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

December 22, 2016

Mr. Ernest J. Kapopoulos, Jr.
Vice President, Operations Support
Duke Energy Carolina, LLC
526 South Church St.
Charlotte, NC 28202

SUBJECT: CATAWBA NUCLEAR STATION, UNITS 1 AND 2, AND MCGUIRE NUCLEAR STATION, UNITS 1 AND 2, SCREENING AND PRIORITIZATION RESULTS REGARDING SEISMIC HAZARD REEVALUATIONS FOR RECOMMENDATION 2.1 OF THE NEAR-TERM TASK FORCE REVIEW OF INSIGHTS FROM THE FUKUSHIMA DAI-ICHI ACCIDENT

Dear Mr. Kapopoulos:

The purpose of this letter is to transmit the U.S. Nuclear Regulatory Commission (NRC) staff's revised seismic screening and prioritization determination for Catawba Nuclear Station, Units 1 and 2 (Catawba), and McGuire Nuclear Station, Units 1 and 2 (McGuire).

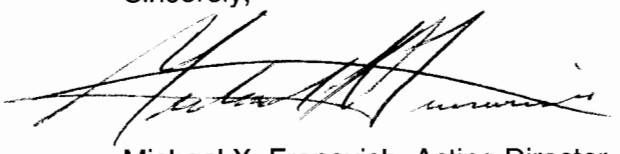
Based on the additional information provided by Duke Energy Carolinas, LLC (Duke), in its submittal dated October 20, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16295A342), and after consultation with the Director of the NRC's Office of Nuclear Reactor Regulation, the NRC has determined that seismic probabilistic risk assessments (SPRAs) for Catawba and McGuire are no longer necessary to fulfill the March 12, 2012, request for information pursuant to Title 10 of the *Code of Federal Regulations*, Part 50, Section 50.54(f) (ADAMS Accession No. ML12053A340).

The basis for the staff's conclusion is discussed in the enclosure to this letter. In summary, the staff concludes that the plant-specific combination of seismic hazard exceedances, the general estimation of the seismic core damage frequencies for Catawba and McGuire, and insights related to the conditional containment failure probabilities at both these plants indicate that the increase in seismic risk due to the reevaluated seismic hazard is adequately addressed within the margin inherent in the design of these plants and, as such, the completion of SPRAs is not necessary. In addition, the staff considered insights from the recently-issued draft technical report for the State-of-the-Art Reactor Consequence Study for the Sequoyah Nuclear Plant (ADAMS Accession No. ML16096A374) in its assessment.

High frequency evaluations and mitigating strategies assessments continue to be necessary to gain insights into these plants' responses to high frequency ground motion and to ensure that mitigating strategies capabilities address the reevaluated seismic hazard conditions. As stated in Duke's October 20, 2016, submittal, the NRC expects Catawba and McGuire to submit these assessments by August 31, 2017.

If you have any questions on this matter, please contact Brett Titus, Japan Lessons-Learned Division Senior Project Manager, at (301) 415-3075 or at Brett.Titus@nrc.gov.

Sincerely,



Michael X. Franovich, Acting Director
Japan Lessons-Learned Division
Office of Nuclear Reactor Regulation

Docket Nos. 50-413 and 50-414 (Catawba)
50-369 and 50-370 (McGuire)

Enclosure:
Staff Screening Evaluation for Seismic Probabilistic Risk Assessments

cc:
Mr. Robert T. Simril
Site Vice President
Duke Energy Carolinas, LLC
Catawba Nuclear Station
4800 Concord Road
York, SC 29745

Mr. Steven D. Capps
Vice President – McGuire Site
Duke Energy Carolinas, LLC
McGuire Nuclear Station
12700 Hagers Ferry Road
Huntersville, NC 28078-8985

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STAFF SCREENING EVALUATION FOR SEISMIC PROBABILISTIC RISK ASSESSMENTS OF CATAWBA NUCLEAR STATION AND MCGUIRE NUCLEAR STATION

This enclosure documents the U.S. Nuclear Regulatory Commission (NRC) staff's evaluation of the screening and prioritization determination for Catawba Nuclear Station, Units 1 and 2 (Catawba), and McGuire Nuclear Station, Units 1 and 2 (McGuire). In this evaluation, the NRC considered information associated with the plant-specific combination of seismic hazard exceedances, seismic risk evaluation insights, and information related to the seismic containment capacities based on additional information provided by Duke Energy Carolinas, LLC (Duke, the licensee), in its submittal dated October 20, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16295A342).

BACKGROUND

On March 12, 2012, the NRC issued a request for information pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.54(f) (ADAMS Accession No. ML12053A340; hereafter referred to as the 50.54(f) letter). The 50.54(f) letter was issued as part of implementing lessons learned from the accident at the Fukushima Dai-ichi nuclear plant. One of the objectives of the 50.54(f) letter was to gather information concerning seismic hazards at each operating reactor plant and to enable the NRC staff to determine whether licenses should be modified, suspended, or revoked. Further, the 50.54(f) letter stated that the NRC would provide screening and prioritization results to indicate schedules for individual plants to complete seismic risk evaluations (e.g., seismic margins analyses or seismic probabilistic risk assessments (SPRAs)) that assess the total plant response to the reevaluated seismic hazard. In response to the 50.54(f) letter, all addressees committed to follow the Electric Power Research Institute Report (EPRI), "Seismic Evaluation Guidance: Screening, Prioritization and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic," (ADAMS Accession No. ML12333A170), as supplemented by the EPRI Report, "Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic" (ADAMS Accession No. ML13102A142).

In response to the 50.54(f) letter, Catawba and McGuire submitted their reevaluated seismic hazards on March 31, 2014, and March 20, 2014, respectively (ADAMS Accession Nos. ML14093A052 and ML14098A421). Subsequently, the NRC provided staff assessments of the reevaluated hazards for Catawba and McGuire by letters dated April 27, 2015, and July 20, 2015, respectively (ADAMS Accession Nos. ML15096A513 and ML15182A067).

Additionally, by letter dated May 9, 2014 (ADAMS Accession No. ML14111A147), the NRC staff informed all licensees of operating reactors in the Central and Eastern United States (CEUS) of the screening and prioritization results to support completing seismic risk and limited-scope evaluations, as described in Enclosure 1 of the 50.54(f) letter.

INITIAL SCREENING AND PRIORITIZATION PROCESS

As discussed in the NRC's May 2014 letter, the NRC staff's screening review was performed using the SPID guidance. The SPID provides guidance on seismic screening when the reevaluated hazard (represented here as a ground motion response spectra (GMRS)) is above the safe shutdown earthquake (SSE).

The NRC placed the "screened in" plants into three groups that reflect certain key parameters such as (1) the maximum ratio of the new reevaluated hazard (GMRS) to the SSE in the 1-10 Hertz (Hz) range, (2) the maximum ground motion in the 1-10 Hz range, and (3) insights from previous seismic risk evaluations. Group 1 plants were generally those that had the highest reevaluated hazard relative to the original plant seismic design-basis (GMRS-to-SSE), as well as ground motions in the 1-10 Hz range that are generally higher in absolute magnitude. The plants screened into Group 2 had an increase in seismic hazard and new ground motion estimate that were smaller than Group 1 plants. Group 3 plants had GMRS-to-SSE ratios that were greater than 1, but the amount of exceedance in the 1-10 Hz range was relatively small, and the maximum ground motion in the 1-10 Hz range was also not high. In the May 9, 2014, letter, Catawba was classified as a Group 2 plant and McGuire was classified as a Group 3 plant, both of which "screened in" for a seismic risk assessment.

The initial screening documented in the May 9, 2014, letter for CEUS sites, and a subsequent May 13, 2015, letter for Western United States sites, categorized 33 sites as needing to submit an SPRA. Following this initial screening, the NRC staff performed an additional assessment examining available information to determine the need for these plants to perform a SPRA. For each plant, the NRC staff assessed if the reevaluated seismic hazard creates a significant increase in seismic demands, such that an SPRA is necessary to inform the NRC's decision described in the 50.54(f) letter.

By letter dated October 27, 2015, the NRC issued its final determination to (1) inform power reactor licensees of the remaining seismic evaluations that each licensee will perform, (2) inform those licensees that will perform a SPRA, and (3) establish the associated due dates for the seismic evaluations and SPRAs to complete licensees' responses to the 50.54(f) letter. The October 27, 2015, letter stated that, for 20 sites, SPRAs continue to be the appropriate analysis to assess the total plant response to the reevaluated hazard. For Catawba and McGuire, SPRAs were judged to be warranted and to be submitted by September 30, 2019, and December 31, 2019, respectively.

The final screening decisions communicated by the October 27, 2015, letter took certain factors into consideration based on the information available at the time. The first consideration focused on the change in the seismic hazard. Specifically, the amount by which the GMRS exceeds the SSE in the 1-10 Hz frequency range and the peak spectral acceleration in the 1-10 Hz frequency range were considered. If the GMRS exceedance and/or peak spectral acceleration were considered significant, then the NRC staff concluded that an SPRA continues to be necessary for that site. If the first consideration was judged as not significant, then the second of the two considerations focused on a general estimation of the plant's seismic core damage frequency (SCDF) and on insights related to the conditional containment failure probability (CCFP) for that plant's specific type of containment. As with the first consideration, if the estimated SCDF was considered significant and/or if there were potential implications in the context of the containment

type, then the NRC staff concluded that an SPRA evaluation continues to be the appropriate approach. Based on the information available to the NRC at that time, SPRAs were determined to be warranted for both Catawba and McGuire, primarily based on containment type (both plants use ice condenser containments).

SCREENING AND PRIORITIZATION REVIEW RE-ASSESSMENT

On September 14, 2016, the NRC held a public meeting with Duke to discuss additional information which Duke believed provided a technical basis for reconsideration of the NRC's decision to necessitate SPRAs for Catawba and McGuire (ADAMS Accession No. ML16264A123). The topics discussed during this public meeting and the corresponding site-specific information for both Catawba and McGuire were documented and formally submitted to the NRC in a Duke letter dated October 20, 2016 (ADAMS Accession No. ML16295A342).

The October 20, 2016, submittal stated that the seismic risk at Catawba and McGuire is not significant and performance of SPRAs would not provide meaningful additional risk insights for the sites because of the significant body of knowledge already available. Specifically, Duke cited reevaluated seismic hazard and associated seismic demand-versus-capacity information, previous generic and site-specific seismic risk evaluations, and site-specific CCFP analyses. A summary of the information provided by Duke is captured below.

REEVALUATED HAZARD INFORMATION

As stated in the "Background" section above, Catawba and McGuire submitted their reevaluated seismic hazard reports in March 2014, and the NRC provided staff assessments of the reevaluated hazards in July and April 2015. The original Duke submittals and the corresponding NRC staff assessments concluded that the reevaluated hazards exceeded the design bases of both sites in the 1-10 Hz frequency range. The sites quantified the exceedances of the reevaluated hazard above the current design bases in support of the Expedited Seismic Evaluation Process (ESEP) reports. Catawba's ESEP Report (ADAMS Accession No. ML15002A261) calculated the largest ratio of the GMRS-to-SSE spectral accelerations to be 1.91. McGuire's ESEP Report (ADAMS Accession No. ML15005A085) calculated the largest ratio of the GMRS-to-SSE spectral accelerations to be 1.74. These values were confirmed by the NRC and reflected in the ESEP staff review letters for Catawba and McGuire (ADAMS Accession Nos. ML16072A037 and ML16072A038, respectively).

By letter dated March 12, 2014, the Nuclear Energy Institute (NEI) provided information to the NRC with the subject title, "Seismic Risk Evaluation for Plants in the Central and Eastern United States" (ADAMS Accession No. ML14083A584). Attachment 2 of this letter was entitled, "Perspective on the Seismic Capacity of Operating Plants" (ADAMS Accession No. ML14083A587). The attachment stated that, due to several conservative design practices, ground motions at levels 1.5 to 2 times the SSE are expected to produce only a small probability of failure (e.g. approximately 1 percent) for safety-related structures, systems, and components.

GENERIC AND SITE-SPECIFIC SEISMIC RISK EVALUATIONS

The October 20, 2016, submittal provided a summary of several generic and site-specific seismic risk evaluations which have been performed over the years using various methods and inputs to quantify the SCDF at Catawba and McGuire. Some of the analyses, such as the Individual Plant Examination of External Events, were performed by Duke, and other evaluations, such as the safety/risk assessment of Generic Issue 199 (GI-199), "Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants" (ADAMS Accession No. ML100270582), were performed by the NRC staff. The most recent evaluation was performed by EPRI and submitted by NEI to the NRC in the aforementioned letter dated March 12, 2014. This evaluation used the same methodology as GI-199 coupled with the new site-specific, reevaluated seismic hazard information for Catawba and McGuire to calculate SCDF values.

The range of SCDF values from these calculations are captured in Attachment 2, Table 1: "Historical Range of SCDF for Catawba and McGuire," of the October submittal. The listed SCDF values for McGuire range from 1.1E-5/year to 4.7E-5/year, and the Catawba values range from 1.5E-5/year to 4.3E-5/year. Notably, the most recently calculated SCDF point estimate values from the EPRI report using the reevaluated seismic hazard information at the peak ground acceleration are 2.7E-5/year for McGuire and 2.8E-5/year for Catawba.

SITE-SPECIFIC CONDITIONAL CONTAINMENT FAILURE PROBABILITY

One of the factors that led to SPRAs being warranted for Catawba and McGuire in the NRC's October 27, 2015, letter was consideration of performance of ice-condenser containments during seismically-initiated events. In the October 20, 2016, submittal, Duke provided additional information on the pressure capacity of the containment. In response to an NRC staff clarification question, Duke provided additional information regarding the seismic capacities of some major components inside containment (ADAMS Accession No. ML16356A108).

Regarding the pressure capacity of the containments, the Duke submittal stated that containment capacity analyses had been performed for Catawba and McGuire as a part of the Individual Plant Examinations performed to address NRC Generic Letter 88-20. These analyses were used to develop graphs of the containment failure probability as a function of containment pressure. The curves were stated to combine the pressure fragility from the containment vessel shell, penetrations, and anchorage failure modes that were analyzed.

For McGuire, the curve showed a high confidence of low probability of failure (HCLPF) containment pressure capacity of 56 pounds per square inch (psi). This means that the containment is expected to remain intact and retain its pressure boundary integrity approximately 99 percent of the time when subjected to internal pressures reaching 56 psi. The HCLPF value is 3.7 times the containment design pressure of 15 psi. For Catawba, the HCLPF containment pressure capacity was determined to be 55 psi which is also approximately 3.7 times the containment design pressure of 15 psi.

With regard to the seismic capacity of the containments, the supplemental information provided by Duke indicated that major components in the containments had median seismic capacities greater than 2.5g for McGuire and greater than 1.92g for Catawba.

Additionally, Duke's submittal contained information taken from a calculation performed in support of a Significance Determination Process evaluation for Catawba. For that evaluation, five common, but not all-inclusive, thermal-hydraulic cases were analyzed to show containment pressure response following a station black-out (SBO) event that results in reactor vessel failure. The results provided in Attachment 2, Table 2: "Catawba CCFP Contributions for Various SBO Sequences," showed that four out of five of the analyzed sequences did not result in an overpressurization failure of the containment. The fifth sequence showed a 0.78 CCFP value corresponding with a peak calculated internal containment pressure of 106 psi (absolute).

SUMMARY AND CONCLUSION

The NRC staff has considered the additional information provided by Duke that pertains to the SPRA decision-making criteria stated in the NRC's October 27, 2015, letter. The staff concludes that the plant-specific combination of seismic hazard exceedances, the general estimation of the SCDFs, and the insights related to the CCFPs at both Catawba and McGuire indicate that the increase in seismic risk due to the reevaluated seismic hazard is addressed within the margin inherent in the design and that SPRAs are not warranted. Therefore, SPRAs for Catawba and McGuire are no longer necessary to fulfill the response to the seismic portion of the 50.54(f) letter.

High frequency evaluations and mitigating strategies assessments continue to be necessary to gain insights into these plants' responses to high frequency ground motion and to ensure that mitigating strategies capabilities address the reevaluated seismic hazard conditions. As stated in Duke's October 20, 2016, submittal, the NRC expects Catawba and McGuire to submit these assessments by August 31, 2017.

CATAWBA NUCLEAR STATION, UNITS 1 AND 2, AND MCGUIRE NUCLEAR STATION, UNITS 1 AND 2, SCREENING AND PRIORITIZATION RESULTS REGARDING SEISMIC HAZARD REEVALUATIONS FOR RECOMMENDATION 2.1 OF THE NEAR-TERM TASK FORCE REVIEW OF INSIGHTS FROM THE FUKUSHIMA DAI-ICHI ACCIDENT DATED December 22, 2016

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RidsNroDsea	RidsNrrDorl	RidsNrrOd	RidsNrrPMCatawba
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ADAMS Accession No: ML16344A313 ***via e-mail**

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