UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

DUKE POWER COMPANY

MCGUIRE NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-369 AND 50-370

CATAWBA NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-413 AND 50-414

1.0 INTRODUCTION

By letters dated October 13, 1995 (Reference 1) and December 4, 1995 (Reference 2), as supplemented by letters dated April 26, 1996 (Reference 3) and September 5, 1996 (Reference 4), Duke Power Company (DPC or the licensee) requested the use of the BWU-Z critical heat flux (CHF) correlation for analyses of the McGuire and Catawba reactor cores, which consist of a full core of Mark-BW 17x17 type fuel assemblies.

2.0 DISCUSSION/EVALUATION

The licensee submitted Appendix C to DPC-NE-2005P-A to support plant-specific applications to the reload analyses for the McGuire and Catawba plants. Specifically, Appendix C contains the plant-specific data and limits with Mark-BW 17x17 type fuel using the BWU-Z form of the BWU CHF correlation, the VIPRE-01 thermal-hydraulic computer code (Reference 6), and Duke Power Company thermal-hydraulic (T-H) statistical core design (SCD) methodology (Reference 7). The licensee stated that the BWU-Z form of the BWU correlation used in the analyses for the McGuire and Catawba units is exactly the same as the correlation used in BAW-10199P (Reference 5).

In addition, the licensee used the approved method as described in Reference 7 regarding the statepoint propagation. In its calculation of the statistical limit, the licensee increased the number of cases from 3,000 to 5,000 per statepoint. The licensee stated that increasing the number of cases provided higher confidence of defining the bounding behavior and reducing the multipliers. The 5,000-case number was selected due to a balance between computer resources required for the calculation and the reduction in statistical uncertainty to determine a conservative Statistical Design Limit (SDL).

The maximum statepoint statistical value for departure from nucleate boiling ratio (DNBR) for the 5,000-case propagation is given in Table C-4 of Reference 3. This table also contains the values where case propagation is

less than the 5,000-case propagation. The 5,000-case value will be used in analyses with the BWU-Z form of the BWU CHF correlation for Mark-BW 17x17 type fuel at McGuire and Catawba.

The statistical design limit given in Table C-4 is applicable to this analysis only when all statepoint parameters fall within the McGuire/Catawba key parameter ranges given in Table C-5 of Reference 3.

DPC has also used the VIPRE-01 thermal-hydraulic computer code (Reference 6) to calculate the measured-to-predicted (M/P) CHF ratios with respect to mass velocity, pressure, or thermodynamic quality. The results show that the average M/P value and the data standard deviation are within 1% of the values reported in BWU CHF correlation (Reference 5).

A comparison between the BWU-Z ranges of applicability for Mark-BW 17x17 type fuel database given in Table 4-1 of Reference 5 and the parameter ranges provided in Table C-1 of Reference 3 shows a 0.01 difference in design limit DNBR using the LYNX and the VIPRE-01 code (1.19 design limit DNBR resulted from the LYNX code versus 1.18 design limit DNBR resulted from VIPRE-01 code). However, DPC will use the larger of the two non-statistical correlation limits.

The staff reviewed the submitals provided by DPC (Reference 1 through Reference 4), and found that the proposed use of BWU-Z CHF correlation is acceptable for use at the McGuire and Catawba plants. This conclusion is based on core analyses that (1) both plants have a full homogeneous core of Mark-BW 17 x 17 type fuel assemblies for upcoming reloads, (2) NRC-approved methodologies (T-H SCD, VIPRE-01, and BWU-Z CHF) are used, (3) the larger of the two correlation limits (VIPRE-01 or LYNX) will be used for non-SCD analyses, and (4) the conservative result from the 5,000-case propagation will be used for SCD analyses.

3.0 CONCLUSION

Based on the above discussions, the staff concludes that the proposed use of BWU-Z critical heat flux correlation for McGuire Nuclear Station, Units 1 and 2, and Catawba Nuclear Station, Units 1 and 2, acceptable.

4.0 REFERENCES

1. Letter from M. S. Tuckman to USNRC requesting review the use of the BWU-Z critical heat flux correlation, dated October 13, 1995.

2. Letter from M. S. Tuckman to USNRC discussing Duke Power Company intent to use of the BWU-Z critical heat flux correlation, dated December 4, 1995.

3. Letter from M. S. Tuckman to USNRC submitting the Appendix to DPC-NE-2005P-A, "McGuire/Catawba Plant Specific Data, Mark-BW Fuel BWU-Z Critical Heat Flux Correlation," dated April 26, 1996.

4. Letter from M. S. Tuckman to USNRC responding to the USNRC's Request for Additional Information regarding Appendix C to DPC-NE-2005P-A, dated September 5, 1996.

5. BAW-10199P, The BWU Critical Heat Flux Correlations, BWFC, November 1994 (Approved by letter from R. C. Jones to J. H. Taylor, dated April 5, 1996).

6. DPC-NE-2004P-A, Duke Power Company McGuire and Catawba Nuclear Stations Core Thermal-Hydraulic Methodology Using VIPRE-01, December 1991.

7. DPC-NE-2005P-A, Duke Power Company Thermal-Hydraulic Statistical Core Design Methodology, February 1995.

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