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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REVISED LOCA ANALYSIS FOR THE PALISADES PLANT

1.0 Introduction

In Reference 1, the licensee stated that as a result of additional steam generator tube plugging during the current outage, the number of steam generator tubes plugged would exceed the number assumed in the plant LOCA analysis. Thus, as required by the safety evaluation in support of Amendment 31 to the Palisades Operating License, revised LOCA analysis would be submitted for staff review and approval prior to resumption of operation. The revised LOCA analysis, documented in Reference 2, increases the number of plugged steam generator tubes from the current license base of 4175 tubes to 5000 tubes. The revised analysis was submitted by the licensee via Reference 3. Our evaluation of the analysis follows.

It should be noted that within Reference 2, analyses are presented which evaluate the effect of increased core inlet temperature and increased pressurizer pressure. These analyses are not the subject of this SER as changes in inlet temperature and pressurizer pressure are not being implemented at the Palisades Plant.

2.0 Evaluation

In Reference 2, the licensee provided a revised LOCA analysis for the limiting case break assuming 5000 total plugged steam generator tubes. The break analyzed was a double-ended guillotine break in the pump discharge piping with a discharge coefficient of 0.6. Previous large

break spectrum analyses, reported in Reference 4, have identified this case as yielding the highest peak cladding temperature (PCT).

The analysis was performed using the ENC WREM-II PWR Evaluation Model (References 5, 6, and 7). This model was approved by the staff, in References 8 and 9, as meeting the requirements of Appendix K to 10 CFR 50.

The analyses were performed for the ENC reload batch E fuel design with an assumed axial power shape peaked at 0.6 of core height. A linear heat generation rate (LHGR) of 15.28 kw/ft was used. The LHGR corresponds to a total peaking of 2.76 with a radial peaking of 1.45 and a local bundle peaking of 1.224. These values are consistent with those used in previous LOCA analyses, (Reference 10).

Using the 5000 plugged steam generator tubes, a PCT of 2106°F was calculated for the limiting break. This PCT is only 25°F higher than that obtained in the previous analysis (Reference 10) using 4175 plugged tubes. Local oxidation was calculated to be less than 17% and whole-core metal-water reaction was less than 1%. Thus, the analysis demonstrates that the Palisades Plant, with up to 5000 plugged tubes, satisfies the requirements of 10 CFR 50.46.

During our review, we noted that the cladding swelling and rupture models of NUREG-0630 are not a part of the ENC WREM-II PWR Evaluation Model. However, analyses submitted by the licensee in reference 12 shows that the ENC WREM-II model predicts conservative peak cladding

temperatures for the Palisades Plant relative to the values obtained using the NUREG-0630 models. The staff approved these analyses in Reference 13. Thus, we find that the ENC WREM-II model is wholly in compliance with Appendix K for the Palisades Plant.

The current core configuration for Palisades consists of ENC reload batches H, I, and J. These batches are all of the same rod design. However, the batch E fuel, which was used for this analysis, is of a slightly different design. Analyses in References 10 and 14, at BOL conditions, show PCTs of 2081°F and 2057°F for the batch E and batch H/I/J design, respectively. Thus, use of the batch E fuel design for this analysis is conservative.

3.0 Conclusion

Based upon the foregoing, we conclude that the Palisades Plant, with up to 5000 total steam generator tubes plugged, is in compliance with 10 CFR 50.46. Therefore, the requirement, in the safety evaluation in support of Amendment 31 of the Palisades Operating License, to resubmit the LOCA analysis for NRC approval has been satisfied.

While we have concluded that the LOCA analysis is acceptable, we note that the licensee has provided no information on the impact of increased tube plugging on other postulated plant transients and accidents. The licensee should evaluate the impact of increased tube plugging on other postulated plant transients and accidents prior to plant operation with more than 4175 plugged tubes.

References

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13. Letter, D. M. Crutchfield (NRC) to D. P. Hoffman (CPCo), "ECCS Clad Swelling and Rupture (Task No. B-47) - Palisades Plant and Big Rock Point," September 11, 1980

14. "Palisades Cycle 5 Reload Fuel Safety Analysis Report," XN-NF-81-34(P), Exxon Nuclear Company, May 1981

4.0 Acknowledgement

This safety evaluation was prepared by R. Jones.

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