Docket No. 50-305 June 19, 1984

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Mr. C. W. Giesler, Vice President
Nuclear Power
Wisconsin Public Service Corporation
Post Office Box 1200
Green Bay, Wisconsin 54305

Dear Mr. Giesler:

The Commission has issued the enclosed Amendment No. 54 to Facility Operating License No. DPR-43 for the Kewaunee Nuclear Power Plant. The amendment consists of changes to the Technical Specifications in response to your application transmitted by letter dated December 14, 1983.

The amendment revises the Technical Specifications to change the burnup dependent total peaking factor. Specifically, the exposure range for which the total peaking factor is defined has been extended from 37 GWD/MT to 43 GWD/MT (peak rod).

A copy of the related Safety Evaluation is enclosed. A Notice of Issuance will be included in the Commission's next regular monthly Federal Register notice.

Sincerely,

/s/DNeighbors

Joseph D. Neighbors, Project Manager
Operating Reactors Branch #1
Division of Licensing

Enclosures:
1. Amendment No. 54 to DPR-43
2. Safety Evaluation

cc: w/enclosures
See next page

ORB#1:DL	ORB#1:DL	C-ORB#1:DL	OELD	AD:OR:DL
CParrish	JDNeighbors;ps	SVarga		GLainas
5/25/84	5/29/84	5/29/84	6/1/84	6/19/84

Telephone concurrence by Bordenick on 6/19/84 re: environmental consideration

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P PDR

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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 PLANT

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 54
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 licensee) dated December 14, 1983, 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 indicatd 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. 54 , are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

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

FOR THE NUCLEAR REGULATORY COMMISSION

Steven A. Varga, Chief
Operating Reactors Branch #1
Division of Licensing

Attachment:
Changes to the Technical
Specifications

Date of Issuance: June 19, 1984

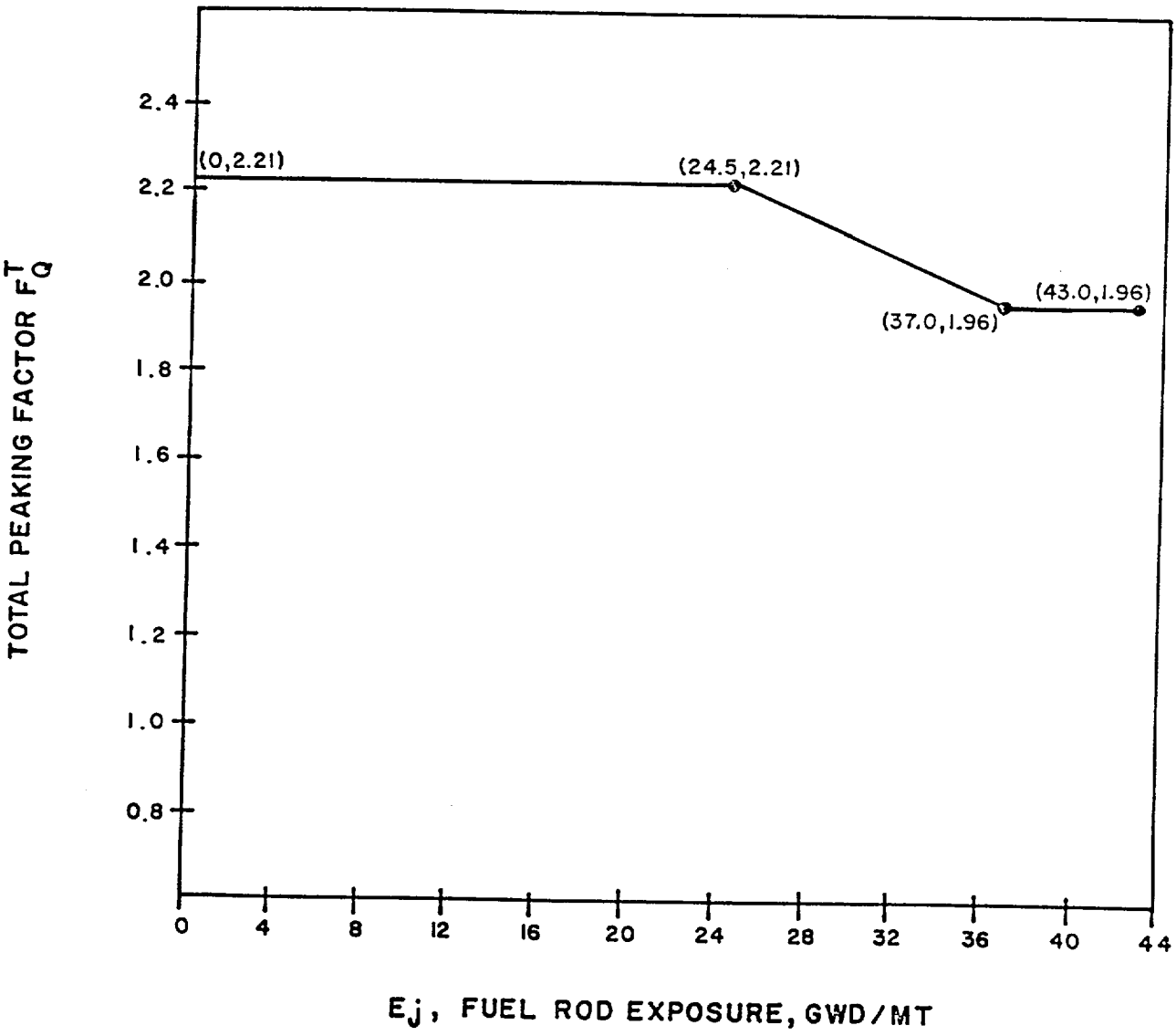
ATTACHMENT TO LICENSE AMENDMENT

AMENDMENT NO. 54 TO FACILITY OPERATING LICENSE NO. DPR-43

DOCKET NO. 50-305

Revise Appendix A as follows:

Remove Page	Insert Page
Figure 3.10-6	Figure 3.10-6



F_Q^T VERSUS ROD EXPOSURE: F_Q^T (E_j) FOR ENC FUEL
REFERENCE SPECIFICATIONS 3.10.b.1.a.(ii)

FIGURE TS 3.10-6

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 54 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

Introduction

In a letter dated December 14, 1983, Wisconsin Public Service Corporation (the licensee) requested an amendment to Facility Operating License No. DPR-43 which would revise the Kewaunee Nuclear Power Plant Technical Specifications. This change extends the burnup dependent total peaking factor, Fq^T, at a constant value of 1.96 from 37 GWD/MT to 43 GWD/MT (peak rod).

Evaluation

Earlier analyses by Exxon Nuclear Company, which established the Technical Specification for an exposure dependent Fq^T, were performed for a design burnup of 37,000 MWD/MTU. Consequently the burnup of Exxon fuel rods was implicitly limited to 37,000 MWD/MTU. To extend the burnup limit, the licensee has provided an Exxon analysis examining the thermal hydraulic design, plant transient analyses, fuel mechanical design, and the LOCA ECCS calculations.

The proposed amendment does not result in any configuration changes in the fuel assembly, therefore previously approved thermal hydrualic analyses remain valid. The proposed amendment does not remove the neutronic parameters from within the bounds used in the existing plant transient analyses, so that no plant transients need to be reanalyzed.

The fuel mechanical design was reanalyzed at a peak rod exposure of 43 GWD/MTU. All the design limits meet applicable criteria and thus support a peak rod exposure to 43 GWD/MTU. The prediction that creep collapse will not occur is based upon a model which is discussed below.

Evaluation of Proposed ENC Creep Collapse Criterion

Part of any safety analysis for fuel rod operation in a commercial reactor is the concern that the cladding, as it creeps inward due to the difference between the reactor coolant pressure and the internal fuel rod pressure, will collapse into a pre-existing axial gap along the fuel column. The axial gap can be formed as the fuel column length decreases due to fuel densification at the same time as a pellet somewhere in the fuel pellet column "hangs up", i.e., becomes stuck in one axial position and cannot move downward as the fuel column below densifies and shortens.

Past creep collapse analyses have required that no collapse occurs during the irradiation life of a fuel rod with the assumption that the fuel rod is a tube of infinite length with no fuel pellets to prevent its collapse. Past creep collapse analyses have also assumed that an axial gap exists in all fuel rods within a reactor core that is large enough to allow cladding to collapse. Obviously, these are conservative assumptions. They were initiated by NRC at a time when fuel densification, pellet hang up and creep collapse were not well understood (Ref. 1).

The licensee has proposed a new criterion for analyzing creep collapse which relies on the elimination of axial gap formation as a viable mechanism (Ref. 2). This is accomplished by demonstrating that pellet hang-up will not occur early in life due to fuel-clad gap closure when fuel densification is still active. Fuel-clad gap closure later in life is not a concern since fuel densification is complete and thus no mechanism exists for axial gap formation in ENC designed fuel. This proposed criterion will be referred to as the "Proposed" method.

The two areas of review of the "Proposed" method were:

(1) the likelihood of pellet hang up due to mechanisms other than fuel-clad gap closure, e.g., pellet chips and pellet cocking, and

(2) the adequacy of the "Proposed" method of predicting pellet hang-up and the margin of conservatism in this method.

The first area of concern, pellet hang-up due to pellet chips and pellet cocking, has been addressed by ENC through the examination of several hundred fuel rods (Ref. 3). ENC has examined 434 BWR fuel rods by axial gamma scanning and found only nine rods with relatively small axial gaps (< 0.145 inches). These gaps were attributed to thermal differences between the hot and cold conditions and were not believed to exist in the hot condition, nor were these gaps found to be permanent. ENC has also examined 4,690 PWR fuel rods visually for crud pattern irregularities with assembly burnups ranging from 7 MWd/kgM to 46 MWd/kgM. ENC has demonstrated that irregularities in crud patterns can be associated with axial gap formations with a detection limit of at least 0.4 inches. No such crud pattern irregularities were observed in the 4,690 PWR rods examined. It should be noted that definitive crud patterns in PWR fuel rods do not form until two cycles of operation or longer. However, even if it is assumed that only one-third of the rods examined have definitive crud patterns, it can be concluded that approximately 1500 fuel rods have not shown axial gap formation, by examination of crud patterns, at a detection limit significantly below that necessary for cladding collapse. Consequently, through the examination of at least 2,000 ENC fuel rods, ENC has found no axial gaps near the size necessary for creep collapse and no evidence of permanent pellet hang-up and axial gap formation due to pellet chips and/or cocking. The lack of axial gap formation in ENC designed fuel can be attributed to the relatively stable fuel and prepressurized design used by ENC for PWR rods.

The second area of concern, the adequacy of the "Proposed" method and the margin of conservatism, has been addressed by ENC in two ways. The first is by comparison against data from fuel rods irradiated in the Ginna reactor, some of which experienced in-reactor creep collapse. The "Proposed" method for creep collapse (Ref.2) predicted gap closure early-in-life, indicating that creep collapse was likely for these rods. This comparison has indicated that the "Proposed" method is at least best estimate in nature but it has not provided a measure of the conservatism that exists in this metnodology. The measure of conservatism is also not apparent by close examination of the elements that exist in the "Proposed" method, because it cannot be

easily related to the hot fuel-clad gap conditions that exist in reactors. In order to provide a measure of conservatism, ENC has provided a more mechanistic method of predicting in-reactor hot gap closure to serve as a standard for comparison against the "Proposed" method (Ref. 4). ENC has labeled the mechanistic method as "Best Estimate"; however, this is misleading, because conservatism has been introduced in the input values and the calculational models to provide a conservative bound on the calculated gap closure. This "Best Estimate" method has been reviewed and found to have an appropriate margin of conservatism for calculating gap closure and thus pellet hang-up. The "Best Estimate" method has predicted pellet hang-up and axial gap formation for the Ginna Rods. Also, comparison of the "Best Estimate" and the "Proposed" methods to a variety of ENC designs has indicated that the latter will predict pellet hang-up and thus creep collapse before the "Best Estimate" method. Consequently, the "Proposed" method is the more conservative of the two methods and because the "Best Estimate" method has been judged to have an appropriate margin of conservatism, the "Proposed" method is also judged to have an appropriate margin of conservatism.

In summary, the above ENC methodology for determining creep collapse is acceptable based on (1) ENC's examination of several hundred ENC fuel rods with no evidence of permanent axial gaps in the fuel column stacks due to early-in-life pellet hang up, and (2) an appropriate margin of conservatism in the "Proposed" method.

The analysis of the creep collapse of the Westinghouse fuel in Kewaunee is based on Westinghouse analytical methods which have been previously approved.

The licensee has provided an analysis justifying that the LOCA ECCS calculations support extension of the exposure to 43.0 GWD/MTU, with Fq^T constant at a 1.96 value from 37.0 to 43.0 GWD/MTU. We have reviewed this analysis and find it satisfactory.

The techincal information submitted states that a peak rod exposure of 43 GWD/MT corresponds to 35 GWD/MT batch average burnup. The value is below the generic limit of 38 GWD/MT batch at discharge found by the NRC to be acceptable for radiological consequences of accidents. The

technical evaluation states that other parameters of importance in the radiological evaluation of accidents remain unchanged. Therefore, the conclusions of previous Safety Evaluation Reports also remain unchanged and operation of the plant with the new burnup limit is acceptable.

Based on the above evaluation, we conclude that the proposed Technical Specification is acceptable.

Environmental Consideration

This amendment involves a change in the installation or use of a facility component located within the restricted area. The staff has determined that the amendment involves no significant increase in the amounts of any effluents that may be released offsite and that there is no significant increase in individual or cumulative occupation radiation exposure. The Commission has previously issued a proposed finding that this amendment involves no significant hazards consideration and there has been no public comment on such finding. Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR Sec 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

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: June 19, 1984

Principal Contributor:

Marvin Dunenfeld

References

1. Technical Report on Densification of Light Water Reactor Fuels, Regulatory Staff, USAEC, November 14, 1972.

2. M. J. Ades, et al. 1982. Qualification of Exxon Nuclear Fuel for Extended Burnup, XN-NF-82-06 (P) Revision 1.

3. Letter, R. A. Copeland (ENC) to R. Lobel (NRC), Subject: Response to Question on Creep Collapse Criterion, dated March 15, 1984.

4. Letter, J. C. Chandler (ENC) to Dr. C. O. Thomas (NRC), Subject: XN-NF-82-06 (P), "Qualification of Exxon Nuclear Fuel for Extended Burnup," dated April 16, 1984.