Docket No. 50-305

March 25, 1977

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Buchanan
RBaer

Wisconsin Public Service Corporation
ATTN: Mr. E. W. James
Senior Vice President
Post Office Box 1200
Green Bay, Wisconsin 54305

Gentlemen:

The Commission has issued the enclosed Amendment No. 16 to Facility Operating License No. DPR-43 for the Kewaunee Nuclear Power Plant. This amendment consists of changes to the Technical Specifications in response to your request dated December 10, 1976, as supplemented February 8, 1977.

The amendment revises the Technical Specifications to (1) incorporate the results of an ECCS reanalysis performed as a result of the Order for Modification of License dated August 27, 1976, (2) clarify Figure TS. 3.10-6 on operating limits for axial flux difference and (3) increase reactor coolant boron concentration during refueling.

Copies of the Safety Evaluation and Federal Register Notice are also enclosed.

Sincerely,

Original signed by

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

Enclosures:
1. Amendment No. 16 to DPR-43
2. Safety Evaluation
3. Federal Register Notice

cc w/enclosures:
See next page

Const. 1

GD

OFFICE	ORB#1	RS:OT	OELD	ORB#1	AD:OR
SURNAME	DNeighbors	RBaer	W.D. Paton	ASchwencer	RAClark Acting for KRGoller
DATE	3/11/77	3/ /77	3/21/77	3/23/77	3/25/77

27433:tsb 3/11

NRC FORM 318 (9-76) NRCM 0240 ☆ U.S. GOVERNMENT PRINTING OFFICE: 1976 — 626-624

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Mr. Donald L. Quistorff
Chairman Kewaunee County Board
Kewaunee County Courthouse
Kewaunee, Wisconsin 54216

Mr. Lester Huber
Chairman, Town of Carlton
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Kewaunee, Wisconsin 54216

Mr. Norman M. Clapp, Chairman
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Federal Activities Branch
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Chicago, Illinois 60604

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. 16
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 December 10, 1976, as supplemented February 8, 1976, 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 Appendices A and B, as revised through Amendment No. 16 , 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.

FOR THE NUCLEAR REGULATORY COMMISSION

Robert W. Reid Acting For

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

Date of Issuance: March 25, 1977

ATTACHMENT TO LICENSE AMENDMENT NO. 16

FACILITY OPERATING LICENSE NO. DPR-43

DOCKET NO. 50-305

Revise Appendix A as follows:

Remove the following pages:

3.3-1
3.8-1
3.10-1
3.10-9
3.10-11
3.10-13
Figure TS 3.10-2
Figure TS 3.10-6

Insert revised identically numbered pages.

3.3 ENGINEERED SAFETY FEATURES AND AUXILIARY SYSTEMS

Applicability

Applies to the operating status of Engineered Safety Features and Auxiliary Systems.

Objective

To define those limiting conditions for operation that are necessary: (1) to remove decay heat from the core in emergency or normal shutdown situations, and (2) to remove heat from containment in normal operating and emergency situations.

Specification

a. Safety Injection and Residual Heat Removal Systems

1. The reactor shall not be made critical unless the following conditions are satisfied, except for low-power physics tests and except as provided by Specification 3.3.a.2.

   A. The Refueling Water Storage Tank contains not less than 272,500 gal. of water with a boron concentration of at least 1950 ppm.

   B. Each accumulator is pressurized to at least 700 psig and contains at least 1250 ft^3 $\pm$25 ft^3 of water with a boron concentration of at least 1900 ppm, and is not isolated.

   C. TWO safety injection pumps are operable.*

   D. TWO residual heat removal pumps are operable.

   E. TWO residual heat exchangers are operable.

3.8 REFUELING

Applicability

Applies to operating limitations during refueling operations.

Objective

To ensure that no incident occurs during refueling operations that would affect public health and safety.

Specification

a. During refueling operations:

1. The equipment hatch and at least one door in each personnel air lock shall be closed. In addition, at least one isolation valve shall be operable or locked closed in each line, other than the fuel transfer tube, which penetrates the containment and which provides a direct path from containment atmosphere to the outside.

2. Radiation levels in fuel handling areas, the containment and the spent fuel storage pool shall be monitored continuously. High activity levels shall be cause for closing the normal vent path.

3. The reactor will be subcritical for 100 hours prior to movement of its irradiated fuel assemblies. Core subcritical neutron flux shall be continuously monitored by at least TWO neutron monitors, each with continuous visual indication in the control room and ONE with audible indication in the containment available whenever core geometry is being changed. When core geometry is not being changed at least ONE neutron flux monitor shall be in service.

4. At least ONE residual heat removal pump shall be operable.

5. During reactor vessel head removal and while loading and unloading fuel from the reactor, the minimum boron concentration of 2100 ppm shall be maintained in the Reactor Coolant System, and verified by sampling daily.

3.3 ENGINEERED SAFETY FEATURES AND AUXILIARY SYSTEMS

Applicability

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   A. The Refueling Water Storage Tank contains not less than 272,500 gal. of water with a boron concentration of at least 1950 ppm.

   B. Each accumulator is pressurized to at least 700 psig and contains at least 1250 ft^3 $\pm$25 ft^3 of water with a boron concentration of at least 1900 ppm, and is not isolated.

   C. TWO safety injection pumps are operable.*

   D. TWO residual heat removal pumps are operable.

   E. TWO residual heat exchangers are operable.

$F^N_{\Delta H}$, Nuclear Enthalpy Rise Hot Channel Factor, is defined as the ratio of the integral of linear power along the rod on which minimum DNBR occurs to the average rod power.

It should be noted that $F^N_{\Delta H}$ is based on an integral and is used as such in the DNB calculations. Local heat fluxes are obtained by using hot channel and adjacent channel explicit power shapes which take into account variations in horizontal (x-y) power shapes throughout the core. Thus the horizontal power shape at the point of maximum heat flux is not necessarily directly related to $F^N_{\Delta H}$.

An upper bound envelope of 2.25 times the normalized peaking factor axial dependence of Figure TS 3.10.2 has been determined from extensive analyses considering all operating maneuvers consistent with the technical specifications on power distribution control as given in Section 3.10. The results of the loss of coolant accident analyses based on this upper bound envelope indicate a peak clad temperature of 2172°F corresponding to a 28°F margin to the 2200°F limit.

When an F_Q measurement is taken, both experimental error and manufacturing tolerance must be allowed for. Five percent is the appropriate allowance for a full core map taken with the movable incore detector flux mapping system and three percent is the appropriate allowance for manufacturing tolerance.

In the specified limit of $F^N_{\Delta H}$ there is an 8% allowance for uncertainties[1] which means that normal operation of the core is expected to result in $F^N_{\Delta H} < 1.55/1.08$. The logic behind the larger uncertainty in this case is that (a) normal perturbations in the radial power shape (e.g. rod misalignment) affect $F^N_{\Delta H}$, in most cases without necessarily affecting F_Q, (b) the operator has a direct influence on F_Q through movement of rods, and can limit it to the desired value, he has no

The permitted relaxation in $F^N_{\Delta H}$ allows radial power shape changes with rod insertion to the insertion limits. It has been determined that provided the above conditions 1 through 4 are observed, these hot channel factors limits are met.

In specification 3.10.b.1 F_Q is arbitrarily limited for $P \leq 0.5$ (except for low power physics tests).

The specifications for axial power distribution control referred to above are designed to minimize the effects of xenon redistribution on the axial power distribution during load-follow maneuvers.

Conformance with specification 3.10.b.6 through 3.10.b.9 ensures the F_Q upper bound envelope of 2.25 times Figure TS 3.10-2 is not exceeded and xenon distributions are not developed which at a later time would cause greater local power peaking, even though the current flux difference is within the limits specified.

The target (or reference) value of flux difference is determined as follows. At any time that equilibrium xenon conditions have been established, the indicated flux difference is noted with part length rods withdrawn from the core and with the full length rod control rod bank more than 190 steps withdrawn (i.e., normal full power operating position appropriate for the time in life, usually withdrawn farther as burnup proceeds). This value, divided by the fraction of full power at which the core was operating is the full power value of the target flux difference. Values for all other core power levels are obtained by multiplying the full power value by the fractional power. Since the indicated equilibrium value was noted, no allowances for excore detector error are necessary and indicated deviation of ± 5% ΔI are permitted from the indicated reference value. During periods where extensive load following is required, it may be impractical to establish the required core conditions for measuring the target flux difference every month. For this reason, the specification provides two methods for updating the target flux difference. Figure TS 3.10-6 shows a typical construction of the target

distributions may be significantly changed and operation at 50% is required to protect against potentially more severe consequences of some accidents unless incore monitoring is initiated. Only when the target band is violated do the limits under specification 3.10.b.8.a apply.

As discussed above, the essence of the procedure is to maintain the xenon distribution in the core as close to the equilibrium full power condition as possible. This is accomplished, without part length rods, by using the boron system to position the full length control rods to produce the required indicated flux difference.

For Condition II events the core is protected from overpower and a minimum DNBR of 1.30 by an automatic protection system. Compliance with the specifications is assumed as a precondition for Condition II transients, however, operator error and equipment malfunctions are separately assumed to lead to the cause of the transients considered.

The radial power distribution within the core must satisfy the design values assumed for calculation of power capability. Radial power distributions are measured as part of the startup physics testing and are periodically measured at a monthly or greater frequency. These measurements are taken to assure that the radial power distribution with any quarter core radial power asymmetry conditions are consistent with the assumptions used in power capability analyses.

The quadrant tilt power deviation alarm is used to indicate a sudden or unexpected change from the radial power distribution mentioned above. The two percent tilt alarm setpoint represents a minimum practical value consistent with instrumentation errors and operating procedures. This symmetry level is sufficient to detect significant misalignment of control rods. Misalignment of control rods is

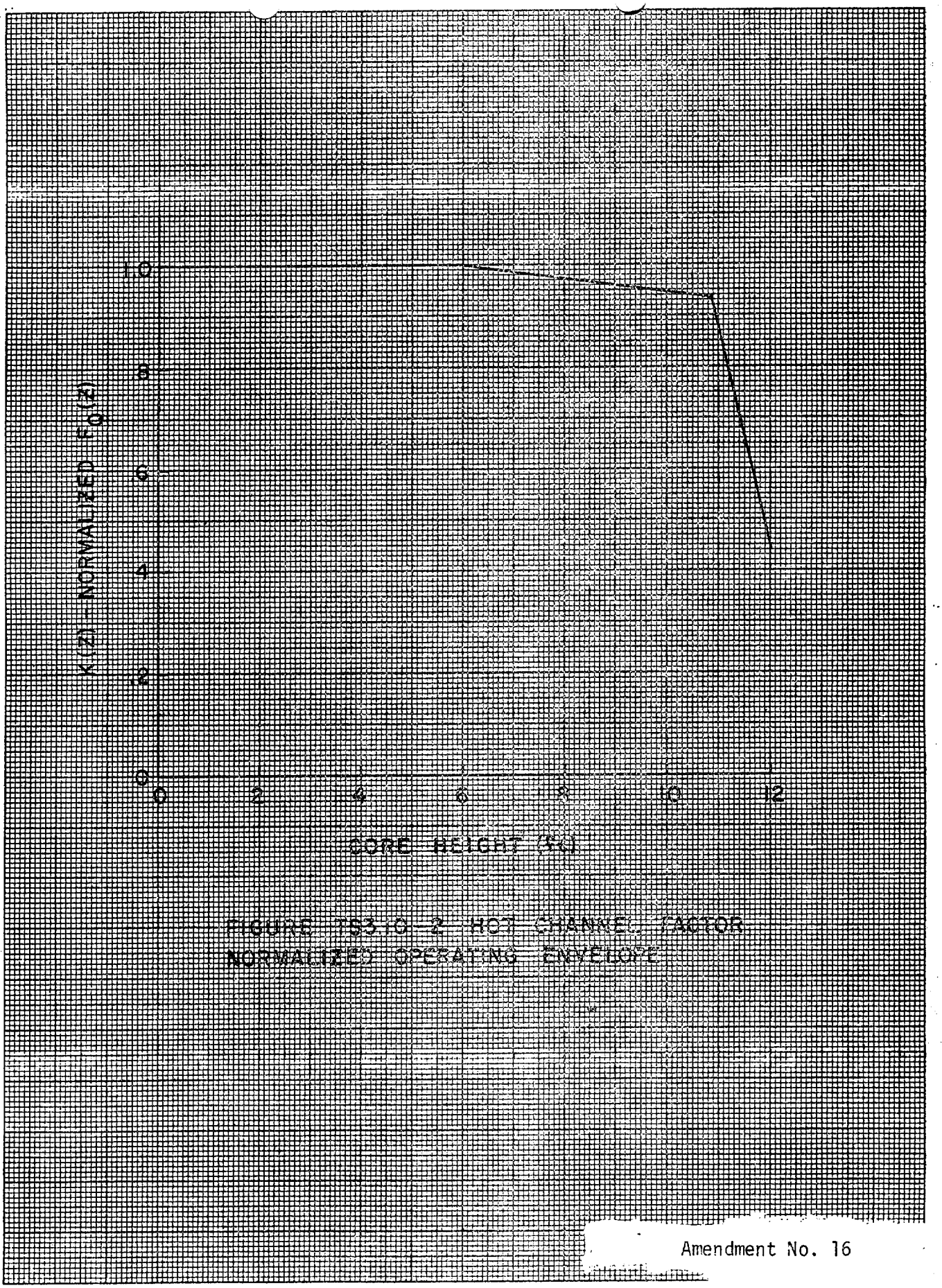

FIGURE TS3.10-2 HOT CHANNEL FACTOR NORMALIZED OPERATING ENVELOPE

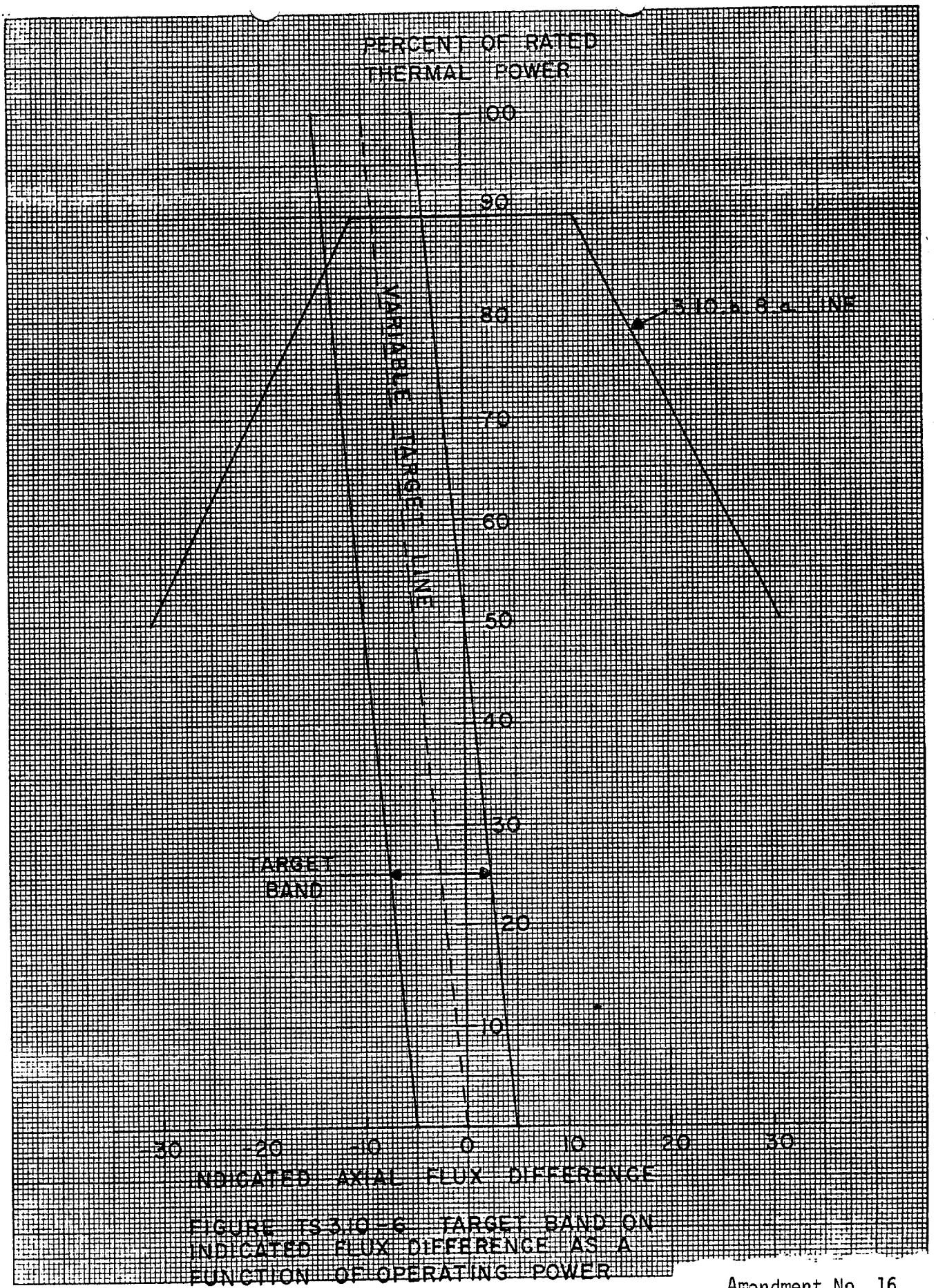

FIGURE TS 3.10-6 TARGET BAND ON INDICATED FLUX DIFFERENCE AS A FUNCTION OF OPERATING POWER LEVEL (TYPICAL)

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 16 TO FACILITY 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

Introduction

By letter dated December 10, 1976, and supplemented February 8, 1977, Wisconsin Public Service Corporation (WPSC) submitted an application for amendment of Facility Operating License No. DPR-43 for the Kewaunee Nuclear Power Plant. The amendment would change the Technical Specifications related to ECCS, operating limits for the axial flux difference, and boron concentration during reactor refueling.

Discussion

In support of its application for amendment WPSC submitted an ECCS analysis which was performed in response to our Order for Modification of License issued August 27, 1976.

The analysis was made using the October 1975 version of the Westinghouse ECCS Evaluation Model (References: 1,2,3 and 4); assuming an upper head fluid temperature equal to the reactor outlet (hot leg) fluid temperature. This analysis supersedes the previous one (Reference 5) which used the March 1975 version of the evaluation model and was based on the assumption that the upper head temperature was equal to the reactor inlet (cold leg) fluid temperature. The new ECCS analysis was required because recent experimental data had indicated that the actual temperature in the upper reactor vessel head for Westinghouse reactors was in the range of 50-75 percent of the difference between vessel inlet and outlet temperatures (Reference 6).

We therefore requested all licensees with Westinghouse reactors to reevaluate the ECCS performance with upper head fluid temperature equal to the fluid outlet temperature. By the August 27, 1976 Order, WPSC was required to operate Kewaunee with a reduced peaking factor (F_Q) of 2.11 until the new analysis was made and evaluated.

Based on reanalysis of the ECCS F_Q was increased to 2.25. This required modification of the hot channel factor normalized operating envelope (Fig. TS 3.10-3) and a change of the accumulator water volume. The two additional changes proposed by WPSC, but not related to the ECCS reanalysis, are an improved definition of the operating limits for the axial flux difference (Fig. TS 3.10-6) and a change in reactor coolant boron concentration during refueling operation.

Evaluation

The ECCS analysis provided by WPSC was for a double ended cold leg guillotine break (DECLG) with a discharge coefficient (C_D) of 0.4. WPSC claimed this as the limiting loss of coolant accident (LOCA) break with respect to peak clad temperature and local Zr-H_2O reaction. The input parameters used in the analysis are listed in Table 1 below:

TABLE 1

Core Power:	102 percent of rated power (1650 MWt) (Except for SATAN-VI blowdown hydraulic calculation which was based on 102 percent of 1722 MWt).
Peak Linear Power:	102 percent of 14.16 Kw/ft
Peaking Factor; F_Q:	2.25
Accumulator Volume:	1250 ft^3 $\pm$ 25 ft^3

To justify limiting the ECCS analysis to only one break size, WPSC relied upon Westinghouse topical report WCAP-8854 (Reference 7) which provided sensitivity studies for two loop (14x14) reactors and which already had NRC approval (Reference 8). Those studies presented a spectrum of LOCA breaks which demonstrated that the critical break corresponded to a DECLG with a C_D of 0.4. WPSC showed the analysis presented in WCAP-8854 to be fully applicable to Kewaunee (Reference 9), and concluded, therefore, that the break size analyzed (DECLG with a C_D of 0.4) was the critical break for Kewaunee. That break would result in a peak clad temperature of 2172°F, a maximum local Zr-H_2O reaction of 7 percent and a core wide Zr-H_2O reaction of less than 0.3 percent.

The modification of the hot channel factor normalized operating envelope is required because increased peaking factor affects the linear heat generation rate (LHGR) limits at all core elevations except for the upper part of the core where these limits are controlled by a small break LOCA. In this region the LHGR limits remain unchanged because the original small break LOCA analysis, performed with the peaking factor of 2.32, is still applicable. Upon normalization to the maximum LHGR value (licensed value), the third segment of the curve, corresponding to the small break LOCA, is slightly displaced and the intersection between the third and the second segment of the curve moves down the core elevation. This modification is illustrated in proposed Fig. TS 3.10-2.

Based on our review of the submitted documents (References 1 thru 9) we find that the results of the ECCS reanalysis, using the October, 1975 version of the Westinghouse Evaluation Model with an upper head temperature equal to the reactor outlet fluid temperature and with a peaking factor equal to 2.25, yield values for peak clad temperature and $Zr-H_2O$ reaction which are conservative relative to the 10 CFR 50.46 criteria. The change of the peaking factor value in the Technical Specifications to 2.25 is, therefore, justified. We conclude that this change is acceptable.

The modification to Figure 3.10-2 is acceptable because it reflects changes in the new ECCS analysis. Similarly, the changes in accumulator liquid volume to 1250 $\pm$ 25 ft is consistent with the new ECCS analysis input. We conclude that these changes are acceptable.

The revision to the flux difference curve (Fig. TS 3.10-6) consists of including an additional operating target band for the flux difference applicable when the reactor is operated at 90 percent of rated core power or less. This change is consistent with the power distribution control methodology developed by Westinghouse (Reference 10). Since this change provides additional clarification, we find it to be acceptable.

The proposed change from 2000 ppm boron to 2100 ppm boron concentration in the reactor coolant is necessary to assure the required 10 percent shutdown margin for fuel handling operations. The proposed change is in the conservative direction. We conclude that this change is acceptable.

Environmental Consideration

We have determined that the amendment does not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that the amendment involves

an action which is insignificant from the standpoint of environmental impact and pursuant to 10 CFR §51.5(d)(4) that an environmental impact statement or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of these amendments.

Conclusion

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

Date: March 25, 1977

References

1. WCAP-8339, "Westinghouse ECCS Evaluation Model - Summary, July, 1974.

2. WCAP-8471 (Proprietary), WCAP-8472 (Nonproprietary), "Westinghouse ECCS Evaluation Model - Supplementary Information", April, 1975.

3. WCAP-8622 (Proprietary), WCAP-8623 (Nonproprietary), "Westinghouse ECCS Evaluation Model - October, 1975 version", November, 1975.

4. Letter NS-CE-924, C. Eicheldinger (Westinghouse) to D. B. Vassallo (NRC), dated, January 23, 1976.

5. Wisconsin Public Service Corporation letter (E. W. James) to USNRC (R. A. Purple), dated July 8, 1976.

6. Letter NS-CE-1163, C. Eicheldinger (Westinghouse to V. Stello (NRC), dated August 13, 1976.

7. WCAP-8854, "Westinghouse ECCS - Two Loop Plant (14x14) Sensitivity Studies", September, 1976.

8. "USNRC Evaluation of Westinghouse Topical Reports on Effect of Upper Head Fluid Temperature on ECCS Performance," December 17, 1976.

9. Wisconsin Public Service Corporation (E. W. James) to USNRC (A. Schwencer), dated February 8, 1977.

10. WCAP-8385, "Topical Report-Power Distribution Control and Load Following Procedures", September, 1974.

UNITED STATES NUCLEAR REGULATORY COMMISSION

DOCKET NO. 50-305

WISCONSIN PUBLIC SERVICE CORPORATION

WISCONSIN POWER AND LIGHT COMPANY

MADISON GAS AND ELECTRIC COMPANY

NOTICE OF ISSUANCE OF AMENDMENT TO FACILITY OPERATING LICENSE

The U. S. Nuclear Regulatory Commission (the Commission) has issued Amendment No. 16 to Facility Operating License No. DPR-43, issued to Wisconsin Public Service Corporation, Wisconsin Power & Light Company, and Madison Gas & Electric Company (the licensees), which revised Technical Specifications for operation of the Kewaunee Nuclear Power Plant, located in Kewaunee County, Wisconsin. The amendment is effective as of its date of issuance.

The amendment revises the Technical Specifications to (1) incorporate the results of an ECCS reanalysis performed as a result of the Order for Modification of License dated August 27, 1976, (2) clarify Figure TS. 3.10-6 on operating limits for axial flux difference and (3) increase reactor coolant boron concentration during refueling.

The application for amendment complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations. The Commission has made appropriate findings as required by the Act and the Commission's rules and regulations in 10 CFR Chapter I, which are set forth in the license amendment. Notice of Proposed Issuance of Amendment to Facility

Operating License in connection with this action was published in the FEDERAL REGISTER on January 17, 1977 (42 FR 3226). No request for a hearing or petition for leave to intervene was filed following notice of the proposed action.

The Commission has determined that the issuance of this amendment will not result in any significant environmental impact and that pursuant to 10 CFR §51.5(d)(4) an environmental impact statement, or negative declaration and environmental impact appraisal need not be prepared in connection with issuance of this amendment.

For further details with respect to this action, see (1) the application for amendment dated December 10, 1976 as supplemented February 8, 1977, (2) Amendment No. 16 to License No. DPR-43, and (3) the Commission's related Safety Evaluation. 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 Kewaunee Public Library, 314 Milwaukee Street, Kewaunee, Wisconsin 54216. A copy of items (2) and (3) 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 25th day of March 1977.

FOR THE NUCLEAR REGULATORY COMMISSION

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