of 740 fuel assemblies. The proposed SFP modification consists of installation of new fuel storage modules. Each module is composed of fuel storage tubes arranged in a 13 X 13 array. Thirteen such modules, one existing fuel storage rack, and two of the existing control rod/defective fuel storage racks will provide storage locations for 2237 assemblies. The new modules and the three existing racks comprise the proposed High Density Fuel Storage System.

   The fuel storage tube is fabricated by forming an outer and inner sheet of 304 stainless steel sandwiching a core of Boral (clad by aluminum) into a single rectangular tube. The inner and outer walls of the storage tube are welded together at each end, which isolated the Boral from direct contact with fuel pool water. Except for the Boral and aluminum, all structural material used in fabrication of the new modules is type 304 stainless steel.

The module design, material, and fabrication are in accordance with the requirements set forth in Section III, Subsection NF of the ASME Boiler and Pressure Vessel Code. The modules are designed to remain within Code allowed stress limits for both Operating Basis Earthquake (OBE) and Safe Shutdown Earthquake (SSE) conditions. The modules were analyzed as cantilever beams attached to a rigid base using qualified computer codes to derive loads in a water filled rectangular pool. These loads were derived for horizontal and vertical accelerations specified in the General Electric BWR Systems Department seismic criteria document and were compared to the allowable stresses. The analysis indicates that the derived loads do not overstress the modules since the Monticello accelerations at the fuel pool elevation are 0.2g (SSE) and the analysis was performed for 3g (SSE). Added damping due to fluid effects was conservatively neglected. Stresses due to seismic loading in the three orthogonal directions were combined by the Square Root of the Sum of the Squares Method as outlined in Regulatory Guide 1.92.

The module design is free-standing, transferring shear forces to the pool slab through friction resistance provided by the normal force of the weight of the module through the support columns resting on the pool floor liner. NSP has used a minimum value for the coefficient of friction in the sliding analysis, a value which was verified by recent tests of stainless steel materials. The coefficient of friction used was sufficient to ensure that sliding will not occur for earthquake motions corresponding to OBE and SSE. An additional non-linear analysis for sliding was performed to determine relative displacements if the coefficient of friction were less than the minimum value used. This analysis gives added assurance that there should be no interaction between modules as a consequence of the SSE.

The NSP has re-evaluated the fuel pool structural capacity for the High Density Fuel Storage System and has shown that the existing structure is capable of supporting the increased load.

Since the possibility of long term storage of spent fuel exists, we are investigating the effects of the pool environment on the modules, fuel cladding and pool liner. Based upon our preliminary review and previous operating experience, we have concluded that at the pool temperature and the quality of the demineralized water, and taking no credit for inservice inspection, there is reasonable assurance that no significant corrosion of the modules, the fuel cladding or the pool liner will occur over the lifetime of the plant. However, if the results of the current generic review indicate that additional protective measures are warranted to protect the modules, the fuel cladding and/or the liner from the effects of corrosion, the necessary steps and/or inspection programs will be required to assure that an acceptable level of safety is maintained. Any conceivable problems which could be uncovered are of a long term nature and warrant no need for immediate concern.

The criteria used in the analysis, design, and construction of the High Density Fuel Storage System to account for the anticipated loadings and postulated conditions that may be imposed on the structures during their service lifetime are in conformance with established criteria, codes, standards, and specifications acceptable to the NRC Staff. The new modules meet the standards for seismic Category I components and are designed to maintain the spent fuel assemblies in a safe configuration through all environmental and abnormal loadings. Therefore, we find that the proposed expansion is acceptable from the aspect of mechanical, material, and structural considerations.

2. Criticality Considerations

The proposed spent fuel assembly racks are to be made up of alternating stainless steel containers. Thus, there will be only one container wall between adjacent spent fuel assemblies. Each container wall is to have a core of Boral sandwiched between 0.036 inch inside and 0.090 inch outside stainless steel containers. The containers will be about 14 feet long and will have a square cross section with an outer dimension of 6.563 inches and a total wall thickness of 0.2015 inches. The nominal pitch between fuel assemblies will be 6.563 inches.

The Boral core is made up of a central segment of a 0.056 inch thick dispersion of boron carbide in aluminum. This central segment is clad on both sides with 0.010 inches of aluminum. NSP states that the minimum homogeneous concentration of the boron-ten isotope will be 0.013 grams per square centimeter of the Boral plate. This is equivalent to 0.78×10^{21} boron-ten atoms per square centimeter. These Boral plates are to be sealed between two stainless steel containers by welding.

The NSP fuel pool criticality calculations are based on an unirradiated BWR fuel assembly with no burnable poison and a fuel loading of 15.2 grams of uranium-235 per axial centimeter of fuel assembly. The General Electric Company (GE) performed the criticality analyses for NSP. GE made the calculations with the MERIT Monte Carlo program with cross sections which were processed from ENDF/B-IV data. The accuracy of this calculational method was assessed by using it to calculate the following experiments: (1) thermal reactor benchmark experiments TRX-1 through 4 of the Cross Section Evaluation Work Group; (2) the Babcock and Wilcox UO_2 critical assemblies; and (3) the Oyster Creek BWR experiments with boron curtains. From this qualification program, GE determined that this calculational method underpredicts k_{eff} by 0.5 per cent Δk.

GE first used these computer programs to calculate the neutron multiplication factor for an infinite array of fuel assemblies in the nominal storage lattice at 20°C with the minimum boron concentration in the Boral, i.e., 0.013 grams of boron-ten per square centimeter. Since the outside dimension of these storage containers is the same as the lattice pitch; i.e., 6.563 inches, GE assumed that this is essentially a close packed configuration and that the average pitch could not be less than 6.563 inches. Thus this calculation was for minimum boron and minimum lattice pitch. GE found the k_∞ for this configuration to be 0.87 after the 0.5 per cent experimental bias was included.

GE then calculated the k_∞'s for the following conditions: (1) increasing the temperature to 65°C; (2) increasing the lattice pitch; (3) locating every four fuel assemblies as close together as possible; and (4) reducing the density of the water. GE found that all of these changes resulted in a decrease in k_∞.

Because of the alternating lattice design, wherein there will be only one storage container for every two fuel assemblies, there will be spaces on the periphery of the rack modules which will not have Boral plates. Thus it will be possible for two rack modules to be put together so that adjacent fuel assemblies will not have a Boral plate between them. GE calculated the effect of these missing Boral plates for the minimum attainable gap between rack modules and found that it would not increase the maximum k_∞ of 0.87. GE also analyzed the situation where a fuel assembly is moved as close as possible to an unpoisoned location on the periphery of a filled storage rack and found that the neutron multiplication factor would not increase above 0.90.

In its February 13, 1978 submittal, NSP stated that neutron source testing at the Monticello Plant will be performed to verify the presence of the Boral plates in the fabricated fuel storage modules. NSP also stated that since calculations have demonstrated a K_{eff} of less than 0.90 at a 95 percent confidence level with any four complete Boral plates missing, any module with more than four missing Boral plates will be rejected.

We have evaluated the results of these criticality calculations, and find that all factors that could affect the neutron multiplication factor in this pool have been conservatively accounted for and that the maximum neutron multiplication factor in this pool with the proposed racks will not exceed 0.95. This is NRC's acceptance criterion for the maximum (worst case) calculated neutron multiplication factor in a spent fuel pool. This 0.95 acceptance criterion is based on the uncertainties associated with the calculational methods and provides sufficient margins to preclude criticality in the fuel pool. We also find that the uncertainty in the results of the criticality calculations will increase if the fuel loading in the fuel assemblies is increased. We, therefore, have requested, and NSP has agreed to provide for the NRC's review and approval, a revised criticality analysis of the fuel pool whenever and prior to storing fuel assemblies in it which have a fuel loading greater than 15.2 grams of uranium-235 in any axial centimeter.

With regard to NSP's onsite neutron radiography testing of the Boral plates, we find that with the quality assurance program procedures in effect there should be no Boral plates missing from the prescribed locations in the fabricated fuel storage modules. If NSP finds any Boral plates missing they should specifically note and document this finding in the test report.

In summary, we find that when any number of the fuel assemblies which NSP described in these submittals, which have no more than 15.2 grams of uranium-235 per axial centimeter of fuel assembly are loaded into the proposed racks, the neutron multiplication factor will be less than 0.95.

On this basis, we conclude that there is reasonable assurance that the health and safety of the public will not be endangered by the use of the proposed racks.

3. Spent Fuel Pool Cooling Capacity

The licensed thermal power for Monticello is 1670 MWt. In their submittal, NSP assumed an 18 month refueling cycle. This will require the replacement of about 141 of the 484 assemblies in the core every 18 months. In its September 12, 1977 submittal, NSP assumed a four day (96 hour) time interval between reactor shutdown and the time 141 spent fuel assemblies have been transferred to the spent fuel pool and a 150 hour time interval between reactor shutdown and the time a full core offload is completed. For these cooling times, NSP states that the maximum heat load to the SFP due to normal eighteen months refuelings will be 11.3×10^6 BTU/hr and that the maximum heat load due to a full core offload will be 27.2×10^6 BTU/hr.

As indicated in Table 10-2-1 of the FSAR, the SFP cooling system consists of two pumps and two heat exchangers in parallel. Each pump is designed to pump 450 gpm (2.25×10^5 pounds per hour). Each heat exchanger is designed to transfer 2.87×10^6 BTU/hr from 125°F fuel pool water to the 95°F water in the Reactor Building Closed Cooling Water System. For higher heat loads, such as the full core offload, NSP states that the residual heat removal system (RHR) will be used in conjunction with the SFP cooling system. In their September 12, 1977 submittal, NSP stated that the RHR system has a capacity for removing 57.5×10^6 BTU/hr.

Section 10 of the FSAR indicates that instrumentation is provided in the spent fuel cooling system which will monitor pool water level, water temperature, and system flow. A loss of system flow will actuate an alarm in the reactor building.

Section 10 of the FSAR describes the 3500 gpm capacity Emergency Service Water System. Since this is piped to the RHR system, it could also be used for emergency makeup water for the SFP. NSP's calculated decay heat loads are based on a specific operating power of 30 KW/kgU. This is conservative because the presently licensed average, specific power of the Monticello Plant is about 19 KW/kgU. NSP's assumed fuel pool transfer times of 96 hours for 141 fuel assemblies and 150 hours for 484 assemblies are conservatively short. NSP used the ORIGEN computer program to calculate the decay heat loads. NSP's calculated decay heats are larger and hence more conservative than those obtained by using the method identified on pages 9.2.5-8 through 14 of the NRC Standard Review Plan.

We find that the maximum incremental heat load in this SFP that will be added by increasing the number of fuel assemblies stored in the pool from 740 to 2,237 assemblies will be 1.3×10^6 BTU/hr. This is the difference in peak heat loads for full core offloads that essentially fill the present and modified pools.

NSP's calculated fuel pool outlet water temperatures are consistent with the stated flow rates and the design of the heat exchangers. We calculate that with both spent fuel cooling pumps operating at design capacity and with NSP's peak heat load for any refueling (i.e., 11.3×10^6 BTU/hr), the maximum SFP water temperature will be less than 140°F. The 57.5×10^6 BTU/hr capacity of the RHR system is adequate to remove the maximum full core heat load of 27.2×10^6 BTU/hr and maintain the SFP outlet water temperature below 125°F.

Assuming a maximum fuel pool temperature of 150°F, the minimum possible time to achieve bulk pool boiling after any credible accident will be 5.6 hours. After bulk boiling commences, the maximum evaporation rate will be 56 gpm. We find that 5.6 hours would be sufficient time for NSP to establish a 56 gpm makeup rate from the Emergency Service Water System. We also find that under bulk boiling conditions the temperature of the fuel will not exceed 350°F. This is an acceptable temperature from the standpoint of fuel element integrity and surface corrosion.

We find that the present cooling capacity in the SFP of the Monticello Plant will be sufficient to handle the incremental heat load that will be added by the proposed modifications. We also find that this incremental heat load will not alter the safety considerations of SFP cooling from that which we previously reviewed and found to be acceptable. We conclude that there is reasonable assurance that the health and safety of the public will not be endangered by the use of the proposed deisgn.

4. Fuel Handling and Installation of the Modified Spent Fuel Racks

In its September 12, 1977 submittal, NSP stated the following:

1) The reactor building crane has been modified to satisfy Regulatory Guide 1.104 as applicable to operating plants. This modification was reviewed and found acceptable by the NRC staff;

2) Procedures will be written that will prevent loads which weigh more than a fuel assembly from being moved over new or spent fuel during the rack replacement program;

3) Administrative controls will be established which will prohibit the movement of loads which weigh more than a fuel assembly from being moved over new or spent fuel during the rack replacement; and

4) Proposed modification will not increase the consequences or probability of the design basis fuel handling accident.

NSP has upgraded the Monticello reactor building crane to satisfy the provisions of Regulatory Guide 1.104, as far as practical for an operating facility. The use of this upgraded crane along with NSP's stipulation that racks will not be taken over fuel assemblies present in the pool will make the probability for an empty rack falling on a loaded rack in the pool acceptably small.

After the racks are installed in the pool, the fuel handling procedures in and around the pool will be the same as those procedures that were in effect prior to the proposed modifications.

We conclude that there is reasonable assurance that the health and safety of the public will not be endangered by the installation and use of the proposed racks.

5. Occupational Radiation Exposure and Radioactive Waste Treatment

We have reviewed the licensee's plan for the removal, disassembly and disposal of the low density racks and the installation of the high density racks with respect to occupational radiation exposure. The occupational radiation exposure for this operation is estimated by the licensee to be about 22 man-rem. We consider this to be a conservative estimate. This operation is expected to be performed only once during the lifetime of the station and will therefore represent a small fraction of the total man-rem burden from occupational exposure.

We have estimated the increment in onsite occupational dose resulting from the proposed increase in stored fuel assemblies on the basis of information supplied by the licensee and by utilizing relevant assumptions for occupancy times and for dose rates in the spent fuel area from radionuclide concentrations in the SFP water. The spent fuel assemblies themselves contribute a negligible amount to dose rates in the pool area because of the depth of water shielding the fuel. The occupational radiation exposure resulting from the proposed action represents a negligible burden. Based on present and projected operations in the SFP area, we estimate that the proposed modification should add less than one percent to the total annual occupational radiation exposure burden at this facility. The small increase in radiation exposure should 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.

The plant contains waste treatment systems designed to collect and process the gaseous, liquid and solid wastes that might contain radioactive material. The waste treatment systems were evaluated in the Safety Evaluations (SE) dated March 1970 and February 1973. Although there have been system improvements, such as the installation of an augmented offgas system, since the issuance of the latest SE, there will be no change in the waste treatment systems or in the conclusions of the evaluation of these systems, as described in Section 11.0 of the SE, because of the proposed modification.

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

(1) The increase in occupational radiation exposure to individuals due to the storage of additional fuel in the SFP would be negligible.

(2) The installation and use of the new fuel racks does not alter the consequences of the design basis accident for the SFP, i.e., the rupture of a fuel assembly and subsequent release of the assembly's radioactive inventory within the gap.

(3) The overhead handling system is provided with a sufficient degree of redundancy to preclude cask and/or load handling accidents.

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.

Dated: April 14, 1978

ENVIRONMENTAL IMPACT APPRAISAL

BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO MODIFICATION OF THE SPENT FUEL STORAGE POOL

NORTHERN STATES POWER COMPANY

MONTICELLO NUCLEAR GENERATING PLANT

DOCKET NO. 50-263

ENVIRONMENTAL IMPACT APPRAISAL
BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATING TO MODIFICATION OF THE SPENT FUEL STORAGE POOL
NORTHERN STATES POWER COMPANY
MONTICELLO NUCLEAR GENERATING PLANT
DOCKET NO. 50-263

1.0 Description of Proposed Action

In their submittal of August 17, 1977, supplemented by letters dated September 12, 1977, December 8, 1977, December 14, 1977, January 3, 1978, January 30, 1978, March 10, 1978, March 16, 1978 and March 28, 1978. Northern States Power Company (the licensee) requested an amendment to Provisional Operating License No. DPR-22 for the Monticello Nuclear Generating Plant. The amendment to the license concerns the proposed expansion of the storage capacity of the spent fuel storage facility at Monticello. The proposed change would increase the storage capacity of the spent fuel pool (SFP) from 740 to 2237 fuel assemblies.

The modification evaluated in this environmental impact appraisal is the proposal by the licensee to increase the storage capacity of the SFP by replacing the existing spent fuel storage racks with closer spaced racks and to use these new racks for the longer term storage of more spent fuel in the SFP.

2.0 Need For Increased Storage Capacity

Monticello achieved initial criticality on December 10, 1970. The facility recently completed its fifth refueling, as a result of which there are currently 616 spent fuel assemblies stored in the SFP. The current licensed storage capacity of the SFP is 740 fuel assemblies. With 616 assemblies presently stored in the pool, there is only storage space for an additional 124 assemblies. A full core for Monticello consists of 484 assemblies. Thus, Monticello does not have room in the SFP with the present storage capacity to off-load a full core. While the capability to off-load a full core is not required from the standpoint of safety, it is desirable from an economic and operational standpoint (e.g., to allow inspection of core intervals). Under the current fuel management plan, approximately 1/4 of the core (about 121 fuel assemblies) is replaced every 12 months. With the present storage capacity of the SFP, the pool will be full after the next refueling (i.e., after the refueling tentatively scheduled for about October 1978). If the storage capacity of the SFP is not increased or if alternate storage space for spent fuel from this facility is not located, Monticello would have to be shutdown about late 1979.

With the proposed modification, the SFP would have storage capacity to accommodate twelve additional refuelings (of 121 fuel assemblies per refueling). This would provide storage space for the spent fuel which is expected to be generated through late 1990. There would also be space in the SFP to discharge a full core through to about late 1987. With the proposed modification, Monticello could operate through late 1991 before the facility would be forced to shutdown due to lack of storage space for spent fuel in the SFP. In our evaluation, we considered the impact which may result from storing up to an additional 1497 spent fuel assemblies in the SFP.

The proposed modification would not alter the external physical geometry of the spent fuel pool or involve modifications to the SFP cooling or purification systems. The proposed modification does not affect in any manner the quantity of uranium fuel utilized 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 remains unchanged as a result of the proposed expansion. The modification will increase the number of spent fuel assemblies that could be stored in the SFP and the length of time that some of the fuel assemblies could be stored in the pool.

On the basis of the evaluation discussed herein, we have concluded that authorization should be granted to increase the storage capacity of the Monticello SFP.

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 (MFRP) 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 through 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 fuel 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 reprocessing facility. A fourth plant, the Exxon plant proposed for construction in Tennessee, was under license review; this review was terminated as a result of the Commission's decision announced December 23, 1977 to terminate the proceedings on pending or future plutonium recycle-related license applications.

4.0 The Plant

The Monticello Nuclear Generating Plant is described in the Final Environmental Statement (FES) related to operation of the facility and issued by the Commission in November 1972. The plant has a single boiling water reactor, manufactured by the General Electric Company, which generates steam at 1000 psig to drive the turbine-generator. The reactor has a rating of 1670 megawatts thermal (Mwt), corresponding to a net electrical output of 545 megawatts electrical (Mwe). Pertinent descriptions of principal features of the plant as it currently exists are summarized below to aid the reader in following the evaluations in subsequent sections of this appraisal.

4.1 Fuel Inventory

The reactor core, which contains 484 fuel assemblies, is normally refueled every twelve months, with about 25 percent, or 121 fuel assemblies, replaced during each refueling period. The assemblies now in use were manufactured by General Electric Company.

4.2 Plant Cooling Water Systems

Cooling of the main condenser is accomplished by a circulating water system which has been designed for open cycle, once through cooling towers, closed cycle with cooling towers, and variations of these modes. The system for open cycle operation consists of an intake structure, two half-capacity pumps which deliver water to the condenser, and a discharge structure from which the water is returned to the river downstream from the intake. During closed cycle operation, two half-capacity pumps located in the discharge structure pump heated water to the top of the cooling tower. Cooled effluent returns to the intake structure from the cooling tower basins. Blowdown overflows the side weirs of the basins and is piped to the discharge canal. Makeup is supplied from the intake structure. Open cycle is normally used. Cooling towers are normally used only when river flow is low or to meet the regulations on river temperature rise. The towers are used either in closed cycle, partial recirculation cycle, or a "helper" cycle in which no water is recirculated but part or all of the condenser effluent is discharged through the cooling towers before return to the river.

A separate service water system supplies cooling water for the main generator, building air conditioning units, instrument and service air compressors, reactor building closed cooling water system heat exchangers and various other systems requiring cooling.

At maximum power output the plant requires a total flow of 290,000 gallons per minute (GPM) 230,000 gpm for main condenser cooling and 10,000 gpm for service water requirements. The difference in heat rejected to the river due to the proposed modification has been calculated to be 0.45 x 10^6 BTU/hr. Since the design main condenser heat load at maximum power is 3.7 x 10^9 BTU/hr, the additional heat rejected represents an increase of 0.012%, which is negligible and will be indistinguishable in the environment.

During normal station shutdown, cooling water is supplied to the reactor shutdown cooling system heat exchangers. The full capacity of the system is 16,000 gpm. The heat load at this full capacity is 1.15 x 10^8 BTU/hr.

The system consists of 4 pumps grouped into two sets of two pumps, each set serving its own full-capacity heat exchanger. Each pump is rated at 4000 gpm.

The reactor building closed cooling water system provides controlled cooling via a closed loop to auxiliary equipment including the following components:

Nonregenerative heat exchangers
Reactor coolant recirculation system circulation pump coolers
Fuel pool cooling heat exchangers
Primary containment drywell coolers
Control rod drive feed pump coolers

The cooling water temperature is maintained at less than 90-95°F by heat rejected to loop heat exchangers which are cooled by the service water system.

4.3 Radioactive Waste Treatment

The plant contains waste treatment systems designed to collect and process the gaseous, liquid and solid wastes that might contain radioactive material. The waste treatment systems were evaluated in the Safety Evaluations (SE) dated March 1970 and February 1973. Although there have been system improvements, such as the installation of an augmented offgas system, since the issuance of the latest SE, there will be no change in the waste treatment systems or in the conclusions of the evaluation of these systems, as described in Section 11.0 of the SE, because of the proposed modification.

4.4 Purpose of SFP

The SFP at Monticello 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 during a core refueling, or to allow for inspection and/or modification to core internals. The latter may require the removal and storage of up to a full core. The assemblies are initially intensely radioactive due to their fission product content and have a high thermal output. They are stored in the SFP to allow for radioactive and thermal decay.

The major portion of decay occurs during the first 12-day period following removal from the reactor core. After this period, the assemblies may be withdrawn and placed into a heavily shielded fuel cask for an additional period which will provide for additional fission product decay and thermal cooling prior to shipment.

4.5 SFP Cooling and Demineralizer System

The SFP for Monticello is provided with a cooling and demineralizer system which removes residual heat from the fuel stored in the SFP and also maintains water purity and clarity. The system, which is described in Section X of the FSAR, was designed to maintain SFP temperature less than or equal to 125°F during maximum anticipated normal and emergency storage conditions.

The SFP purification system consists of two 450 gpm circulating pumps, two filter-demineralizers and the required piping, valves and instrumentation. The SFP cooling system pumps draw water from a skimmer surge tank which is connected to the pool. This flow is passed through the filter-demineralizer and is then returned to the pool.

During refueling outages both filter demineralizers are operated continuously except for a weekly backwashing of each one. After the outage, only one is normally operated with monthly backwashing. The radiation level over the spent fuel pool has normally been one mrem/hr by the end of the outage and for the duration of the plant operating cycle. This radiation level in the vicinity of the pool is acceptably small and represents a typical level in the vicinity of the pools at other nuclear power plants.

Because of the prior performance of the SFP purification system during many refuelings and because we expect only a small increase in radioactivity released to the pool water as a result of the proposed modification, we conclude the SFP purification system is adequate for the proposed modification and will keep the concentrations of radioactivity in the pool water to acceptably low levels.

Provision is made for connection to the Residual Heat Removal System for additional heat removal capacity.

5.0 Environmental Impacts of Proposed Action

5.1 Land Use

The proposed modification will not alter the external physical geometry of the SFP. No additional commitment of land is required.

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 this thermal heat output. The Commission has never set a limit on how long spent fuel assemblies could be stored onsite. 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 from up to six normal refuelings. The modification would provide storage for up to eighteen 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. Storing additional spent fuel in the SFP will increase the heat load on the SFP cooling system, which is transferred to the Reactor Building Cooling Water System and thence to the plant Service Water System. The modification will not change the flow rate within these cooling systems. In the August 17, 1977 submittal, the licensee stated that for both the annual refueling and the full core offload (which also requires RHR cooling), the spent fuel pool outlet temperature will be maintained below 125°F. As discussed in the staff's Safety Evaluation of this proposed modification, we conclude that the 125°F is a conservative estimate of the maximum pool outlet water temperature if both trains of the spent fuel pool cooling system are operating. Since the temperature of the SFP water during normal refueling operations will remain below the 125°F 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 impacts associated with the expansion of the spent fuel storage capacity were evaluated and determined to be environmentally insignificant as addressed below.

The additional spent fuel which would be stored due to the expansion is fuel which should have decayed at least six 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 predominantly nonvolatile. The primary impact of such nonvolatile radioactive nuclides is their contribution to radiation levels to which workers in and near the SFP would be exposed. The volatile fission product nuclides of most concern that might be released through defects on the fuel cladding are the noble gases (xenon and krypton), tritium and the iodine isotopes.

5.3.2 Effect of Fuel Failures on the SFP

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 water in the spent fuel pool during refueling operations) or crud dislodged from the surface of the spent fuel during transfer from the reactor core to the SFP. During and after refueling, the spent fuel pool cleanup system reduces the radioactivity concentrations considerably.

A recent Battelle Northwest Laboratory (BNL) report, "Behavior of Spent Nuclear Fuel in Water Pool Storage" (BNWL-2256 dated September 1977), states that radioacivity concentrations may approach a value up to 0.5 μCi/ml during fuel discharge in the SFP. After the refueling, the SFP ion exchange and filtration units will reduce and maintain the pool water in the range of 10^{-3} to 10^{-4} μCi/ml.

It is theorized that most failed fuel contains small, pinhole-like perforations in the fuel cladding at the reactor operating condition of approximately 800°F. A few weeks after refueling, the spent fuel cools in the spent fuel pool so that fuel clad 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 decreases the gas pressure in the gap between pellets and clad, thereby tending to retain the fission products within the gap. In addition, most of the gaseous fission products have short half-lives and decay to insignificant levels within a few months.

In handling defective fuel, the BNL study found that the vast majority of failed fuel does not require special handling and is stored in the same manner as intact fuel. Two aspects of the defective fuel account for its favorable storage characteristics. First, when a fuel rod perforates in-reactor, the radioactive gas inventory is released to the reactor primary coolant. Therefore, upon discharge, little additional gas release occurs. Only if the failure occurs by mechanical damage in the basin are radioactive gases released in detectable amounts, and this type of damage is extremely rare. In addition, most of the gaseous fission products have short half-lives and decay to insignificant levels. The second favorable aspect is the inert character of the uranium oxide pellets in contact with water. This has been demonstrated in laboratory studies and also by casual observations of pellet behavior when broken rods are stored in pools.

Operators at several reactors have discharged, stored, and/or shipped relatively large numbers of Zircaloy-clad fuel which developed defects during reactor exposures, e.g., Ginna, Oyster Creek, Nine Mile Point, and Dresden Unit Nos. 1 and 2. Several hundred Zircaloy-clad assemblies which developed one or more defects in-reactor are stored in the GE-Morris pool without need for isolation in special cans. Detailed analysis of the radioactivity in the pool water indicates that the defects are not continuing to release significant quantities of radioactivity. Normal radioactivity concentrations in the Morris pool water are about 3×10^{-4} μCi/ml which is near the maximum desired concentration for occupational exposure considerations in bathing and culinary uses. The radioactivity concentrations rose to 2×10^{-3} μCi/ml during a month when the water cleanup system was removed from service.

Based on the operational reports submitted by the licensees and discussions with the operators, there has not been any significant leakage of fission products from spent light water reactor fuel stored in the Morris Operation (MO) pool (formely Midwest Recovery Plant) at Morris, Illinois, or at Nuclear Fuel Services' (NFS) storage pool at West Valley, New York. Spent fuel has been stored in these two pools which, while it was in a reactor, was determined to have significant leakage and was, therefore, removed from the core. After storage in the onsite spent fuel pool, this fuel was later shipped to either MO or NFS for extended storage. Although the fuel exhibited significant leakage at reactor operating conditions, there was no significant leakage from this fuel in the offsite storage facility.

5.3.3 Radioactive Material Released to Atmosphere

With respect to gaseous releases, the only significant noble gas isotope attributable to storing additional assemblies for a longer period of time would be Krypton-85. As discussed previously, experience has demonstrated that after spent fuel has decayed 4 to 6 months, there is no significant release of fission products from defective fuel. However, we have conservatively estimated that an additional 74 curies per year of Krypton-85 may be released when the modified pool is completely filled. This 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 additional total body dose to the estimated population within a 50-mile radius of the plant is less than 0.001 man-rem/year. This is less than the natural fluctuations in the dose this population would receive from natural background radiation. Under our conservative assumptions, these exposures represent an increase of less than 0.1% of the exposures from the plant 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 of exposures offsite.

Assuming that the spent fuel will be stored onsite for several years, Iodine-131 releases from spent fuel assemblies to the SFP water will not be significantly increased because of the expansion of the fuel storage capacity since the Iodine-131 inventory in the fuel will decay to negligible levels between refuelings.

Storing additional spent fuel assemblies is not expected to increase the bulk water temperature during normal refuelings above the 125°F used in the design analysis. Therefore, it is not expected that there will be any significant change in the annual release of tritium or iodine as a result of the proposed modification from that previously evaluated. Most airborne releases from the plant result from leakage of reactor coolant which contains tritium and iodine in higher concentrations than the spent fuel pool. Therefore, even if there were a slightly higher evaporation rate from the spent fuel pool, the increase in tritium and iodine released from the plant as a result of the increase in stored spent fuel would be small compared to the amount normally released from the plant and that which was previously evaluated in the FES. If levels of radioiodine become too high, the air can be diverted to charcoal filters for the removal of radioiodine before release to the environment.

5.3.4 Solid Radioactive Wastes

The concentration of radionuclides in the pool is controlled by the filter-demineralizers and by decay of short-lived isotopes. The activity is high during refueling operations while reactor coolant water is introduced into the pool and decreases as the pool water is processed through the filters and demineralizers. The increase of radioactivity, if any, should be minor because the additional spent fuel to be stored is relatively cool, thermally, and radionuclides in the fuel will have decayed significantly.

While we believe that there should not be an increase in solid radwaste due to the modification, as a conservative estimate, we have assumed that the amount of solid radwaste may be increased by 66 cubic feet of resin a year from the demineralizers (twelve additional resin beds/year). The annual average amount of solid waste shipped from Monticello during 1972 to 1976 is 9,340 cubic feet per year. If the storage of additional spent fuel does increase the amount of solid waste from the SFP purification systems by about 66 cubic feet per year, the increase in total waste volume shipped would be less than 0.8% and would not have any significant environmental impact.

The present spent fuel racks to be removed from the SFP are contaminated and will be disposed of as low level waste. It has been estimated by the licensee that about 10,000 cubic feet of solid radwaste will be removed from the SFP because of the proposed modification. Therefore, the total waste shipped from the plant will be increased by less than 3% per year when averaged over the lifetime of the plant. This will not have any significant environmental impact.

5.3.5 Radioactivity Released to Receiving Waters

There should not be a significant increase in the liquid release of radionuclides from the plant as a result of the proposed modification. The amount of radioactivity on the SFP filter-demineralizers might slightly increase due to the additional spent fuel in the pool, but this increase of radioactivity would not be released in liquid effluent from the station.

The filter medium resins are periodically flushed with water to the condensate phase separator tank. The water used to transfer the spent resin is decanted from the tank and returned to the liquid radwaste system for processing. The soluble radioactivity will be retained on the resins. If any activity should be transferred from the spent resin to this flush water, it would be removed by the liquid radwaste system.

Leakage from the SFP is collected in the Reactor Building floor drain sumps. This water is transferred to the liquid radwaste system and is processed by the system. No liquid radwaste system effluent has been discharged to the Mississippi River for several years.

5.3.6 Occupational Exposures

We have reviewed the licensee's plan for the removal, disassembly and disposal of the low density racks and the installation of the high density racks with respect to occupational radiation exposure. The occupational exposure for this operation is estimated by the licensee to be about 22 man-rem. We consider this to be a conservative estimate. This operation is expected to be performed only once during the lifetime of the plant and will be only a small fraction of the total man-rem burden from occupational exposure.

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

5.3.7 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 additional discharge of heat to the atmosphere and to the Mississippi River. Storing spent fuel in the SFP for a longer period of time will add more heat to the SFP water. The spent fuel pool heat exchangers are cooled by the reactor building cooling water system which in turn is cooled by the plant service water system. An evaluation of the augmented spent fuel storage facility was made to determine the effects of the increased heat generation on the plant cooling water systems, and ultimately, on the environment.

The maximum incremental heat load that will be added by use of the proposed rack modification is that from unloading a full core which would fill the pool. The NSP analysis conservatively assumed that the previous normal discharge had occurred during a reload 30 days prior to full core removal allowing the discharged normal batch to cool only 30 days during which the refueled core was operated for some period of time. The full core was then completely discharged to the SFP 150 hours after shutdown. The maximum calculated heat generation rate in this case (at 150 hours after shutdown) would be 27.2×10^6 BTU/hr.

At ten days after shutdown, the heat generation rate is 21.5×10^6 BTU/hr. Of this, 15.7×10^6 BTU/hr (73%) is contributed by the full core offload (484 assemblies), with the remainder attributable to the 1753 assemblies previously in the pool, 141 of which had only 40 days cooling. Note that 141 assemblies, rather than 121, were assumed in this worst-case analysis.

Even under such extreme and unrealistic conditions, it is obvious that the maximum heat input to the SFP is from the assemblies being discharged from the core rather than those assemblies which had been stored in the spent fuel pool from previous discharges.

Under the normal reload conditions of 121 assemblies per year, the additional capacity will result in a maximum incremental heat load of $.45 \times 10^6$ BTU/hr., which is about .01% of the 3.9×10^9 BTU/hr. total heat load on the environment, as derived from the FES.

Compared to the existing heat load, which was evaluated in the FES and has been evaluated by continuing environmental monitoring programs, the additional thermal impact from the proposed modification would be negligible.

5.5 Impacts on the Community

The new storage racks will be fabricated offsite and shipped to the plant. No environmental impacts on the environs outside the spent fuel storage areas are expected during removal of the existing racks and installation of the new racks. The nonradiological impacts within this building are expected to be limited to those normally associated with metal working activities; the radiological impacts were discussed in Section 5.3. 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 Accidents

Although the new high density racks will accommodate a larger inventory of spent fuel, we have determined that the installation and use of the racks will not change the radiological consequences of a postulated fuel handling accident in the SFP area from those values reported in the FES for Monticello dated November 1972.

Additionally, the NRC staff has under way a generic review of load handling operations in the vicinity of spent fuel pools to determine the likelihood of a heavy load impacting fuel in the pool and, if necessary, the radiological consequences of such an event. Because Monticello has committed to prohibit the movement of loads in excess of the combined weight of a fuel assembly and handling tool over fuel assemblies in the SFP, we have concluded that the likelihood of a heavy load handling accident is sufficiently small that the proposed modification is acceptable and no additional restrictions on load handling operations in the vicinity of the SFP are necessary while our review is under way.

7.0 Alternatives

In regard to this licensing action, the NRC 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 $4,900,000 or approximately $2200 for each of the 2237 fuel assemblies that the increased storage capacity will accommodate.

7.1 Reprocessing of Spent Fuel

As discussed earlier, none of the three commercial reprocessing facilities in the U.S. is currently operating. The General Electric Company's Midwest Fuel Recovery Plant at Morris, Illinois, is in a decommissioned condition. On September 22, 1976, Nuclear Fuel Services, Inc. (NFS) informed the Nuclear Regulatory Commission that they were "withdrawing from the nuclear fuel reprocessing business." The Allied-General Nuclear Services (AGNS) reprocessing plant received a construction permit on December 18, 1970. In October 1973, AGNS applied for an operating license for the reprocessing facility; construction of the reprocessing facility is essentially complete but no operating license has been granted. On July 3, 1974, AGNS applied for a materials license to receive and store up to 400 MTU of spent fuel in the onsite storage pool, on which construction has also been completed but hearings with respect to this application have not yet commenced and no license has been granted.

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 metric tons of uranium (MTU) in spent fuel.

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."

On December 23, 1977, the Nuclear Regulatory Commission announced that it would order the termination of the now-pending fuel cycle licensing actions involving GESMO (Docket No. RM-50-5), Barnwell Nuclear Fuel Plant Separations Facility, Uranium Hexflouride Facility, and Plutonium Product Facility (Docket No. 50-332, 70-1327 and 70-1821), the Exxon Nuclear Company, Inc. Nuclear Fuel Recovery and Recycling Center (Docket No. 50-564), the Westinghouse Electric Corporation Recycle Fuels Plants (Docket No. 70-1432), and the Nuclear Fuel Services, Inc. West Valley Reprocessing Plant (Docket No. 50-201). The Commission also announced that it would not at this time consider any other applications for commercial facilities for reprocessing spent fuel, fabricating mixed-oxide fuel, and related functions. At this time, any considerations of these or comparable facilities has been deferred for the indefinite future. Accordingly, the Staff considers that shipment of spent fuel to such facilities for reprocessing is not a reasonable alternative to the proposed expansion of the Monticello spent fuel pool especially when considered in the relevant time frame - i.e., through the 1980's - when expanded capacity at Monticello will be needed.

The licensee had intended to reprocess the spent fuel to recover and recycle the uranium and plutonium in the fuel. Due to a change in national policy and circumstances beyond the licensee's control, reprocessing of the spent fuel is not an available option at this time.

7.2 Independent Spent Fuel Storage Facility

An alternative to expansion of onsite spent fuel pool storage is the construction of new "independent spent fuel storage installations" (ISFSI). Such installations could provide storage space in excess of 1000 MTU of spent fuel. This is far greater than the capacities of onsite storage pools. Fuel storage pools at GE Morris and NFS are functioning as ISFSIs although this was not the original design intent. Likewise, if the receiving and storage station at AGNS is licensed to accept spent fuel, it would be functioning as an ISFSI until the reprocessing facility is licensed to operate. The license for the GE facility at Morris, Illinois, was amended on December 3, 1975 to increase the storage capacity to about 750 MTU:* as of November 1, 1977 295 MTU was stored in the pool in the form of over 1000 assemblies. The staff has discussed the status of storage space at MO with GE personnel. We have been informed that GE is primarily operating the MO facility to store either fuel owned by GE (which had been leased to utilities on an energy basis) or fuel which GE had previously contracted to reprocess. We were informed that the present GE policy is not to accept spent fuel for storage except for that fuel for which GE has a previous commitment. The NFS facility has capacity for about 260 MTU, with approximately 170 MTU presently stored in the pool. The storage pool at West Valley, New York, is on land owned by the State of New York and leased to NFS thru 1980. Although the storage pool at West Valley is not full, since NFS withdrew from the fuel reprocessing business, correspondence we have received indicates that they are not at present accepting additional spent fuel for storage even from the reactor facilities with which they had contracts. The status of the storage pool at AGNS was discussed in Section 7.1 above.

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.

*An application for an 1100 MTU capacity addition is pending. Present schedule calls for completion in 1980 if approved. However, by motion dated November 8, 1977 General Electric Company requested the Atomic Safety and Licensing Board to suspend indefinitely further proceedings on this application. This motion was granted.

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 (ANS Transactions, 1975 Winter Meeting, Vol. 22, TANSAO 22-1-836, 1975). In 1974, E. R. Johnson Associates estimated their construction cost at about $20 million.

Several licensees have evaluated construction of a separate independent spent fuel storage facility and have provided cost estimates. In 1975, Connecticut Yankee, for example, estimated that to build an independent facility with a storage capacity of 1000 MTU (BWR and/or PWR assemblies) would cost approximately $54 million and take about 5 years to put into operation. Commonwealth Edison estimated the construction cost to build a fuel storage facility at about $10,000 per fuel assembly. To this would be added the costs for maintenance, operation, safeguards, security, interest on investment, overhead, transportation and other costs.

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

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

In the long-term, the U.S. Department of Energy (USDOE) is modifying its program for nuclear waste management to include design and evaluation of a retrievable storage facility to provide Government storage at central locations for unreprocessed spent fuel rods. The pilot plant is expected to be completed by late 1985 or 1986. It is estimated that the long-term storage facility will start accepting commercial spent fuel about 1990. The design is based on storing the spent fuel in a retrievable condition for a minimum of 25 years. The criterion for acceptance is expected to be that the spent fuel must have decayed a minimum of ten years so it can be stored in dry condition without need for forced air circulation. As an interim alternative to the long term retrievable storage facility, on October 18, 1977, USDOE announced a new "spent nuclear fuel policy." USDOE will determine industry interest in providing interim fuel storage services on a contract basis. If adequate private storage services cannot be provided, the Government will provide interim fuel storage facilities. It was announced by USDOE at a public meeting held on October 26, 1977, that this interim storage is expected to be available in the 1981-1982 time frame. USDOE thru their Savannah River Operations Office is preparing a conceptual design for a possible spent fuel storage pool of about 5000 MTU capacity. Based on our discussions with USDOE personnel, it appears that the earliest such a pool could be licensed to accept spent fuel would be about 1983. The interim facility(s) would be designed for storage of the spent fuel under water. USDOE stated that it was their intent to not accept any spent fuel that had not decayed a minimum of five (5) years.

The Monticello plant does not now have space in the SFP to discharge a full core. If the storage capacity of the SFP is not increased, the pool will be filled in late 1978. The precise date that interim storage would be available is not known at this time with sufficient precision to provide for planning. Should government facilities not be available by 1979, the Monticello plant might be forced to shutdown. Therefore, this does not appear to be a practical alternative, expecially when considering the impact of plant shutdown as compared with the negligible environmental consequences of the proposed amendment.

The proposed increase in storage capacity will allow Monticello to operate until 1991, by which time the Federal repository for spent fuel is expected to be operable.

In their submittal of August 17, 1977, the licensee stated that they had evaluated storage at commercial storage facilities. The licensee indicates the commercial storage facilities evaluated were ones in existence (e.g., Morris Operations). The licensee stated that it has been determined that the average cost for storage at a commercial facility is approximately \$3700 to \$5000 per year per assembly. Based on the staff's evaluation of costs in conjunction with other licensing actions of this type, the \$3700 to \$5000 figure is in line with what it would cost to store BWR fuel at an existing facility. The licensee pointed out that even if this alternative were available, this alternative is less economical than modification of the pool and storage onsite.

The staff concludes that even if offsite storage facilities are available, it is more economical to store spent fuel onsite and that there are no environmental benefits associated with offsite storage compared to the proposed action.

7.3 Storage at Another Reactor Site

Northern States Power Company's other licensed nuclear plant, the two-unit Prairie Island Nuclear Generating Plant, has experienced the same need for expanded spent fuel storage as Monticello. Both units at Prairie Island are pressurized water reactors (PWR), the fuel assemblies for which are larger than those of a BWR such as Monticello. Prairie Island is presently expanding the spent fuel storage capacity in order to meet their own needs, and is not licensed to receive spent fuel. In fact, there is no reactor facility which is licensed to receive Monticello spent fuel, nor is any other reactor facility believed to be interested in providing long term spent fuel storage.

According to a survey performed and documented by the former Energy Research and Development Administration, up to 27 of the operating nuclear power plants will lose the ability to refuel during the period 1977-1987 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, it is unlikely that the cost would be less than storage onsite as proposed.

7.4 Shutdown of Facility

Storage of spent fuel from Monticello in the existing racks is possible but only for a short period of time. As discussed above, if expansion of the SFP capacity is not approved and if an alternate storage facility is not located, the licensee would have to shutdown Monticello in 1979 due to a lack of spent fuel storage facilities, resulting in the cessation of up to 545 megawatts net electrical energy production.

The licensee in their submittal of August 17, 1977 stated that the current costs associated with replacing Monticello's power capacity and the energy which would otherwise be generated by Monticello would be $55.7 million for the first year alone. Replacement energy costs would be expected to escalate in following years. This is obviously not an economical alternative and would have an adverse socio-economic impact on customers, utilities of the Mid-Continental Area Reliability Coordination Agreement, employees of Northern States Power, and on the communities in the licensee's service area.

7.5 Summary of Alternatives

In summary, the alternatives (1) to (3) described above are presently not available to the licensee or could not be made available in time to meet the licensee's need. Even if available, alternatives (2) and (3) are likely to be more expensive than the proposed modification and do not offer any advantages in terms of environmental impacts. 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 capacity of the spent fuel pool for Monticello would have a negligible environmental impact. Accordingly, deferral or severe restriction of the proposed action 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 adverse environmental impacts on the land, water, air or biota of the area.

8.1.2 Radiological Impacts

Expansion of the storage capacity of the SFP will not create any significant additional 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 0.001 man-rem/yr, respectively, and is less than the natural fluctuations in the dose this population would receive from background radiation. The total occupational exposure of workers during removal of the present storage racks and installation of the new racks is estimated by the licensee to be about 22 man-rem. This is a small fraction of the total man-rem burden from occupational exposure at the station. Operation of the plant with additional spent fuel in the SFP is not expected to increase the occupational radiation exposure by more than one percent of the present total annual occupational exposure at this facility.

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

Expansion of the storage capacity of the SFP, which would permit the plant to continue to operate until 1991 when offsite storage facilities are expected to be available for interim or long-term storage of spent fuel, will not change the evaluation in the FES.

8.3 Irreversible and Irretrievable Commitments of Resources

8.3.1 Water, Land and Air Resources

The proposed action will 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 storage racks in the SFP will be replaced by new fuel storage modules. The new modules will be fabricated stainless steel structures composed of fuel storage tubes, which are made by forming an outer tube and an inner tube of 304 stainless steel with an inner core of Boral (B_4C-Al matrix bonded between two layers of aluminum) into a single fabricated tube. The outer and inner tubes are welded together and the completed storage tubes are fastened together to form a 13 x 13 storage module. Each module is approximately 7 feet square and 14 feet high and provides storage space for 169 BWR fuel assemblies. The assemblies are on an approximately 6.5 inch center-to-center spacing.

Storage will be provided for canned defective fuel and used control rods in addition to spent fuel. Two existing racks will be used for defective fuel cans or control rods, each rack holding up to ten cans or control rods as needed. Up to 121 temporary spaces for control rod storage will be provided on the periphery of the spent fuel pool.

The stainless steel to be committed for fabrication of the new spent fuel storage racks is approximately 225,000 pounds. Annual use of stainless steel in the U. S. is approximately 2.82 x10" pounds. 55,500 pounds of Boron Carbide (B_4C) will be used, out of a total annual U. S. consumption of 3 - 9 x 10^5 pounds. Also, 2.54 x 10^4 pounds of aluminum will be required, with annual U. S. consumption estimated to be 8 x 10^9 pounds. We conclude that since the amount of each material to be used represents a small fraction of each consumed annually in the United States, the material required for the new Monticello racks is insignificant and does not represent a significant irreversible commitment of material resources.

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

We conclude that the expansion of the SFP at the Monticello 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 actions designed to ameliorate a possible shortage of spent fuel storage capacity.

8.4 Commission Policy Statement Regarding Spent Fuel Storage

On September 16, 1975, the Commission announced (40FR 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 draft statement is expected to be issued by mid-1978.

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 proposed here would have a utility that is independent of the utility of other licensing actions designed to ameliorate a possible shortage of spent fuel capacity?

   A reactor core for Monticello contains 484 fuel assemblies. Typically, the reactor is refueled once every 12 months: Each refueling replaces about 1/4 of the core (about 121 assemblies), and each new assembly contains about 183 kilograms of uranium. The SFP was designed on the basis that a fuel cycle would be in existence that would only require storage of spent fuel for a year or two prior to shipment to a reprocessing facility.

Initially, sufficient racks were installed to store 740 spent fuel assemblies (1 1/2 cores), which was a typical design basis for BWRs in the late sixties and early seventies. When Monticello was designed, a SFP storage capacity for 1 1/2 cores was considered adequate. This provided for complete unloading of the reactor even if the spent fuel from a previous refueling were in the pool. While not required from the standpoint of safety considerations, it is a desirable 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 121 fuel assemblies are discharged every 12 months, the SFP will be full after the refueling scheduled for late 1978. 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 will have to shutdown Monticello about late 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.

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 desirable 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 Monticello 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 nonmaterial resources are primarily the labor needed to accomplish the proposed modification and the increased storage capacity of the Monticello spent fuel pool.

The increased storage capacity of the spent fuel pool was evaluated relative to proposed similar licensing actions 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 commit the NRC to repeat this action or a related action in 1990, at which time the modified pool is estimated to be full if no fuel is removed.

We conclude that the expansion of the SFP at Monticello, 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 nonradiological 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 nonradiological 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?

This Environmental Impact Appraisal and the accompanying Safety Evaluation respond to the questions concerning health, safety and environmental concerns. All technical issues which have arisen in connection with this application have been resolved with the licensee.

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. Accordingly, deferral or severe restriction of the action here proposed would not be in the public interest.

9.0 Benefit-Cost-Balance

This section summarizes and compares the cost and the benefits resulting from the proposed modification to those that would be derived from the selection and implementation of each alternative. The table below presents a tabular comparison of these costs and benefits. The benefit that is derived from three of these alternatives is the continued operation of Monticello and production of electrical energy. As shown in the table, the reactor shutdown and subsequent storage of fuel in the reactor vessel results in the cessation of electrical energy production. While this would have the "benefit" of eliminating thermal, chemical and radiological releases from Monticello, these effluents have been evaluated and it has been determined that the environmental impacts of these releases are not significant. Therefore, there would be no significant environmental benefit in their cessation. The alternative of storage at other nuclear plants is not possible at this time or in the foreseeable future except on a short term emergency basis.

From examination of the table, it can be seen that the most cost-effective alternative is the proposed spent fuel pool modification. As evaluated in the preceding sections, the environmental impacts associated with the proposed modification would not be significantly changed from those analyzed in the Final Environmental Statement for the Monticello Nuclear Generating Plant issued November 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 proposed license amendment will not significantly affect the quality of the human environment and that there will be no significant environmental impact attributable to the proposed action other than that which has already been predicted and described in the Commission's Final Environmental Statement for the facility dated November 1972. Therefore the staff 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
Reprocessing of Spent Fuel		None - This alternative is not available either now or in the foreseeable future.
Increase storage capacity of Monticello SFP	$2200/assembly	Continued operation of Monticello and production of electrical energy
Storage of Independent Facility*	$3700 to $5000/ assembly per year plus shipping costs to facility	Continued operation of Monticello and production of electrical energy. This alternative is not available for several years.
Storage at Other Nuclear Plants	Comparable to storage at Monticello	Continued operation of Monticello and production of electrical energy. However, this alternative is not available.
Reactor Shutdown	$55.7 million for first year alone for replacement energy and replacement power capacity, plus annual costs for maintenance, security and carrying charges on investment.	None - No production of electrical energy.

*Costs for interim Government storage are expected to be published on 1978.

UNITED STATES NUCLEAR REGULATORY COMMISSION

DOCKET NO. 50-263

NORTHERN STATES 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. 34 to Provisional Operating License No. DPR-22 issued to Northern States Power Company (NSP) (the licensee) which revised the license for operation of the Monticello Nuclear Generating Plant (the facility) located in Wright County, Minnesota. The amendment is effective as of its date of issuance.

The amendment authorizes the increase of the spent fuel pool storage capacity from 740 to 2237 fuel assemblies.

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 Consideration of Proposed Modification to Facility Spent Fuel Storage Pool in connection with this action was published in the FEDERAL REGISTER on September 19, 1977 (42 FR 46964). The Minnesota Pollution Control Agency petitioned for leave to intervene and was admitted as party to the proceeding. No other party sought intervention.

On January 6, 1978, the NRC Staff, NSP and MPCA filed a motion in which MPCA requested leave of the Board to withdraw its petition to intervene and the parties jointly moved the Board to approve MPCA's withdrawal of its petition to intervene. Following a special prehearing conference, held on January 31, 1978 in St. Paul, Minnesota, the Atomic Safety and Licensing Board, by order dated February 27, 1978, dismissed the proceeding.

The Commission has prepared an environmental impact appraisal and has concluded that an environmental impact statement for this particular action is not warranted because there will be no environmental impact attributable to the action other than that which has already been predicted and described in the Commission's Final Environmental Statement for the facility dated November 1972.

For further details with respect to this action, see (1) the NSP filing dated August 17, 1977 as supplemented by letters dated September 12, December 8, December 14, 1977, January 3, January 30, March 10, March 16, and March 28, 1978, (2) Amendment No. 34 to License No. DPR-22, (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 Environmental Conservation Library, Minneapolis Public Library, 300 Nicollet Mall, Minneapolis, Minnesota 55401. 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 14th day of April 1978.

FOR THE NUCLEAR REGULATORY COMMISSION

George Lear

George Lear, Chief
Operating Reactors Branch #3
Division of Operating Reactors