



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

June 6, 2012

Mr. Regis T. Repko
Vice President
McGuire Nuclear Station
Duke Energy Carolinas, LLC
12700 Hagers Ferry Road
Huntersville, NC 28078

SUBJECT: MCGUIRE NUCLEAR STATION, UNITS 1 AND 2, REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT RELATED TO MEASUREMENT UNCERTAINTY RECAPTURE POWER UPRATE (TAC NOS. ME8213 AND ME8214)

Dear Mr. Repko:

By letter dated March 5, 2012, Duke Energy Carolinas, LLC (the licensee), submitted a proposed license amendment to change the McGuire Nuclear Station, Units 1 and 2 (McGuire 1 and 2), Technical Specifications (TSs). The proposed change revises the TSs to implement a measurement uncertainty recapture power uprate for McGuire 1 and 2.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the licensee's submittal and determined that additional information is needed in order to complete our review. The enclosed document describes this request for additional information (RAI). Please note that the numbering of the questions in this RAI does not begin at the number one. Two prior RAIs regarding this proposed license amendment were issued to you by letters dated April 27, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12117A175) and May 22, 2012 (ADAMS Accession No. ML12138A267), with RAI questions numbered one through four and five through nineteen, respectively.

A written response should be provided to the NRC staff within 30 days of the issuance of this letter in order to support our timely review of this application. If you have any questions, please call me at 301-415-1119.

Sincerely,

A handwritten signature in black ink that reads "Jon Thompson".

Jon Thompson, Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-369 and 50-370

Enclosure: RAI

cc w/encl: Distribution via Listserv

REQUEST FOR ADDITIONAL INFORMATION
BY THE OFFICE OF NUCLEAR REACTOR REGULATION
REGARDING LICENSE AMENDMENT REQUEST RELATED TO THE
IMPLEMENTATION OF A MEASUREMENT UNCERTAINTY RECAPTURE POWER UPRATE
MCGUIRE NUCLEAR STATION, UNITS 1 AND 2

By letter dated March 5, 2012 (Agencywide Documents Access and Management System (ADAMS), Accession No. ML12082A210), Duke Energy Carolinas, LLC (Duke Energy, the licensee), submitted a license amendment request (LAR) to change the McGuire Nuclear Station, Units 1 and 2 (McGuire 1 and 2), Technical Specifications (TSs). The proposed change revises the TSs to implement a measurement uncertainty recapture (MUR) power uprate for McGuire 1 and 2.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the licensee's submittal and determined that the following additional information is needed in order to complete our review:

Regulatory Basis

Nuclear power plants are licensed to operate at a specified maximum core thermal power. Appendix K, "ECCS [emergency core cooling system] Evaluation Models," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," requires loss-of-coolant accident and emergency core cooling system (ECCS) analyses to assume "that the reactor has been operating continuously at a power level at least 102% of the licensed thermal power level to allow for instrumentation uncertainties." Alternatively, Appendix K allows such analyses to assume a value lower than the specified 102%, but not less than the licensed thermal power level, "provided the proposed alternative value has been demonstrated to account for uncertainties due to power level instrumentation error." This allowance gives licensees the option of justifying a power uprate with reduced margin between the licensed power level and the power level assumed in the analysis by using more accurate instrumentation to calculate the reactor thermal power.

The maximum power level of a nuclear plant is a licensed limit, and, as a result, the NRC staff must review and approve a proposal to raise the licensed power level under the license amendment process. The LAR should include a justification for the reduced power measurement uncertainty to support the proposed power uprate.

The licensee developed the format of their submittal for the proposed power uprate based on the guidance of Regulatory Issue Summary (RIS) 2002-03, "Guidance on the Content of Measurement Uncertainty Recapture Power Uprate Applications," dated January 31, 2002 and an approved topical report – ER-157(P-A), Rev. 8, and Rev. 8 Errata, "Supplement to Caldon Topical

Enclosure

Report ER-80P: Basis for Power Uprates with a leading edge flow meter (LEFM) Check or an LEFM CheckPlus System," (ADAMS Accession No. ML102950246). The NRC staff is evaluating the LAR using the provisions outlined in RIS 2002-03 as guidance.

20. The LAR, Attachment 4, provided the following Caldon® Ultrasonics Engineering Reports (ER):

- (1) ER-819, "Bounding Uncertainty Analysis for Thermal Power Determination at McGuire Unit 2 Using the LEFM CheckPlus System," Rev. 1,
- (2) ER-822, "Bounding Uncertainty Analysis for Thermal Power Determination at McGuire Unit 1 Using the LEFM CheckPlus System," Rev. 1,
- (3) ER-822, "Bounding Uncertainty Analysis for Thermal Power Determination at McGuire Unit 1 Using the LEFM CheckPlus System," Rev. 1,
- (4) ER-823, "Meter Factor Calculation and Accuracy Assessment for McGuire Unit 2," Rev. 0,
- (5) ER-874, "Meter Factor Calculation and Accuracy Assessment for McGuire Unit 1," Rev. 1.

These reports provide the analysis of the uncertainty contribution of the LEFM CheckPlus System to the thermal power uncertainty of McGuire, Units 1 and 2. These Reports contain detailed calculations, the results of which are summarized in Appendix C, Table I, of ER-819 and ER-822. These calculations are based on the following references:
(a) Cameron Topical Report ER-80P, "Improving Thermal Power Accuracy and Plant Safety While Increasing Operating Power Level Using the LEFM Check System," and
(b) Cameron Engineering Report ER-157P, "Supplement to Cameron Topical Report ER-80P: Basis for Power Uprates with an LEFM Check or an LEFM CheckPlus," dated May, 2008, Rev. 8 and Rev. 8 Errata.

To assist the NRC staff review in completing its review, please provide:

- a. A detailed and explicit cross reference between the plant-specific Cameron Engineering Reports ER-819, ER-822, ER-823, and ER874 and the Cameron Topical reports ER-80P and ER-157P.
- b. Confirmation that the assumptions listed in Cameron Caldon® Ultrasonics Engineering Report No. ER-157P, Rev. 8 and Rev. 8 Errata, Appendix A, are valid for the McGuire 1 and 2 application.
- c. The LAR in Enclosure 2, Item I.1.D, Criterion 1, from ER-157 (Rev 8, Page E2-6), requires the licensee to justify continued operation at the pre-failure level for a pre-determined time and the decrease in power that must occur following that time. The response provided in the LAR states that an engineering evaluation was

performed to justify an allowed outage time upon loss of the LEFM signal. The LAR further states that the analysis established a bounding uncertainty of 0.045% RTP over a 7-day period. Provide an engineering evaluation on how the bounding uncertainty of 0.045% RTP was established and justifications for the selection of a 7-day time period.

- d. The LAR states in Table I.1.E-1, Total Thermal Power Uncertainty Determination, that the McGuire Specific Gains/Losses are +0.088% and -0.087%. Provide detailed information on how these parameters have been established.

(EICB 1)

21. In Section IV.1.A.V, "Balance-of-Plant (BOP) piping," of the LAR, the licensee stated that at MUR-PU [measurement uncertainty recapture – power uprate] conditions the steam generator blowdown system (SGBS) will continue to remain within its design basis. Please confirm that the SGBS will continue to perform its intended function given the higher flow and potentially higher impurity content under the proposed MUR-PU conditions. (ESGB 1)
22. Please discuss whether components susceptible to flow-accelerated corrosion (FAC) in the SGBS will continue to be managed in accordance with the FAC program. (ESGB 2)
23. On page E2-69 of Enclosure 2 of the LAR, the licensee stated that FAC-related piping wear rates will be impacted by the MUR-PU; however, the changes will be small. The FAC monitoring program includes the use of a predictive method to calculate the wall thinning of components susceptible to FAC. In order for the NRC staff to evaluate the accuracy of these predictions, the NRC staff requests a sample list of components most affected by FAC for which wall thinning is predicted and measured by (UT) or other methods. Include the initial wall thickness (nominal), current (measured) wall thickness, and a comparison of the as-measured wall thickness to the thickness predicted by the CHECWORXTM modeling software. (ESGB 3)
24. Please provide the differential pressure across the steam generator (SG) tubes, the temperature of the secondary water, and the feedwater and steam flow rates through the SG for power uprate conditions. Confirm that the SGs will still satisfy all original design criteria under these conditions. If not, please provide a reassessment to address the current condition of your SGs (e.g., the plugs, any repairs to the as-built configuration, loose parts, etc.) at the proposed power uprate conditions. (ESGB 4)
25. Confirm that your SG plugging limit is still appropriate for the proposed MUR-PU conditions, given the guidance in Regulatory Guide (RG) 1.121. (ESGB 5)
26. On Table II.1-1: McGuire Analyses of Enclosure 2 of the LAR, the licensee stated that the feedwater system malfunction causing an increase in feedwater flow and the excessive increase in secondary steam flow analyses were performed at 3469 MWt and are bounding for MUR-PU conditions. The NRC staff notes that the power used in the

analyses is 101.7 % of 3411 MWt (authorized core power level), which is equal to the MUR-PU conditions. Please discuss how these analyses are bounding for MUR-PU conditions. (ESGB 6)

27. Confirm that the coating qualification temperature and pressure profile used to qualify the original maintenance Service Level 1 coatings continue to bound the Design Basis Accident temperature and pressure profile under the proposed power uprate conditions. (ESGB 7)
28. Test fidelity, such as test versus planned plant configuration, test variations to address configuration differences, and potential effects of operation on flow profile and calibration, should be addressed on a plant-specific basis. Applicant requests must provide a comparison of the test and plant piping configurations with an evaluation of the effect of any differences that could affect the ultrasonic flow meter (UFM) calibration. Further, sufficient variations in test configurations must be tested to establish that test-to-plant differences have been bracketed in the determination of UFM calibration and uncertainty. The turbulent flow regimes that exist when the plant is near full power result in limited upstream flow profile perturbation from downstream piping. Consequently, the effects of downstream equipment need not be considered for normal CheckPlus operation, provided changes in downstream piping, such as the entrance to an elbow, are located greater than two pipe diameters downstream of the chordal paths. However, if the CheckPlus is operated with one or more transducers out of service, the acceptable separation distance is likely a function of transducer to elbow orientation. In such cases, if separation distance is less than five pipe diameters, it should be addressed. Therefore the NRC staff requests that the licensee provide downstream distances from the UFM to the next non-straight pipe component at the Alden labs test setup to verify their applicability to the in plant setup. (SRXB 1)
29. Each applicant for a power uprate must conduct an in-depth evaluation of the UFM following installation at its plant that includes consideration of any differences between the test and in-plant results and must prepare a report that describes the results of the evaluation. This should address such items as calibration traceability, potential loss of calibration, cross-checks with other plant parameters during operation to ensure consistency between thermal power calculation based upon the LEFM and other plant parameters, and final commissioning testing. The process should be described in written documentation and a final commissioning test report should be available for NRC inspection. Therefore the staff requests the licensee to provide a summary of the data comparing the LEFM Checkplus operating data to the Venturi data for the past six months to verify consistency between thermal power calculation based on LEFM and other plant parameters. (SRXB 2)
30. RIS 2002-03, Section II, provides for accidents and transients for which the existing analyses of record bound plant operation at the proposed power level. Please explain how the 0.3% feedwater flow measurement uncertainty is treated in departure from nucleate boiling analysis for which the stated analysis is bounded by the current analysis of 101.7%. (SRXB 3)

31. Table II.1-1, "McGuire Analyses," of the LAR provides information regarding, the McGuire 1 and 2 confirmation that the bounding event remains valid (i.e. Enclosure 2, Section II.1.D, of the LAR) and the references for the NRC staff approval of these events. Many of the Section II.1.D evaluations of the impact of the MUR on the dose analysis address the impact of the MUR on the offsite doses, but not control room doses. Many of the references for the NRC approval reference only the NRC's Standard Review Plan (SRP) or RGs rather than the documents that provide the NRC's approval for LARs such as an NRC Safety Evaluation or sections in the Updated Final Safety Analyses Report (UFSAR).

The regulation at 10 CFR, Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," Criterion 19 (GDC 19) states that a control room shall be provided from which actions can be taken to operate the nuclear power unit safely under normal conditions and to maintain it in a safe condition under accident conditions. It also states that adequate radiation protection shall be provided to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 5 rem whole body, or its equivalent to any part of the body, or 5 rem Total Effective Dose Equivalent as applicable.

SRP 15.0, "Introduction – Transient and Accident Analysis," Revision 3, dated March 2007 (ADAMS Accession No. ML070710376) states:

The reviewer considers the possible case variations of AOOs [anticipated operational occurrences] and postulated accidents presented to verify that the licensee has identified the limiting cases.

Using the information provided in the LAR and in the UFSAR, the NRC staff is unable to verify that the radiological limits in GDC 19 are met with the proposed change. Please provide the references to the NRC-approved evaluation or provide an evaluation of the impact of the proposed change on control room doses for all accidents and AOO's in the design bases so that the NRC staff can verify that the limiting cases have been identified and confirm that GDC 19 is met or state where this information can be found. If there are many references for the information, it would be helpful to summarize the accident doses for the control room in a table. (AADB 1)

June 6, 2012

Mr. Regis T. Repko
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12700 Hagers Ferry Road
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Sincerely,

/RA/

Jon Thompson, Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-369 and 50-370
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ADAMS Accession No. ML12158A481

OFFICE	NRR/LPL2-1/PM	NRR/LPL2-1/LA	NRR/LPL2-1/BC	NRR/LPL2-1/PM
NAME	JThompson	SFiguroa	NSalgado (JBoska for)	JThompson
DATE	06/06/12	06/06/12	06/06/12	06/06/12

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