

July 27, 2004

Mr. H. B. Barron
Executive Vice President
Nuclear Generation
Duke Energy Corporation
526 South Church Street
Charlotte, North Carolina 28202

SUBJECT: SUPPLEMENT 2 TO SAFETY EVALUATION FOR PROPOSED AMENDMENTS
TO THE FACILITY OPERATING LICENSE AND TECHNICAL
SPECIFICATIONS TO ALLOW USE OF MIXED OXIDE FUEL LEAD
ASSEMBLIES (TAC NOS. MB7863 AND MB7864)

Dear Mr. Barron:

Enclosed is a copy of Supplement No. 2 to the U.S. Nuclear Regulatory Commission (NRC) staff's Safety Evaluation (SE) regarding your application submitted on February 27, 2003, as supplemented, to revise the Technical Specifications for the Catawba Nuclear Station (Catawba) to allow the use of four mixed oxide (MOX) fuel lead test assemblies (LTAs) in one of the two Catawba units. The NRC staff's SE that was issued on April 5, 2004, on this matter stated that subsequent supplements to the SE would be issued to address other matters as appropriate. This supplement provides the NRC staff's evaluation of the proposed use by Duke Energy Corporation of eight LTAs of the Westinghouse Next Generation Fuel design as that may relate to the use of the four MOX LTAs.

The issuance of this SE supplement does not constitute NRC approval of your application to modify the licensing basis for Catawba. This SE supplement documents the technical and regulatory disposition of the subject discussed within. NRC approval of your application, should it be appropriate, will be under separate correspondence.

In the event of any comments or questions, please contact me at (301) 415-1493.

Sincerely,

/RA/

Robert E. Martin, Sr. Project Manager, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-413 and 50-414

Enclosure: MOX LTA SE Supplement No. 2

cc w/encl: See next page

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* See Previous Concurrence

** No Significant Changes to SE input NRR-058

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SUPPLEMENT NO. 2 TO SAFETY EVALUATION FOR PROPOSED AMENDMENTS TO THE
FACILITY OPERATING LICENSE AND TECHNICAL SPECIFICATIONS TO ALLOW USE OF
MIXED OXIDE FUEL LEAD TEST ASSEMBLIES (TAC NOS. MB7863, MB7864)

Dated: July 27, 2004

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SUPPLEMENT NO. 2 TO SAFETY EVALUATION BY THE
OFFICE OF NUCLEAR REACTOR REGULATION
RENEWED FACILITY OPERATING LICENSE NPF-35

AND

RENEWED FACILITY OPERATING LICENSE NPF-52

DUKE ENERGY CORPORATION, ET AL.

CATAWBA NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-413 AND 50-414

1.0 INTRODUCTION

By letter dated February 27, 2003, as supplemented by letters dated September 15, September 23, October 1 (two letters), October 3 (two letters), November 3, November 4, December 10, 2003, and February 2 (two letters), March 1 (three letters), March 9 (two letters), March 16 (two letters), March 26, March 31, April 13, April 16, May 13, and June 17, 2004, Duke Energy Corporation (Duke) submitted a request for changes to the Catawba Nuclear Station (Catawba), Units 1 and 2, technical specifications (TSs) and associated Bases to allow the use of four mixed oxide (MOX) fuel lead test assemblies (LTAs).

The U. S. Nuclear Regulatory Commission (NRC) staff issued its Safety Evaluation (SE) on April 5, 2004, on Duke's application for the use of four MOX LTAs. The information provided by Duke prior to the issuance of that SE indicated that the reactor core utilizing MOX LTAs would consist of 189 Westinghouse Robust Fuel Assemblies (RFAs) and the four MOX LTAs. Subsequently, the NRC staff learned that Duke plans to also include eight Westinghouse Next Generation Fuel (NGF) LTAs in the Catawba core that would include the MOX LTAs. The NRC staff issued requests for additional information (RAIs) on April 30 and May 19, 2004. Duke responded to the NGF issue and to the RAIs in letters dated April 16, May 13 and June 17, 2004.

2.0 STAFF ACCEPTANCE OF OPERATION WITH LEAD TEST ASSEMBLIES

Catawba is permitted to utilize LTAs by its TS Section 4.0. Duke has previously described its LTA program in an application for an exemption related to the type of cladding used in the NGF LTAs. The NRC regulations currently specify the use of either ZIRLO or Zircaloy cladding whereas Duke proposes to use NGF LTAs with a low tin version of ZIRLO. The NRC staff granted an exemption for Catawba from the requirements of the regulations that currently specify only ZIRLO or Zircaloy in an exemption and SE dated August 4, 2003 (Reference 10).

Enclosure

Although the exemption granted on August 4, 2003, dealt with the cladding material, it did not address the changed thermal-hydraulic conditions arising from other features of the NGF design, such as the additional spacer grids since those features are not specifically addressed in the NRC regulations. The potential for changed thermal-hydraulic conditions was the NRC staff's principle concern on learning that NGF LTAs with some differences in thermal-hydraulic characteristics from Westinghouse RFA fuel would be used with the MOX LTAs. This concern was the focus of the NRC staff's RAIs dated April 30 and May 19, 2004, as discussed above, on the NGF fuel.

3.0 TECHNICAL EVALUATION

3.1 Use of WRB-2M Critical Heat Flux correlation for NGF Fuel

Duke's RAI response dated June 17, 2004, provided extensive information on applicability of the WRB-2M critical heat flux (CHF) correlation to NGF fuel. The information demonstrates that the thermal-hydraulic characteristics of NGF fuel have previously been incorporated into the Westinghouse and Duke analyses to support operation in the fuel cycles that will use combinations of RFA, NGF and MOX fuel assemblies. This includes a description of the CHF testing program for NGF fuel implemented by the fuel vendor, Westinghouse, and the limits on locations in the core that NGF LTAs may be placed in. These limits ensure that the NGF LTAs will not be in limiting positions in the core and that they will not significantly impact operation of the MOX LTAs. The NRC staff concludes that Duke has adequately analyzed the applicability of the WRB-2M CHF correlation to the NGF fuel with respect to its effects on MOX LTA fuel.

3.2 Loss-of-Coolant Analyses

An analysis of record (AOR) has been performed for the Westinghouse RFA fuel resident in the Catawba core prior to the insertion of the MOX LTAs, using the approved Westinghouse realistic large-break loss-of-coolant accident (LOCA) methodology based on the WCOBRA/TRAC computer code (Reference 5), with the NRC staff's approval found in Reference 6.

Review of the documentation regarding the NGF LTAs indicates that the LTAs are neutronically identical to the RFA resident fuel assemblies. Due to hardware differences, such as spacer grids, end fittings, etc., the NGF LTA has different hydraulic characteristics than the RFA fuel. Duke performed studies on the effect the NGF LTA hydraulics would have on both the RFA fuel and the MOX LTAs. Those studies indicated an NGF assembly could perturb the flow in an adjacent assembly; therefore, Duke has determined that the MOX and NGF LTAs should not be placed in such configuration as to have face-to-face alignment. In addition, the LTAs must have at least two RFA fuel assemblies separating them. Thus, the core loading pattern for Catawba, Unit 1, Cycle 16 will place the MOX and NGF LTAs in locations resulting in separation by at least two RFA assemblies and an offset such that the LTA sides are not in direct alignment.

Based on analyses performed by Westinghouse on the LOCA response of the NGF LTAs, Duke's submittal dated June 17, 2004, reports that a limitation of 3.2 percent on two of the peaking factors will maintain the predicted peak cladding temperature (PCT) below that of the AOR.

3.3 NRC Staff Safety Evaluation Report Correction

In the NRC staff's SE on the MOX LTAs (Reference 7), the predicted PCT for the MOX LTAs is quoted as being 2018 degrees Fahrenheit, based on Reference 1. Subsequent analyses resulted in a correction to that PCT value. The corrected value should be noted as 2019.5 degrees Fahrenheit. The quoted maximum local oxidation is correct as stated at 4.5 percent.

4.0 CONCLUSION

Based on the NRC staff's review of the Duke and Westinghouse NGF LTA analyses, the NRC staff concludes that the effect of the eight NGF LTAs on the four MOX LTAs has been conservatively evaluated and that the NGF assemblies will not have any significant effect on the MOX LTAs.

5.0 REFERENCES

1. Letter, M. S. Tuckman, Duke, to NRC, "Proposed Amendments to the Facility Operating License and Technical Specifications to Allow Insertion of Mixed Oxide (MOX) Fuel Lead Assemblies and Request for Exemption from Certain Regulations in 10 CFR Part 50," February 27, 2003.
2. Letter, R. E. Martin, NRC, to Duke, requesting additional information on reactor systems, radiological consequences, and environmental impacts, July 25, 2003.
3. Letter, M. S. Tuckman, Duke, to NRC, responding to 23 of the NRC staff's RAIs of July 25, 2003, dated October 3, 2003.
4. Letter, M. S. Tuckman, Duke, to NRC, responding to all of the NRC staff's RAIs of July 25, 2003 (Proprietary), November 3, 2003.
5. WCAP-12945P-A, *Code Qualification Document for Best-Estimate Loss of Coolant Analysis*, March 1998.
6. R. C. Jones, NRC, to N. J. Liparulo, Westinghouse, June 28, 1996.
7. Letter, R. E. Martin, NRC, to H. B. Barron, Duke, transmitting Safety Evaluation, April 5, 2004.
8. Letter, R. E. Martin, NRC, to H. B. Barron, Duke, transmitting RAI, April 30, 2004.
9. Letter, R. E. Martin, NRC, to H. B. Barron, Duke, transmitting RAI, May 19, 2004.

10. Letter, R. E. Martin, NRC, to D. M. Jamil, Duke, transmitting an exemption from the requirements fo 10 CFR 50.44, 50.46 and 10 CFR Part 50, Appendix K, August 4, 2003.

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Date: July 27, 2004

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