March 7, 1991

Docket No. 50-305

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Mr. Ken H. Evers
Manager - Nuclear Power
Wisconsin Public Service Corporation
Post Office Box 19002
Green Bay, Wisconsin 54307-9002

Dear Mr. Evers:

SUBJECT: AMENDMENT NO. 92 TO FACILITY OPERATING LICENSE NO. DPR-43 (TAC NO. 77108)

The Commission has issued the enclosed Amendment No. 92 to Facility Operating License No. DPR-43 for the Kewaunee Nuclear Power Plant. This amendment revises the Technical Specifications in response to your application dated July 5, 1990.

The amendment revises TS 5.3.a.3 to increase the allowable fuel enrichment at Kewaunee Nuclear Power Plant from 38.5 grams of U-235 per axial centimeter of fuel assembly (or 3.67 weight percent) to 49.2 grams per axial centimeter (or 4.75 as-built weight percent). This amendment allows the reload of the higher enrichment fuel assemblies and the storage of such assemblies prior to and subsequent to loading in the reactor. Plant operation using the higher enriched fuel will be demonstrated to be acceptable by a cycle-specific reload safety evaluation performed prior to each fuel loading.

A copy of the Safety Evaluation is also enclosed. Notice of issuance will be included in the Commission's next regular biweekly Federal Register notice.

Sincerely,

original signed by

Michael J. Davis, Project Manager
Project Directorate III-3
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

Enclosures:
1. Amendment No. 92 to License No. DPR-43
2. Safety Evaluation

cc w/enclosures:
See next page

DOCUMENT NAME: 77108 AMD

Office:	LA/PDIII-3	PM/PDIII-3	SRXB	OGC-WF1	PD/PDIII-3
Surname:	PKreutzer	MDavis/bj	R JONES		JHannon
Date:	1/15/91	1/31/91	3/01/91	2/11/91	3/6/91

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Office:	LA/PDIII-3	PM/PDIII-3	RXB	OGC-WF1	PD/PDIII-3
Surname:	PKreutzer	MDavis/bj	R JONES	[illegible]	JHannon
Date:	1/15/91	1/31/91	3/01/91	2/11/91	3/6/91

Mr. Ken H. Evers
Wisconsin Public Service Corporation

Kewaunee Nuclear Power Plant

cc:
David Baker, Esquire
Foley and Lardner
P. O. Box 2193
Orlando, Florida 32082

Glen Kunesh, Chairman
Town of Carlton
Route 1
Kewaunee, Wisconsin 54216

Mr. Harold Reckelberg, Chairman
Kewaunee County Board
Kewaunee County Courthouse
Kewaunee, Wisconsin 54216

Chairman
Public Service Commission of Wisconsin
Hill Farms State Office Building
Madison, Wisconsin 53702

Attorney General
114 East, State Capitol
Madison, Wisconsin 53702

U.S. Nuclear Regulatory Commission
Resident Inspectors Office
Route #1, Box 999
Kewaunee, Wisconsin 54216

Regional Administrator - Region III
U.S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Mr. Robert S. Cullen
Chief Engineer
Wisconsin Public Service Commission
P.O. Box 7854
Madison, Wisconsin 53707

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

WISCONSIN PUBLIC SERVICE CORPORATION

WISCONSIN POWER AND LIGHT COMPANY

MADISON GAS AND ELECTRIC COMPANY

DOCKET NO. 50-305

KEWAUNEE NUCLEAR POWER PLANT

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 92
License No. DPR-43

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

   A. The application for amendment by Wisconsin Public Service Corporation, Wisconsin Power and Light Company, and Madison Gas and Electric Company (the licensees) dated July 5, 1990, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

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

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

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

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

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. DPR-43 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 92, are hereby incorporated in the license. The licensees shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance, and is to be implemented within 30 days of the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

John N. Hannon, Director
Project Directorate III-3
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical Specifications

Date of issuance: March 7, 1991

ATTACHMENT TO LICENSE AMENDMENT NO. 92

FACILITY OPERATING LICENSE NO. DPR-43

DOCKET NO. 50-305

Revise Appendix A Technical Specifications by removing the page identified below and inserting the enclosed page. The revised page is identified by amendment number and contains a marginal line indicating the area of change.

REMOVE	INSERT
TS 5.3-1	TS 5.3-1

5.3 REACTOR

Applicability

Applies to the reactor core and the Reactor Coolant System.

Objective

To define those design features which are essential in providing for safe system operations.

Specifications

a. Reactor Core

1. The reactor core contains approximately 48 metric tons of uranium in the form of slightly enriched uranium dioxide pellets. The pellets are encapsulated in Zircaloy-4 tubing to form fuel rods. The reactor core is made up of 121 fuel assemblies. Each fuel assembly contains 179 fuel rods. (1)

2. The average enrichment of the initial core is a nominal 2.90 weight percent of U-235. Three fuel enrichments are used in the initial core. The highest enrichment is a nominal 3.40 weight percent of U-235. (2)

3. Reload fuel will be similar in physical design to the initial core loading and shall have a maximum enrichment of 49.2 grams of uranium-235 per axial centimeter of fuel assembly.

4. Burnable poison rods are incorporated in the initial core. There are 704 poison rods in the form of 8, 12 and 16 rod clusters, which are located in vacant rod cluster control tubes. The burnable poison rods consist of borosilicate glass clad with stainless steel.

5. There are 29 full-length Rod Cluster Control (RCC) assemblies in the reactor core. The full-length RCC assemblies contain a 142-inch length of silver-indium-cadmium alloy clad with stainless steel.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO AMENDMENT NO. 92 TO FACILITY OPERATING LICENSE NO. DPR-43

WISCONSIN PUBLIC SERVICE CORPORATION
WISCONSIN POWER AND LIGHT COMPANY
MADISON GAS AND ELECTRIC COMPANY

KEWAUNEE NUCLEAR POWER PLANT

DOCKET NO. 50-305

1.0 INTRODUCTION

By letter dated July 5, 1990, Wisconsin Public Service Corporation, the licensee, submitted a proposed amendment request to increase the allowable fuel enrichment at the Kewaunee Nuclear Power Plant (KNPP). The current enrichment limit is 38.5 grams of U-235 per axial centimeter of fuel assembly which corresponds to an as-built U-235 weight percent (w/o) of 3.67. The requested enrichment limit is 49.2 grams of U-235 per axial centimeter which corresponds to an as-built U-235 w/o of 4.75. The proposed change would modify paragraph 5.3.a.3 of the KNPP Technical Specifications to allow the reload of fuel assemblies with enrichments up to 49.2 grams of U-235 per axial centimeter and the storage of such assemblies prior to and subsequent to loading in the reactor. Plant operation using the higher enriched fuel will be demonstrated to be acceptable by a cycle specific reload safety evaluation performed prior to each fuel loading.

2.0 EVALUATION

2.1 Criticality Consideration

The KNPP spent fuel storage pool (SFP) consists of high density storage racks with 990 locations for fuel assemblies. The spent fuel storage racks are designed to store new (unirradiated) fuel and spent (irradiated) fuel in a vertical configuration under water. The fuel assemblies are maintained at a nominal center-to-center pitch of 10 inches and contain boron carbide plates as neutron absorbers. The new (unirradiated) fuel storage facility consists of storage racks with 44 locations for fuel assemblies. These racks store unirradiated fuel assemblies in a dry, vertical configuration with a minimum center-to-center spacing of 20.24 inches between fuel assemblies.

The criticality analyses for the storage racks used KENO-IV, a multigroup Monte Carlo theory computer code, for reactivity calculations. Neutron cross sections were based on data from the ENDF/B-II cross section library. The analytical methods and models were benchmarked against experimental configurations using various combinations of fuel assembly spacings and interspersed absorbing materials and were found to adequately reproduce the critical values. All benchmark cases used water as the moderating material and no critical configurations explicitly modeled the large new fuel storage rack spacing. However, the staff concludes that the method bias selected is conservative with respect to the large new fuel storage rack assembly spacing as well as the reduced density cases discussed below. Therefore, the analysis methods used for the new and spent fuel storage racks are found to be acceptable.

The prevention of criticality in fuel storage and handling is required by General Design Criterion 62 of Appendix A to 10 CFR Part 50. The design basis for preventing criticality in the spent fuel storage racks is that, including uncertainties, there is a 95 percent probability at a 95 percent confidence level (95/95 probability/confidence) that the effective multiplication factor (k_{eff}) of the fuel assembly array will be no greater than 0.95 when fully flooded with pure (unborated) water. The criticality criteria for the new fuel storage racks is that, including uncertainties, there is a 95/95 probability/confidence that k_{eff} will be no greater than 0.95 when fully flooded with pure water and no greater than 0.98 when filled with extreme, low-density water or other hydrogenous material such as may occur for fog, mist, and fire-fighting foam.

For the spent fuel storage racks, criticality analyses were performed to determine the maximum fuel enrichment which would still maintain k_{eff} less than or equal to 0.95. The following conditions were assumed in the analyses:

1. No structural braces or material were considered for the rack except the inner and outer stainless steel cans and B_4C poison plates.

2. No soluble poisons were considered.

3. The pool water was assumed to be at the optimum (highest reactivity) temperature of 50°F.

4. All fuel contained an enrichment tolerance of +0.05 w/o U-235.

5. The fuel assemblies contained no burnable poisons.

6. Maximum thicknesses were used for the stainless steel inner and outer cans that surround the B_4C poison plates.

7. Minimum assembly pitches were calculated using cumulative tolerances.

8. No intermediate spacer grids were modeled.

In addition to assuming these most adverse (highest reactivity) initial conditions, biases and uncertainties in the calculational method were also included. All uncertainties correspond to a 95/95 one-sided tolerance level, as required by the NRC.

Abnormal occurrences such as off-center fuel placement, fuel assembly drop accidents, and fuel assemblies misplaced between the racks and fuel pool walls were also analyzed. The limiting spent fuel rack accident was found to be the fuel pool flooded with unborated water concurrent with a misplaced assembly. The maximum k_{eff} for this scenario, considering all appropriate uncertainties and biases and a maximum enrichment of 52.3 grams of U-235 per axial centimeter (5.05 w/o), was calculated to be 0.93428 with a 95/95 tolerance level. This is within the NRC acceptance limit of 0.95 and is, therefore, acceptable.

For the new fuel storage racks, criticality analyses were performed to determine the maximum fuel enrichment which would still maintain k_{eff} no greater than 0.95 for flooded conditions and no greater than 0.98 for low-density conditions. The new fuel rack analyses assumed the same initial conditions as specified above for the spent fuel rack analyses. In addition, for the 100% dense water moderated cases the racks were assumed to be infinite in the x-y directions with a top 12-inch water reflector and a 24-inch thick concrete floor. For the low-density condition, a thickness of at least 13 feet of low density moderator was modeled above the active fuel and a concrete wall reflector in the x-y direction.

In addition to these adverse initial conditions, biases and uncertainties in the calculational method were included with all uncertainties corresponding to a 95/95 one-sided tolerance level, as required by the NRC.

Abnormal events such as off-center fuel placement and fuel assembly drops were considered as well as complete flooding of the dry new fuel storage racks by pure water and low-density water conditions. The maximum reactivity for fully flooded conditions was 0.91541 for an assumed enrichment of 5.05 w/o U-235, which is well within the NRC limit of 0.95. The limiting accident was found to be the new fuel storage area misted with 7% dense water concurrent with no assembly guides. This resulted in a k_{eff} of 0.97666 for an assumed enrichment of 49.2 grams per axial centimeter (4.75 w/o U-235). This is within the NRC limit of 0.98 for low-density water conditions and, therefore, acceptable.

2.2 SFP Thermal Considerations

The licensee made an assessment of decay heat values based upon assessments of fuel up to 5 w/o U-235 and burnups to 52.5 gigawatt days per metric ton. The licensee found the limiting case to be 3.9 w/o U-235, which provided a heat generation rate of 19.4 MBTU/Hr for the full core offload and 6.84 MBTU/Hr for a normal refueling offload, assuming a minimum decay time of 100 hours. A comparison of this value was made with the value obtained in using BTP ASB 9-2, "Residual Decay Energy for Light Water Reactors for Long Term Cooling." The comparison showed that the licensee calculated the decay heat correctly. The staff found this to be acceptable.

The licensee used the calculated decay heat generation for a full core offload to determine the SFP coolant temperature to be expected under that condition. The licensee assumed a single active failure of a spent fuel pool pump, and service water (SW) coolant temperature to the HX to be 80°F. The results of the calculations showed the bulk fluid temperature of SFP coolant to be 141.2°F.

While the licensee provided no analysis for the case of a normal refueling offload, it is anticipated that the resultant coolant temperature would be less than 141.2°F.

The design temperature for the SW had originally been 66°F. However, the licensee has determined that temperatures as high as 75°F had been found for SW. Therefore, the licensee selected 80°F as a conservative SW coolant temperature upon which to base the analyses.

The staff finds the use of 80°F as the temperature of the service water into the SFP heat exchanger to be acceptable. The resultant SFP coolant exit temperatures in both the cases of refueling and full core offload were also found to be acceptable since they were less than the design limit of 150°F.

The licensee stated that, in the case of failure of all SFP cooling methods, the plant had three alternate methods of adding coolant as makeup. These are:

(1) Service water through a 6-inch line already installed,
(2) Reactor makeup water, and
(3) Borated water through a boric acid addition line.

The service water system (SWS) supply is almost unlimited since it draws water from Lake Michigan. Each SW pump has the capacity to pump 6400 gpm (design flow) at a head of 204 feet (approximately 85-90 psi) through a 6 inch line as makeup to the spent fuel pool. This would satisfy the need for makeup of approximately 42 gpm with a full core offload, assuming all the spent fuel decay heat (19.4 MBTU/Hr) is utilized to boil off spent fuel pool coolant. In the case of a normal refueling offload, the makeup need would be approximately 15 gpm.

The other provisions for providing makeup are: (1) the reactor makeup system through a 2 inch line. There are two pumps available, each with a capacity of 95 gpm and two tanks available, each with a water content of 40,000 gallons, (2) the boric acid transfer system through a 2 inch line. There are two pumps available, each with a capacity of 40 gpm, and two tanks, each with a water content of 4000 gallons. The staff finds this to be acceptable.

2.3 Spent Fuel Building Air Temperature

The licensee analyzed the SFP building air temperature. The calculations included single failure of one SFP cooling train and introduction of 12000 cfm of air from the auxiliary building via the spent fuel pool supply fan. Natural circulation was considered the means by which the air in the building was heated by the spent fuel pool. The analysis considered the case of a full core offloaded into the SFP and the single failure of a SFP cooling pump.

The licensee calculated that the air entering the SFP area would increase by 1.7 °F (to 121.7°F) assuming the air entering from the auxiliary building was at the existing design temperature. (120°F). The staff finds this to be acceptable.

2.4 SFP Coolant Cleanliness

The SFP cooling system keeps the SFP coolant clean and clear by passing it through filters in line with each SFP pump. The filters are capable of removing particulate matter down to 15 microns in size. In addition, part of the coolant, approximately 10%, is passed through a filter (prefilter), a demineralizer and another filter (post-filter) and is then returned to the SFP. The licensee reported that the demineralizer resin would not be affected, materially, by SFP coolant temperatures less than 250°F. The staff finds this to be acceptable.

2.5 Findings

Based on the above evaluation, the staff concludes that the proposed change to the KNPP Technical Specifications which would allow the storage of reload fuel assemblies with enrichments up to 49.2 grams of U-235 per axial centimeter (4.75 w/o) in the new and spent fuel racks, and reload of such fuel in the reactor core, satifies applicable storage criteria and is acceptable. The maximum U-235 enrichment of reload fuel which can be placed in the fuel storage racks or in the core is specified in TS 5.3.a.3, and that TS has been modified accordingly. The specification of the maximum fuel enrichment in the reactor core section would allow reload of such fuel in the reactor core, but does not authorize operation with the higher enriched fuel. Actual plant operation using the higher enriched fuel must be demonstrated to be acceptable by a cycle-specific reload safety evaluation performed prior to each fuel loading.

3.0 ENVIRONMENTAL CONSIDERATION

Pursuant to 10 CFR 51.21, 51.32, and 51.35, an environmental assessment and finding of no significant impact has been prepared and published in the Federal Register on March 6, 1991 (56 FR 9371). Accordingly, based upon the environmental assessment, the Commission has determined that the issuance of this amendment will not have a significant effect on the quality of the human environment.

4.0 CONCLUSION

The staff published notice of this proposed action in the Federal Register on August 27, 1990 (55 FR 34385) and contacted the State of Wisconsin. No comments were received from the public or the State of Wisconsin.

The staff has 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.

Principal Contributor: L. Kopp

Dated: March 7, 1991