UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

TOPICAL REPORT BAW-10229P

"MARK-B11 FUEL ASSEMBLY DESIGN TOPICAL REPORT"

1.0 INTRODUCTION

By letter dated September 30, 1997, Framatome Cogema Fuels (FCF) submitted Topical Report BAW-10229P, "Mark-B11 Fuel Assembly Design Topical Report," for NRC review.

BAW-10229P describes a new fuel assembly mechanical design, Mark-B11, for fuel reload licensing applications in pressurized-water reactors (PWRs). The Mark-B11 fuel design is very similar to the previously approved Mark-B fuel designs. The Mark-B11 fuel consists of a 15x15 square array of fuel rods, control rod guide tubes, and a central instrumentation tube. The main differences between the Mark-B11 fuel design and the earlier Mark-B fuel designs is the Mark-B11's use of smaller diameter fuel rods, flow mixing vanes on five of the six intermediate zircaloy grids, and an improved grid restraint system on the central instrumentation tube. The Mark-B11 fuel design also intends to improve its thermal-hydraulic performance.

The NRC staff was supported in this review by its consultant, Pacific Northwest National Laboratory (PNNL). PNNL's technical evaluation report (TER) is attached.

2.0 EVALUATION

The staff has reviewed the attached TER, and has determined that the TER describes the technical basis for approving BAW-10229P with the exception of TER Section 5.2, Violent Expulsion of Fuel. With regard to Section 5.2, the staff believes that additional clarification is necessary with respect to the acceptance criteria in Regulatory Guide 1.77, "Assumptions Used for Evaluating a Control Rod Ejection Accident for Pressurized Water Reactors," and Standard Review Plan Section 4.2, "Fuel System Design," for the rod ejection accidents. These acceptance criteria are considered nonconservative in light of some test data from foreign test reactors on reactivity-initiated accidents. However, the staff considers the fuel to be acceptable to a rod-average burnup level of 62,000 Mwd/MTU burnup because the probability of these accidents is low and generic plant transient calculations indicate that energy inputs during these transients are low and will remain below the relevant test data failure levels. This position is consistent with the Agency Program Plan for High-Burnup Fuel and the memorandum from J. Callan to the Commissioners dated July 15, 1997.

The following plant-specific analyses will be required for those licensees applying the Mark-B11 fuel in reload fuel designs: (1) cladding oxidation (TER Section 3.5), (2) rod internal pressures (TER Section 3.8), (3) overheating of cladding (TER Section 4.3), and (4) ECCS related

analyses (TER Sections 5.1, 5.2, and 5.3). In a letter dated July 27, 1999, from T. A. Coleman (FCF) to U. S. NRC, FCF confirmed that the above mentioned four items will be performed on a plant-specific basis for each reload application.

With the above clarification and plant-specific analyses requirements, the staff agrees with PNNL's conclusion that the Mark-B11 fuel assembly mechanical design described in BAW-10229P is acceptable for fuel reload licensing applications in PWRs up to a rod-average burnup of 62,000 MWd/MTU. Based on our review, the staff adopts the findings in the attached TER.

3.0 CONCLUSION

The staff has reviewed the FCF's Mark-B11 fuel assembly mechanical design described in BAW-10229P, and finds that the Mark-B11 fuel design is adequate and thus acceptable for fuel reload licensing applications up to 62,000 MWd/MTU rod average burnup in PWRs. Plant-specific analyses will be required for those licensees using the Mark-B11 fuel in reload fuel designs: (1) cladding oxidation, (2) rod internal pressures, (3) overheating of cladding, and (4) ECCS related analyses as described in the above Section 2.0 of this safety evaluation.

Attachment: Technical Evaluation Report

Principle Contributor: S. L. Wu

Date: October 26, 1999