EMCB REVIEW OF THE HIGH ENERGY LINE BREAK MITIGATION STRATEGIES FOR THE OCONEE UNITS AS PROPOSED BY DUKE IN A LETTER DATED NOVEMBER 30, 2006
(TAC NOS. MD3724/5/6)

BACKGROUND

The NRC staff determined that the Oconee units do not comply with their licensing basis for high energy line break (HELB) considerations. The staff's concerns in this regard were communicated to Mr. Ronald A. Jones, Vice President, Oconee Site, in a letter dated December 23, 2005, and to Mr. Bruce Hamilton, Vice President, Oconee Site, in a letter dated July 12, 2006. The licensee's proposed HELB mitigation strategies, as discussed in a letter to James Dyer from Henry B. Barron, Group Vice President and Chief Nuclear Officer, Nuclear Generation, Duke Energy, dated November 30, 2006, is in response to NRC enforcement findings and the concerns that have been expressed by the NRC staff relative to these areas.

HELB criteria was developed to satisfy the requirements of General Design Criterion (GDC) 4. GDC 4 requires that structures, systems and components important to safety be protected against the effects of potential pipe ruptures. The staff reviews the HELB criteria to determine whether the HELB criteria, taken in its entirety, satisfy the requirements of GDC 4. The Oconee licensing basis criteria for HELB is based on meeting the criteria contained in the Giambusso letter provided in Appendix B to SRP Section 3.6.1. SRP Section 3.6.1 indicates that the Giambusso letter provides guidance on acceptable design approaches to meet GDC 4. Updated guidance for postulating HELB locations was provided in SRP Branch Technical Position (BTP) MEB 3-1. Generic Letter (GL) 87-11 provided Revision 2 to BTP MEB 3-1, which included several relaxations to the criteria originally contained in the Giambusso letter. However, Revision 2 to BTP MEB 3-1 also contains additional criteria not provided in the Giambusso letter. The staff has repeatedly requested Duke to compare its proposed HELB criteria with the full criteria contained in BTP MEB 3-1 in order for the staff to perform a thorough safety review of the Duke HELB proposal. The November 30, 2006, letter only addresses the criteria from BTP MEB 3-1 which provide relaxations to the Oconee licensing basis HELB criteria.

Duke has committed to provide license amendment requests for all three Oconee units to update the HELB licensing bases. The acceptability of the proposed HELB criteria will be determined based upon the results of the evaluations that are performed by the staff in accordance with the policies and procedures set forth in LIC-101, "License Amendment Review Procedures." In order for the staff to perform this licensing amendment review, it will be necessary for Duke to clearly address how its proposed new licensing basis meets all the criteria in BTP MEB 3-1 or provide a basis for any deviations to the criteria. While most of the specific commitments proposed by Duke in the November 30, 2006, letter are considered to be acceptable, the staff does not fully agree with those that relate to the specific issues identified below.

REVIEW RESULTS

In Attachment 4 to the November 2006 letter, Duke proposes to use periodic volumetric examinations in lieu of evaluating the effects of pipe rupture at most of the pipe rupture locations in the turbine and auxiliary buildings. The proposed alternative to use periodic volumetric examinations <u>in lieu</u> of pipe rupture evaluation is not part of the criteria contained in

the Giambusso letter or the criteria contained in BTP MEB 3-1. BTP MEB 3-1 requires 100% volumetric examination of all welded connections between the containment isolation valves in addition to meeting the stress limits specified in B.1.b of the BTP MEB 3-1. The basis for the BTP MEB 3-1 criteria is to provide a high level of assurance that breaks do not occur in the critical area between the containment isolation valves. BTP MEB 3-1 does not contain a provision for performing periodic volumetric examinations as an alternative to postulating the pipe cracks and ruptures at the locations required by BTP MEB 3-1.

The staff has previously accepted augmented volumetric inspections as a compensatory measure in lieu of evaluating the effects of pipe ruptures in limited circumstances at older operating facilities where alternative approaches are impractical. Duke needs to provide a specific justification for each pipe rupture location it plans to deviate from the staff guidance in BTP MEB 3-1.

In Attachment 4 to the November 2006 letter, Duke proposes to use criteria similar to the criteria contained in BTP MEB 3-1 to limit the number of locations that meet the definition of a high energy system. The criteria provided in BTP MEB 3-1 is acceptable to the staff for this purpose. However, the Duke letter does not indicate whether its proposal fully satisfies the position in footnote 5 of BTP MEB 3-1, Revision 2. Specifically, footnote 5 states that systems operated during PWR startup, hot standby, or shutdown qualify as high energy systems. Duke needs to clarify that it will satisfy the definition of high energy system contained in footnote 5 of BTP MEB 3-1.

In Attachment 4 to the November 2006 letter, Duke proposes to use criteria similar to the criteria contained in BTP MEB 3-1 to limit the number of branch pipe attachments where pipe breaks need to be postulated. The BTP MEB 3-1 criteria is acceptable to the staff for this purpose. However, the Duke letter does not indicate whether its proposal fully satisfies the position in footnote 3 of BTP MEB 3-1. Specifically, footnote 3 states that for piping runs which are maintained pressurized during normal plant conditions for only a portion of the run (i.e., up to the first normally closed valve) a terminal end of such runs is the piping connection to this closed valve. This means that a pipe rupture would have to be postulated at the connection to the closed valve. Duke needs to clarify that it will satisfy the complete criteria contained in footnote 3 of BTP MEB 3-1.

In Attachment 5 to the November 2006 letter, Duke argues that the reactor coolant letdown line outside the containment does not qualify as a high energy system in accordance with its licensing basis because the system does not exceed both 200 degrees F and 275 psig. However, the Oconee licensing basis criteria provided in Duke Report No. OS-73.2, "Analysis of the Effects Resulting from Postulated Piping Breaks Outside Containment for Oconee Nuclear Station, Units 1, 2, and 3, " clearly states that a higher energy lines are defined as those that have either a normal service temperature greater than 200 degrees or a pressure greater than 275 psig. This is the same criteria that is referenced in BTP MEB 3-1. Duke needs to treat the reactor coolant letdown line as a high energy line up to the isolation valve.

In Attachment 4 to the November 2006 letter, Duke indicates that breaks will not be postulated at the penetration anchors for small bore piping penetrations because the penetration anchors are located inside the containment. Instead, Duke indicates that breaks are postulated in the piping run outside the containment wall and remote from the anchor. This is not consistent with the criteria provided in Section 2.1 of Duke Report No. OS-73.2 which requires break locations at the terminal end of the piping run. BTP MEB 3-1 also requires postulation of breaks at the terminal end. The basis for the criteria is that breaks are expected to occur at locations that

provide rigid constraint to the piping, such as anchor points. Duke needs to either evaluate the effect of pipe breaks at the terminal end (anchor point) as required by the criteria or provide justification as to why the alternative location it selected is the most likely location for a HELB.

In Attachment 5 to the November 2006 letter, Duke indicates that breaks were not postulated at the east penetration room main steam terminal end anchor point because the penetration anchor is located inside the containment. Instead, Duke indicates that the break is postulated in the piping run outside the containment wall and remote from the anchor. This is not consistent with the criteria provided in Section 2.1 of Duke Report No. OS-73.2 which requires break locations at the terminal end of the piping system. Duke needs to either evaluate the effect of a pipe break at the terminal end (anchor point) as required by the criteria or provide justification as to why the alternative location it selected is the most likely location for a HELB.

PRE-APPLICATION REVIEW BY THE BALANCE OF PLANT BRANCH OF PROPOSED TORNADO AND HIGH ENERGY LINE BREAK MITIGATION STRATEGIES FOR THE OCONEE UNITS (TAC NOS. MD3721/2/3 & MD3724/5/6)

BACKGROUND

The NRC staff have raised concerns and have taken enforcement action regarding Duke Energy Company's (Duke or the licensee) compliance with the tornado and high energy line break (HELB) licensing basis for the Oconee units. The staff's concerns in this regard have been communicated to Mr. Ronald Jones, Vice President, Oconee Site, in letters dated September 22 and November 4, 2004, and to Mr. Bruce Hamilton, Vice President, Oconee Site, in a letter dated July 12, 2006. The licensee's proposed resolution of the NRC staff's concerns in these areas was submitted in a letter dated November 30, 2006, and Attachments 1 and 3 of the licensee's submittal established specific commitments for resolving these issues.

REVIEW RESULTS

The Balance of Plant Branch (SBPB) has completed its review of Duke's November 30 submittal and detailed comments are provided in the Attachment. Our review was focused primarily on those areas where SPBP has review responsibility, and consequently much of the HELB and environmental qualification (EQ) information was not included within the scope of this review. Schedules that were established by Duke for completing commitments and the licensee's request that the NRC delay or suspend any enforcement activities relative to HELB and tornado issues in order to help facilitate implementation of the mitigation strategies were also not considered to be within the scope of this review. Because it is the licensee's intent to followup the November 30 submittal with License Amendment Requests (LARs) to obtain NRC approval of the proposed tornado and HELB mitigation strategies, our review of the information that was submitted is considered to be a pre-application review for the LARs that will follow.

We do not fully agree with the licensee's characterization of the licensing basis for the Oconee units, but we believe that the proposed installation and use of a protected service water system and switchgear for supplying power to (among other things) the high pressure injection (HPI) pumps (referred to as the PSW/HPI system) in conjunction with the standby shutdown facility (SSF) is a viable strategy for mitigating tornado and HELB events. As indicated below, we have identified several major issues that have not been adequately addressed and remain to be resolved by the licensee. The staff's acceptance of the proposed approach also depends on several important clarifications where the information that was provided in the November 30, 2006, letter is either not clear, inadequate, or the licensee's position is not adequately justified. These remaining issues and necessary clarifications will be pursued by the staff during our evaluation of the followup LARs that are submitted for resolving the tornado and HELB mitigation issues. The acceptability of the proposed tornado and HELB mitigation strategies will be determined based upon the results of the evaluations that are performed by the staff in accordance with the policies and procedures that are set forth in LIC-101, "License Amendment Review Procedures." Therefore, while the specific commitments that have been established by Duke are considered to be acceptable for the most part, we do not fully agree with those that relate to the specific issues and clarifications that are referred to below and discussed in the attachment.

ENCLOSURE

Major Issues to be Resolved

- TS requirements that assure the operability and availability of structures, systems and components (SSCs) that are relied upon for the tornado and HELB mitigation strategies must be established, such as for the standby shutdown facility (SSF), the PSW/HPI system, the Unit 2 condenser circulating water (CCW) system, and for reactor coolant system leakage.

- In order for the SSF to be credited, operators would have to be dispatched to the SSF during a tornado watch, not during a tornado warning as proposed. Once a tornado watch has been declared, the only question that remains is whether or not the tornado will touch down at Oconee or someplace else. If this is the one that hits Oconee, the SSF would not be accessible and it would be too late at this point to man the SSF until the tornado has passed.

- It is the NRC staff's position that the plant licensing basis for postulated failures of the letdown line includes consideration of single active failures, and postulated failures of the letdown lines for the Oconee units must be addressed accordingly.

Clarifications Required Concerning the Tornado and HELB Mitigation Strategies:

- While the licensee seems to suggest that the PSW/HPI system will be installed as safety-related, seismic Category 1, and will be controlled in accordance with 10 CFR 50 Appendix B requirements, this needs to be clearly stated to assure that there is no misunderstanding.

- The licensing basis includes the capability to place the plant in cold shutdown and the mitigation strategy does not adequately address how this capability is assured relative to the extent of damage that can be experienced, recognizing that: a) it is critical to recover PSW/HPI within the 72-hour mission time of the SSF, and b) an assured source of cooling water that is good for at least 30-days is needed for the three Oconee units at the onset of tornado and HELB events.

Clarifications Required Concerning the Tornado Mitigation Strategy:

- In addition to the specific tornado effects that the licensee referred to, the following additional considerations are also applicable: a complete loss of offsite power; and while the tornado is not assumed to cause tornado missile damage to the Keowee Hydro Units (KHU) and the Oconee units concurrently, it is assumed that both KHU and the Oconee units can be exposed to tornado force winds concurrently.

- The use of TORMIS must be requested in a LAR, and the TORMIS analysis should be applied to all SSCs that can adversely impact the tornado mitigation strategy, not just those SSCs that perform the functions that support the updated tornado mitigation strategy. For example, if a tornado missile ruptures an ammonia tank in the vicinity of the ADVs making it impossible to access the ADVs, then the ammonia tank would have to be included in the TORMIS analysis. Another example: if tornado missiles cause a structural failure of the TB that impacts the tornado mitigation strategy (such as by

causing a failure of MS or other high energy piping), this would have to be included. The TORMIS LAR will have to include a detailed listing of all SSCs that are included in the analysis, and address anything that is beyond the scope of the NRC staff's approval of TORMIS, such as modeling considerations and damage assessment of specific SSCs.

- The Oconee Updated Final Safety Analysis Report (UFSAR) states that the electrical equipment and cable rooms were constructed to UFSAR Class 1 structure tornado wind, differential pressure (DP), and missile criteria. This is a valid part of the plant licensing basis and it is consistent with the Oconee design criteria. The fact that these rooms were not constructed in accordance with the UFSAR description does not necessarily mean that the UFSAR is in error, but this may well be another licensing-basis discrepancy. Therefore, a change to the UFSAR in this regard must be properly evaluated and addressed in accordance with 10 CFR 50.59 requirements.

Clarifications Required Concerning the HELB Mitigation Strategy:

- The plant licensing basis is to be able to mitigate HELB events, including the capability to place the plant in cold shutdown and consideration of single active failures. Loss of power is also postulated for those HELB events that can reasonably be expected to cause a loss of power, such as causing a trip of the main turbine.

- The SSF cannot be credited for backup mitigation if the non-main steam (MS) HELB results in a plant cooldown that exceeds SSF RCS makeup capability (which appears to be the case for postulated turbine bypass valve (TBV) and feedwater control valve (FWCV) failures as referred to in Attachment 4, page 10, of the submittal (for example).

- HELB single active failure considerations rely upon the capability to align PSW/HPI power to the SSF. Therefore, contrary to the licensee's position (Section 1.2 on Page 3 of Attachment 2 of the submittal), it is necessary to credit this capability in the plant licensing basis.

- The environmental profile is determined based upon analysis of the actual conditions that will exist following the pipe break, and the assumption that the environment is "non-condensing" must be justified and supported by the analysis.

- The consequences of HELB are determined based upon appropriate analyses, and the assumption that HELBs do not result in an uncontrolled blowdown of either steam generator (SG), or excessive cooldown for that matter, must be justified accordingly (as well as any other assumptions that are credited in the HELB analyses).

CONCLUSION

The proposed installation and use of the PSW/HPI system in conjunction with the SSF is a viable strategy for mitigating tornado and HELB events, and is worth pursuing. However, a number of issues and important clarifications have been identified as summarized above and listed in more detail in the attachment that must be resolved and/or addressed as appropriate in the applicable LARs that are submitted by the licensee. While the specific commitments that have been established by Duke are considered to be acceptable for the most part, we do not

fully agree with those that relate to the specific issues and clarifications that have been identified above and discussed in the attachment. Note that the Division of Engineering may have identified additional issues that need to be addressed relative to HELB and EQ considerations.

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Pre-Application Review of Duke Letter Dated November 30, 2006

Letter Content:

Actions selected for implementation include:

a. Station modifications that provide reinforcement of an expansive portion of key structures to better withstand the effects of tornados - use of fiber reinforced polymer. What structures will be protected?

b. The installation of a new protected service water (PSW) system with switchgear capable of providing an assured source of electrical power to (among other things) the high pressure injection (HPI) pumps. Contrary to the information that was provided, this PSW/HPI system is not totally independent of the standby shutdown facility because they share the same water source.

c. The expansion of piping inspection programs intended to minimize the potential of high energy line breaks (HELBs).

d. The submittal of License Amendment Requests (LARs) to revise and clarify the licensing basis for the Oconee units.

In parallel with this, a risk reduction effort has been initiated that is intended to improve the reliability and availability of the standby shutdown facility (SSF) - there was no mention of a commitment or followup with the NRC for this item.

While HELB and tornado mitigation strategies are being implemented, any future issues that are identified as a result of these activities will be entered into Oconee Nuclear Station (ONS) corrective action program - no mention of GL 91-18 actions to address issues of this nature, or other actions that will be taken to assure that NRC requirements are satisfied.

Indicates that installation of PSW and HPI improvements will reduce reliance on the SSF by providing a system capable of independently establishing safe shutdown conditions, thereby significantly improving overall plant risk - not truly independent due to shared water source and west penetration room (WPR) vulnerabilities; no mention of establishing a Technical Specification (TS) requirement pursuant to 10 CFR 50.36 even though the licensee recognizes that the PSW/HPI modifications will "significantly" improve overall plant risk.

Attachment 1, "Summary of Tornado Mitigation Strategy and Regulatory Commitments":

Page 2, first paragraph: In addition to the tornado effects that the licensee referred to, the following additional considerations are also applicable: a complete loss of offsite power; and while the tornado is not assumed to cause tornado missile damage to the Keowee Hydro Units (KHU) and the Oconee units concurrently, it is assumed that KHU is exposed to the tornado-force winds and vice-versa for a tornado striking KHU.

Page 2, third paragraph: The Oconee current licensing basis (CLB) does not rely "extensively" on the SSF. This is only the case for when the tornado strikes KHU resulting in a loss of power

to the Oconee station. Otherwise, Station ASW and EFW of the other unaffected units was relied upon in the CLB.

Page 2, fourth paragraph: The manual alignment of the spent fuel pool (SFP) to HPI is a change to the original licensing basis that was not submitted for NRC review and approval.

Page 3, first paragraph: the use of physical separation or physical barriers to protect one or more of the systems is not entirely accurate in that a TORMIS analysis will also be used.

Page 3, first bullet: for how long and for how many cycles will the main steam relief valves (MSRVs) be credited; what assurance will be provided that they won't stick open, possibly compromising the mitigation strategy? What limitations are required relative to reactor coolant system (RCS) leakage when using the MSRVs and atmospheric dump valves (ADVs) for steam generator (SG) pressure control and crediting the SSF, and what changes are necessary to the TS in this regard?

Page 3, first bullet: SSF and PSW will both use the Unit 2 condenser circulating water (CCW) inlet piping as a water source. How will availability of this water source be assured? The current SSF TS requirements did not include consideration of the proposed mitigation strategy and the current 45 day allowed outage time (AOT) for the Unit 2 CCW inlet is of concern. This needs to be reconsidered since the basis for the 45 day AOT is no longer valid, and the AOT should be limited based on tornado and HELB considerations recognizing that there are not other sources of water.

Page 3, first bullet: Relative to the capability to power the submersible pump by the PSW switchgear, what TS operability and surveillance requirements are appropriate?

Pages 3/4, second bullet: The TORMIS analysis should be applied to all structures, systems, and components (SSCs) that can adversely impact the tornado mitigation strategy, not just those SSCs that perform the functions that support the updated tornado mitigation strategy. For example, if a tornado missile ruptures an ammonia tank in the vicinity of the ADVs making it impossible to access the ADVs, then the ammonia tank would have to be included in the TORMIS analysis. Another example: if tornado missiles cause a structural failure of the turbine building (TB) that results in a failure of main steam (MS) or other high energy piping that can compromise the tornado mitigation strategy, this would have to be included.

<u>Attachment 1, "Regulatory Commitment Table"</u>

Commitments 3T and 4T: To what extent Is TORMIS being used for this analysis?

Commitment 5T: How will a tornado missile strike that compromises the fiber reinforced polymer be addressed in the TORMIS analysis?

Commitment 7T:

- First bullet: licensing basis clarity should be reflected in the Updated Final Safety Analysis Report (UFSAR), and TS requirements should be established in accordance with 10 CFR 50.36 requirements.

- Second bullet: the use of TORMIS for must be requested in a LAR and the TORMIS analysis should be applied to all SSCs (safety and non-safety related) that can adversely impact the tornado mitigation strategy, not just those SSCs that perform the functions that support the updated tornado mitigation strategy (a complete listing of SSCs included in the TORMIS analysis is required). The NRC staff will allow the use of TORMIS provided it is consistent with what has been approved for use by other licensees. Any exceptions to the approved methodology, including modeling or analyses that are not included within the scope of TORMIS, will not be approved unless adequately justified.

- Third bullet: the spent fuel pool (SFP) to the HPI pump flow path that was established by Duke after initial licensing of the Oconee units was not submitted for NRC review and approval.

- Fifth bullet: the licensing basis specifies the capability to place the Oconee units in cold shutdown condition and therefore, the licensee must be clear on what is being credited within the plant licensing basis in this regard such that the capability to achieve cold shutdown is assured.

- Sixth and seventh bullets: the commitment should specify that the PSW/HPI and related switchgear modifications will satisfy safety-related, seismic Category 1 criteria, and will be controlled and maintained in accordance with 10 CFR 50, Appendix B criteria.

Why aren't PSW/HPI design criteria and time critical actions included similar to HELB commitments that were made?

<u>Attachment 2, "Tornado Mitigation Strategy"</u>

Page 2, second paragraph: Any differences in the design of Units 2 and 3 that could compromise the proposed tornado mitigation strategy that is based on Unit 1 design considerations need to be specifically identified and addressed.

Page 2, Section 1.1:

- If flow is provided to only one S/G, could there be a problem initiating flow to the other S/G later due to thermal stress or other considerations?

- What are the maximum number of cycles the MSRVs will experience and why doesn't one or more MSRV sticking open pose a problem?

- How is water supply from the Unit 2 CCW assured to be available? The existing TS AOT must be reconsidered accordingly recognizing the new tornado and HELB mitigation functions.

- Vulnerable CCW piping should be included in the TORMIS analysis.

- How is capability of submersible pump (powered by either SSF or PSW/HPI) assured by TS requirements?

Page 3, Section 1.2:

- Operators should be dispatched to the SSF during a tornado watch. A tornado warning means that the tornado has already touched down and it would be too late at this point to man the SSF if this turns out to be the tornado that hits the Oconee site.

- The discussion indicates that steam pressure may be controlled using the ADVs to limit the number of MSRV cycles. What number of MSRV cycles are considered acceptable and why? What assurance is there that the MSRV cycles will be limited accordingly?

Page 3, Section 1.3: what impact does tornado missile damage to the PSW piping in one penetration room have on the capability of PSW/HPI to perform its functions?

Page 5, Section 1.5: how will the TORMIS analysis evaluate turbine building structural failures that are sufficient to cause MS pipe or other high energy pipe failures, thereby compromising the tornado mitigation strategy?

Page 5, Section 1.6:

- The capability to install (via a tornado protected connection) and use temporary power within 72 hours should also be considered since PSW/HPI is relied upon exclusively for maintaining SSD beyond 72-hours and for plant cooldown.

- Is existing plant vital I&C power tornado protected; and are power sources for PSW/HPI vulnerable to tornado effects?

Page 6, Section 2.3: what impact does damage to piping/electrical/I&C in one penetration room have on tornado mitigation capability of PSW/HPI? What is the effect on other units? Similarly for SSF?

Page 8, Section 2.5: is any of the PSW I&C power not tornado protected?

Page 8, Section 3: what part of the CCW piping is not protected from tornado missiles, and is it being evaluated by TORMIS?

Page 9, Section 4: will SSCs that are located in the cable spread, equipment, and control battery rooms be included within the scope of TORMIS? How will tornado missile capability to fail TB operating deck be addressed by the analysis?

Page 9, Section 5.1: In addition to protecting the SSF and PSW/HPI components "that perform the functions," what about any support equipment that is needed (I&C, ADVs, RCP SI, etc.)?

- Second bullet: the design details specified in the UFSAR that indicates that the electrical equipment and cable rooms were constructed to UFSAR Class 1 structure tornado wind, DP, and missile criteria is considered plant licensing basis and a change to the UFSAR in this regard must be addressed accordingly in accordance with 10 CFR 50.59 requirements.

Page 10, Section 5.2:

- The TORMIS analysis must include all SSCs that can adversely impact the tornado mitigation strategy, not just those SSCs that perform the functions that support the updated tornado mitigation strategy, and "significant damage" would apply to all of these SSCs (e.g., damage to SSCs that can result in a main steam line failure and excessive cooldown; damage to SSCs that can prevent operators from taking required actions).

- The proposed use of TORMIS must be requested and justified via an LAR; the previous approval does not apply to the current situation.

- The TORMIS LAR will have to address anything that is beyond the scope of TORMIS approval, such as modeling considerations and damage assessment of specific SSCs (to the extent that this is utilized).

Page 12, Section 6: The plant licensing basis includes the capability to achieve cold shutdown. The EDGs for other plants provide a 7-day capability to restore offsite power or to establish additional fuel oil inventory. The proposed 72-hour capability is not commensurate with the 7-day capability that is provided by other plants and the extensive damage that can be caused to the electrical distribution network in the vicinity of the Oconee station following a tornado strike at KHU could require well beyond 72-hours to restore a normal source of electrical power. Therefore, in order to assure the capability to maintain safe shutdown conditions and to subsequently achieve cold shutdown, the PSW/HPI mods should also include consideration of a tornado-protected capability to connect a temporary power source within 72-hours that is adequate for powering the PSW/HPI functions. Also note that there is no mention of how SFP makeup and boron addition will be accomplished over an extended period of time.

Page 13, Section 7: The SSF should be manned upon declaration of a tornado watch. A tornado warning means that the tornado has already touched down and it would be too late at this point to man the SSF if this turns out to be the tornado that hits the Oconee site.

<u>Attachment 3: "Summary High Energy Line Break (HELB) Mitigation Strategy and Regulatory Commitments"</u>

Page 2, third paragraph: The plant licensing basis is to be able to mitigate HELB events, including consideration of single active failures, and to place the plant in cold shutdown condition. The onus is on the licensee to demonstrate that the 72-hour mission time of the SSF is adequate for this purpose (e.g., extent of damage and time required to make necessary repairs and to resolve postulated failures of the PSW/HPI must be addressed).

<u>Attachment 3, "Regulatory Commitment Table"</u>

Page 7 (Commitments 22H/23H/24H), first bullet: licensing basis clarity should be reflected in the UFSAR, and TS requirements should be established in accordance with 10 CFR 50.36 requirements.

Page 9 (Commitments 22H/23H/24H), fourth bullet: how are water hammer loads addressed?

Page 10 (Commitments 22H/23H/24H), third bullet: the NRC staff does not agree with the

licensee's characterization in this commitment of the plant licensing basis relative to the letdown line; the single failure criterion is applicable and must be considered (see Attachment 5, Issue No. 4, below).

Page 10, (Commitments 22H/23H/24H), fifth bullet: why aren't these PSW/HPI design considerations reflected in the tornado commitments?

Page 10, (Commitments 22H/23H/24H), sixth bullet: why aren't time critical actions reflected in the tornado commitments; and what are the bases for the times?

Attachment 4: "High Energy Line Break (HELB) Mitigation Strategy"

Page 4, paragraph before "Mitigation Functions": how are water hammer loads addressed?

Page 7, fourth paragraph: the SSF cannot be credited as backup if the non-MS HELB results in a plant cooldown that exceeds SSF reactor coolant system (RCS) makeup capability, such as the turbine bypass valve (TBV) and feedwater control valve (FWCV) failures that are referred to on page 10 (for example). Also, it would seem that if this is a problem for non-MS HELBs, that it would be a problem for MS and main feedwater (MF) HELBs (also see Page 11, third paragraph)? Per Page 10, third paragraph, Duke to confirm the adequacy of previous analysis that the MS HELBs in the turbine building satisfies the specified criteria (no damage to protection systems, Class 1E electrical systems, or ES equipment on the affected unit, plus single failure consideration) such that the PSW/HPI and SSF do not have to be credited.

Page 8, second paragraph: why isn't this sort of thing a problem for the MSLB in the TB (i.e., HELB in the TB can cause a loss of chilled water and power for HVAC; loss of colored buses)?

Page 10, first paragraph: the environmental profile is determined based upon analysis of the actual conditions that will exist following the pipe break, and the assumption that the environment is "non-condensing" must be justified and supported by the analysis.

Page 11, third paragraph, last bullet: where are the battery chargers located? Are they protected from HELB?

Page 11, last paragraph: the consequences of HELB is determined based upon appropriate analyses, and the assumption that HELBs do not result in an uncontrolled blowdown of either SG (or excessive cooldown for that matter) must be justified accordingly, as well as any other assumptions that are credited in the HELB analyses. The HELB analyses must also address single failure considerations without exception.

Page 12, second paragraph: no flood protection will be provided for systems and components in the TB that are necessary to reach cold shutdown (CSD). This could require the plant to be maintained in safe shutdown (SSD) conditions for an extended period of time which places additional importance on the PSW/HPI capability since the SSF is only good for 72-hours. The extent of potential damage and single failures must be considered and addressed such that the capability to restore/use the PSW/HPI system is assured.

Page 12, third paragraph: what is being done to assure that the seal between the reactor building (RB) and auxiliary building (AB) is properly maintained and does not leak excessively so that that flood mitigation features are not compromised?

Page 12, fifth paragraph states: "The PSW system would be designed and constructed to meet Duke's standards for a safety-related system (QA-1)." Why isn't this characterized as a commitment (see Page 10 of Attachment 3, "Regulatory Commitment Table," fifth bullet)?

Attachment 5: "Responses to Key Issues Identified In July 12, 2006 NRC Letter":

Issue No. 1, "Use of TORMIS":

- The proposed use of TORMIS must be requested and justified via an LAR; the previous approval does not apply to the current situation.

- The TORMIS analysis must include all SSCs (safety-related and non-safety related) that can adversely impact the tornado mitigation strategy, not just those SSCs that perform the functions that support the updated tornado mitigation strategy; and "significant damage" would apply to all applicable SSCs in this regard (e.g., damage to SSCs that can result in a main steam line failure and excessive cooldown; damage to SSCs that can prevent operators from taking required actions).

- The TORMIS LAR will have to address anything that is beyond the scope of TORMIS approval, such as modeling considerations (including "secondary effects" modeling) and damage assessment of specific SSCs (to the extent that this is credited).

- In addition to the tornado effects that the licensee referred to, the following additional considerations also apply: the tornado effects include a complete loss of offsite power, and while the tornado is not assumed to cause tornado missile damage to KHU and the Oconee units concurrently, it is assumed that KHU is exposed to the tornado-force winds that would exist; and vice-versa for a tornado striking KHU.

- Page 5, Third Bullet: This is taken out of context; the SSF auxiliary service water (ASW) system was specifically credited for mitigating the tornado that damages KHU with concurrent LOOP. Otherwise, the NRC SE accepted the licensee's analysis that credited station ASW and emergency feedwater (EFW) from the unaffected units.

Issue No. 2, "Cold Shutdown"

- The plant licensing basis for both tornado and HELB includes the capability to achieve and maintain cold shutdown conditions. In the case of tornado, the station ASW system is credited for being able to maintain SSD for at least 30 days and the same capability should be provided by the PSW/HPI system. The submittal needs to explain how this capability will be assured, especially with respect to TS requirements.

- The CLB relies upon SSF for providing secondary side decay heat removal (SSDHR) only when the tornado takes out KHU; otherwise station ASW is relied upon for long-term cooling.

- The 72-hour mission time of the SSF does not establish what the mission time is for mitigating HELB scenarios. Adequate assurance must be established that the PSW/HPI and SSF are capable of mitigating the HELB event to the point of establishing cold

shutdown conditions, irrespective of the SSF mission time. The 30-day capability of the PSW/HPI system can be credited in this regard, but assurance that sufficient water inventory will be available and that the PSW/HPI can be restored within 72-hours is required.

- The proposed licensing basis for HELB induced damage inside the TB indicates that no time-critical actions are required. The basis for this position is not obvious in that the SSF is only credited for 72-hours and the capability restore/use the PSW/HPI system prior to exceeding 72-hours is required, Also, the licensee needs to explain how a source of water for mitigating the HELB event is assured.

- HELB single active failure considerations rely to some extent upon the capability to align PSW/HPI power to the SSF. Therefore, contrary to the licensee's position as stated on Page 3 of Attachment 2, in Section 1.2, this capability should be included in the plant licensing basis.

Issue No. 3, "Technical Specifications"

- A TS is required for the PSW/HPI system in accordance with 10 CFR 50.36(c)(2)(ii)(D). As stated on Page 3 of the November 30, 2006, submittal, Duke indicated that "the installation of a new PSW system and HPI system improvements will reduce reliance on the SSF by providing a system capable of independently establishing safe shutdown conditions, **and thereby significantly improve overall plant risk**." TS requirements were required for the SSF to assure its SSDHR function (even though other sources of SSDHR were considered to be available). The risk significance of the PSW/HPI system is on the same order of magnitude as the SSF and in this case, other sources of SSDHR may not be available.

- Tornado and HELB events at Oconee represent at least the same level of risk as associated with design basis accidents (DBAs).

- The licensee proposes to rely upon the PSW/HPI system in conjunction with the SSF for tornado and HELB mitigation, and the licensee's TORMIS analysis is predicated on this. Therefore, TS requirements should be established not only to assure the operability of the PSW/HPI system, but also to assure that both the SSF and PSW/HPI systems are not both rendered inoperable at the same time.

- The PSW/HPI capability is the only means that can be relied upon for tornado and HELB mitigation beyond 72-hours, and it is the only means available for cooling down the Oconee units.

- Operability of the water inventory for the SSF and PSW/HPI must be addressed. The current SSF TS in this regard was based on the availability of other systems such as EFW for performing the SSDHR function, which is not valid for the proposed tornado and TB HELB mitigation strategies. Furthermore, both the SSF and the PSW/HPI systems rely upon the same water supply and the licensee has not addressed how the water supply will be assured for both tornado and HELB mitigation.

Issue No. 4, "Reactor Coolant Letdown Line"

- Contrary to Duke's position, the MDS Report (Section 3.1.9) indicates that the break is isolated by automatic closure of xHP-3, xHP-4, and xHP-5; and Duke did not take exception to the single failure criterion for this break scenario. In fact, for those break locations where the MDS report did find that the single failure criterion was not satisfied, the condition was specifically recognized and interim compensatory measures and plant modifications were identified for resolving the single failure discrepancies that were found. Furthermore, Duke indicated that the NRC criteria that was specified for addressing HELB were satisfied. Therefore, the plant licensing basis for postulated failures of the letdown line includes consideration of single active failures.

- The NRC staff has suggested that Duke determine how this problem was addressed for the other B&W reactor plants and propose a similar resolution for the Oconee units.

- Duke may be able to perform inspections of the letdown line in accordance with the guidance provided in GL 87-11 in lieu of postulating a break.

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