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

March 2, 2015

Mr. Scott Batson
Site Vice President
Oconee Nuclear Station
Duke Energy Carolinas, LLC
7800 Rochester Highway
Seneca, SC 29672-0752

SUBJECT: OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3, REQUEST FOR ADDITIONAL INFORMATION RE: 10 CFR 50.46 – 30 DAY REPORT ON ESTIMATED IMPACTS TO PEAK CLADDING TEMPERATURE DUE TO FUEL PELLET THERMAL CONDUCTIVITY DEGRADATION (TAC NOS. MF5572, MF5573, AND MF5574)

Dear Mr. Batson:

By letter dated December 17, 2014, Duke Energy Carolinas, LLC (the licensee) submitted a report describing a significant error identified in the emergency core cooling system evaluation model, and an estimate of the effect of the error on the predicted peak cladding temperature for Oconee Nuclear Station, Units 1, 2, and 3. This report was submitted pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 46 (10 CFR 50.46), paragraph (a)(3).

The Nuclear Regulatory Commission has reviewed the information submitted by the licensee, and has determined that additional information is needed to complete its review. The specific questions are found in the enclosed request for additional information (RAI). Please provide a response to these RAIs within 30 days of the date of this letter.

If you have any questions, please call me at 301-415-4032.

Sincerely,

Jeffrey A. Whited for

James R. Hall, Senior Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-269, 50-270, and 50-287

Enclosure:
RAI

cc w/encl: Distribution via Listserv

REQUEST FOR ADDITIONAL INFORMATION

BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REPORT SUBMITTED PURSUANT TO 10 CFR 50.46 REQUIREMENTS

DUKE ENERGY CAROLINAS, LLC

OCONEE NUCLEAR STATION, UNITS 1, 2 AND 3

DOCKET NOS. 50-269, 50-270, AND 50-287

BACKGROUND

By letter dated December 17, 2014,[1] Duke Energy Carolinas, LLC (Duke, the licensee), submitted a report describing a significant error identified in the emergency core cooling system (ECCS) evaluation model, and an estimate of the effect of the error on the predicted peak cladding temperature (PCT) for Oconee Nuclear Station (ONS), Units 1, 2, and 3. This report was submitted pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 46 (10 CFR 50.46), paragraph (a)(3).

The reported error concerned the BWNT LOCA ECCS evaluation model (EM), which is documented in Volume I of the NRC-approved licensing topical report (LTR) BAW-10192P-A, "BWNT Loss-of-Coolant Accident Evaluation Model for Once-Through Steam Generator Plants, Volume I – Larger Break." The error relates to the ability of upstream fuel performance analysis codes to provide accurate predictions of the fuel pin initial temperature. The TACO3 code documented in NRC-approved LTR BAW-10162P-A, "TACO3 – Fuel Pin Thermal Analysis Computer Code," and the GDTACO code documented in NRC-approved LTR BAW-10184P-A, "GDTACO – Urania Gadolinia Fuel Pin Thermal Analysis Code," use uranium thermal conductivity models that do not account for the degradation of the thermal conductivity that occurs as a function of the fuel burnup.

Correction for this error caused a significant increase in the PCT predicted for ONS. Most notably, thermal conductivity degradation (TCD) causes the predicted PCT for loss-of-coolant accidents (LOCAs) that initiate at middle-of-life (MOL) or end-of-life (EOL) core conditions to increase significantly. Because fuel at the beginning-of-life (BOL) does not experience appreciable TCD, the effects of the error at BOL conditions are much less significant. Similarly, EOL fuel operates at a non-limiting linear heating rate (LHR), and remains generally non-limiting even when corrected for TCD. Therefore, TCD effects are most significant at MOL conditions.

The U.S. Nuclear Regulatory Commission (NRC, or Commission) staff evaluated the report, and has determined that additional information is required to evaluate whether the report satisfies the reporting requirements of 10 CFR 50.46(a)(3). In particular, 10 CFR 50.46(a)(3)(ii) states, for significant errors, that licensees shall "provide this report within 30 days and include with the report a proposed schedule for providing a reanalysis or taking other action as may be needed to show compliance with §50.46 requirements." In light of the significant model changes required to

[1] Agencywide Documents Access and Management System (ADAMS) Accession No. ML14353A214.

correct for this error, it is not clear to the NRC staff how fulfilling the reanalysis commitment provided in the report will show compliance with §50.46 requirements.

REQUEST FOR ADDITIONAL INFORMATION

SNPB RAI-1) The letter dated December 17, 2014, stated that "AREVA's recommendation to Duke Energy with respect to a LB [large break] LOCA reanalysis for Oconee is to perform an explicit analysis of the limiting PCT case. COPERNIC2[2] will be used to obtain the appropriate uncertainty factors with TCD effects considered..." The letter also documents a regulatory commitment to perform this reanalysis.

The NRC has determined that the TACO3/GDTACO fuel temperature uncertainty values are explicitly reflected in the NRC-approved fuel performance methodology documented in BAW-10162P-A and BAW-10184P-A.[3] In addition, the BWNT LOCA ECCS EM requires the use of NRC-approved fuel thermal-mechanical models.[4] Although the COPERNIC code has been approved by the NRC, as documented in BAW-10231P-A, the NRC staff does not consider the application of COPERNIC-based uncertainty values to TACO-based fuel performance methods, for application within the BWNT-LOCA ECCS evaluation model, to be accordant with NRC-approved methodology.

Regarding calculated emergency core cooling performance evaluation (i.e., LOCA analysis), 10 CFR 50.46 states, in part, "ECCS cooling performance must be calculated in accordance with an acceptable evaluation model..." The change in fuel temperature uncertainty discussed above has not been submitted to the NRC staff for generic review and approval; therefore, it is not possible for the NRC staff to conclude that the evaluation model, once updated to incorporate this new uncertainty, would remain acceptable.

In light of the fact that the proposed TACO and GDTACO fuel temperature uncertainty values have not been previously reviewed and approved by the NRC, explain how Duke will ensure that the corrected ECCS evaluation is performed in accordance with an acceptable evaluation model, pursuant to 10 CFR 50.46(a)(1)(i).

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[2] COPERNIC is another NRC-approved, AREVA-proprietary fuel performance code. Refer to BAW-10231P-A, "COPERNIC Fuel Rod Design Computer Code."

[3] Refer, for example, to Appendix I of BAW-10162P-A.

[4] Refer, for example, to Section 4.3.2.3 of BAW-10192P-A.

SNPB RAI-2) Based on previous reports submitted to the NRC pursuant to 10 CFR 50.46 requirements, the NRC staff understands that the TCD-related model changes will be incorporated into a version of the BWNT LOCA ECCS EM that corrects for an error previously reported, concerning the nodalization of column weldments above the core. Altogether, these model changes will significantly change the predicted emergency core cooling performance for ONS.

Regarding the evaluation of ECCS performance, 10 CFR 50.46(a)(1)(i) states, in part, that ECCS cooling performance "must be calculated for a number of postulated loss-of-coolant accidents of different sizes, locations, and other properties sufficient to provide assurance that the most severe postulated loss-of-coolant accidents are calculated." It is unclear whether the implementation of the changes described above will affect the predicted emergency core cooling performance for the spectrum of break sizes, locations, and other properties, such that the existing, most limiting LOCA event analyzed remains the most severe hypothetical loss-of-coolant accident.

Since the December 17, 2014, letter indicates that a "reanalysis for the highest PCT case at Middle-of-Life for Oconee Nuclear station..." will be performed, explain how this analysis will address the requirement identified above, regarding assurance that the most severe hypothetical loss-of-coolant accidents are calculated.

SNPB RAI-3) ONS TS 5.6.5, "Core Operating Limits Report," Section b., requires that the "analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC for use at ONS," including BAW-10192P-A, "BWNT LOCA – BWNT Loss of Coolant Accident Evaluation Model for Once-Through Steam Generator Plants."

Explain how Duke will ensure that the reanalysis performed in fulfillment of the commitment provided in the December 17, 2014, letter, will remain consistent with the latest approved revision to BAW-10192P-A.

Specifically, as discussed in RAI 1, above, the updated fuel temperature uncertainty value does not appear consistent with the NRC-approved BWNT LOCA ECCS Evaluation Model. The application of COPERNIC-based fuel temperature uncertainties to TACO3 and GDTACO evaluation models is not consistent with NRC-approved fuel performance methodology.

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/RA/ Jeffrey A. Whited for
James R. Hall, Senior Project Manager
Plant Licensing Branch II-1
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Docket Nos. 50-269, 50-270, and 50-287
Enclosure:
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NAME	JWhited	SFigueroa	JDean	RPascarelli	JHall (JWhited for)
DATE	02/27/15	02/27/15	02/27/15	03/02/15	03/02/15

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