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Proprietary and Security Information Notice
This letter forwards proprietary information in accordance with 10CFR2.390. The balance of this letter may be considered non-proprietary and non-security-related upon the removal of Enclosures 2 and 4.

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MFN 08-630

Docket No. 52-010

August 14, 2008

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Subject: **Response to Portion of NRC Request for Additional Information Letter Nos. 100 and 181 Related to ESBWR Design Certification Application - Reactor Building Mixing and Leakage Requirements - RAI Numbers 6.2-165 and 15.4-26 S01, and Transmittal of Licensing Topical Report (LTR) Document No. 092-134-F-M-06000, "Reactor Building Gothic Mixing Model Calculation Report," Issue 1, May 27, 2008, and GOTHIC Input Files**

Enclosure 1 contains the GE Hitachi Nuclear Energy (GEH) responses to NRC RAI 6.2-165 transmitted via the Reference 1 letter, and RAI 15.4-26 S01 originally transmitted via the Reference 2 letter and supplemented by an NRC request for clarification in Reference 3. In support of these RAI responses, Enclosures 2 and 3 transmit the proprietary-security-related and non-proprietary and non-sensitive versions of Licensing Topical Report (LTR) Document No. 092-134-F-M-06000, "Reactor Building Gothic Mixing Model Calculation Report," Issue 1, May 27, 2008.

Enclosure 2 contains proprietary and sensitive information as defined in 10CFR2.390. Enclosure 4 Compact Disc (CD) with GOTHIC input files is entirely proprietary and no public version is available. The affidavit contained in Enclosure 5 identifies that the information contained in Enclosures 2 and 4 have been handled and classified as proprietary to GEH. GEH hereby requests that the proprietary and sensitive information in Enclosure 2 and the entirely proprietary information in Enclosure 4 CD be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390 and 9.17. Enclosure 3 is the non-proprietary and non-sensitive version of the LTR, which does not contain proprietary or sensitive information and is suitable for public disclosure.

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NRO

If you have any questions or require additional information, please contact me.

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

References:

1. MFN 07-327, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 100 Related to ESBWR Design Certification Application*, May 30, 2007
2. MFN 07-084, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 90 Related to ESBWR Design Certification Application*, January 29, 2007
3. MFN 08-427, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 181 Related to ESBWR Design Certification Application*, April 22, 2008

Enclosures:

1. MFN 08-630 - Response to Portion of NRC Request for Additional Information Letter Nos. 100 and 181 Related to ESBWR Design Certification Application - Reactor Building Mixing and Leakage Requirements - RAI Numbers 6.2-165 and 15.4-26 S01
2. MFN 08-630 - Licensing Topical Report (LTR) Document No. 092-134-F-M-06000, "Reactor Building Gothic Mixing Model Calculation Report," Issue 1, May 27, 2008 - GEH Proprietary and Security-Related Information
3. MFN 08-630 - Licensing Topical Report (LTR) Document No. 092-134-F-M-06000, "Reactor Building Gothic Mixing Model Calculation Report," Issue 1, May 27, 2008 - Non-Proprietary and Non-Security-Related Version
4. MFN 08-630 Compact Disc – GOTHIC Input Files – Case A1.GTH and Case B1.GTH – GEH Proprietary Information
5. Affidavit - David H. Hinds - dated August 14, 2008

cc:	AE Cubbage	USNRC (with enclosures)
	BE Brown	GEH/Wilmington (with enclosures)
	eDRF	RAI 6.2-165: 0000-0085-7218
		RAI 15.4-26 S01: 0000-0088-0045

Enclosure 1

MFN 08-630

Response to Portion of NRC Request for Additional Information Letter Nos. 100 and 181 Related to ESBWR Design Certification Application

Reactor Building Mixing and Leakage Requirements

RAI Numbers 6.2-165 and 15.4-26 S01

NRC RAI 6.2-165:

DCD, Tier 2, Revision 3, Chapter 6.2.3 the applicant states that GDC 16 is not applicable. In order to understand the basis for GDC 16 to be accepted as not applicable, the staff needs to understand the basis for control of radioactivity releases from the reactor building (RB). The applicant has made two assumptions in the design basis analysis for LOCA in Chapter 15 Table 15.4-5 based on RB functional design. The first is an assumption that all of the source term entering the RB is diluted by mixing with 40% of the RB volume of air. Regulatory Guidance 1.183 (Appendix A, paragraph 4.4) states that "credit for dilution in the secondary containment may be allowed when adequate means to cause mixing can be demonstrated. Otherwise the leakage from the primary containment should be assumed to be transported directly to the exhaust systems without mixing."

A. Please provide a technical basis that demonstrates a means to cause mixing in the RB and the level of mixing that would be attained. The discussion provided in NEDE-33279P Appendix B - RB Mixing Assumptions is inadequate to demonstrate mixing. The staff believes that this technical basis must be well established with uncertainties identified and addressed because of the significant impact of the mixing assumption on the dose results of design basis analyses.

The second assumption is that the RB leak rate to the environment is 50 percent of the volume of the building per day. The staff is concerned that this represents a large exfiltration from the RB that has a significant impact on the results of design basis analyses and notes it would be an unmonitored ground level release from unidentified pathways.

B. Please provide: (1) the maximum leak rate that could occur from the RB under design basis conditions, including weather conditions, (2) the test procedures used to test RB leakage, and (3) the frequency of the test.

C. The applicant has not proposed the use of any non-safety system to address the uncertainties in the assumptions on mixing and RB leakage. If there are non-safety systems that could be qualified in accordance with SECY 94-084, Regulatory Treatment of Non-Safety Systems, please identify them and the conditions under which they would be used if it is desired they be considered by the staff.

GEH Response:

DCD Tier 2, Revision 5, Subsection 6.2.3 no longer states that General Design Criteria (GDC) 16 is not applicable.

A. The Reactor Building (RB) mixing assumption provided in DCD Tier 2, Table 15.4-5, has been revised. The technical basis for the revised assumption is a detailed GOTHIC analysis that supports the credited mixing volume, and is provided in DCD Tier 2, Revision 5, Subsection 15.4.4.5.2.3, Reactor Building Mixing Analysis.

   Use of the GOTHIC computer code in this application is reasonable based on examination of empirical testing from the GOTHIC Qualification Report, GOTHIC Containment Analysis Package Qualification Report, Version 7.2a(QA), January 2006. The complete GOTHIC analysis is provided as Enclosures 2 (GEH Proprietary Version) and 3 (Non-Proprietary Version) of this RAI response.

Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) items to demonstrate RB volume consistent with dose analysis assumptions, and to verify exfiltration rate, have been added in DCD Tier 1, Revision 5, Table 2.16.5-2 (items 4 and 10).

B. RB leakage rate has been changed from 50 percent of the volume of the RB per day to an exfiltration value of 300 cfm, as documented in DCD Tier 2, Revision 5, Table 15.4-5.

The test methodology is described in DCD Tier 2, Revision 5, Subsection 6.2.3.4, Test and Inspections. The test pressure accounts for assumed worst-case wind loading. DCD Tier 2, Revision 5, Chapter 16, Technical Specification (TS) Surveillance Requirement (SR) 3.6.3.1.5 specifies a test frequency of every 60 months. It should be noted that there could be confusion around the use of 300 cfm in DCD Tier 2, Section 6.2 and Table 15.4-5, and the 297 cfm referenced in the response to RAI 6.2-167 S01 (MFN 08-361, dated April 29, 2008), which was converted to 211 scfm and is used in the DCD Tier 2, Revision 5, Chapter 16, Technical Specifications. An acceptance criteria of 297 cfm is conservative, and results in a conservative test value when compared to the 300 cfm used in the radiological dose calculations.

C. DCD Tier 2, Subsection 9.4.6.1 describes use of the RB HVAC Purge Exhaust Filter Units following a loss-of-coolant accident (LOCA) as part of the system design basis. However, the ESBWR does not credit use of the RB HVAC Purge Exhaust Filter Units during the passive phase of the design basis event. The RB provides adequate holdup to support radiological dose assumptions without credit for any RB ventilation subsystem. However, at the point where the plant can be transitioned to a cold shutdown condition safely, the RB HVAC Purge Exhaust Filter Units are used to support operations to place the Reactor Water Cleanup (RWCU)/Shutdown Cooling (SDC) System cross-tie to the Fuel and Auxiliary Pools Cooling System (FAPCS) in service as described in DCD Tier 2, Revision 5, Subsection 6.2.1.1.3.5.1, Post-LOCA Containment Cooling and Recovery Analysis. As a result, the RB HVAC Purge Exhaust Filter Units have been categorized Regulatory Treatment of Non-Safety Systems (RTNSS) Category E. This RTNSS Category is described in DCD Tier 2, Chapter 19, Appendix A, Subsection 19A.6.2.2, Assessment of Potential Adverse Spatial Interactions. Controls and testing of the system are described in DCD Tier 2, Chapter 19, Appendix A, Administrative Controls Manual (ACM), Administrative Control (AC) 3.7.5, Reactor Building HVAC Purge Exhaust Filtration.

DCD Impact:

DCD Tier 1, Revision 5, Table 2.16.5-2 (items 4 and 10), and DCD Tier 2, Revision 5, Subsection 6.2.1.1.3.5.1; Subsection 6.2.3.4; Subsection 6.2.3; Subsection 9.4.6.1; Subsection 15.4.4.5.2.3; Table 15.4-5; Chapter 16, TS SR 3.6.3.1.5; Chapter 19, Appendix A, Subsection 19A.6.2.2; and Chapter 19, Appendix A, ACM, AC 3.7.5 include the information described in the response above. No other DCD changes will be made in response to this RAI.

NRC RAI 15.4-26 S01:

a) *Please confirm that the leak test criteria will always be less than or equal to the leakage assumed in the design basis analysis. Please state what that leakage is in terms of the units being used for flow rate in the testing for leakage.*

b) *The information provided on testing needs to be related to a flow rate at a differential pressure (such as 750 cfm at 1/4 in wg). The pressure should be established in essentially all areas of the RB and maintained for a period of time such as currently done in existing BWR's. The differential pressure should be reflective of the worst meteorological conditions that could be expected to influence exfiltration from the building. The test procedures should be addressed in RAI 6.2-167 S01 and, or RAI 6.2-165 part B. The testing should be described in the DCD in Section 6.2.3. Please provide the location of the SR and the TS criteria for the test in the DCD.*

c) *Please explain how GEH modeled the 50%/day RB leakage and 40 percent of volume mixing. The revision 4 TS basis is not consistent with the GEH dose analyses. Please revise the TS basis.*

d) *For DCD Tier 2, Section 15.4.4.5.2.3, discuss how GEH converted to scfm. GEH should explain how they modeled the 50%/day RB leakage and 40% of building volume mixing. The Revision 4 Technical Specification (TS) basis is not consistent with the GEH dose analysis. GEH should revise TS bases and clarify in Chapter 15 what assumptions are made so TS bases can be written to be consistent with Chapter 15. These questions are also related to RAI 6.2-165.*

GEH Response:

a) The loss-of-coolant accident (LOCA) radiological dose calculation was revised for Revision 5 of the DCD. Details of the revision are also documented in NEDE-33279P, Revision 2, which was transmitted to the NRC in letter MFN 06-205 Supplement 3, dated July 9, 2008. A flow rate of 300 cfm was assumed to leak from the Reactor Building (RB) compartment directly to the environment.

   DCD Tier 2, Revision 5, Chapter 16, Technical Specification (TS) 3.6.3.1 provides the testing requirements for the RB – Contaminated Area HVAC Subsystem (CONAVS) area. The Bases for TS 3.6.3.1 were revised in DCD Tier 2, Revision 5, to reflect the revised LOCA radiological dose calculation. The Bases reflects the test acceptance criteria necessary to ensure the LOCA radiological dose calculation assumption remains bounding. The response to RAI 6.2-167 S01 (MFN 08-361, dated April 29, 2008) elaborates on RB leakage test methods and leak rate criteria of 211 scfm at + ¼"w.g. found in DCD Tier 2, Chapter 16 Bases. This equates to 297 cfm at accident conditions, which conservatively bounds the 300 cfm assumed in the radiological dose consequence analysis.

b) Periodic functional testing of the Reactor Building (RB) is performed to verify the exfiltration rate is less than the leakage assumed in the design basis radiological analysis for the LOCA inside containment. RAI 6.2-167 S01 elaborates on Reactor Building leakage test methods and leak rate criteria (211 scfm at + ¼"w.g.). Numerous pressure measurements will be taken at designated areas and interconnecting doors and dampers will be opened to ensure uniform pressure is

established within the contaminated areas of the RB. The Reactor Building exfiltration test pressure will be maintained for sufficient period of time to ensure steady state conditions are established (approximate ½ hr to 1 hr). Testing is discussed in DCD, Tier 2, Section 6.2.3.4.

c) The LOCA radiological dose calculation was revised for Revision 5 of the DCD. Details of the revision are also documented in NEDE-33279P, Revision 2, which was transmitted to the NRC in letter MFN 06-205 Supplement 3, dated July 9, 2008. The DCD Tier 2, Revision 5, LOCA radiological dose calculation modeled the RB as a single compartment with a volume of 16000 m^3 (565000 ft^3). A flow rate of 300 cfm was assumed to leak from the RB compartment directly to the environment. No credit was taken for holdup or decay in the other RB volumes, which includes the Clean Area HVAC Subsystem (CLAVS) and the Refueling and Pool Area HVAC Subsystem (REPAVS).

   TS 3.6.3.1 provides the testing requirements for the RB – CONAVS area. The Bases for TS 3.6.3.1 were revised in Revision 5 to reflect the revised LOCA radiological dose calculation. The Bases reflects the test acceptance criteria necessary to ensure the LOCA radiological dose calculation assumption remains bounding.

d) As discussed previously, the LOCA radiological dose calculation documented in DCD Tier 2, Subsection 15.4.4 and Chapter 16, TS 3.6.3.1, were updated in DCD Revision 5. The revised TS Bases ensure that the LOCA radiological dose calculation assumption for the RB remains bounding.

DCD Impact:

DCD Tier 2, Revision 5, Subsection 6.2.3.4; Subsection 15.4.4; and Chapter 16, TS 3.6.3.1 and Bases include the information described in the response above. No other DCD changes will be made in response to this RAI.