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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION RELATED TO DUKE POWER COMPANY TOPICAL REPORT DPC-NE-2001, REVISION 1, "FUEL MECHANICAL RELOAD ANALYSIS METHODOLOGY FOR MARK-BW FUEL" DUKE POWER COMPANY CATAWBA NUCLEAR STATION, UNITS 1 AND 2 DOCKET NOS. 50-413 AND 50-414 AND MCGUIRE NUCLEAR STATION, UNITS 1 AND 2 DOCKET NOS. 50-369 AND 50-370

1.0 INTRODUCTION

By letter dated January 22, 1990, from H. B. Tucker, Duke Power Company, to NRC, the licensee requested that the NRC review a topical report, "Fuel Mechanical Reload Analysis Methodology for Mark-BW Fuel," (DPC-NE-2001) Revision 1, dated January 1990, for McGuire and Catawba reload applications. The methodology described in DPC-NE-2001, Rev. 1, has been approved previously for B&W-designed Oconee reload applications. The licensee intends to use the same methodology for Mark-BW fuel in Westinghouse-designed McGuire and Catawba. The Mark-BW fuel design was approved in Topical Report BAW-10172P. Mark-BW fuel is very similar to the currently B&W-designed Mark B and Mark C fuel. Report DPC-NE-2001, Rev. 1, addresses such analyses as cladding stress and strain, cladding collapse, fuel centerline temperature, rod pressure, and Emergency Core Cooling System (ECCS) initial conditions. All the analyses are performed using the previously approved TACO2 and CROV codes. The licensee has determined that the use of the described methodology for Mark-BW fuel does not create any safety concern, nor require any Technical Specification changes, nor involve any unreviewed safety questions for Catawba and McGuire. Our evaluation follows.

2.0 EVALUATION

2.1 Cladding Collapse

If axial gaps in the fuel pellet column were to occur due to densification, the cladding would have the potential of collapsing into a gap, i.e., flattening. Because of the large local strains that would result from collapse, the cladding is assumed to fail. The licensee used the CROV and TACO2 computer codes to analyze the likelihood of cladding collapse for Mark-BW fuel. Since the CROV and TACO2 computer codes have been approved previously for this analysis, we conclude

that the licensee's methodology of analyzing cladding collapse is acceptable for Mark-BW fuel in McGuire and Catawba reload applications.

2.2 Cladding Strain

The licensee cladding strain criterion is limited to 1% strain during normal operation and transients. The staff has previously approved the criterion. The licensee analyzed the maximum strain using the TACO2 code to determine that 1% strain limit is not exceeded. The method is similar to those methods used by B&W and had been approved by the staff. We therefore consider that the licensee cladding strain analysis is acceptable for Mark-BW fuel in McGuire and Catawba reload applications.

2.3 Cladding Stress

The licensee cladding stress criterion is based on the ASME Code which is acceptable to the staff. The licensee stress analysis methodology is based on the approved B&W methodology to calculate the maximum stress to assure that it remains below the allowable stress. We, thus, consider that the licensee cladding stress analysis is acceptable for Mark-BW fuel in McGuire and Catawba reload applications.

2.4 Rod Pressure

The licensee rod pressure criterion is that the rod pressure shall remain below the system pressure throughout the design lifetime. This criterion is consistent with the staff Standard Review Plan (SRP) criterion and is approved by the staff. To calculate the maximum rod pressure, the licensee used the TACO2 code to predict the gas pressure buildup. Since the TACO2 is an approved code, we conclude that the licensee's rod pressure calculation is acceptable for Mark-BW fuel in McGuire and Catawba reload applications.

2.5 Fuel Centerline Temperature

To assure that a fuel rod does not fail by overheating, the conservative criterion provided by the SRP is that the fuel centerline temperature should not reach the fuel melting point during normal operation and transients. To analyze the melting possibility, the licensee performed maximum linear heat generation rate (LHGR) calculations using the approved TACO2 code to determine the power-to-melt bounding curve. Fuel melting is prevented by maintaining the operating power below the power-to-melt curve. This method is consistent with previously approved B&W analytical methods. We therefore consider that the licensee fuel centerline temperature calculation is acceptable for Mark-BW fuel in McGuire and Catawba reload applications.

2.6 ECCS Initial Conditions

The TACO2 code can also be used to calculate initial conditions such as rod pressure, densification, stored energy, and fuel cladding gap for the ECCS analysis. The staff has previously approved the use of TACO2 for establishing ECCS

initial conditions. We thus consider that the licensee's use of TACO2 to determine ECCS initial conditions is acceptable for Mark-BW fuel in McGuire and Catawba reload applications.

3.0 CONCLUSIONS

We have reviewed the licensee's submittal concerning the use of methodology described in DPC-NE-2001, Rev. 1, for Mark-BW fuel reloads in McGuire and Catawba. Based on the use of previously approved analytical methods and the approved TACO2 and CROV codes, and the similarity between Mark-BW and Mark B and Mark C fuel, we conclude that the DPC-NE-2001, Rev. 1, report is acceptable for Mark-BW fuel licensing applications in McGuire and Catawba. We also determine that there are no unreviewed safety questions and no need of Technical Specification changes for McGuire and Catawba. This approval is limited to the use of the TACO2 code. If, in the future, the licensee decides to use the newer approved code, TACO3, the staff requires the licensee to demonstrate its proficiency in using the TACO3 code.

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