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

October 8, 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 (ONS) - REQUEST FOR ADDITIONAL INFORMATION (RAI) REGARDING THE LICENSE AMENDMENT REQUESTS (LARs) FOR UPGRADING THE LICENSING BASIS FOR HIGH ENERGY LINE BREAK MITIGATION (TAC NOS. ME1761, ME1762, AND ME1763)

Dear Mr. Baxter:

By letters dated June 26, 2008, December 22, 2008 and June 29, 2009, Duke Energy Carolinas, LLC (the licensee), submitted LARs for ONS, which propose revisions to the current licensing basis regarding high energy line break mitigation.

The Nuclear Regulatory Commission staff has reviewed the LARs and determined that additional information is required in order to complete the review. The requested additional information is enclosed. In a phone conversation with Mr. Kent Alter of your staff, it was agreed that the licensee would respond to the RAIs within 60 days after receipt of this letter.

If you have any questions, please contact 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 REQUESTS (LARs)

TO REVISE PORTIONS OF THE UPDATED FINAL SAFETY ANAYLSIS REPORT (UFSAR)

RELATED TO THE

HIGH ENERGY LINE BREAK MITIGATION LICENSING BASIS

DUKE ENERGY CAROLINAS, LLC

OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3 (ONS)

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

By letters dated June 26, 2008, December 22, 2008 and June 29, 2009, to the U.S. Nuclear Regulatory Commission (NRC) (Agencywide Documents Access and Management System, (ADAMS) Accession Nos. ML081910559, ML090020355, and ML091870501), Duke Energy Carolinas, LLC (the licensee, Duke), submitted LARs for ONS, which proposed revisions to the current licensing basis regarding high energy line break (HELB) mitigation. The Nuclear Regulatory Commission (NRC) staff has reviewed the LARs and determined that the following RAI is required in order to complete the review.

By letter dated July 24, 2009 (ADAMS Accession No. ML091830265) the NRC staff issued RAIs. The licensee responded to the RAIs by letter dated October 23, 2009 (ADAMS Accession No. ML093000501). The responses in some cases were incomplete and as such have been restated below. Some of the RAIs are also related to an LAR dated June 26, 2008 (ADAMS Accession No. ML081840371), currently under review by the NRC staff concerning the ONS tornado mitigation strategies. To facilitate review, the RAIs have been annotated with **[T]** for tornado and/or **[H]** for HELB applicability. If the RAI has already been answered in relation to the tornado mitigation strategies LAR, please reference the appropriate submittal.

**RAI 1 [H]**

The description provided in Section 7.3 of the LARs, letdown line break, does not provide the NRC staff with sufficient information necessary to perform an independent dose consequence calculation. To ensure a complete and accurate safety assessment of the proposed LAR, the NRC staff needs to assess the safety significance of all of the changes to the current licensing basis (CLB) parameters used in the letdown line break dose consequence analysis.

Provide additional information describing all of the basic parameters used in the letdown line break off-site and control room dose consequence analyses. For each parameter, please indicate the CLB value, the revised value where applicable, as well as the basis for any changes to the CLB values. Please provide additional information describing all of the basic parameters used for the letdown line break off-site and control room dose consequence analyses. For each parameter, please indicate the CLB value, the revised value where applicable, as well as the basis for any changes to the CLB values.

**RAI 2 [H]**

The analysis provided in Section 7.3 of the HELB report in the Unit 3 LAR, for the letdown line break, assumes a double-ended guillotine break of the 2.5-inch letdown line. Please provide additional information describing the basis for the selection of this line to ensure that the most severe radioactive releases have been considered.

**RAI 3 [H]**

Provide additional information describing the calculated mass flow rate out of the break as well as the total quantity released as used in the dose analysis.

**RAI 4 [H]**

Provide additional information describing the initial fission product concentrations in the reactor coolant system (RCS) and the basis for their selection as the maximum equilibrium values permitted by the technical specifications (TSs).

**RAI 5 [H]**

Provide the results as well as all the necessary inputs required to determine the RCS concurrent iodine spike isotopic appearance rates and total production for the duration of the assumed spike.

**RAI 6 [H]**

BACKGROUND:

The HELB report states for the Unit 1 extraction steam system the failure of column G-17 should not result in structural damage that would block the pre-defined repair pathway. Therefore, damage repairs to restore low-pressure service water (LPSW) remain available.

ISSUE:

The phrase in the HELB report "should not result in failure" leaves the possibility that the column would result in failure. Other portions of the HELB report identify a column that could fail and then address the impact of the column failing. The failure of column G-17 may impact the pre-defined repair cable routing pathway utilized in the damage repair procedure for providing direct current (DC) power to the emergency 4160 volt (V) switchgear. However, an alternate pathway for the cable routing remains available to effect repairs.

REQUEST:

Provide a description of the consequences of the failure of Column G-17 and the impact on the plant's ability to restore the LPSW system.

Provide the damage repair procedure that addresses the potential consequences of the failure of Column G-17.

**RAI 7 [H]**

BACKGROUND:

The HELB report stated that the Unit 1 main feedwater system states the following:

> Sub-break 9 interacts with Column G-23 and may result in its failure
>
> The failure of Column G-23 is not expected to block the pre-defined repair pathway to replace the LPSW pump motors

ISSUE:

The phrase "is not expected to block the pre-defined repair pathway," leaves the possibility that the failure of column G-23 would block the pre-defined repair pathway. Other portions of the HELB report identify a column that could fail and then addresses the impact of the column failing. For example, for the Unit 2 main feedwater system the failure of the column may impact the pre-defined repair cable routing pathway utilized in the damage repair procedure for providing DC power to the emergency 4160V switchgear. However, an alternate pathway for the cable routing remains available to effect repairs.

REQUEST:

Provide a description of the consequences of the failure of column G-23 and the impact on the ability to restore the LPSW system.

Provide the damage repair procedure that addresses the potential consequences of the failure of column G-23.

**RAI 8 [H]**

BACKGROUND:

The HELB report states that the Unit 1 main feedwater system states the following:

> Sub-break 7 interacts with Column Ga-24 and may result in its failure however collateral damage from the failure of Column Ga-24 may result in a rupture to the circulating cooling water (CCW) piping leading to the turbine building flooding.
>
> The failure of Column Ga-24 may result in debris blocking the pre-defined repair pathway to replacement of the A LPSW pump motor. The pathway to the C LPSW pump remains available. Plant damage repair procedures will need to be revised to include the option of replacing and re-powering the C LPSW pump motor.

ISSUE:

ONS does not have procedures in place that direct the plant staff to perform actions that may be required in the event Column Ga-24 fails as a result of sub-break 7.

REQUEST

Provide a description of the consequences of the failure of Column Ga-24.

Provide the damage repair procedure that addresses the potential consequences of the failure of Column Ga-24.

**RAI 9 [H]**

BACKGROUND:

The HELB report in the Unit 3 LAR states the following for the Unit 1 main feedwater system:

> Sub-break 11 interacts with Column K-23 and may result in its failure. The failure of Column K-23 is not expected to block the pre-defined repair pathways for LPSW pump motor replacement or the pre-defined repair pathway for cable routing to the low-pressure injection (LPI) and LPSW pump motors.

ISSUE:

The phrase "not expected to block the pre-defined repair pathway," leaves the possibility that the column would block the pre-defined repair pathway if the column fails. Other portions of the HELB report identified columns that could fail and then addressed the impact on their failure. The HELB report is not clear on the pre-defined repair pathway following an HELB which results in the failure of Column K-23.

REQUEST:

Provide a description of the consequences of the failure of Column K-23 and the impact on the plant's ability to restore the LPSW system.

Provide the damage repair procedure to address the potential consequences of the failure of Column K-23.

**RAI 10 [H]**

BACKGROUND:

The HELB report in the Unit 3 LAR states the following for the Unit 2 condensate system:

The failure of either column (H-32 or H-33a) may impact the pre-defined repair cable routing pathway utilized in the damage repair procedures. An alternate pathway must be determined.

ISSUE:

The phrase "an alternate pathway must be determined" leaves open the question of what will ONS do if there is a column failure.

REQUEST:

Explain why the damage control procedures do not identify the alternate pathway.

Provide a description of what actions will be taken to prepare for the possibility of the loss of the pre-defined repair pathway.

**RAI 11 [H]**

BACKGROUND

The HELB report in the Unit 3 LAR states the following for the Unit 2 extraction steam system:

> Running break 2-ES-024-R is on 42-inch 2C steam extraction pipe. The failure of the column may impact the pre-defined repair pathway for motor replacement and power cable routing for the 3A LPSW Pump, should it be needed.

ISSUE:

The phrase "may impact the pre-defined pathway" leaves the possibility that the failure will impact the pre-defined pathway.

REQUEST:

Provide a description of what actions will be taken to prepare for the possibility of the loss of the pre-defined repair pathway.

**RAI 12 [H]**

BACKGROUND:

The HELB report states the following for the Unit 2 extraction steam system:

> Running break 2-ES-20-R is on a 36-inch...
>
> Sub-break 3 interacts with Column H-39 and may result in its failure. The failure of the column may impact the pre-defined repair pathway for motor replacement and power cable routing for the 3A LPSW Pump, if needed.

ISSUE:

For the potential failure of Column H-39, the HELB report is unclear on the pre-defined repair pathway.

REQUEST:

Provide a description of what actions will be taken for the possibility of the loss of the pre-defined pathway.

RAIs 13 through 30 are related to the July 24, 2009, NRC staff's RAIs and the licensee's October 23, 2009, response.

**RAI 13 [H]**

The licensee's response to RAI 2 did not include a commitment to meet all of the criteria in Branch Technical Position (BTP) Mechanical Engineering Branch (MEB) 3-1, Revision 2, as requested in part (a) of RAI 2, despite the continued application of portions of the BTP. Nor did the response provide a detailed comparison of the full criteria contained in BTP MEB 3-1 with the ONS proposed LAR HELB criteria, as requested in Part (b).

a) Please provide a detailed comparison of the full criteria contained in BTP MEB 3-1 with the ONS proposed LAR HELB criteria.

The licensee's criteria for defining pipe break locations lacks the provisions found in the Giambusso Letter that breaks are defined where thermal stresses alone exceed $0.8S_A$.

b) Provide a commitment to define breaks where thermal stresses alone exceed $0.8S_A$, or justify not doing so.

The licensee's response to RAI 2 states in the discussion of postulation of critical cracks:

> A further enhancement is provided for portions of the MS [main stream] and MFDW [main feedwater] Systems located in the [Auxiliary Building] AB. These systems receive periodic volumetric inspections at all accessible girth welds locations and adjacent base metal to provide early warning of potential degradation in these systems that might result in the formation of a break or crack.

c) Please clarify what is being done to assure the integrity at inaccessible girth weld locations and provide specific data identifying the locations and number of inaccessible locations.

**RAI 14 [H]**

Based on the licensee's response to RAI 3 (items a), b), and c)), the following additional item is requested with regards to RAI 3:

Please provide the following information:

For every system classified as moderate-energy based on the 1 percent of total plant run time, provide the total time spent at high-energy conditions and the total time spent operating. In addition, provide the total time the plant ran during the same time interval.

These times can be taken from the time interval researched in the previous RAI submittal:

- For Unit 1: From 7/8/1999 to 6/1/2008
- For Unit 2: From 12/16/1999 to 12/12/2008
- For Unit 3: From 5/21/2000 to 11/11/2008

**RAI 15 [H]**

For the licensee's response to RAI 4(b), please include within the body of the text, references to the specific documentation that supports the discussion of field walk downs, piping interactions, break analyses, and mitigation of piping break effects.

**RAI 16 [H]**

In response to RAI 5, the licensee judged that the energy contained in the 1.5-inch and 2-inch high energy (HE) piping as being insufficient to damage adjacent piping systems or structural components. Please identify the technical evaluation or reference that supports this basis?

In addition,

a) How many feet of HE piping in excess of a 1 nominal pipe size (nps) lower limit are there in the plants? List lengths for each size in excess of 1 nps.

b) Are there any restrictions between the HE piping in excess of 1 nps and the ultimate gas source?

c) The Electro Hydraulic Control systems are not mentioned in the detailed response. Please discuss why this piping has been eliminated from the HE candidates?

**RAI 17 [H]**

In response to RAI 6(a), the licensee states that "Giambusso/Schwencer does address the postulation of terminal end breaks at isolation valves for Class 1 piping."

a) Provide and fully reference specific statements from criteria that discuss isolation valves and, for each instance/location where such end breaks are postulated, demonstrate compliance with the criteria.

   The licensee states that "Giambusso/Schwencer required the postulation of terminal end breaks at rigidly fixed valves that may act to restrain thermal movement." The licensee also states, "all isolation valves that serve in this manner are in line valves that are not independently supported or supported in a way that would prohibit piping motion and thermal movement."

b) Please provide documentation and a technical basis that confirms this condition at all isolation valves.

> The licensee states that relative to postulating break locations, "The NRC has previously approved this interpretation at the Oconee Nuclear Station for the Passive Low Pressure Injection Cross Connection Modifications."

c) Document similarities which demonstrate applicability to the current ONS LAR on excluding boundary valves from being terminal ends.

**RAI 18 [H]**

The note in BTP MEB 3-1 discussed in RAI 7 and its response states in part: "A branch connection to a main piping run is a terminal end of the branch run, except where the branch run is classified as part of a main run in the stress analysis and is shown to have a significant effect on the main run behavior." This is a vintage artifact of the limited analysis capabilities available at the time of the BTP. Model sizes were limited to the point where branch piping was included in a model of run piping, where it had no influence, and was not accurately represented in the model's response.

a) What modeling criteria does the licensee have in place to ensure an accurate response of branch piping that does not influence the response of the run piping, e.g., responds in a significantly different frequency range than the run piping?

A note in RAI 7 states:

> The NRC staff has, in the past, asked the licensee to clarify that it will satisfy the complete criteria contained in Footnote 3 of BTP MEB 3-1. It does not appear that this has taken place in the proposed LAR. In addition, the NRC staff has previously requested the licensee to compare its proposed HELB criteria with the full criteria contained in BTP MEB 3-1 in order for the NRC staff to perform a thorough safety review of the Duke HELB proposal. The proposed LAR only addresses the criteria from BTP MEB 3-1, which provides relaxations to the Oconee licensing basis HELB criteria.

b) These two requests are noted as still having not been addressed, and, therefore are still pending.

**RAI 19 [H]**

Seismic Category I piping is piping classified by application of criteria found in Regulatory Guide 1.29, "Seismic Design Classification." Please provide a list of the seismic category I piping, for which the summary information found in item 4 of the Giambusso letter still needs to be provided and address how the requirements from (a) to (e) of item 4 are met.

**RAI 20 [H]**

This question is applicable to the licensee's responses to RAIs 9 and 10.

How does the criteria and methodology used to design containment penetrations under line rupture forces and moments generated by their own rupture compare to the criteria and methodology used with pipe whip restraints in the current HELB evolution?

**RAI 21 [H]**

The LARs identifies various sections of the high energy piping that have been excluded due to normal operating temperature and pressure conditions.

Please provide a complete list of excluded high energy piping systems, if such a list cannot be found in the calculation.

**RAI 22 [H]**

In the response to RAI 12(a), the licensee discussed the new term "Initial Operating Conditions." According to the discussion, this term is consistent with the analysis presented in Section 3.0 of the Mechanical Design Section (MDS) Report OS-73-2."

a) Please provide specific details, including a comparison of the Normal Plant Conditions, defined in Auxiliary Systems Branch (ASB) 3-1 and the Operation Modes defined in HELB report, to demonstrate that the statement is correct and applicable to this situation.

b) In the licensee's response to RAI 12(b), reference is again made to their response to RAI 3. As stated by the NRC staff in RAI 3, a complete list of the systems with a data summary on each should be assembled and made available to reviewers.

**RAI 23 [H]**

a) The licensee states that "Those systems that could be operated at high energy conditions for short periods of time during modes 1 through 4 were excluded." Please provide specific details on the criteria used to qualify "short periods of time," and provide the data that served as the bases for the calculations performed to demonstrate that the stated exclusions are justified.

b) In the licensee's response to RAI 13, reference is again made to their response to RAI 3. As stated by the NRC's staff in RAI 3, a complete list of the systems with a data summary on each should be assembled and made available.

**RAI 24 [H]**

In the response to RAI 14, in the HELB report, the licensee states "the subject piping....is seismically designed, analyzed, and supported... to assure that the Class G/F boundary is

seismically protected." Please provide references to the appropriate calculations and evaluations or assessments that demonstrate the validity of the statements that are made.

**RAI 25 [T/H]**

In RAI 15, the NRC staff requested a list of all the equipment types (including manufacturer and model number) that need to be qualified for the environmental conditions of the LAR, with confirmation that all the identified components are qualified in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.49.

The licensee's response included a tabulated list with a statement referring to the list:

> All of the above components existed prior to the LAR and that none of these components needed to be added to the Equipment Qualification program as a result of the LAR. All PSW [Protected Service Water] System components will be qualified for the applicable environment. None of the above listed components were replaced as a result of the LAR. The temperature and pressure profile for components located inside the [East Penetration Room] EPR [and] & [West Penetration Room] WPR was changed as a result of a new analysis for the postulated breaks on the main steam piping and main feedwater piping located inside the East Penetration Room. The above components were reviewed for the new pressure and temperature profiles and found to be qualified. The component evaluations are documented in calculation [Oconee site calculation] OSC-8505 [Oconee Nuclear Design Study] (ONDS-351, Revision 2, Ref. 10.2.17).

Define what the protected service water (PSW) components are and state when and how the PSW system components will be qualified for the applicable environment.

**RAI 26 [H]**

a) Please provide the calculations discussed in the response for review: OSC-8505 (ONDS-351, Revision 2, Reference 10.2.17), and OSC-8104 (ONDS-35I, Revision 2, Reference 10.2.3).

b) Also, in the response to RAI 16, the licensee states that: "For postulated HELBs in other areas of the Auxiliary Building, equipment qualification is not required. Either the loss of any shutdown components in these areas would not preclude achieving and maintaining a safe shutdown condition, or adverse environmental conditions are not generated...."

Please provide reference to the documentation that forms the basis of this evaluation and conclusion.

**RAI 27 [T/H]**

In RAI 17, the licensee states, "The primary and backup cables associated with the 125 vdc vital [instrumentation and control] I&C system will be rerouted out of the Turbine Building to eliminate vulnerabilities to HELB and/or Tornado events."

Please provide a reference to the documentation that validates this statement. Note that there is no commitment to reroute the cables in the commitments listed in the HELB report in the Unit 3 LAR.

**RAI 28 [H]**

a) It is not clear how the response to RAI 18 confirms that appropriate drainage is provided for all junction boxes. How were the holes sized?

b) Please provide details of, or reference to, an inspection plan or a controlled document that specifies the frequency of weep hole inspections.

c) Please address whether it is possible that the weep holes could provide a pathway for water to enter the enclosures?

**RAI 29 [H]**

The licensee's response to RAI 19 does not address RAI 19, as it does not discuss how the licensee ensured that failure of nonsafety-related components would not adversely affect the safety function of a safety-related component under postulated environmental conditions. Please address this issue.

**RAI 30 [H]**

In the response to RAI 21, the licensee states:

> The postulated HELBs in the Auxiliary Building do not directly or indirectly impact any of the remaining components or their support systems. Cables for these components that are routed through the East or West Penetration Rooms are qualified for the adverse environmental conditions in these rooms, created by these postulated Main Feedwater or Main Steam line HELBs. The qualification of the cables is documented in calculation OSC-8505 (ONDS-351, Rev. 2, Ref. 10.2.17).

The NRC staff requests a copy of calculation OSC-8505 for review.

**RAI 31 [H]**

NUREG 0800, Section 3.6.2, Item I (OL) 4, Revision 1, and NUREG 0800, Section 3.6.2, Item I.7, Revision 2, identify as a specific area of review:

> The design adequacy of systems, components, and component supports to ensure that the intended design functions will not be impaired to an unacceptable level of integrity or operability as a result of pipe-whip or jet impingement loadings.

In order to cover this area of review adequately, the following calculations are requested for review:

1. Calculation OSC-7516.01, "ONS Unit 1 HELB High Energy Line Break Stress Evaluation" (Application of criteria used to define break and crack locations and configurations).
2. OSC-7516.03, "Unit I HELB Turbine Building Structural Interactions Evaluations" (Application of methodology used to define the forcing functions, including the jet thrust reaction at the postulated pipe break or crack location and jet impingement loadings on adjacent safety-related, structures, systems and components (SSCs).
3. Calculation OSC-7516.04, "Safe Shutdown Equipment Damage Assessment for HELB - ONS Unit 1" (Application of criteria used to define break and crack locations and configurations).
4. OSC-8505, "Oconee HELB EQ Analysis for Penetration Rooms" (Application of methods used to validate the equipment qualification of the Shutdown Electrical Components).

**RAI 32 [H]**

The HELB report in the Unit 3 LAR refers to ONS "HELB Outside Containment Walkdown Criteria & Requirements," (Reference 10.3.17). Please provide the document for review.

**RAI 33 [H]**

Section 2.1 of the HELB report in the Unit 3 LAR states that:

> The High Energy (Piping) lines are those lines that during Initial Operating Conditions the fluid inside of the pipe has either or both of the following conditions:
>
> 1. A normal operating temperature greater than 200 °F.
>
> 2. A normal operating pressure greater than 275 psig [pounds per square inch gage].

According to the NUREG-0800 definition, a piping system with either a 200 °F service temperature or a 275 psig design pressure would be considered high energy piping, while under the definition in the Unit 3 LAR they would not. Is there any piping that was eliminated from the high energy piping population because it had an exact 200 °F service temperature?

**RAI 34 [H]**

Section 2.2.2 of the HELB report in the Unit 3 LAR states the following:

> For branch connections to piping runs, a branch, appropriately modeled in a rigorous stress analysis with run flexibility and applied branch line movements included and where the branch connection stress is accurately known, will use the stress criteria for seismically analyzed piping lines; for postulating HELB locations.

Do the "applied branch line movements" include amplified seismic response of the run piping at the branch line termination? If not, please address how "stress is accurately known" at that location?

**RAI 35 [H]**

The HELB report in the Unit 3 LAR states:

> 2.2.3 High Energy Break Type Criteria
>
> The following criteria are used to identify the [high energy] HE break types, required to be postulated at the identified break locations in the ONS. There are three (3) types of HELBs at the ONS. These include circumferential breaks, longitudinal breaks, and critical cracks. The definition and description of each of these break types are provided in Section 1.5. The criteria for each break type are as follows (References 10.1.1, 10.1.3, & 10.3.17)[1]:
>
> 1. Circumferential Breaks are to be postulated in HE lines that exceed 1 inch in nominal pipe size.
>
> 2. Longitudinal Breaks are to be postulated in HE piping that has a nominal pipe size of four (4) inches or greater.
>
> 3. Critical Cracks are to be postulated on seismically analyzed HE piping that exceeds 1 inch in nominal pipe size (See Section 2.2.2 for exceptions).
>
> 4. HELBs of any type are not postulated on HE piping that has a nominal pipe of 1 inch or less.
>
> 5. Only circumferential breaks are to be postulated at terminal ends of HE piping runs. (Longitudinal breaks are not postulated at terminal ends.)
>
> 6. Longitudinal breaks are to be postulated only at intermediate break locations on HE piping runs.
>
> 7. For piping that has a nominal pipe size of four (4) inches or greater both circumferential and longitudinal breaks are to be postulated at the intermediate break locations but not concurrently.
>
> 8. Longitudinal breaks are to be postulated parallel to the pipe axis and orientated at any point on the pipe circumference.
>
> 9. The break area of a longitudinal break is equal to the effective cross-sectional flow area of the pipe immediately upstream of the break location.
>
> 10. Longitudinal breaks are not required to be postulated at branch connections.

Criterion 1 states that circumferential breaks are to be postulated in HE lines that exceed 1 inch in nominal pipe size. This concurs with 3.(b) of BTP ASB 3-1(Appendix B of SRP 3.6.1, Revision 1, July 1981).

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[1] Note that bullets are used in the original text. Numbers are used here for clear reference below.

Provide documentation that the cited stress range condition is not exceeded in any lines that are 1 inch or smaller nominal pipe size.

Criterion 2 states that longitudinal breaks are to be postulated in HE piping that has a nominal pipe size of four (4) inches or greater. This concurs with 3.(a) of BTP ASB 3-1 (Appendix B of SRP 3.6.1, Revision 1, July 1981). Provide documentation that the cited stress range condition is not exceeded in any lines that are smaller than 4 inches nominal pipe size.

For Criterion 3, please explain the significance of postulating critical cracks on "seismically analyzed" HE piping that exceeds 1 inch in nominal pipe size. Please address the difference between seismically analyzed piping versus piping analyzed for all necessary load cases.

Criterion 10 states longitudinal breaks are not required to be postulated at branch connections. The criterion appears to assume that branch connections are synonymous with terminal ends.

Provide the bases where, the branch runs are not classified as part of a main run in the stress analysis, that the branch runs does not have a significant effect on the main run behavior.

**RAI 36 [T/H]**

Section 3.4 of the HELB report in the Unit 3 LAR provides design criteria for the main steam isolation valves (MSIVs) to be installed. Are these valves to be designed to close against a flow resulting from an HELB immediately downstream?

**RAI 37 [T/H]**

Provide the following information for the installation of the MSIVs.

1. Valve functional design, drawing, and specifications

2. Qualification program for demonstrating that the MSIV is capable of performing its specified functions under design basis conditions.

3. Inservice testing program for monitoring and ensuring that the MSIV is capable of performing its functions under specified conditions.

4. Qualification test report

**RAI 38 [T/H]**

Describe the inadvertent closure of Main Steam Isolation Valves (MSIVs) and the affect on the plant.

**RAI 39 [T/H]**

For the operator actions associated with tornado and HELB mitigation provide the following information:

1. What is the required training?

2. How often will the training occur?

3. Will simulator training be used?

**RAI 40 [T/H]**

Provide the following information for the tornado and HELB restoration procedures:

1. How will the restoration procedures be laid out?

2. Will the procedures be symptom-based such that it would be able to be used for any tornado or HELB?

3. When will they be completed and implemented?

**RAI 41 [T/H]**

In the licensee's October 23, 2009, supplement, the licensee refers to agreements with the NRC staff on a number of different issues concerning tornado/HELB mitigation strategies. The NRC staff notes that that these agreements have not been submitted to the NRC in accordance with 10 CFR 50.4. Please provide the documentation in accordance with 10 CFR 50.4.

**RAI 42 [T/H]**

Describe how the PSW system will be isolated from other safety systems and/or will not cause unintended results should a PSW system active or passive failure occur. Include information for both the electrical and mechanical system associated with the PSW installation.

**RAI 43 [T/H]**

Provide the following information for the new protected service water (PSW) system 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 auxiliary service water [ASW] switchgear ratings, and (4) the periodic inspection and testing requirements for electrical equipment. Provide applicable schematic and single line diagrams.

**RAI 44 [T/H]**

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 45 [T/H]**

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 46 [T/H]**

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 47 [T/H]**

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

**RAI 48 [T/H]**

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 49 [T/H]**

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 50 [T/H]**

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 these cables to monitor their performance, and (6) provide the electrical schematics and one-line drawings for these power feeds.

**RAI 51 [T/H]**

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

**RAI 52 [T/H]**

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 building.

**RAI 53 [T/H]**

To ensure licensing-basis clarity and component operability, TSs need to properly address the tornado mitigation systems (e.g., 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/HELB. The proposed TS change for the PSW system and the existing SSF does not preclude both diverse systems being out of service concurrently. Please provide a justification for this.

**RAI 54 [T/H]**

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

**RAI 55 [T/H]**

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

a. List of equipment that will be used.

b. Initial plant conditions.

c. Discuss any scenarios where with use of only the SSF/PSW to achieve and maintain hot standby would 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/PSW 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 of time when other systems (SSF/PSW/HPI) will have to be repaired/restored to maintain the units in a safe and stable condition following a tornado/HELB.

**RAI 56 [T/H]**

Discuss how cold shutdown will be achieved following a design basis tornado/HELB including, (a) define the actions necessary for achieving cold shutdown based on the worst-case repairs that will need to be made following a tornado/HELB; (b) recognition of the strategy/systems to be used (e.g., residual heat removal, PSW, SSF, LPI, HPI, pressurizer heaters, atmospheric dump valves, instruments, etc.) identification of specific vulnerabilities that need to be addressed, equipment to be staged (e.g., cable, motors, motor control centers, switchgear portable pumps etc.); and, (c) a human factors assessment of effort/repair that is consistent with the NRC review standards/guidance. Provide a time line and procedures for maintaining safe and stable conditions after entering into hot standby and an estimate for achieving cold shutdown. Provide the limitations of the SSF/PSW systems if these are the only systems used to achieve hot standby and maintain safe and stable conditions.

**RAI 57 [T/H]**

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

**RAI 58 [T/H]**

Discuss the how the RCP seals are protected following a tornado/HELB.

**RAI 59 [T/H]**

It has been noted by the NRC staff that the LARs for both tornado and HELB mitigation strategies contain information that appears not up to date (i.e. commitments, commitment dates,

system designs, complete documentation, HELB report) Please review the LARs and all supplemental submittals and update the LARs as necessary.

**RAI 60 [T/H]**

If the SSF or PWS systems are activated to mitigate a tornado or HELB what is the potential for accelerated corrosion of the steam generator tubes which could lead to a steam generator tube leak or rupture?

October 8, 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 (ONS) - REQUEST FOR ADDITIONAL INFORMATION (RAI) REGARDING THE LICENSE AMENDMENT REQUESTS (LARs) FOR UPGRADING THE LICENSING BASIS FOR HIGH ENERGY LINE BREAK MITIGATION (TAC NOS. ME1761, ME1762, AND ME1763)

Dear Mr. Baxter:

By letters dated June 26, 2008, December 22, 2008 and June 29, 2009, Duke Energy Carolinas, LLC (the licensee), submitted LARs for ONS, which propose revisions to the current licensing basis regarding high energy line break mitigation.

The Nuclear Regulatory Commission staff has reviewed the LARs and determined that additional information is required in order to complete the review. The requested additional information is enclosed. In a phone conversation with Mr. Kent Alter of your staff, it was agreed that the licensee would respond to the RAIs within60 days after receipt of this letter.

If you have any questions, please contact 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

cc w/encl: Distribution via Listserv

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GWilson, NRR
GCasto, NRR
J.Parillo, NRR
ATsirigotis, NRR
ESmith, NRR

**ADAMS Accession No. ML102650017** ***via memo dated**

| OFFICE | NRR/LPL2-1/PM | NRR/LPL2-1/LA | SBPB/BC | AADB/BC | NRR/EMCB/BC | NRR/LPL2-1/BC | NRR/LPL2-1/PM |
|---|---|---|---|---|---|---|---|
| NAME | JStang | MO'Brien | GCasto* | RTaylor* | MKhanna* | GKulesa | JStang |
| DATE | 10/6/10 | 10/6/10 (w/ changes) | 12/22/09 | 10/16/09 | 05/20/2010 | 10/8/10 | 10/6/10 |

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