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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION RELATING TO TOPICAL REPORT BAW-10174, REVISION 1 MARK-BW RELOAD LOCA ANALYSIS FOR CATAWBA AND MCGUIRE UNITS DUKE POWER COMPANY CATAWBA NUCLEAR STATION AND MCGUIRE NUCLEAR STATION DOCKET NOS. 50-413, 50-414, 50-369, 50-370

1.0 INTRODUCTION

Babcock & Wilcox Fuel Company (BWFC) will supply reload fuel to the Duke Power Company Catawba and McGuire units beginning in 1991. To support operation of the Catawba and McGuire Units with BWFC fuel, loss-of-coola t accident (LOCA) analyses for Catawba and McGuire were performed with the BWFC LOCA Evaluation Model (EM) described in the BWFC topical report, "B&W Loss-of-Coolant Accident Evaluation Model for Recirculating Steam Generator Plants," BAW-10168P, Revision 1, September 1989, and approved in the NRC staff safety evaluation report (SER) dated January 22, 1991. The adaptation of this generic model for the analyses of the Catawba and McGuire plants is described in the topical report, "Mark-BW Reload LOCA Analysis for the Catawba and McGuire Units," BAW-10174, September 1989. By letters dated March 27, 1990, June 7, 1990, July 25, 1990, August 8, 1990, November 7, 1990, and December 4, 1990 (BAW-10174, Revision 1, November 1990), the licensee provided information to clarify and supplement BAW-10174. This safety evaluation report addresses BAW-10174, Revision 1, which includes, supplements, and supersedes the original BAW-10174 document.

2.0 STAFF EVALUATION

The staff performed its evaluation of the LOCA analyses described in BAW-10174, Revision 1 with the technical assistance of the Idaho National Engineering Laboratory (INEL). The evaluation and findings are described in detail in the

INEL technical evaluation report (TER) which is enclosed as a part of this report.

2.1 Analysis Methodology Applicability to Catawba and McGuire

The methodology used to perform the Catawba and McGuire large-break LOCA analyses is described in BAW-10168, Revision 1 as approved with conditions as identified in the staff SERs of January 22, 1991, May 19, 1989, April 18, 1990, and August 13, 1990. Applicability of the BAW-10168, Revision 1 methodology as adapted for Catawba and McGuire was justified by the licensee as discussed in the enclosed TER, Sections 2.1 through 2.5. The TER concluded that the Catawba and McGuire LOCA analyses were performed using NRC-approved methods and computer programs, and that this use conformed to NRC conditions of approval. The staff concurs with these findings stated in TER, Section 2.6.

2.2 Sensitivity Studies and Spectrum Analyses (B&W Analyses)

Duke Power Company provided a number of sensitivity studies and a break spectrum analysis to justify the initial and boundary conditions and break size used in the LOCA limits analysis. The studies covered the accumulator configuration, break spectrum analysis, break type (double-ended or split break), and the maximum versus minimum ECCS study. These are discussed in the enclosed TER, Section 3.

As a result of the studies performed, the following boundary conditions were chosen for the LOCA limits analysis: Catawba accumulator configuration, guillotine break with discharge coefficient of 1.0, and the maximum ECCS flow. The TER concluded that the conditions chosen are appropriate for use in the Duke Power Company LOCA limits analysis based on the fact that the conditions that resulted in the highest PCT were chosen. The staff concurs with this TER finding.

2.3 Results of LOCA Analyses

2.3.1 Large-Break LOCA (B&W)

The licensee provided analyses and other information to address the performance requirements of 10 CFR 50.46(b). Analyses which were provided assumed a burnup and elevation-dependent total peaking factor (F_q) with a peak value of 2.32. The calculated peak cladding temperature assuming the above peaking factor and limiting conditions discussed in Section 2.2 is 1945°F for B&W fuel, with a corresponding maximum local oxidation of 4.9 percent, and total core-wide oxidation of 0.55 percent. These values are within the performance requirements of 10 CFR 50.46(b)(1), (2), and (3) of 2200°F, 17 percent, and 1 percent, respectively. The licensee also addressed 10 CFR 50.46(b)(4) and (5) regarding maintenance of coolable geometry and long term cooling. The enclosed TER discusses these considerations in TER Section 4.1 and concludes that the large-break LOCA analyses for B&W fuel are in conformance with the requirements of 10 CFR 50.46(b). The staff concurs with this finding.

2.3.2 Large-Break LOCA (Westinghouse)

The LOCA analyses of record for Catawba and McGuire indicate that the calculated peak cladding temperatures for Catawba and McGuire are 1704°F and 1841°F, respectively. These values are lower than the PCT for B&W fuel.

2.3.3 Small-Break LOCA

The licensee provided information and qualitative analyses to show that the B&W fuel peak cladding temperature (PCT) response to a small-break LOCA would be similar to the response of Westinghouse fuel. The licensee's analyses indicate that the small-break LOCA PCT spectrum is bounded by the large-break LOCA spectrum for both Westinghouse and B&W fuel. Small-break LOCAs are discussed in Section 4.2 of the attached TER. The TER concludes that small-break LOCAs are not limiting for Catawba and McGuire. We concur with the TER findings.

2.3.4 Mixed Core LOCA Effects

The licensee provided information and qualitative analyses which indicate that the large-break LOCA analysis for a core composed entirely of B&W fuel bounds analyses for any mixed core combination of B&W and Westinghouse fuels. This is discussed in Section 4.3 of the enclosed TER. The TER concludes that the licensee's results are acceptable. The staff concurs with this TER finding. However, the staff limits this concurrence as applicable only to the specific types of B&W (Mark-BW) and Westinghouse fuel (OFA) addressed in the analyses because other vendor fuel series may have different thermal-hydraulic characteristics.

2.4 Conditions of Acceptance Identified in TER

The enclosed TER identifies two conditions of acceptance among its conclusions in TER Section 5. These will be satisfied by Catawba and McGuire as discussed below.

2.4.1 TER, Section 5, conclusion 6 identifies that the boron precipitation time and the time to post-LOCA hot leg recirculation was recalculated and set at 9 hours because of the reduction in core coolant volume due to the use of Mark-BW fuel. By letter dated May 8, 1991, the licensee committed that the next FSAR updates for the Catawba and McGuire and their respective emergency procedures for operation with B&W Mark-BW fuel will reflect the amended calculation. The staff finds this commitment acceptable to satisfy this condition of acceptance.

2.4.2 TER, Section 5, conclusion 7 identifies that the plant should be operated within the bounds set by analysis limits for the Doppler and Moderator density coefficients. Operation within the Technical Specifications limits for the plants, as reviewed and reported in separate staff evaluations, assure conformance with this condition of acceptance. The staff finds this condition satisfied.

3.0 CONCLUSIONS

Based on our review, summarized above, we have concluded that the licensee has appropriately identified the bounding LOCA event, a double-ended cold leg guillotine (DECLG) break with a break discharge coefficient ((d) of 1.0, and assuming maximum ECCS flow. This event also assumes a core fully loaded with B&W Mark-BW fuel operated at a burnup and elevation dependent total peaking factor (F_Q) with a peak value of 2.32. The licensee has properly analyzed this case using an approved model conforming with the requirements of 10 CFR 50 Appendix K consistent with conditions of acceptance of the model. Results of these calculations, PCT=1945°F, peak local cladding oxidation of 4.9 percent, and total core-wide oxidation of 0.55 percent are within the limits specified in 10 CFR 50.46(b)(1), (2), and (3) of 2200°F, 17 percent, and 1 percent, respectively. The core geometry will remain amenable to cooling, and long-term cooling is assured, as required by 10 CFR 50.46(b)(4) and (5), respectively, with the implementation of the revised boron precipitation calculated time (see Section 2.4.1). The staff therefore finds the LOCA analyses for Catawba and McGuire described in the topical report BAW-10174, Revision 1, acceptable.

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Dated: