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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 58 TO LICENSE NO. DPR-20

CONSUMERS POWER COMPANY

PALISADES PLANT

DOCKET NO. 50-255

1.0 INTRODUCTION AND DISCUSSION

By letter dated May 14, 1980 (Reference 1) Consumer's Power Company (CPCo), (the licensee) requested an amendment to Appendix A of the Provisional Operating License No. DPR-20 for the Palisades Plant. This is the third in a series of related requests, pertaining to the peaking factors of the Cycle-4 H-design loading. CPCo was requested by letter from D. Ziemann (NRC) to D. Bixel dated July 11, 1979 (Reference 2), to submit information which would provide assurance that water hole peaking is appropriately considered in the calculation of flux distributions. CPCo's replies dated September 10, 1979 and February 26, 1980 (letters D. Hoffman CPCo to D. Ziemann NRC, References 3 and 4 respectively) dealt with the calculational procedure used to compute water hole peaking. CPCo by letter dated February 26, 1980 submitted information supporting the addition of the "Total Interior Rod Radial Peaking Factor F_r^{AH}". The licensee considered it appropriate to impose a limit on the product of total radial peaking factor times the interior pin local peaking factor to assure that the assumptions in the DNB analysis remain valid in all cases. This proposed addition has been reviewed and accepted by the NRC staff (Reference 5).

The current request (Reference 1) concerns a change of the Palisades Plant Technical Specifications to increase the limit of the Total Radial Peaking Factor F_r^T for Type H fuel assembly rods adjacent to the wide water gap from 1.77 (1.0 + 0.5 (1-P)) to 1.90 (1.0 + 0.5 (1-P)) where P is the core thermal power in fraction of core rated thermal power (2530 Mwt). This increase is only for the Cycle 4 loading and will allow operation at full power for the total fuel cycle, whereas operation under the present Technical Specifications will result in plant operation derated by 12% power for part of this cycle.

2.0 EVALUATION

We reviewed the above submittals by the licensee and required additional information. We held a meeting with the licensee on June 5, 1980 and indicated the additional information needed. The licensee responded with letters dated June 6, 1980 (References 6 and 9). The following sections give a summary of our evaluation.

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2.1 CORE PHYSICS

Reference 6 provided information pertaining to the physics methods used to compute the peaking factors. This analysis included a comparison of computed peaking factors for the Palisades H-design fuel peaking factors with PDQ-4 group and XMC, a Monte Carlo code, and a comparison in a similar geometric arrangement of the XMC code, diffusion method, with experimental gamma scan results. These methods were found applicable and acceptable for this review.

Analysis of the H-design fuel indicates that the maximum allowable heat generation rate limit of 15.28 kW/ft is the same as previously established in the Exxon Nuclear Company E&G designs. Likewise the radial peaking factor of 1.45 remains unchanged. The proposed increase from 1.22 to 1.31 is for the corner wide gap edge rod local peaking factor. Hence, the proposed Technical Specification 3.10.3(g) limit for F_r^I, the total radial peaking factor, is: 1.31 x 1.77/1.22 = 1.90. The licensee's analysis indicates that the DNBR limit remains the same.

The proposed modification of the Technical Specification 3.11.g which refers to lowering the reactor power in case the limit defined by 3.10.3(g) is found to be exceeding, is of the form: $(1-2\,(\frac{1}{x}-1))P$ where x is the ratio of the peaking factor limit defined in 3.10.3(g) to the peaking factor in excess of the same limit. In the old specification, the power would be lowered within six hours to a power level of x · 2530 MWt. In the new specification the power will be lowered to $(1-2\,(\frac{1}{x}-1))\cdot P$ MWt within one hour. If we write $x = 1-\Delta x$ the new expression can be written as:

$$(1-2(\frac{1}{1-\Delta x} - 1)) \simeq 1-2(1+\Delta x-1) = 1-2\Delta x$$

which is a more conservative value. In summary, the proposed Technical Specification changes have (a) been based on an acceptable calculational method, (b) do not affect the DNBR limit, and (c) the 3.11(g) results in a more conservative power level in shorter time, and they are found to be acceptable.

2.2 THERMAL-HYDRAULIC DESIGN AND TRANSIENT ANALYSES

The licensee's thermal hydraulic analysis for Cycle 4 reload using H-type fuel (Reference 8,9) with increased local peaking for the wide gap edge rods shows that the minimum departure from nucleate boiling ratio (MDNBR) is not less than the design criterion value of $\geq$ 1.30 when calculated using the W-3 correlation at the design overpower condition or for the most limiting anticipated operational occurrence (four pump coast down). The steady state overpower calculations were performed at 2910 MWt (115% rated power). The analysis of the limiting transient was performed from an initial power of 2580.6 MWt (102% of rated power). The active core flow rated used in the analysis was found to correspond to the Technical Specification limit. The analysis was performed using previously approved methods and the results meet the approved thermal-hydraulic design criteria.

A comparison of analysis results for Cycle 4 versus Cycle 3 is provided in Table 2.1. It can be seen that the results are essentially unchanged since the total peaking factor (F_Q) is unchanged by the increased local peaking value of the wide gap edge rods in the Type H fuel. The staff concludes that the thermal hydraulic design of the Cycle 4 reload using Type H fuel is acceptable.

2.3 ECCS ANALYSIS

The results of a partial ECCS reanalysis to account for Type H fuel was presented by the licensee in Reference 1. The reanalysis involved only the hot channel and hot pin calculations for the limiting break. It was not necessary to repeat the hydraulic analyses since the changes to Type H fuel would not have a substantive hydraulic effect. An axial shape sensitivity study was also performed. The change in peak clad temperature between the Type G fuel and the Type H fuel with the changed peaking factor is insignificant. We find the ECCS results and methodology acceptable.

3.0 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 this amendment.

4.0 CONCLUSION

We have concluded, based on the considerations discussed above, that: (1) because the amendment does not involve a significant increase in the probability or consequences of accident previously considered and does not involve a significant decrease in a safety margin, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Date: June 6, 1980

REFERENCES

1. Letter, D. P. Hoffman CPCo to D. L. Ziemann, NRC dated May 14, 1980 transmitting application for amendment to Provisional Operating License DPR-20.

2. Letter, D. L. Ziemann, NRC, to D. Bixel, CPCo, dated July 11, 1979.

3. Letter, D. P. Hoffman, CPCo to D. L. Ziemann, NRC, dated September 10, 1979.

4. Letter, D. P. Hoffman, CPCo, to D. L. Ziemann, NRC, dated February 26, 1980.

5. Amendment 57 to Provisional Operating License DPR-20 for the Palisades Plant dated June 6, 1980 and the supporting Safety Evaluation Report.

6. Letter, D. P. Hoffman, CPCo, to D. Crutchfield, NRC, dated June 6, 1980.

7. Exxon Nuclear Methodology for Boiling Water Reactors Volume 1, Neutronics Methods for Design and Analysis. XN-NF-80-19(8), May 1980.

8. Exxon Nuclear Company, "ECCS and Thermal-Hydraulic Analysis for the Palisades Reload H Design." XN-NF-80-18, April 1980.

9. Letter, D. P. Hoffman, CPCo, to D. Crutchfield, NRC, dated June 6, 1980.

Table 2.1

DNB Analysis

Comparison of Cycle 4 and Cycle 3

	Cycle 3	Cycle 4
Nominal Core Power (MWt)	2530	2530
Design Overpower (MWt)	2910	2910
Total Vessel Flow Rate (10^6 lb m/hr)	120.2	120.2
Active Core Flow Rate (10^6 lb m/hr)	113.0	113.0
Core Inlet Temperature (°F)	542.5	542.5
Core Pressure (psia)	2010	2010
Core Pressure Drop (psi)	13.2 ± 0.5	13.2 ± 0.5
Fuel Bundles in Core	204	204
Core Average Linear Heating Rate (kW/ft) at 2530 MWt	5.37	5.37
Fraction of Heat Generated in Fuel	0.975	0.975
Total Peaking Factor (F_Q)	2.76	2.76
MDNBR (at design overpower)	1.309	1.305
Hot Bundle Flow Factor	0.98	0.97
MDNBR (worst anticipated transient*)	1.43	1.45

*four pump coastdown