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

May 25, 2010

Mr. Dave Baxter
Vice President, Oconee Site
Duke Energy Carolinas, LLC
7800 Rochester Highway
Seneca, SC 29672

SUBJECT: OCONEE NUCLEAR STATION UNITS 1, 2, and 3 - REQUEST FOR ADDITIONAL INFORMATION (RAI) REGARDING THE LICENSEE AMENDMENT REQUEST FOR UPGRADING THE LICENSING BASIS FOR TORNADO MITIGATION (TAC NOS. ME1710, ME1711, AND ME1712)

Dear Mr. Baxter:

By letters dated June 26, 2008, and June 29, 2009, Duke Energy Carolinas, LLC, submitted license amendment requests (LARs) for the Oconee Nuclear Station, Units 1, 2, and 3 which proposes revisions to the current licensing basis regarding tornado mitigation. The NRC staff has reviewed the LARs and determined that additional information is required in order to complete the review. The requested additional information is enclosed. Please provide a response to the request within 30 days from the date of this letter. The draft RAIs were e-mailed to members of your staff in February 2010. If you cannot respond to the RAIs within 30 days please provide a letter within 15 days from the date of this letter providing a schedule when requested information will be submitted.

If you have any questions, please call me at 301-415-1345.

Sincerely,

John Stang, 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 (RAI)

LICENSE AMENDMENT REQUEST

TO REVISE PORTIONS OF THE

UPDATED FINAL SAFETY ANALYSIS REPORT (UFSAR) RELATED TO THE

TORNADO LICENSING BASIS

DUKE ENERGY CAROLINAS, LLC

OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3

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

By letters dated June 26, 2008 and June 29, 2009, (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML081840372 and ML091871223), Duke Energy Carolinas, LLC (the licensee, Duke), submitted license amendment requests (LARs) for the Oconee Nuclear Station (ONS), Units 1, 2, and 3 which proposes revisions to the current licensing basis regarding tornado mitigation. By letter dated July 6, 2009, (ADAMS Accession No. ML091700738) the U.S. Nuclear Regulatory Commission (NRC, the Commission) staff sent the licensee a request for additional information (RAI) concerning the June 26, 2008, LAR. By letter dated September 2, 2009, (ADAMS Accession No. ML092520189), the licensee responded to the RAIs. Upon review of the September 2, 2009, RAI responses, and the June 29, 2009, LAR the NRC staff has determined that the following additional information is required in order to complete the review of the LARs.

RAI 2-1

BACKGROUND

The response to RAI 11 transmitted by letter dated September 2, 2009[1] was found to be unacceptable. The licensee failed to address two (2) of the three (3) questions. The licensee only addressed the first issue: (a) provide a basis for stating the LAR contains an expansion of the use of the TORMIS methodology. The licensee did not address the other two issues in the RAI: (b) provide a basis for stating the NRC staff acknowledged the licensee's specific application of the TORMIS methodology, and (c) provide clarification as to the LAR being based on the NRC staff having accepted the probabilistic analysis as the current licensing basis (CBL) for tornado protection.

The following excerpts from the LAR 2006-009 form the basis for this RAI.

[1] Letter from D. Baxter, Duke Energy, to U.S. Nuclear Regulatory Commission, "Responses to Request for Additional information for License Amendment Request to Revise Portions of the Updated Final Safety Analysis Report Related to Tornado Licensing Basis; License Amendment Request 2006-009," September 2, 2009 (ADAMS Accession No. ML081840371)

Excerpt 1, from Enclosure 2, Section 2, "BACKGROUND/CIRCUMSTANCES," pages 3 and 4:

> In 1989, the NRC issued an SER [Safety Evaluation Report] that acknowledged Duke's specific application of the TORMIS methodology. In the 1989 SER[3] which closed out the post-TMI [Three Mile Island] EFW [Emergency Feedwater] issue, the NRC stated,
>
> > *'..the undamaged EFW system in one unit can supply feedwater to the SGs [steam generators] in a unit with damaged EFW system cross-connections in the pump discharge piping...Based on review of your probabilistic analysis, the staff concludes that the ONS secondary side heat removal capability complies with the criterion for protection against tornadoes, and is therefore acceptable. This conclusion is based primarily on the availability of the SSF [standby shutdown facility] ASW [auxiliary service water] system.'*
>
> The SSF ASW, Station ASW and the EFW systems from the unaffected unit were credited with supplying SSDHR [secondary side decay heat removal] following a damaging tornado.[2],

Excerpt 2, from Enclosure 2, Section 3, "DETAILED DESCRIPTION OF PROPOSED CHANGES," page 6:

> This LAR incorporates revisions to the tornado CLB and includes a number of plant modifications, UFSAR [Updated Final Safety Analysis Report] revisions, and an expansion of the use of the tornado missile probabilistic methodology (TORMIS) in determining which systems, structures, or components require physical protection from tornado-generated missiles at the site.

ISSUE

Excerpt 1 is identified as being from the 1989 SER. This is incorrect. The excerpt is from the letter transmitting the SER.

Excerpt 1 states that the NRC has "... acknowledged Duke's specific application of the TORMIS methodology." The staff acknowledges that the probability analysis, which is referred to in the 1989 SER and contained in a1986 submittal from Duke Power Company to NRC[3] is based on the TORMIS methodology. However, there are no references in the 1989 SER to the TORMIS

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[2] Letter from Hal B. Tucker, Duke Power Company, to Harold R. Denton, U.S. Nuclear Regulatory Commission, dated September 15, 1986 with Attachment "Response to NRC Request for Additional Information, Dated May 30, 1986, EFW Tornado Protection, Oconee Nuclear Station Units 1, 2, and 3"

[3] Wiens, Leonard A., Project Manager, Division of Reactor Projects I/II, Office of Nuclear Reactor Regulation, to Tucker, H. B., Vice President, Nuclear Production Department, Duke Power Company, "Safety Evaluation Report of Effect of Tornado Missiles on Oconee Emergency Feedwater System," dated July 28, 1989

methodology. Further, the NRC staff can find no documented approval for the use of the TORMIS methodology at ONS in any correspondence.

Excerpt 2 implies that the NRC staff has approved the use of the TORMIS methodology for ONS with the words: "This LAR incorporates revisions to the tornado CLB and includes...an expansion of the tornado missile probabilistic methodology (TORMIS) ... The NRC staff acknowledges that considering the words contained in Excerpt 1 in isolation, it could be concluded that the NRC staff based its acceptance of the ONS response to the TMI Action Plan pertaining to the feedwater systems at least partially on the probabilistic analysis that was performed by the licensee. The NRC staff finds that a complete reading the 1989 SER and its transmittal letter concludes that the NRC staff's acceptance was based on having several independent means of providing emergency feedwater, and not the calculated probability from the probability analysis. This is based on the following excerpts from the SER and its transmittal letter:

Excerpt 3, from the transmittal letter:

> ... However, the probabilistic analysis was incomplete in that it did not include loss of the EFW system as a result of failure of the emergency power source due to damage to Keowee dam structures and components. The staff, therefore, concluded that loss of secondary heat removal capability by the EFW system due to tornado missiles would exceed [emphasis added] the Standard Review Plan (SRP) acceptance criteria of 1×10^{-6}. However, your submittal noted that the Oconee plant also has other methods of providing feedwater to the steam generators in any unit with a damaged or inoperable EFW system as follows:
>
> **1.** Standby shutdown facility auxiliary service water (SSFASW) system...

Excerpt 4, from the SER:

> 2.0 Evaluation
>
> ...The analysis did not include loss of the EFW and ASW systems due to damage to structures and components at the Keowee dam itself. Consequently, the licensee value for loss of secondary decay heat removal capability due to tornado missiles is underestimated. Despite this, the staff determined from its review of the licensee's probabilistic that because of the availability of the tornado missile protected SSFASW system, the probability of loss of secondary decay heat removal capability is within the Standard Review Plan (SRP) tornado acceptance criterion. The tornado missile protected SSFASW system provides sufficient additional capability to bound the above deficiency in the licensee probabilistic analysis and thereby ensure that the probability of loss of secondary decay heat removal due to tornado missiles is acceptably low.

Excerpt 5, from the SER:

> 3.0 Conclusion
>
> ... the staff concludes that the probability of failure of the EFW and ASW system combined with the protection against tornado missiles afforded the SSFASW, satisfies the SRP probabilistic criterion, and is therefore, acceptable. The NRC staff concludes that the protected SSFASW system provides sufficient additional capability to overcome the deficiency in the licensee's probabilistic analysis regarding proper consideration of tornado missile damage to the EFW and ASW emergency power supply...

Based on Excerpts 3, 4, and 5, the NRC staff finds that the NRC did not accept the probability analysis using the TORMIS methodology as the basis for accepting the ONs EFW tornado protection. The NRC staff found the analysis incomplete and not meeting the SRP acceptance criteria. The NRC staff acceptance was based on the defense-in-depth provided by the protected SSFASW system.

The NRC staff has not identified where the NRC has accepted the TORMIS methodology, or any probability analysis, for use at ONS. Since the use of the TORMIS methodology has not been accepted for use at ONS, there can be no expansion of the use of the TORMIS methodology when discussing the CLB for ONS.

REQUEST

The licensee is requested to either:

a. Provide documentation that the NRC staff ":...acknowledged Duke's specific application of the TORMIS methodology" and explaining the basis for LAR 2006-009 saying it contains ".... an expansion of the use of the tornado missile probabilistic methodology (TORMIS)....", or

b. Failing "a", the licensee is requested to revise LAR 2006-009 to remove all references to the prior approval/acknowledgement/use of the TORMIS methodology or other probability analysis when discussing the ONS CLB.

RAI 2-2

BACKGROUND

RAI-12, transmitted by letter dated July 6, 2009, RAI-12, requested the licensee to:

> Provide a basis for the use of the TORMIS methodology in identifying and/or excluding systems structures and components (SSC) requiring or not requiring tornado protection as part of the ONS licensing basis.

The licensee's response, transmitted by letter dated September 2, 2009, contained the following:

For clarification, the first sentence in Enclosure 2, Section 3 of the LAR, is modified as follows:

> *This LAR incorporates revisions to the tornado CLB and includes a number of plant modifications, USFAR [updated final safety analysis report] revisions, and an expansion of the use of the tornado missile probabilistic methodology (TORMIS) in determining which systems, structures, or components require added physical protection from tornado-generated missiles at the site.*

This change clarifies that the use of TORMIS at Oconee is for evaluation of plant upgrades (for exemption) rather than to imply that TORMIS is used to determine which structures systems and components (SSCs) are subject to protection requirements.

The NRC staff's position on the use of the TORMIS methodology is contained in several documents. The SER [4] approving the use of the TORMIS methodology, Section III, "Conclusion," states: "... Further, use of the EPRI PRAs or any tornado missile probabilistic study should be limited to the evaluation of specific plant features where additional costly tornado missile protective barriers or alternative systems are under consideration." The NRC staff's position was clarified in a memorandum[5] dated November 7, 1983, which states: "We believe that the deterministic approach in the current SRP for tornadoes should continue to be used, with the PRA approach employed on a case by case basis for assessing specific plant features which are exceptions." The NRC staff further clarified its position on the use of the TORMIS methodology in Regulatory Issue Summary (RIS) 2008-014[6]. Specifically, the RIS states under "Summary of Issue – Use of TORMIS." "The TORMIS methodology is not currently approved for the following: justifying not providing positive tornado missile protection (i.e., barriers) for plant modifications."

ISSUE

The TORMIS methodology is approved for use as a basis for not providing positive tornado missile protection for structures and components when the CLB requires positive tornado missile protection. The TORMIS methodology is only to be used on existing plant structures and components.

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[4] Memorandum from L. S. Rubenstein, Assistant Director for Core and Plant Systems, Division of Systems Integration, to Frank J. Miraglia, Assistant Director for Safety Assessment, Division of Licensing, "Safety Evaluation Report – Electric Power Research Institute (EPRI) Topical Reports Concerning Tornado Missile Probabilistic Risk Assessment (ORA) Methodology," dated October 23, 1983, (ADAMS Accession No. ML080870291)

[5] Memorandum from Harold Denton, Director, Office of Nuclear Reactor Regulation, to Victor Stello, Deputy Executive Director for Regional Operations and Generic Requirements, "Position On The Use Of Probabilistic Risk Assessment In Tornado Missile Protection Licensing Actions," dated November 7, 1983, (ADAMS Accession No. ML080870287)

[6] "NRC Regulatory Issue Summary 2008-14 Use of TORMIS Computer Code for Assessment of Tornado Missile Protection," dated June 16, 2008 (ADAMS Accession No. ML080230578)

The proposed revision to first sentence in Enclosure 2, Section 3, of the June 26, 2008, LAR can be interpreted that the TORMIS methodology is being used to determine what level of positive tornado missile protection is required. Including the word "added" to the sentence provides no substantive difference from the original wording. Thus the staff finds the proposed revision to first sentence in Enclosure 2, Section 3, of the LAR to be not in compliance with the approved use of the TORMIS methodology and is not acceptable.

The statement "... that the use of TORMIS at Oconee is for evaluation of plant upgrades (for exemption) rather than to imply that TORMIS is used to determine which SSCs are subject to protection requirements" does not comply with the guidance provided in RIS 2008-14. The RIS clearly states that the TORMIS methodology is not approved for use in justifying not providing positive tornado missile protection. Therefore, the NRC staff finds the licensee's position on the use of the TORMIS methodology not in compliance with the staff's guidance on the use of the TORMIS methodology.

As noted in RAI 2-1, the NRC staff takes exception to use of the phrase "...expansion of the use of the tornado missile probabilistic methodology (TORMIS)..." The NRC staff has not approved the use of the TORMIS methodology for ONS. Therefore, since the use of the methodology does not exist from a regulatory perspective, there can be no expansion of its use in a regulatory document.

REQUEST

a. Revise the LAR to clearly state that the TORMIS methodology is only used to justify not providing positive tornado missile protection and then only when the conditions spelled out in the SER approving the use of the TORMIS methodology are met.

b. Revise the LAR to be in compliance with the staff's position regarding the use of the TORMIS methodology to evaluate plant upgrades (modifications). Identify what plant upgrades/modifications were evaluated using the TORMIS methodology and what changes/modifications will be required as a result of complying with the staff's position.

c. Revise the proposed first sentence in Enclosure 2, Section 3 of the LAR to remove reference to "...expansion of the use of the tornado missile probabilistic methodology (TORMIS)..." (Also requested in RAI 2-1).

RAI 2-3

BACKGROUND

Enclosure 2 of the June 26, 2008 LAR, Section 4.1 (pg 10), "Tornado LB Description," under "Revised LB" states:

> The "Severe Weather" emergency procedure is entered for a tornado watch[17], severe thunderstorm warning, or high wind warning. At that time, the main Control Room (CR) Senior Reactor Operator (SRO) will appraise the situation, via National Weather Service (NWS) bulletins received in the CR, and determine

> the need to staff the SSF. If required, the SRO will dispatch one (1) licensed reactor operator to the SSF to establish communications with the main CR. The SRO will consider each specific situation for example, if a hurricane has come through the Gulf and the tornado watch and warning boxes are tracking toward ONS, it would be prudent to man the SSF. However, if the storm is an afternoon thunderstorm that just pops up or the storm is tracking away from ONS, the SRO may decide not to staff the SSF.

[17] A tornado watch is issued to alert for the possibility of tornado development in the area. A tornado warning means that a tornado has actually been sighted or is indicated by NWS RADAR

ISSUE

The June 26, 2008 LAR, describes the actions of the SRO with respect to staffing the SSF. The LAR does not describe any criteria to be used by the SRO in making the decision to man the SSF nor are the qualifications and training for that makes the SRO qualified to make this decision provided.

REQUEST

a. Provide a description of the qualifications and training the SRO receives that qualifies the SRO to make the decision on when to man the SSF in case of a tornado warning in the area of ONS.

b. Provide a description of any guidelines/action statements contained in the "Severe Weather" emergency procedure that provide guidance to the SRO on when the SSF is to be manned.

RAI 2-4

BACKGROUND

The June 26, 2008 LAR, Section 3.5, states:

> Each unit's BWST will be physically protected to the extent necessary to assure that the tank and flowpath are available following a tornado. Since the borated water storage tanks (BWSTs) are vented, tornado induced ΔP damage is not a concern. Duke will reconstitute the original wind analysis to ensure that the tanks can withstand UFSAR Class I wind criteria. As required, vulnerable areas of the tanks and flow paths will be physically modified to protect against UFSAR Class I tornado missiles.

RAI-15, Item b, transmitted by letter dated July 6, 2009[7], requested the licensee to provide a schedule for completion of the reconstitution of the "original wind analysis" and provide a description of all modifications made to protect the BWSTs and flow paths. The licensee

[7] Letter from John Stang, Project Manager, U.S. Nuclear Regulatory Commission, to Dave Baxter, Site Vice President, Oconee Nuclear Station, Duke Energy Carolinas, LLC, "Request for Additional Information Regarding License Amendment Request for Updating the Licensing Basis for Tornado Mitigation," July 6, 2009

response to RAI-15, Item b, transmitted by letter September 6, 2009[8], provided an expected date of September 2009 for completion of the reconstituted wind analysis. The response further stated that "Modifications to protect vulnerable areas of the tanks and flow paths began in July 2009." A general description of the protective structures was provided and that excavation work was started in July 2009.

ISSUE

The licensee's response did provide an expected date for completion of the wind analysis and a general description of some steel enclosures is provided. Regarding the steel enclosures, no basis for the enclosures is provided. It is not clear if the steel enclosures are the only modifications that are involved with protecting BWSTs and associated flow paths. A full description of the modifications is required for the NRC review. The NRC staff needs to understand the bases for the modifications as well as the description of the modifications.

REQUEST

a. Notify the NRC when the wind analysis reconstitution is completed and available for NRC staff review.

b. Identify all structures and components requiring protection from tornado missiles. Provide the bases and descriptions for all modifications required to protect the BWSTs and the associated flow paths. Include a description and bases for what portions of the BWSTs are protected and not protected from tornado missiles.

RAI 2-5

BACKGROUND

Enclosure 2, Section 4.2, "Damage Repair Guidelines and Procedures," states:

> ...The portions of the SSF in the WPR [West Penetration Room]/CDTR [cask decontamination tank room] will be protected from wind and ΔP, and a TORMIS analysis has concluded that the possibility of damage from a tornado missile is acceptably low. As such, restoration procedures will not be required to maintain SSFASW flow and RCS [reactor coolant system] indication.

ISSUE

The NRC has only approved the use of the TORMIS methodology as a basis for not providing positive tornado missile protection. The NRC staff is unaware of other uses for the methodology, e.g., to justify not providing restoration procedures. Since the licensee is relying on restoring equipment that may be damaged by a tornado missile to cool down ONS to approximately 250°F using the new protected service water (PSW) system or SSF ASW pump, it is prudent to provide restoration procedures for the SSFASW pumps to the same degree as

[8] Ibid, Note 1

other restoration procedures for other systems and components required to bring the plant to cold shutdown.

REQUEST

Provide a detailed justification for not providing restoration procedures for the SSFASW flow and RCS indication. Include a basis for using the TORMIS methodology.

RAI 2-6

BACKGROUND

Enclosure 2, Section 4.2, "Damage Repair Guidelines and Procedures," states: "...Consequently, there it is unlikely that the integrity of these walls would not be compromised by a damaging tornado missile."

ISSUE

The cited sentence as presented is stating "that the integrity of these walls" would be compromised – "...unlikely that...walls would not be compromised..." means that it is likely that the walls would be compromised.

REQUEST

a. Clarify the cited sentence.

b. If the sentence is correct, provide a description of the consequences of compromising the walls.

RAI 2-7

BACKGROUND

Enclosure 2, Section 4.4, "TORMIS Methodology," states: "The TORMIS methodology is used to establish compliance with SRP guidance for tornado missile protection..."

ISSUE

The SER approving the use of the TORMIS methodology states in Section III, "Conclusion," that "...this is an acceptable probabilistic approach for demonstrating compliance with the requirements of General Design Criteria 2 and 3 regarding protection of safety-related plant features from the effects of tornado..." [NOTE: for ONS in lieu of General Design Criteria substitute "Criterion 2 – Performance Standards", see ONS UFSAR, Section 3.1 "Conformance with General Design Criteria"]

Title 10 of the *Code of Federal Regulations (10 CFR)*, Part 50, Section 34, paragraph (h)(3) [10 CFR 50.34(h)(3) states:

> The SRP was issued to establish criteria that the NRC staff intends to use in evaluating whether an applicant/licensee meets the Commission's regulations. The SRP is not a substitute for the regulations, and compliance is not a requirement.

Based on these citations, it is clear that in dealing with regulatory matters the TORMIS methodology is not "...used to establish compliance with SRP guidance..." Rather, it is used in limited cases to demonstrate compliance with regulatory requirements and a plant's licensing basis.

REQUEST

Revise the Enclosure 2, Section 4.4, to correct the statement regarding the use of the TORMIS methodology.

RAI 2-8

BACKGROUND:

The licensee's response to RAI 11, transmitted by letter dated September 2, 2009, stated that Duke Energy Carolinas, LLC has utilized the TORMIS methodology in previous responses to tornado missile-related NRC inquiries. However, these submittals did not result in TORMIS being incorporated into the tornado LB. Duke proposes to 'expand' its use by formally incorporating the TORMIS methodology into Oconee's tornado licensing basis (LB).

ISSUE

As indicated in the licensee's response to RAI 11, transmitted by letter dated September 2, 2009, the NRC staff has never accepted the referenced ONS probabilistic analysis as the current licensing basis. The NRC staff requires additional information on the probabilistic analysis to complete its review.

The licensee submitted a letter on September 15, 1986 (ADAMS Accession No. 8609250224), which discuses two past tornado analyses, a probabilistic analysis addressing the capability to provide secondary decay heat removal in the event of a tornado. In addition by letter dated December 18, 1997 (ADAMS Accession No. 9801020094) the licensee submitted, the tornado probabilistic risk assessment (PRA) that was submitted on December 18, 1997.

The TORMIS method endorsed by the NRC staff in its 1983 SER approving the use of the TORMIS methodology normally estimates the average annual probability of a tornado damaging any of the important SSCs not deterministically protected from tornados. In some cases, multiple SSCs must be simultaneously damaged to be "important" and the TORMIS code can provided the probability of these simultaneous multiple strikes. Rather than performing specific evaluations as to whether the strike(s) can actually cause damage and releases, a damaging tornado missile strike on important SSC(s) is assumed to result in a radioactive release that exceeds 10 CFR Part 100 guidelines. A tornado PRA, in contrast, credits the potential operability of all SSCs that can be used to fulfill mitigation functions after a tornado strike.

Some SSCs would be assigned failure probability caused by tornado damage; others could be assigned random failure probabilities.

REQUEST

a. Provide a description of the scenarios for which frequencies are reported in Table 5 of the June 26, 2008 LAR. What is the end state of the scenarios; damage of important SSCs, failure of mitigation functions, or core damage? Do these scenarios include; tornado damage to any individual important SSC, tornado damage to combinations of important SSCs, or combinations of tornado damaged and randomly failed SSCs (including failures of operator actions)?

b. Provide all logic models linking the failures of individual SSCs (including random failures if used) to the quantified scenarios. These logic models could include event trees, fault trees, and/or logical equations.

c. Provide the failure parameters (both tornado caused failures and random failures) used as inputs to the probabilistic analysis and the results of the probabilistic analysis (if different than Table 5-1).

d. Provide a discussion on how the technical adequacy of the logic models and failure parameters has been assessed. If multiple SSC failures are required (i.e., any AND gates are used) before an end state or top event is reached, please summarize how the scenarios requiring multiple failures were developed.

RAI 2-9

As stated in the June 29, 2009 LAR, the fiber reinforced polymer (FRP) system will be applied to the exterior surface of the masonry brick walls. Page 5 of Enclosure 1 of the LAR states that the proposed FRP system will be exposed to ambient temperature and humidity conditions associated with the local climate. Considering that the temperature and humidity in the confined space between the metal siding and the brick walls are not controlled and will rise during summer months, please provide further information to justify the acceptance of the proposed FRP system.

RAI 2-10

Page 5 of Enclosure 1 of the June 29, 2009 LAR, states that the proposed FRP system will not be exposed to significant radiation levels when applied to the exterior surfaces of masonry walls. Please provide further information to justify the acceptance of the proposed FRP system for the expected radiation levels.

RAI 2-11

Page 4 of Enclosure 1 of the June 29, 2009 LAR, states that the installation of the FRP system will not adversely affect the current structural qualification of the brick walls by significantly increasing the stiffness. Contrary to this statement, based on a review of out-of-plane displacement test results for control wall C3-1.2 (Figure 47) and FRP modified wall S5-1.2-SR

(Figure 111), there is an appreciable increase in the out-of-plane stiffness of the FRP modified wall which, in turn, will change the frequency content of the brick wall. Please address the effects of the installation of the FRP system on the in-plane and out-of-plane stiffness of the brick walls. Also, discuss your plan and subsequent actions to evaluate the effects on the seismic analyses performed in response to the NRC Bulletin 80-11, Masonry Wall Design.

RAI 2-12

Page 3 of Enclosure 1 of the June 29, 2009, LAR states that the existing brick walls will be analyzed in accordance with the SRP, Section 3.8.4. Appendix A to the SRP, Section 3.8.4, states that the analysis should consider both in-plane and out-of-plane loads, and interstory drift effects. The LAR and the experimental testing program only address the effects of the out-of-plane loading on the FRP modified walls. During a design basis tornado event, these in-fill brick walls will also be subjected to the in-plane forces due to the tornado wind acting on the auxiliary building structural framing system. Please discuss the effects of the in-plane forces concurrent with the out-of-plane forces acting on the FRP modified walls.

RAI 2-13

The June 29, 2009 LAR, does not discuss the acceptability of the out-of-plane displacement of the brick walls due to tornado differential pressure load. Please provide further information and discuss the potential spatial interaction with safety-related components. Page 2 of Enclosure 2 of the LAR states that qualification testing will be conducted as part of the commercial grade dedication process. Please confirm that the qualification testing of the FRP constituents will be performed by an independent laboratory and that these tests are in addition to the tests performed by the FRP system manufacturer.

RAI 2-14

Page 4 of Enclosure 1 of the June 29, 2009 LAR, states that the licensee will utilize technical procedures to control testing of concrete substrate and installation and inspection of the FRP system in accordance with ICC AC125, ACI 440.2R-02 and ICC AC178. Please provide further information relative to the conformance of the FRP installation and associated testing with the requirements of the licensee's quality assurance and quality control programs for safety-related applications.

RAI 2-15

Page 4 of Enclosure 2 of the June 29, 2009 LAR, states that as part of the long term surveillance program, visual inspections will be performed on selected portions of FRP strengthened brick walls and adjacent test walls. Please provide further clarification relative to the term "selected portions."

RAI 2-16

Page 4 of Enclosure 2 of the June 29, 2009 LAR, states that the test walls will be more accessible for tension adhesion testing, implying that the test walls are not configured the same as the FRP modified walls (e.g., there is no siding to remove). Considering RAI 2-9 please

provide further discussion to justify that the test walls are exposed to the same environmental conditions as the FRP modified walls.

RAI 2-17

Please discuss how ACI 530R-02, referenced on Page 4 of Enclosure 2 and in Attachment 2.2 of Enclosure 2 of the June 29, 2009 LAR, will be used in tension adhesion testing. There appears to be a typographical error in the designation of the ACI standard.

RAI 2-18

Please confirm that the height of the existing Unit 2 masonry brick wall, located at Elevation 809'-3" and designated as Line X, Column Line 78a to U2 RB in Enclosure 3 of the June 29, 2009 LAR, will be modified so that its aspect ratio is within the range used in the experimental testing program. Also, please discuss the applicability of the experimental test results to the modified configuration of this wall.

RAI 2-19

Enclosure 4 of the June 29, 2009 LAR, states that the structural steel shear restraint system will be installed along the top and sides of the masonry walls since the performance testing program demonstrated that potential shrinkage cracks along the sides or settlement cracks along the top edge of the masonry walls may exist. The design methodology proposed in this LAR uses a simply supported plate on all four sides. The bottom edge of the wall could also be affected by shrinkage cracks and may not provide shear resistance. Considering this uncertainty, relative to the as-built wall boundary condition, to maximize the flexural demand on the FRP system and to maximize the reaction force on the shear restraint system, please provide discussion on the design methodology if the bottom edge of the wall is considered free.

RAI 2-20

Specimen S7-1.2-SR was tested to failure with shear restraints in place. The failure mode is noted as shear sliding. Please provide further detail relative to the failure mechanism (shear restraint failure, anchorage failure, etc.) that caused the shear sliding failure of the wall. Also, it is stated that up to a pressure of 3.9 psi, no visible signs of damage were observed. Referring to Figure 143, of the June 29, 2009 LAR, at location V1, the measured FRP strain exhibits a non-linear behavior beyond 2.4 psi pressure. Please discuss and provide further information regarding this discrepancy.

RAI 2-21

The experimental testing program was conducted using one FRP ply and a maximum coverage of 100 percent. Considering the fact that the experimental testing program was conducted to support the design methodology for the FRP strengthened brick walls, please provide further discussion if the modifications of the existing ONS brick walls require more than one ply of FRP reinforcement, which will be outside the parameters of the tested conditions.

RAI 2-22

Page 10 of Enclosure 4 of the June 29, 2009 LAR, includes a note relative to the shear capacity of unreinforced masonry and limitation of net section, An, to the compression portion of the wall cross section as required in Section 11.2.1.1 of ACI 531-79. Please discuss how this provision is incorporated in the proposed design methodology for the FRP modified walls.

RAI 2-23

Pages 15 and 16 of Enclosure 4 of the June 29, 2009 LAR, states that the shear restraints will be designed based on deflection criteria. Please provide further information and discuss how this deflection design criterion is the controlling case, when compared with the reaction force due to the design basis tornado and seismic loads.

RAI 2-24

The installation of shear restraints is the primary parameter required for the validity of the methodology and boundary conditions used in the analysis of the existing brick walls. Please discuss why the list of regulatory commitments in Attachment 2.2 of Enclosure 2 of the June 29, 2009 LAR, and the flow chart shown in Attachment 4.1 of Enclosure 4 of the LAR do not include the installation of shear restraints.

RAI 2-25

The use of the FRP system to modify selected masonry block walls in the auxiliary building, included in your LAR dated June 1, 2006, (ADAMS Accession No. ML061580078) was approved by the NRC staff and documented in SEs dated February 21, 2008 (ADAMS Accession No. ML080320065), and March 26, 2008 (ADAMS Accession No. ML080720414). The installation of shear restraints should also be applicable to these walls to ensure the validity of the boundary conditions used in the analysis. Please discuss your plans and subsequent actions to incorporate the installation of shear restraints for these masonry block walls.

RAI 2-26

Attachment 2.1 of Enclosure 2 of the June 29, 2009, LAR includes the UFSAR mark-ups. Please discuss the differences between the UFSAR mark-ups in this LAR and the previous LAR approved by the NRC staff and documented in safety evaluations (SEs) dated February 21, 2008 and March 26, 2008.

RAI 2-27 through RAI 2-36 were previously requested in an NRC letter dated July 6, 2009 (ADAMS Accession No. ML091700738). The licensee's response to the RAIs was in the letter dated September 2, 2009 (ADAMS Accession No. ML092520189). The licensee's response to each of the questions indicated that the design of the PSW system was not completed and indicated additional information would be available in the future. Please provide completed answers to these previously requested RAIs.

In some responses you indicated the PSW will be designed and installed in accordance with industry guidance and standards. In response to the following questions please provide specific references.

RAI 2-27

Provide the following information for the new PSW transformer, switchgear, load center and the circuit breakers: (1) equipment design ratings, (2) a summary of the analyses performed to show the loading, short circuit values and the interrupting ratings, voltage drop, and protection and coordination, (3) the existing station ASW switchgear ratings, and (4) the periodic inspection and testing requirements for electrical equipment. Provide applicable schematic and single line diagrams.

RAI 2-28

Provide the following information concerning the proposed PSW instrumentation and control (I&C) power and the interface with the existing plant vital I&C power: (1) design of the direct current (DC) system for the PSW system including how the DC control power for the new PSW load center, switchgear and the transformer will be provided, (2) the impact on existing DC vital system including loading on the existing battery and the battery charger, (3) describe the analysis performed to determine the capacity of the batteries and the battery charger, voltage requirements at the equipment terminals, electrical protection and co-ordination, and (4) the periodic inspection and testing requirements. Provide applicable schematic and single line diagrams.

RAI 2-29

In Enclosure 2, Section 3.3.4 of the June 26, 2008 LAR, the licensee states that the Keowee Hydroelectric Units (KHUs) will provide power supply to the PSW switchgear through underground cables. Provide analyses to show the kilo volt ampere (kVA) loading, new circuit breaker rating, short circuit values, and voltage drop. In addition, provide information on the electrical protection and coordination, and the periodic inspection and testing requirements. Further, explain how the redundancy and independence of the Class 1E power system is maintained as a result of the proposed modification. Provide applicable schematic and single line diagrams.

RAI 2-30

The licensee states in the June 26, 2008 LAR, that the PSW system will be fully operational from the respective unit's main control room and will be activated when existing redundant emergency systems are not available. Describe how the alarms, indications, and the electrical controls will be provided from the main control rooms of Units 1 and 2 to the proposed PSW switchgear. Explain how the controls are provided for Unit 3. Provide applicable electrical schematics and evaluations highlighting the design features.

RAI 2-31

Provide information on how the licensing basis for physical independence and separation criteria are met for the PSW electrical system.

RAI 2-32

The licensee states in the June 26, 2008 LAR, that the new PSW system switchgear will receive power from the KHUs via a tornado-protected underground feeder path. Provide the following information:

1. type of underground cable installation, i.e., direct burial or in duct banks, manholes etc.

2. how the licensee will ensure that the proposed new underground cables remain in an environment that they are qualified for

3. periodic inspections and testing planned for cables to monitor their performance, and

4. details regarding cable size, type, maximum loading requirements, and cable protection devices.

RAI 2-33

Provide information concerning the design details for the new 100/13.8 kV substation, the PSW transformer and switchgear building power feeds, its protection, controls and alarms features. Provide applicable single line diagram and electrical schematics.

RAI 2-34

The licensee states in Enclosure 2, Figure 1, of the June 26, 2008 LAR, that two new power feeds will be installed to the auxiliary building (AB) with one power supply to the Units 1, 2, and 3 AB equipment high-pressure injection (HPI) pumps and vital I&C normal battery chargers and other power supply to the backup power to the Units 1, 2, and 3 pressurizer heaters. Provide the following information concerning this installation: (1) compare and contrast the existing power supply requirements for the above loads, (2) how the electrical separation, independence, and redundancy requirements are maintained, (3) summary of the voltage analyses for the equipment/components affected by this modification, (4) design details for the new power feeds to AB, (5) periodic inspections and testing schedule for the these cables to monitor their performance, and (6) provide the electrical schematics and one-line drawings for these power feeds.

RAI 2-35

Provide confirmation that the maximum float/equalizing voltage does not exceed the equipment maximum dc voltage rating.

RAI 2-36

Describe in detail how the 125 vdc vital I&C primary and backup power cables and the KHU emergency start circuitry will be rerouted from the turbine building to the auxiliary boiler.

RAI 2-37

The new tornado mitigating strategies make the use of the RETRAN 3D code. The NRC staff's SE that generically approved RETRAN-3D for licensing analyses contains 45 conditions and limitations. In light of the licensing basis reconstitution, the ONS plant design is expected to be significantly different, and these differences will likely result in RETRAN-3D model changes. Provide a disposition for each condition and limitation to indicate that modeling any proposed facility modifications remains within the conditions and limitations of the RETRAN-3D as approved by the NRC.

RAI 2-38

For the worst-case main steam line break following a tornado, provide the following information:

a. Tabulate significant parameters, initial conditions, and results to facilitate comparison among analyzed cases.

b. Provide plots of significant parameters for the analyzed cases.

RAI 2-39

In the proposed new tornado mitigation strategies the SSF is credited for achieving and maintain hot standby conditions and cooling the reactor coolant pump seals. In order for the SSF to be credited, operators have to be dispatched to the SSF to man it. The operators are dispatch during a tornado warning and not during a tornado watch. Once a tornado warning has been declared, if the tornado hits the ONS site, before the SSF can be manned the SSF would not be readily accessible and it would be potentially too late to man the SSF until the tornado has passed. Provide the justification for not manning the during a tornado watch.

RAI 2-40

To ensure licensing-basis clarity and component operability, TSs need to properly address the tornado mitigation systems (e.g., PSW/SSF, protected service water/ standby shutdown facility, etc.) in a manner that is consistent with the Standard TS requirements that have been established for the functions that are being performed by these systems. For example, the minimum required mission time should be 7 days and the Completion Times should be limited to 72 hours in most cases for the SSF and the PSW including maintenance. Justify the existing limiting condition for operation (LCO) time for the SSF in the current TSs and the proposed LCO for the PSW system based on the fact the proposed tornado mitigation strategy relies solely on the SSF and the repair of the PSW system to achieve and maintain hot standby and entry into cold shutdown following a design basis tornado.

RAI 2-41

Portions of the reactor coolant system (RSC) and other high energy lines in the plants could possibly be damaged by tornado-generated missiles, resulting in a significant loss-of-coolant accident or high energy line break. Discuss how this vulnerability is being addressed in the new tornado mitigating strategies.

RAI 2-42

Provide a list of any new analyses, codes, and/or models being utilized for the proposed tornado mitigating strategies that need to be integrated into the UFSAR. Provide the justification for their use.

RAI 2-43

Provide the following information concerning the ability to achieve and maintain hot standby (TS MODE 3) following the worst-case design basis tornado.

a. List of equipment that will be used

b. Initial plant conditions.

c. Discuss any scenarios where with use of only the SSF to achieve and maintain hot standby would this cause any of the units to operate outside the normal operating boundaries as described in the UFSAR (i.e., the RCS does not stay sub-cooled with a pressurizer steam bubble).

d. Provide the basis for the SSF initiation times and confirmation that human factors assessment has been completed that is consistent with the NRC review standards and guidance to validate operator actions and times.

e. Provide a list of all operator actions, a timeline for achieving hot standby and the systems that will be available and the amount time when other systems (PSW/HPI) will have to be repaired/restored to maintain the units in a safe and stable condition following a tornado.

RAI 2-44

Discuss how cold shutdown will be achieved following a design basis tornado including, (a) define a time for achieving cold shutdown based on the worst-case repairs that will need to be made following a tornado; (b) recognition of the strategy/systems to be used (e.g., residual heat removal, low-PSW, HPI, pressurizer heaters, atmospheric dump valves, instruments, etc.) identification of specific vulnerabilities that need to be addressed, equipment to be staged (e.g., cable); and, (c) a human factors assessment of effort/repair that is consistent with the NRC review standards/guidance.

RAI 2-45

Discuss the operator needed communications following a tornado for assuring that the necessary action times are not exceeded for establishing hot standby, secondary heat removal and reactor coolant pump (RCP) seal injection.

RAI 2-46

Justify the proposed tornado mitigation strategy conclusion that equipment in the plant necessary to achieve and maintain hot standby is protected by adjacent structures and is not hardened to prevent a tornado missile strike.

RAI 2-47

Describe any dependencies related to the PSW and the HPI pumps (e.g., cooling, lubrication) and justified as appropriate.

RAI 2-48

Describe the most limiting tornado-related main steam line ruptures and their impact to the overall tornado mitigation strategy, including any plant modifications deemed necessary to preclude adverse effects, the schedule for the modifications, and the compensatory measures in place until the modifications have been completed.

RAI 2-49

Describe the BWST critical level and the basis for this level (e.g., cool down, RCS leakage, RCP seal leakage, high point vent loss, etc.). Also, describe how foreign material (e.g., insulation via missile impact, etc.) will be kept from entering the BWST above the critical protected areas.

RAI 2-50

Since the reactor head and/or high-point vents will be used for RCS inventory control, describe how using these vents will affect containment pressure and discuss the environmental effects on the SSF makeup pump.

RAI 2-51

Describe what instrumentation will be available following the worst case tornado. Describe all instrument failures (e.g., pressurizer level, etc.) and how they will be discerned in support of main control room and/or SSF control.

RAI 2-52

Describe how a sufficient water supply for the SSF make-up pumps is provided and also describe how cooling of the spent fuel pools will be provided following a tornado. Describe how criticality concerns associated with the spent fuel pool are addressed following a tornado.

RAI 2-53

Discuss the how the RCP seals are protected following a tornado by the SSF.

Mr. Dave Baxter
Vice President, Oconee Site
Duke Energy Carolinas, LLC
7800 Rochester Highway
Seneca, SC 29672

SUBJECT: OCONEE NUCLEAR STATION UNITS 1, 2, and 3 - REQUEST FOR ADDITIONAL INFORMATION (RAI) REGARDING THE LICENSEE AMENDMENT REQUEST FOR UPGRADING THE LICENSING BASIS FOR TORNADO MITIGATION (TAC NOS. ME1710, ME1711, AND ME1712)

Dear Mr. Baxter:

By letters dated June 26, 2008, and June 29, 2009, Duke Energy Carolinas, LLC, submitted license amendment requests (LARs) for the Oconee Nuclear Station, Units 1, 2, and 3 which proposes revisions to the current licensing basis regarding tornado mitigation. The NRC staff has reviewed the LARs and determined that additional information is required in order to complete the review. The requested additional information is enclosed. Please provide a response to the request within 30 days from the date of this letter. The draft RAIs were e-mailed to members of your staff in February 2010. If you cannot respond to the RAIs within 30 days please provide a letter within 15 days from the date of this letter providing a schedule when requested information will be submitted.

If you have any questions, please call me at 301-415-1345.

Sincerely,

/RA/

John Stang, 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

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ADAMS Accession No. ML101310425 ***transmitted by memo dated**

OFFICE	NRR/LPL2-1/PM	NRR/LPL2-1/LA	NRR/SRXB/BC	NRR/SPSB/BC	NRR/LPL2-1/BC	NRR/LPL2-1/PM
NAME	JStang	MO'Brien (SRohrer for)	GCranston*	GCasto	GKulesa (VSreenivas for)	JStang
DATE	05/25/10	05/12/10	01/19/10	12/15/10	05/25/10	05/25/10

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