October 17, 2007

Mr. Robert E. Brown
Senior Vice President, Regulatory Affairs
GE-Hitachi Nuclear Energy Americas, LLC
3901 Castle Hayne Road MC A-45
Wilmington, NC 28401

SUBJECT: ECONOMIC SIMPLIFIED BOILING WATER REACTOR (ESBWR) CHAPTER 6 OPEN ITEMS

Dear Mr. Brown:

As you are aware, the U. S. Nuclear Regulatory Commission staff is preparing the safety evaluation report (SER) for the ESBWR design certification application submitted by GE-Hitachi Nuclear Energy Americas, LLC (GEH) on August 24, 2005. The staff has identified 113 open items for SER Chapter 6 which are enclosed for your information. The staff is prepared to review your responses to the open items and have conference calls and meetings with your staff, as appropriate, to resolve these open items to support issuance of the SER.

Please provide a response date for any late or unscheduled open items discussed in the enclosure.

This open item letter is based on the staff's review of the ESBWR Design Control Document (DCD) Revision 3 and Request for Additional Information (RAI) responses received to date. The staff will continue its review as additional RAI responses and other deliverables are submitted. The staff will inform cognizant GEH staff of any resulting changes to the status of Chapter 6. If you have any questions, please contact Amy Cubbage at (301) 415-2875 or aec@nrc.gov or Shawn Williams at (301) 415-3207 or saw8@nrc.gov.

Sincerely,

/RA/

Mohammed Shuaibi, Chief
ESBWR/ABWR Projects Branch 1
Division of New Reactor Licensing
Office of New Reactors

Docket No. 52-010

Enclosure: As stated

cc: See next page

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DATE	10/17/2007				

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GE-Hitachi Nuclear Energy Americas LLC (GEH)
ESBWR Preliminary Open Items
Chapter 6
Engineered Safety Features

RAI 6.1-2, Supplement No. 2, 7/26/2007, ML072070078

The following issues were discussed with GE in a phone call on June 7, 2007.

A. The applicant provided its proposed revision of DCD, Tier 2, Table 6.1-1 to be included in DCD, Tier 2, Revision 4. The staff notes that some of the weld filler material classifications, E9018-B3L and ER90S-B3L, were discontinued by ASME several years ago and replaced with classifications E8018-B3L and ER80S-B3L. DCD, Tier 2, Revision 3, Table 5.2-4 contains similar inappropriate references to discontinued classifications. In order for the staff to determine that the weld filler materials used in the ESBWR design meet the requirements of ASME Code, Section II, Part C, the staff requests that the applicant modify Tables 5.2-4 and 6.1-1 to include the correct weld filler material classifications.

B. The applicant's proposed revision to Table 6.1-1 lists the weld filler material that will be used to weld P5C, G1 materials. After reviewing the ESF material specifications provided by the applicant in proposed revised Table 6.1-1, the staff is unable to identify any materials that fall into the P5C, G1 category in accordance with ASME Code, Section IX, Table QW-422. In order for the staff to determine that the materials specifications and grades used in the ESBWR design meet the requirements of ASME Code, Section II, Parts A, B and C, the staff requests that the applicant identify the P5C, Group 1 materials used in the ESBWR design for ESF components or delete this information from the DCD if it does not apply. The staff notes that the same issue exists in DCD, Tier 2, Revision 3, Table 5.2-4, where P5C, G1 materials are referenced as requiring welding, but the staff cannot identify any P5C materials in the reactor coolant pressure boundary (RCPB). Therefore, the staff requests that the applicant also identify the P5C, Group 1 materials used in the ESBWR design for RCPB components or delete this information from the Table 5.2-4 if it does not apply.

C. The applicant's proposed revision to Table 6.1-1 identifies shielded manual arc welding (SMAW) filler material E8018-G for use in welding low alloy steel in the ESBWR design. In order for the staff to complete its review and evaluate the applicant's compliance with 10CFR 50.55a, the staff requests that the applicant provide the complete GE specification that will be used to purchase E8018-G which will be used to fabricate ASME Code, Section III, Class 1, 2 and 3 components. In addition, provide a technical justification for using the GE specification in lieu of using commercially available welding electrodes.

Status: GEH has not committed to a response date.

RAI 6.2-6, Supplement No. 1, 5/22/2007, ML071430342

DCD, Tier 2, Revision 3, Section 6.2.1.1.2 states that "[t]here is sufficient water volume in the suppression pool to provide adequate submergence over the top of the upper row of horizontal vents, as well as the passive containment cooling system (PCCS) return vent, when water level in reactor pressure vessel (RPV) reaches one meter above the top of active fuel and water is removed from the pool during post-loss-of-coolant accident (LOCA) equalization of pressure between RPV and the wetwell." If the ESBWR design relies on the suppression pool equalization line to maintain one meter depth of water above active fuel in RPV, the suppression pool equalization line should be designed as such. In response to RAI 6.3-40, GEH stated that the suppression pool equalization line will not open for 72 hours and beyond for all design basis LOCA scenarios. DCD, Tier 2, Revision 3, Section 6.3.2.7.2 states that "[s]uppression pool equalization lines have an intake strainer to prevent the entry of debris material into the system that might be carried into the pool during a large break LOCA." Please provide information on how the intake strainer is designed to prevent the entry of debris material into the system.

Status: *GEH committed to provide a response by 1/11/08.*

<u>RAI 6.2-14, Supplement No. 1, 5/22/2007, ML071430342</u>

The information provided in this response is necessary to support the basis for a reasonable assurance finding. Thus, please update DCD, Tier 2 to include information provided in response to RAI 6.2-14.

Status: *GEH committed to provide a response by 10/19/07.*

<u>RAI 6.2-15, Supplement No. 1, 3/21/2007, ML070810061</u>

GE's response to RAI 6.2-15, MFN 06-159, and DCD, Tier 2, Rev. 3, Section 6.2.1.2.1, states that "[a]t least 15% margin above the analytically determined pressure is applied for structural analysis." DCD,Tier 2, Rev. 3, Section 6.2.1.2, notes that a factor of 1.4 is applied to the peak differential pressure calculated for the subcompartment, structure, and the enclosed components. Please explain this apparent discrepancy.

Status: *GEH responded on 9/12/07,* MFN 06-159 Supplement 1.
GEH's response is under staff review.

<u>RAI 6.2-17, Supplement No. 1, 5/22/2007, ML071430342</u>

The information provided in this response is necessary to support the basis for a reasonable assurance finding. Thus, please update DCD, Tier 2 to include information provided in response to RAI 6.2-17.

Status: *GEH committed to provide a response by 10/19/07.*

<u>RAI 6.2-18, Supplement No. 1, 3/21/2007, ML070810061</u>

GE's response to RAI 6.2-18, and DCD, Tier 2, Rev. 3, Section 6.2.1.2.3 states that "[t]he mass release rates are determined with Moody's Frictionless Critical Flow Model" and "Analyzed with TRACG, the peak subcompartment pressure responses were found to be below the design pressure for all postulated pipe break accidents."

A. Please explain how the statement "subcompartment pressure responses were found to be below the design pressure" relates to the "factor of 1.4" margin stated in Section 6.2.1.2 and the "at least 15% margin" in Section 6.2.1.2.1.

B. In GE's response to RAI 6.2-18, GE stated that it did not use computer codes to calculate mass and energy release for containment subcompartment analysis. Please confirm this statement and include it in DCD, Tier 2.

C. Please provide the design pressure in DCD, Tier 2.

Status: *GEH responded on 9/12/07,* MFN 06-159 Supplement 1.
GEH's response is under staff review.

RAI 6.2-20, Supplement No. 1, 5/22/2007, ML071430342

The GEH response to RAI 6.2-20 provided in GEH letter MFN 06-159, dated June 5, 2006, states that "the reactor is operating at full power and the containment is filled with dry air at atmospheric pressure and 100 C when the postulated pipe break occurs."

Confirm whether 2 percent measurement uncertainty for the reactor power was used and explain why the containment atmosphere was assumed to fill with air instead of nitrogen.

Status: *GEH committed to provide a response by 11/21/07.*

RAI 6.2-23, Supplement No. 1, 3/21/2007, ML070810061

In RAI 6.2-23 the staff requested subcompartment nodalization information in accordance with the formats of Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)," Rev. 3, Section 6.2.1.2. In GEH's response, MFN 06-159, GEH provided nodal data but stated without specifics that it calculated large pipe and vessel support structure volumes and hydraulic diameters and accounted for the additional obstructions by applying a 10 percent reduction factor in the annulus volume for cells where a specific obstruction is not modeled.

Please provide the following information needed to perform a confirmatory subcompartment analysis of the vessel/shield wall annular volume:

A. The TRACG input for the reactor shield wall subcompartment analysis.

B. The results of a sensitivity analysis on the number and size of the control volumes used in the shield wall subcompartment analysis. This information is needed to verify the appropriateness of the control volume nodalization used in the final reported analysis.

C. A copy of the calculation used to obtain the break mass and energy releases. This information is needed to confirm the appropriateness of the assumptions used in this calculation.

D. Detailed information and/or drawings describing the space between the reactor vessel and shield wall to include the following:

1. The outer diameter of the reactor vessel.

2. A description of the upper and lower heads of the reactor vessel.

3. A description of the shield wall including inner diameter and the volumes surrounding the upper and lower vessel heads.

4. The type and thickness of the reactor vessel insulation, and information on how the insulation is treated in the subcompartment analysis (i.e., whether the insulation is assumed to stay in place or blown away and its affect on the calculated volume and nodalization of the annular volume).

5. A description of the flow obstructions in the reactor vessel/shield wall annular volume: flow area, flow resistance, and flow obstructions providing boundaries for the control volume nodalization.

6. A description of the flow connections (i.e., flow area and flow resistance) between the reactor vessel/shield wall annulus and the upper part of the drywell.

Status: *GEH responded on 9/12/07,* MFN 06-159 Supplement 1.
GEH's response is under staff review.

RAI 6.2-29, Supplement No. 1, 5/22/2007, ML071430342

Concerning GEH's response to RAI 6.2-29, TRACG04 model description, please provide code validation information on TRACG evaluation of subcompartment pressurization and comparison to approved methods. This information is not provided in NEDE-32176P, "Licensing Topical Report: TRACG Model Description," Revision 3, April 2006.

Status: *GEH committed to provide a response by 9/21/07.*
No response has been submitted as of the date of this letter.

RAI 6.2-36, Supplement No. 1, 5/24/2007, ML071490063

In GEH's response to RAI 6.2-36, MFN 06-264, GEH concluded that no DCD changes will be made in response to this RAI. While DCD Rev. 3 does contain the M&E tables for the various breaks, there is no analysis of record (AOR) for the M&Es - they just appear without explanation.

A. The staff finds that the information provided in the response, except for the proprietary comparison of ABWR vs. ESBWR mass and energy release data for case 1 (bounding case), belongs in the DCD so that staff can reach a reasonable assurance finding that the M&Es are consistent with the SRP and that GDC 4 is met. In addition, Table 6.2-11 needs to be updated to reflect the break size for each break to ensure that the building ITAAC will confirm the validity of the assumptions used for these calculations.

B. The SAFER04V computer code is not mentioned in the ABWR DCD, Revision 4, yet your RAI response states that SAFER04V Computer Code was used for the mass and energy blowdown calculations for the ABWR. ABWR, DCD, Revision 4, Section

6.2.3.3.1.3, Design Evaluation, states that, for the postulated high energy line break, the blowdown mass and energy release rates from the break were determined using Moodys homogeneous equilibrium model for critical flow described in Reference 6.2-2, F.J. Moody, Maximum Discharge Rate of Liquid-Vapor Mixtures from Vessels, General Electric Company, Report No. NEDO-21052, September 1975. The SAFER04V computer code is a LOCA analysis code and it is not apparent that it was used for the mass and energy analysis of the ABWR. Please confirm that the SAFER04V code did generate the ABWR M&Es and provide the appropriate references for the analyses (to support, if necessary, a staff audit). Provide a reference where the staff has accepted this code for this purpose.

C. The dynamics of a break response is not provided. This type of information was presented in ABWR DCD, for example page 6.2-54, Section 6.2.3.3,1.3.1, and page 6.2-55, Section 6.2.3.3.1.3.2. This type of information needs to be captured in the ESBWR DCD as changes to valve types, process signals, etc could change the M&Es. For each break in Table 6.2-11, update the DCD description to include the narrative of the event, including such items as timing of valve movements (open and close), process and safety signal and delay set point assumptions, and other relevant information (initial condition, such as pressures and temperatures) which will enable the staff to determine if a plant design change will require a new licensing analysis.

Status: *GEH committed to provide a response by 9/20/07.*
No response has been submitted as of the date of this letter.

<u>RAI 6.2-46, Supplement No. 2, 10/15/2007, ML072690278</u>

MFN 06-264 Supplement 1, Enclosure 1, Table 6.2-12 (Subcompartment Vent Path Designation) on Page 9 inconsistently reports “FORWARD” in the Flow Direction column, and “TWO WAY PATH” in the last (Comments) column, for Flow Path No. 6. A review of Figure 6.2-18 on Page 23 shows that Flow Path No. 6 joining Cells 6 and 7 is indeed a two-way path and not a blow-out panel. Therefore, “BOTH” should rather be reported for Flow Path No. 6 in the Flow Direction column of Table 6.2-12. DCD, Tier 2, Revision 3, should be revised accordingly.

Status: *GEH has not committed to a response date.*

<u>RAI 6.2-52, Supplement No. 1, 5/25/2007, ML071450269</u>

In response to RAI 6.2-52, MFN 06-348, GE provided changes made to the NRC approved TRACG code. This response included a justification for the changes and the results of tie-back calculations. Regarding GE response to parts B and C of the request, GE stated that “[t]hese discussions will be included in the Supplement in DCD Section 6.2.” Staff believes that the information quoted was incorporated into the DCD, Tier 2, Revision 3, Chapter 6, Appendix 6A, Table 6A-1,”Evaluation of TRACG Application Procedure.” However, GE did not include a discussion of the justification including the results of the tie-back calculation for the changes to the approved TRACG code in the DCD. The justification for a change to the previously approved TRACG code is necessary to be incorporated into a licensing document either the DCD or as a supplement to the Topical Report. Please provide the justification including the results of the tie-back calculations in the DCD or in a supplement to NEDC-33083P-A, "TRACG Application for ESBWR." If NEDC-33083P-A is supplemented, ensure that the supplement is referenced in the DCD.

Status: *GEH committed to provide a response by 10/21/07.*

RAI 6.2-53, Supplement No. 1, 5/22/2007, ML071430342

The GEH response to RAI 6.2-53 is for the feedwater line break accident, which was the limiting DBA then. Please update the response as follows:

(1) include the current limiting DBA of main steam line break accident,
(2) reflect the modeling changes stated in GENE letter MFN 06-364 in response to RAI 6.2-59, and
(3) include graphs for non-condensible gas pressure in wetwell versus time.

Update DCD Tier 2 to provide this information.

Status: *GEH responded on 8/6/07, MFN 06-215 Supplement 1.*
GEH's response is under staff review.

RAI 6.2-56, 6/1/06, ML061520025

The DCD version of the TRACG model adds an additional node to the upper drywell. Provide a discussion of the containment response using the DCD TRACG model, particularly with respect to the movement of non-condensable gases, mixing and stratification, throughout the containment, as compared to the approved pre-application model. Include this information as an update to NEDC-33083P-A, "TRACG Application for ESBWR."

Status: *GEH responded on 7/12/06, MFN 06-215.*
The resolution of this RAI is dependent on the resolution of RAI 6.2-53.

RAI 6.2-58, Supplement No. 2,10/15/2007, ML072690278

In RAI 6.2-58, Supplement 1, the staff stated the following: "In GEH's response to RAI 6.2-58 various single active failures were considered in regards to the emergency core cooling system analysis. However, the intent of this RAI was to identify the limiting sequence considering the worst single active failure with respect to peak containment pressure." In response to RAI 6.2-58, Supplement 1, GEH did not address the original RAI as intended. Please provide the list of single failures considered and the results to identify the limiting sequence considering the worst single active failure with respect to peak containment pressure.

Status: *GEH has not committed to a response date.*

RAI 6.2-59, Supplement No. 1, 5/22/2007, ML071430342

In response to RAI 6.2-59, GEH provides input error corrections and model enhancement for the approved TRACG model. Please include this information in a topical report, for example, a supplement to NEDC-33083P-A, "TRACG Application for ESBWR," March 2005.

Status: *GEH committed to provide a response by 10/21/07.*

<u>RAI 6.2-60, Supplement No. 1, 5/22/2007, ML071430342</u>

In response to RAI 6.2-60, GEH updated DCD, Tier 2, Revision 3, Section 6.2.1.3 to state that "[c]ontainment design basis calculations are performed for a spectrum of possible pipe break sizes and locations to assure that the worst case has been identified." In response to part (B) of RAI 6.2-60, GEH stated the TRACG results regarding break sizes will be incorporated into the DCD.

A. Explain whether you considered different locations of breaks in addition to the different elevations of breaks as discussed in response to part (c) of RAI 6.2-60.

B. Incorporate the response to part (c) of RAI 6.2-60 into the DCD.

Status: *GEH committed to provide a response by 10/21/07.*

<u>RAI 6.2-61, Supplement No. 2, 5/22/2007, ML071430342</u>

DCD, Tier 2, Revision 3, Table 6.2-5 lists the break area for MSLB and FWLB as 0.09832 m^2 and 0.07420 m^2, and a footnote to this table states that for FWLB, "the total break area from the turbine building side is limited at the two parallel [venturi] sections, with flow area of 0.04997 m^2 each. However, the total area of the two parallel venturi of 0.09994 m^2 does not match with the FWLB area of 0.07420 m^2 used. Please explain this discrepancy.

In response to RAI 6.2-61 Part 1, GEH lists the effective total break area for MSLB as 0.9832 m^2 for both RPV and BOP sides. This value is 31 percent of the pipe cross sectional area of 0.3167 m^2, which was calculated using the pipe internal diameter of 0.63501 m. Please explain the difference. Please update the DCD to include the response.

Status: *GEH committed to provide a response by 11/21/07.*

<u>RAI 6.2-62, Supplement No. 2, 7/27/07, ML072080190</u>

The staff accepts GEH's response except for the last statement, "No DCD changes will be made in response to this RAI." Please revise the DCD to include the information provided in this response including the graphs and tables.

Status: *GEH has not committed to a response date.*

<u>RAI 6.2-63, Supplement No. 1, 5/22/2007, ML071430342</u>

The information provided in this response is necessary to support the basis for a reasonable assurance finding. Thus, please update DCD Tier 2 to include information provided in response to RAI 6.2-63.

Status: *GEH committed to provide a response by 10/21/07.*

RAI 6.2-73, Supplement No. 1, 5/22/2007, ML071430342

Please update DCD, Tier 2 by justifying why “-2 sigma” values was used in the footnote on “Crit Flow” of Table 6.2-8, as provided in response to RAI 6.2-73.

Status: *GEH committed to provide a response by 10/21/07.*

RAI 6.2-90, Supplement No. 1, 6/5/2007, ML071590007

Original RAI 6.2-90:

DCD Tier 2, Section 6.2.6.3, "Containment Isolation Valve Leakage Rate Test (Type C)," states that, for the flowmeter method, water may be used as a test medium for Type C tests, “if applicable." Option A, section III.C.2.(a), "Test Pressure," states: "Valves, unless pressurized with fluid (e.g., water, nitrogen) from a seal system, shall be pressurized with air or nitrogen at a pressure of Pa. " Option B, section III.B., begins: "Type B pneumatic tests... and Type C pneumatic tests ...." Applicable guidance is in ANSI/ANS-56.8-1994, section 3.3.5, "Test Medium," which states, in part, "Type B and Type C tests shall be conducted with air or nitrogen." The leakage rate tests for containment isolation valves (CIVs) served by seal systems are not Type C tests per se and are addressed in RAI 6.2-91. Delete the option for water as a Type C test medium from the DCD.

GE’s Response:

As per 10 CFR 50 Appendix J, III.C.2.(b), testing of CIVs served by seal system are Type C tests. Testing some CIVs with water as a test medium is appropriate for a CIV that may be justified equivalent to a valve served by a seal system. Always applying Section III.C.2.(a) to all systems penetrating the containment could result in putting the plant in a less safe condition, and would not always ensure that post-accident leakage would be minimized. For example, the Reactor Water Cleanup/Shutdown Cooling (RWCU/SDC) system has two independent trains for (a) maintaining reactor water purification during plant operations and (b) providing nonsafety-related reactor shutdown cooling. Unlike testing with water, testing CIVs with nitrogen requires that a shutdown cooling train to be taken out-of-service, and thus, it would not be available if a malfunction occurred in the other shutdown cooling train. Therefore, applying Section III.C.2.(a) would reduce shutdown cooling function redundancy, and thus, would put the plant in a less safe condition. Plus, the RWCU/SDC system is kept filled with water, and is designed and maintained for operation at the full reactor power pressure condition as a closed loop outside containment, and thus, its design pressure is about 20 times the post-accident containment pressure. Therefore, any post-accident CIV leakage would still be contained within RWCU/SDC system. The DCD Tier 2, Section 6.2.6.3 second paragraph, second to last sentence is revised as shown in Attachment A.

Staff Followup:

The applicant’s response begins by citing Appendix J, but the citation is from Option A of Appendix J and does not apply to Option B. The staff anticipates that all new reactors will choose to comply with Option B for all types of containment leakage rate tests (Types A, B, and C) due to Option B’s less-restrictive requirements and longer test intervals. This makes Option A-based arguments of limited value. Even within Option A, the applicant’s position is debatable. An additional significant problem with the applicant's position is that both Options of Appendix J require that the sum of all Type B and Type C leakage rates shall be less than a specified acceptance criterion. Liquid-based leakage rates cannot be directly summed with gas-based leakage rates due to the different units of measurement. The liquid-based leakage rates must first be converted to gas-based leakage rates, and the staff's long-standing position is that useable conversions from liquid-based leakage rates to gas-based leakage rates are not technically possible.

A. Clarify in the DCD that "Type C" means testing with air or nitrogen and eliminate water as an allowed Type C test medium.

B. For Options A or B, address the testing of the CIVs in systems such as RWCU/SDC under the requirements for seal systems.

   - For Option B, an alternate or additional approach is to use the provision in NEI 94-01, Rev. 0, section 6.0, which states that no tests are required for containment boundaries (including CIVs) which do not constitute potential containment atmospheric leakage pathways during and following a design basis accident.

Status: *GEH committed to provide a response by 12/7/07.*

<u>RAI 6.2-91, Supplement No. 1, 5/30/07, ML071500023</u>

RAI 6.2-91 requested DCD revisions to better reflect the regulatory requirements related to seal systems. The applicant's response was:

Comment is accepted. DCD Tier 2, Section 6.2.6.3, fourth paragraph will be deleted and replaced with three new paragraphs. Staff reviewed the DCD, Tier 2, Revision 3, Section 6.2.6.3.

Please address the following:

A. 2nd paragraph, 4th sentence: insert "Option A" after "Appendix J" to clarify that the exemption discussed is only necessary under Option A of Appendix J.

B. 4th paragraph, 1st sentence: "sealed system" should be "seal system."

C. 4th paragraph, 2nd sentence: There are many more requirements to be a qualified seal system (see original RAI 6.2-91). Revise this sentence to ensure it is complete and accurate. Also, a system does not have to have been designed specifically or exclusively to be a seal system, but can still be a qualified seal system if it meets the criteria for one (see original RAI 6.2-91).

D. 5th paragraph, 2nd sentence: delete parenthetical phrase citing an exemption because no exemption is needed when there is a qualified seal system.

E. 5th paragraph and 6th paragraph, 2nd bullet: the word "assume" should be "assure" (error in NEI 94-01; see Option A for similar, correct language).

F. 6th paragraph, 1st sentence: change “leak tested” to “local leakage rate tested” to be more consistent with ANS 56.8 section 3.4.

G. 6th paragraph: The paragraph, as a whole, needs revision. The applicant would do well to quote directly from NEI 94-01, Rev. 0, and ANS 56.8, section 3.4 and the definition of “qualified seal system.” Also, the staff recommends this additional guidance from SRP 6.2.6, Rev. 3 -March 2007:...a qualified seal system is defined in ANSI/ANS-56.8-1994 as a system that is capable of sealing the leakage with a liquid at a pressure no less than 1.1 Pa, for at least 30 days following the DB LOCA. The staff's position is that the analysis of the sealing capability includes the assumption of the most limiting single failure of any active component. Also, unless there is a virtually unlimited supply of sealing liquid (such as from a suppression pool or recirculation sump), limits for liquid leakage rate should be assigned to these valves based on analysis and included in the plant technical specifications. Periodic leakage rate testing, using the sealing liquid as the test medium, is then needed to ensure that the technical specification limits are maintained.

Status: *GEH committed to provide a response by 12/7/07.*

<u>RAI 6.2-98, Supplement No. 1,10/15/2007, ML072690278</u>

RAI 6.2-98 was a followup to RAI 6.2-53 (MFN 06-215). The intent of these RAIs was to understand the TRACG calculation for the bounding scenario. ESBWR DCD Tier 2 provides limited information that is insufficient to understand the analyses. These RAIs focused on key phenomena–the trapping and transient distribution of noncondensable gases in the drywell and subsequent transport to the wetwell.

A. The limiting design basis accident changed from feed water line break (FWLB) to main steam line break (MSLB) as given in ESBWR DCD Tier 2 Revision 3. As a result, in RAI 6.2-141, the staff requested GEH to revisit RAIs that were affected by this change, specifically RAI 6.2-98. However, the GEH’s response to RAI 6.2-98 was based only on the FWLB accident. The analyses results of the FWLB accident are important because of their closeness to that of the MSLB accident and the fact that FWLB is the second limiting accident. Please provide the analyses results of the MSLB accident.

B. The addition of a double pipe connection, which was not modeled previously (MFN 06-215), significantly increased the transfer of nitrogen trapped in the GDCS during the GDCS period and subsequently released to the drywell and then to the wetwell. This modeling improvement reduced the amount of holdup of nitrogen in the GDCS from a ~ 10-12% of the total in the previous modeling to a ~ 5% of the total in the current modeling. The holdup of nitrogen of 5% of the total appears to result from the TRACG’s inability to model mixing of gases in the GDCS tank open volume. Please (1) explain whether you chose the nodalization to minimize the nitrogen holdup in the GDCS pools and (2) quantify the effect of using a well mixed atmosphere in the GDCS pools open volume.

C. As shown on Figure 6.2-98-5, the noncondensable gas holdup in the drywell head region at 72 hours resulting in a pressure of 50 KPa is significant. Please (1) provide the mass of noncondensables held up in the drywell head region and (2) quantify the effect on the drywell pressure, if the noncondensables held up in the drywell head and GDCS pools were transferred to the wetwell..

D. After the opening of the DPVs, the long-term containment responses from FWLB accident to MSLB accidents are expected to be similar. However, the results show that they differ. Please (1) identify and justify the nodalization differences between FWLB and MSLB accidents and (2) explain the differences in results.

E. During a phone call with the staff on September 24, 2007, GEH discussed a potential design change to add a drywell gas recirculation system to the PCCS which will start operating three days after the initiation of a LOCA to improve the PCCS's ability to remove thermal energy from the containment. In your response, please address the effect of the drywell gas recirculation system and any other systems that you plan to credit in your analyses.

Status: GEH has not committed to a response date.

<u>RAI 6.2-99, Supplement No. 1, 5/22/2007, ML071430342</u>

The information provided in this response is necessary to support the basis for a reasonable assurance finding. Thus, please update DCD Tier 2 to include information provided in response to RAI 6.2-99.

Status: GEH committed to provide a response by 11/5/07.

<u>RAI 6.2-102, Supplement No. 1, 4/17/2007, ML071070244</u>

DCD Tier 2, Revision 3, Sections 6.2.4.3.2.1 and 6.2.4.3.2.2, state that the passive containment cooling system (PCCS) has no containment isolation valves (CIVs). The heat exchanger modules and piping of the PCCS, outside containment, form closed systems. As the justification for having no CIVs, the DCD states that the PCCS does not penetrate containment, because the heat exchanger modules and piping are designed as extensions of the safety-related containment, and that the design pressure of the PCCS is greater than twice the containment design pressure and the design temperature is the same as the drywell design temperature.

In RAI 6.2-102, the staff stated that the PCCS must have CIVs, and, supported its position with extensive citations from the regulations (10 CFR Part 50, Appendix A, General Design Criterion 56) and the applicable official NRC guidance (Standard Review Plan 6.2.4, Rev. 2, "Containment Isolation System," and Regulatory Guide 1.141, "Containment Isolation Provisions for Fluid Systems," dated April 1978, which endorses national standard ANS-56.2/ANSI N271-1976, "Containment Isolation Provisions for Fluid Systems" (national standard)). Staff provided a quotation from the national standard that stated that even if the closed system outside containment is treated as an extension of containment, at least one CIV per line is still necessary.

GE's response, MFN 06-466, was a reiteration of their position that the system is considered an extension of the containment boundary, meaning that there are no containment penetrations in the PCCS, and therefore GDC 56, the SRP, the RG, and the national standard do not apply.

The applicant cites several documents (other SRPs and GDC) which contain design provisions for the containment boundary, and states that the PCCS satisfies these provisions and so is an extension of containment.

Staff's Review of GE's Response:

(1) Staff's review found that the documents cited by the applicant only address design provisions for the containment in general such as for the walls and roof. The documents cited do not address any situation which is like the applicant's design (that is, a piping system outside of containment) or explain why no CIVs are needed in such a design. On the other hand, the guidance documents cited by the staff do specifically address designs like the PCCS.

(2) Staff understands that there is no explicit definition of "containment penetration" in the documents cited in staff's original RAI. Perhaps the authors felt that, when a pipe passes through the containment wall or roof (like the PCCS does), that this was obviously a containment piping penetration. However, there is the following definition in the national standard, in section 2, "Definitions and Terminology":

> Penetration assembly. An assembly that allows fluid lines or electrical circuits to pass through a single aperture (nozzle or other opening) in the containment.

Also, the national standard begins as follows:

1. Purpose and Scope

   The primary purposes of this standard are to specify minimum design, testing and maintenance requirements for the isolation of fluid systems which penetrate the primary containment of light water reactors. These fluid systems include piping systems (including instrumentation and control) for all fluids entering or leaving the containment.

When applying the definitions of the national standard, it can reasonable be interpreted that the PCCS design does indeed have containment penetrations thus requiring CIVs.

(3) Even within the DCD, there is contradiction as to whether the PCCS has containment penetrations. Revision 3 of the DCD contains a new table, 6.2-47, titled "**Containment Penetrations** Subject to Type A, B, and C Testing." This table lists 18 containment penetrations in the PCCS, numbered T15-MPEN-0001 through T15-MPEN-0018.

Staff agrees that the portion of the PCCS outside of containment is considered to be an extension of containment. However, the applicant concludes without sufficient justification that this inherently means there are no containment penetrations and thus no requirement for any CIVs. The applicant has not provided precedents, regulations, guidance documents, or any other reference to support this conclusion.

Alternatively, staff has cited a national standard endorsed by Regulatory Guide 1.141 which specifically address the case of a closed system outside of containment which is considered to be an extension of containment. This national standard states that there must be at least one CIV in each line.

Provide additional justification for the current design of the PCCS, or revise the DCD with a redesign of the system to include CIVs, per the NRC's applicable regulatory position.

Status: *GEH responded on 8/17/07, MFN 06-466, Supplement 1,* ML072360120.
GEH's response is under staff review.

RAI 6.2-103, Supplement No. 1, 5/30/07, ML071500023

RAI 6.2-103 asked for DCD, Tier 2, Table 1.9-6, "Summary of Differences from SRP Section 6," to be revised to state that the passive containment cooling system (PCCS) was different from SRP 6.2.4 acceptance criteria, in that it had no containment isolation valves (CIVs). The applicant, consistent with their response to RAI 6.2-102, stated that the PCCS do not require CIVs and do not deviate from SRP 6.2.4 acceptance criteria. Consistent with the staff's RAI 6.2-102 supplemental question, the staff requests that the applicant add the PCCS to Table 1.9-6 or change its design to bring it into conformance with SRP 6.2.4. The staff also asked that the Process Radiation Monitoring System be added to the table, because it has both CIVs outside containment. The applicant responded that these lines conform to the provisions of RG 1.11, "Instrument Lines Penetrating Primary Reactor Containment" (as described in their response to RAI 6.2-127), which would mean that they do conform to SRP 6.2.4 acceptance criteria. However, the applicant has not demonstrated that the system does conform with RG 1.11 (see RAI 6.2-127 supplemental question), and so the staff repeats its request that the applicant add the Process Radiation Monitoring System to Table 1.9-6 or change its design to bring it into conformance with SRP 6.2.4.

Status: *GEH committed to provide a response by 9/7/07.*
No response has been submitted as of the date of this letter.

RAI 6.2-104, Supplement No. 1, 5/30/07, ML071500023

One part of RAI 6.2-104 pointed out that DCD, Chapter 6.2.4, 2nd paragraph, stated that the plant meets the relevant requirements of various GDC for containment isolation design. The staff noted that, to the contrary, at least four systems did not meet the specific requirements of GDC 55 and 56. Three of the systems were listed in DCD, Tier 2, Revision 3, Table 1.9-6, and the fourth was the PCCS.

The staff asked the applicant to clarify or correct this apparent discrepancy. The applicant responded by referring to RAI 6.2-102, which addressed the PCCS CIV issue, and concluded that they would make no changes to the DCD. Putting aside the PCCS issue, which is unresolved RAI 6.2-102, the applicant failed to address the other three systems, as requested in the original RAI, for which still states in DCD, Tier 2, Revision 3, Table 1.9-6, in the row titled, "SRP 6.2.4," that: "ESBWR design takes specific exceptions to GDC 55 and GDC 56, while satisfying the intent.

(1) FAPCS suppression pool suction line contains one isolation valve outside containment;
(2) ICS piping contains two isolation valves inside containment; and
(3) Containment Inerting System piping contains two isolation valves outside containment.

Please address the above three systems as they relate to the inconsistency between Chapter 6.2.4, 2nd paragraph, 4^{th} bullet, "the plant meets the relevant requirements of various

GDC 55 and 56...” to the statement in Table 1.9-6, “ESBWR design takes specific exceptions to GDC 55 and GDC 56...”

Status: *GEH committed to provide a response by 8/31/07*.
No response has been submitted as of the date of this letter.

<u>RAI 6.2-106, Supplement No. 1, 5/30/07, ML071500023</u>

The applicant’s response to RAI 6.2-106 did not address the intent of the original RAI. A portion of the RAI is restated below:

In DCD, subsection 6.2.4.1, “Design Bases,” under the heading “Safety Design Bases,” the 3rd bullet states: “The design of isolation valves for lines penetrating the containment follows the requirements of General Design Criteria 54 through 57 **to the greatest extent practicable consistent with safety and reliability**.” [emphasis added]. The staff does not understand the intent of the highlighted phrase. As applicable, remove this statement, request an exemption, or revise the statement to include, “... except as noted below,” and then provide the specific exceptions.

Status: *GEH committed to provide a response by 12/7/07*.

<u>RAI 6.2-109, Supplement No. 1, 5/30/07, ML071500023</u>

RAI 6.2-109 requested information about containment isolation valve (CIV) closure times. In DCD, Revision 3, the applicant made appropriate revisions and included acceptable CIV closure times in Tables 6.2-16 through 6.2-42, except as follows:

Isolation Condenser System - In DCD, Tier 2, Revision 3, Tables 6.2-24, 6.2-26, 6.2-28, and 6.2-30, a number of 20mm (0.8 inch) CIVs have closure times of 30 seconds or less.

High Pressure Nitrogen Gas Supply System - The CIVs are 50 mm (2 inches) in diameter with closure times for valves F0009 and F0026 listed in Table 6.2-40 as 30 seconds or less.

Because DCD, Tier 2, Revision 3, subsection 6.2.4.2.1, states that CIVs which are 80 mm (3 inches) or less in diameter “generally close within 15 seconds,” consistent with national standard ANS-56.2/ANSI N271-1976, section 4.4.4, “Valve Closure Time,” staff is unsure if the quoted closure times of “30 seconds or less” for the above two systems are correct. Please verify. Revise and explain any inconsistency in the DCD.

Status: *GEH committed to provide a response by 8/31/07*.
No response has been submitted as of the date of this letter.

<u>RAI 6.2-110, Supplement No. 1, 5/30/07, ML071500023</u>

Original RAI 6.2-110 referred to DCD, Tier 2, Revision 1, Section 6.2.4.2.2, "Instrument Lines Penetrating Containment," and Section 6.2.4.3.2.5, "Evaluation Against Regulatory Guide (RG) 1.11." The original RAI questioned whether the instrument lines in the ESBWR design conformed with the provisions of RG 1.11. In GE’s response, DCD, Revision 3 contains additional information in Section 6.2.4.2.2. RAI 6.2-110 also asked the applicant to identify and describe, in the DCD tables, all instrument lines penetrating containment. In GE's response, DCD, Revision 3, Table 6.2-47 lists many instrument lines.

Supplemental Request:

The applicant's response is incomplete. The DCD, Revision 3, text specifically addresses some, but not all, of the provisions of RG 1.11, and appears to mean to address the remaining provisions by stating that the instrument lines "follow all the recommendations of Regulatory Guide 1.11." The staff cannot review or verify a simple assertion of conformance to a RG. Further, the new information in Table 6.2-47 is incomplete. Most or all of the instrument line listings have containment penetration identifying numbers ending in "TBD" (presumably "To Be Determined") and give no information regarding compliance with RG 1.11. Considering that the design of the instrument lines appears to be incomplete, provide in the DCD complete information demonstrating conformance with each of the specific regulatory positions of RG 1.11, for every instrument line.

Status: *GEH committed to provide a response by 2/21/08*.

<u>RAI 6.2-115, Supplement No. 1, 5/30/07, ML071500023</u>

RAI 6.2-115(B) stated:

DCD, Tier 2, Revision 1, Section 6.2.4.3.3, "Evaluation of Single Failure," discusses, in general, the principles used to evaluate single failure. It implies that evaluations were performed for the containment isolation system, but does not provide the actual evaluations or even specific conclusions, other than an unsupported statement that "Electrical and mechanical systems are designed to meet the single failure criterion.....". It refers to DCD, Section 3.1 for more information, but 3.1 is only a general discussion of the ESBWR 's compliance with the GDC. Provide the actual single failure evaluations performed for the containment isolation system, or at least a better discussion of the evaluation. Address particularly the example given in part 1 of this RAI. [The example was of 2 redundant CIVs on the same emergency power bus, where a single failure of that bus would fail both CIVs.]

The applicant's response was:

Subsection 6.2.4.3.3, as noted on the attached markup, will be revised to include statement that each of the power operated containment isolation valve for any given penetration is powered from a different division in order to meet the single failure criteria.

Supplemental Request:

GEH's response only addresses the one item particularly called out by the staff. The response does not address the request as a whole. It is necessary for the applicant to demonstrate the soundness of their method to evaluate single failure events. Therefore, for each type or class of penetrations, provide a detailed single failure analyses, with charts and tables naming each failure considered for each penetration or class of penetrations, and explanations for why each single failure would not cause loss of safety function.

Status: *GEH committed to provide a response by 2/15/08*.

RAI 6.2-119, Supplement No. 1, 5/30/07, ML071500023

The containment isolation provisions of the isolation condenser condensate, venting, and purge lines consist of one barrier (a closed system) outside containment and two CIVs inside containment. RAI 6.2-119 stated that this design did not comply with the explicit requirements of GDC 55 or GDC 56, and was inconsistent with the guidelines of the appropriate guidance documents (SRP 6.2.4, Rev. 2; RG 1.141; and national standard ANS-56.2/ANSI N271-1976) for alternate means for complying with GDC 55 or GDC 56. These GDC allow alternate isolation provisions, other than their explicit requirements, if "it can be demonstrated that the containment isolation provisions for a specific class of lines, such as instrument lines, are acceptable on some other defined basis." The guidance documents define other acceptable bases. The applicant's response stated that, effectively, the isolation condenser system (ICS) has three barriers (one outside and two inside containment) and goes "beyond the requirements" in GDC 55 and 56.

Supplemental Request:

The explicit requirements of GDC 55 and 56 are to have one CIV inside and one CIV outside containment. If a containment penetration had, for example, two CIVs inside and one CIV outside containment, or one CIV inside containment, one CIV outside containment, and a closed system outside containment, then it would clearly and simply go beyond the requirements of the GDC. However, one cannot simply add up the number of containment isolation barriers and conclude that three must be better than two. It depends on the configuration. For example, three CIVs inside containment, and none outside, does not satisfy the explicit requirements of the GDC because there is no valve outside containment. It would also not be in accordance with the guidance documents.

Containment isolation design philosophy, as set forth in the regulations and the guidance documents, requires redundant isolation barriers such that no single failure of a pipe or valve can disable the isolation function. Even passive failures are implicitly considered in the design provisions. For example, one locked-closed manual isolation valve on a penetration is not enough, even though no active failure could cause it to fail; a second, redundant barrier is required. Likewise, a closed piping system, inside or outside containment, is not by itself sufficient; a second barrier, typically a valve, is required, and the requirements and guidelines state that it must be outside of containment, presumably to be accessible for manual operator action if it fails to close. Furthermore, when there is a closed system and one CIV outside containment, there must be a special provision to protect against a failure of the pipe segment between the containment wall and the CIV, either by enclosing the pipe segment and valve in a leak-tight or controlled leakage enclosure or by designing them to particular conservative design requirements which are assumed to preclude a breach. This is done because a pipe breach in this location would be unisolable. It is true that standard technical specifications allow, in many circumstances, continued plant operation with only a single isolation barrier in place, but this is with a recognition that the containment isolation system is degraded by this condition and must eventually be restored to the full design capability.

In addition to the explicit GDC 55 and 56 configuration of one CIV inside and one outside containment, the guidance documents allow two other configurations: 1) one CIV and a closed system, both outside containment, or 2) two CIVs outside containment. The ICS design does not conform to either of these. The NRC has the authority to approve additional isolation configurations under the “other defined basis” provision of the GDC, but the applicant must adequately justify their proposed alternative to assure sufficient safety, consistent with the overall containment isolation design philosophy expressed in the GDC and guidance documents. For example, SRP 6.2.4 states, “If it is not practical to locate a valve inside containment (for example, the valve may be under water as a result of an accident), both valves may be located outside containment.” In the ICS case, locating a CIV outside containment would place it under water all of the time. This is good justification for moving it inside containment, if it can also be shown that a single failure would not disable the containment isolation function.

Provide additional justification for the proposed design, as discussed above, in DCD, Tier 2, Section 6.2.4.3.1.1, or revise the design to conform to the GDC requirements and guidance documents provisions.

Status: *GEH committed to provide a response by 8/31/07*.
No response has been submitted as of the date of this letter.

RAI 6.2-120, Supplement No. 1, 5/30/07, ML071500023

RAI 6.2-120 noted that DCD, Tier 2, Revision 1, Section 6.2.4.3.1.2, "Effluent Lines," under the heading "Main Steam and Drain Lines," described the power-operated main steam isolation valves (MSIVs) as closing under either spring force or gas pressure. The staff questioned this statement, considering that virtually every BWR MSIV in the U.S. needs both gas pressure and spring force to close under accident conditions.

Supplemental Request:

The applicant provided an adequate response to this RAI, MFN 06-436, that explained the operation of the valves, which is like the MSIVs in other BWRs. The response included a proposed DCD, Revision 3, Section 6.2.4.3.1.2, which, if it had been incorporated into the DCD, would have resolved this issue. However, the proposed revision was not incorporated in DCD, Revision 3, Section 6.2.4.3.1.2. The version in Revision 3 contains even less information than it did in Revision 1, which causes this RAI to remain unresolved. On another note, the RAI response and current DCD version refers to DCD, Section 5.4.5, for further information, but that section does not seem to address this particular issue.

Please revise the DCD to include the appropriate information as presented in the proposed DCD Revision 3 and revisit the need to reference Section 5.4.5.

Status: *GEH committed to provide a response by 8/18/07*.
No response has been submitted as of the date of this letter.

RAI 6.2-121, Supplement No. 1, 5/30/07, ML071500023

The resolution of this RAI is a subsidiary of RAI 6.2-119. Depending on the resolution of supplemental RAI 6.2-119, the response to RAI 6.2-121 may need to be revised.

Status: *GEH committed to provide a response by 8/31/07*.
No response has been submitted as of the date of this letter.

RAI 6.2-122, Supplement No. 1, 5/30/07, ML071500023

RAI 6.2-122 requested that information about the containment isolation design for the Fuel and Auxiliary Pools Cooling System, currently located in DCD, Tier 2, Revision 3, Subsection 9.1.3.3, be provided in Subsection 6.2.4.3.2.1. The applicant responded: In order to minimize the risk of errors and inconsistencies in future DCD updates, it is preferable to provide a detailed description in only one location and reference it as needed in other sections. By taking this approach, fewer DCD changes will be required if this information needs to be revised in the future. Regulatory Guide 1.70 supports this approach.

Supplemental Request:

The staff does not disagree that a single location for detailed information is preferable. However, the staff believes that the containment isolation design information in Subsection 9.1.3.3 does not belong there. It should be removed from Subsection 9.1.3.3 and placed in Subsection 6.2.4.3.2.1. The staff reviewed DCD, Revision 3, Subsection 9.1.3.3, information and associated tables. Please address the following:

A. Subsection 9.1.3.3 states that the containment isolation valves (CIVs) in the suppression pool supply and return lines fail as-is on loss of electric power or the air supply.

    1. DCD, Tier 2, Revision 3, Table 6.2-33a agrees with this for the “A” lines. To the contrary, Table 6.2-33b states that the CIVs fail closed in the “B” lines. Correct this discrepancy.

    2. The DCD simply states that the CIVs in the suppression pool supply and return lines fail as-is on loss of electric power or the air supply, without any explanation or justification as to why this is acceptable. GDCs 55 and 56 state that, upon loss of actuating power, automatic isolation valves shall be designed to take the position that provides greater safety. SRP 6.2.4, Revision 2, section II.6.j, and ANS-56.2/ANSI N271-1976, sections 4.4.3 and 4.4.7, provide guidance for this requirement. Normally, a CIV should take the post-accident position upon failure; the post-accident position for these valves is “closed,” per the DCD tables. The two CIVs in each suction line are both nitrogen-motor operated without accumulator (NMO) valves, which, by their nature, fail as-is. The guidance documents allow both CIVs in a line to be motor-operated if independent power sources serve the two valves, so that a single power failure does not fail both valves. Considering that the subject valves will fail on loss of either electric power or the air (or nitrogen) supply, provide in the DCD an explanation of the manner in which the CIVs in the suction line(s) are protected from a single power failure rendering both valves inoperable, and potentially open, during an accident.

B. In the suppression pool suction lines, having both CIVs located outside containment is acceptable per section II.6.d of SRP 6.2.4, Revision 2, as cited in the DCD, except for the following two points:

    1. There is no indication as to whether the design provides a capability to detect leakage from the valve shaft and/or bonnet seals and terminate the leakage,

which is also a provision of section II.6.d of SRP 6.2.4, Revision 2. Provide the missing information in the DCD.

2. Note that the option of having both CIVs in a line outside of containment is available only for engineered safety feature (ESF) or ESF-related systems, or systems needed for safe shutdown of the plant. Tables 6.2-33a and 6.2-33b state that these lines are not ESF. Discuss in the DCD whether the suppression pool suction lines satisfy this SRP criterion (for example, are ESF-related or needed for safe shutdown), and, if not, justify the deviation from the guidelines.

C. DCD, Tier 2, Revision 3, Tables 6.2-33a through 6.2-35, provide containment isolation design information for seven containment penetrations in the Fuel and Auxiliary Pools Cooling System, designated G21-MPEN-0001 through G21-MPEN-0007. However, DCD, Tier 2, Revision 3, contains a new table, Table 6.2-47, "Containment Penetrations Subject to Type A, B, and C Testing." This table indicates that there is an additional penetration in the system, designated G21-MPEN-TBD (To Be Determined?) and described as the Reactor Well Drain Line. Provide in the DCD containment isolation design information for this penetration.

Status: *GEH committed to provide a response by 8/31/07*.
No response has been submitted as of the date of this letter.

<u>RAI 6.2-123, Supplement No. 1, 5/30/07, ML071500023</u>

RAI 6.2-123 noted that the influent and effluent lines of the containment inerting system, described in DCD, Tier 2, Revision 1, Sections 6.2.4.3.2.1 and 6.2.4.3.2.2, had all of their containment isolation valves (CIVs) outside of containment, but without adequate justification per the guidelines of SRP 6.2.4, Rev. 2 (section II.d.), RG 1.141, and national standard ANS-56.2/ANSI N271-1976 (sections 3.6.5 and 3.7). The applicant's response provided DCD changes (later made in DCD Revision 3) to address the guidelines.

Supplemental Request:

The DCD revision (Revision 3) satisfies the provisions of the guidance documents, except as described in the following two items:

A. The guidelines state that both CIVs in a line may be located outside of containment if it is not practical to place one inside containment. The DCD does not address this point. If, in fact, it is practical to place one CIV inside containment, justify the deviation from the guidelines.

B. The option of having both CIVs outside containment is available only for engineered safety feature (ESF) or ESF-related systems, or systems needed for safe shutdown of the plant. Tables 6.2-36 through 6.2-38 state that the containment inerting system lines are not ESF. Discuss in the DCD whether the containment inerting system lines satisfy this criterion (for example, are ESF-related or needed for safe shutdown), and, if not, justify the deviation from the guidelines.

Status: *GEH committed to provide a response by 1/21/08*.

RAI 6.2-127, Supplement No. 1, 5/30/07, ML071500023

RAI 6.2-127 questioned the design of the Process Radiation Monitoring System, in that all of the containment isolation valves (CIVs) are outside of containment. The applicant responded that the lines, 1 in (25 mm) in diameter, should be treated as instrument lines and that the design was acceptable because it was in accordance with RG 1.11, "Instrument Lines Penetrating Primary Reactor Containment."

Supplemental Request:

The staff accepts the classification of these lines as instrument lines. However, there is not enough information to conclude that they comply with RG 1.11. RG 1.11, section C.2., states that the lines should have one CIV inside and one outside containment (which they do not), or else conform to sections 1.b. through 1.e. The staff needs more information to determine if the lines satisfy each of these provisions, but notes, for example, that 1.c. states, in part, that the CIVs should fail as-is, whereas DCD, Tier 2, Revision 3, Table 6.2-42 states that they fail closed. Provide in the DCD a discussion showing that these lines conform to RG 1.11, or, if not, the requirements for non-instrument lines.

Status: *GEH has not committed to a response date.*

RAI 6.2-128, Supplement No. 1, 5/30/07, ML071500023

RAI 6.2-128 noted that DCD, Tier 2, Revision 1, Tables 6.2-39 through 6.2-42 did not include information covering the Chilled Water, High Pressure Nitrogen Gas Supply, and Process Radiation Monitoring Systems. In DCD, Revision 3, the applicant filled in the tables.

Supplemental Request:

The new information is generally acceptable, but the staff has the following questions.

A. For the Chilled Water and High Pressure Nitrogen Gas Supply Systems, the stated applicable basis is GDC 57. The applicant's revised response to RAI 6.2-129 (ML071030343) recognizes that no ESBWR system credits a closed system inside containment (per GDC 57) as a containment isolation barrier. Please correct the tables in the DCD.

B. For the High Pressure Nitrogen Gas Supply and Process Radiation Monitoring Systems, the tables indicate that DCD, Tier 2 figures for the systems are "N/A." Why are system figures not applicable? When will figures be provided?

C. Closure times for CIVs in the High Pressure Nitrogen Gas Supply System are unacceptable. See Supplemental RAI 6.2-109 for details.

Status: *GEH committed to provide a response by 8/3/07.*
No response has been submitted as of the date of this letter.

RAI 6.2-131, Supplement No. 1, 8/16/07, ML072150469

The responses to parts (A) and (B) of the original RAI 6.2-131 are acceptable. However, the staff has a further request for part (C). Part (C) requested a discussion of reducing the containment setpoint pressure that initiates containment isolation for nonessential penetrations to the minimum compatible with normal operating conditions. In the response to this RAI, GEH proposed a change to DCD Tier 2, Appendix IA to include the following: The alarm and initiation setpoints of the LD&IS are set to the minimum compatible with normal operating conditions to initiate containment isolation for containment penetrations containing process lines that are not required for emergency operation. The values for these setpoints are determined analytically or are based on actual measurements made during startup and preoperational tests. If setpoints are to be determined analytically, provide the actual numerical value of the containment setpoint pressure that initiates containment isolation for nonessential penetrations and justify that it is the minimum compatible with normal operating conditions. If the setpoints are to be based on actual measurements during startup and preoperational tests then revise the DCD to provide more details regarding how and when this setpoint will be determined.

Status: *GEH has not committed to a response date.*

RAI 6.2-136, Supplement No. 1, 7/24/07, ML072050032

The response to this RAI is not specific enough to allow the staff to draw conclusions as to the acceptability of the design of the hydrogen monitors. Also, the information contained in the responses to the RAI and its supplement(s) needs to be put into the DCD, Tier 2. Here is a detailed description of the additional requested information:

Item (A) a) of the RAI response states that the instrument range will be met under “the specified pressure conditions” for the ESBWR design, yet the response did not include any specified pressure conditions. It is not clear if the “specified pressure conditions” means containment design pressure, pressures resulting from significant beyond design-basis accidents, or something else. Provide the “specified pressure conditions.” Item (A) b) gives numbers for the instrument accuracies, but the numbers are enclosed in square brackets. Staff is not clear on the meaning of the enclosed square brackets. The conventional meaning of square brackets is that the numbers are suggested or typical values, but that individual plants may choose different numbers based on various design considerations. Provide specific accuracies for the hydrogen monitors and justify that they are adequate for their intended function, or develop a COL Action Item to require COL applicants to do so, subject to NRC review and approval during COL reviews. Also in item (A) b), the staff had asked the applicant to provide the placement of the monitor’s sampling points, and to justify that this placement is adequate for their intended function. This information was not provided. Instead, the response stated that sampling points “will be selected” according to certain criteria. Provide the specific information that was orginally requested, or develop a COL Action Item to require COL applicants to do so, subject to NRC review and approval during COL reviews.

The Item (B) response stated that the equipment warmup time “will be evaluated” during the specification and procurement process to ensure that the warmup time noted in Regulatory Guide 1.7, Revision 3, is not exceeded. Develop a COL Action Item to require COL applicants to do this, subject to NRC review and approval during COL reviews.

For Item (C), the staff had asked whether the monitoring system would remain functional and reliable when exposed internally to the temperature, pressure, humidity, and radioactivity of containment atmosphere during a significant beyond design-basis accident. The response stated that the equipment chosen "will be specified" and "will be evaluated" in accordance with certain general criteria. Provide an evaluation of the system's functionality and reliability against ESBWR-specific containment temperature, pressure, humidity, and radioactivity conditions during significant beyond design-basis accidents, or develop a COL Action Item to require COL applicants to do so, subject to NRC review and approval during COL reviews. The staff cautions the applicant that the recommended design provisions for oxygen monitors in the final issue of RG 1.7, Revision 3, section 2.2, are significantly different from those in draft Revision 3, at least in form. If the applicant cites RG 1.7 in the future, the applicant should specify which version (draft or final) is being used.

Status: *GEH committed to provide a response by 11/15/07*.

RAI 6.2-137, Supplement No. 1, 7/24/07, ML072050032

The response to this RAI is not specific enough to allow the staff to draw conclusions as to the acceptability of the design of the oxygen monitors. Also, the information contained in the responses to the RAI and its supplement(s) needs to be put into the DCD, Tier 2. Here is a detailed description of the additional requested information:

Item (1) of the RAI response states that the instrument range will be met under "the specified pressure conditions" for the ESBWR design, yet the response did not include any specified pressure conditions. It is not clear if the "specified pressure conditions" means containment design pressure, pressures resulting from significant beyond design-basis accidents, or something else. Provide the "specified pressure conditions."

Item (2) gives numbers for the instrument accuracies, but the numbers are enclosed in square brackets. What does this mean? A conventional meaning of square brackets is that the numbers are suggested or typical values, but that individual plants may choose different numbers based on various design considerations. Provide specific accuracies for the oxygen monitors and justify that they are adequate for their intended function, or develop a COL Action Item to require COL applicants to do so, subject to NRC review and approval during COL reviews. Also in item (2), the staff had asked the applicant to provide the placement of the monitor's sampling points, and to justify that this placement is adequate for their intended function. This information was not provided. Instead, the response stated that sampling points "will be selected" according to certain criteria. Provide the specific information which was requested, or develop a COL Action Item to require COL applicants to do so, subject to NRC review and approval during COL reviews.

For Item (3), the staff had asked whether the monitoring system would remain functional and reliable when exposed internally to the temperature, pressure, humidity, and radioactivity of containment atmosphere during a significant beyond design-basis accident. The response stated that the equipment chosen "will be specified" and "will be evaluated" in accordance with certain general criteria. Provide an evaluation of the system's functionality and reliability against ESBWR-specific containment temperature, pressure, humidity, and radioactivity conditions during significant beyond design-basis accidents, or develop a COL Action Item to require COL applicants to do so, subject to NRC review and approval during COL reviews. The staff cautions the applicant that the recommended design provisions for oxygen monitors in the final issue of RG 1.7, Revision 3, section 2.2, are significantly different from those in draft Revision 3, at least in form. If the applicant cites RG 1.7 in the future, the applicant should specify which version (draft or final) is being used.

Status: *GEH committed to provide a response by 11/15/07*.

<u>RAI 6.2-138, 11/2/06, ML063060321</u>

Describe and justify capability for ensuring a mixed containment atmosphere.

10 CFR 50.44(c)(1) states:

> Mixed atmosphere. All containments must have a capability for ensuring a mixed atmosphere during design-basis and significant beyond design-basis accidents.

The following is the complete text of DCD, Tier 2, Revision 1, Section 6.2.5.3.4, “Containment Atmosphere Mixing”:

> The ESBWR design provides protection from localized combustible gas deflagrations including the capability to mix the steam and non-condensable gases throughout the containment atmosphere and minimize the accumulation of high concentrations of combustible gases in local areas. The containment design features that will reduce the likelihood of combustible gas deflagrations resulting from localized buildup of combustible gases during degraded core accidents are listed in Section 19.3.

It appears that Section 19.3.2.1, “Hydrogen Generation and Control,” is the only part of Section 19.3 that mentions containment atmosphere mixing. The problem is that the only mention of it is a statement that the analysis of post-accident oxygen concentration assumes “Adequate gas mixing throughout containment.”

Insofar as an assumption is not an explanation or justification, add an appropriate discussion to the DCD which explains and justifies ESBWR’s capability for ensuring a mixed atmosphere during design-basis and significant beyond design-basis accidents. The discussion should address: passive features of the design, including containment/subcompartment layout, elevations, and openings between compartments that impact mixing; active features of the design, including ventilation systems, cooling systems, and spray systems; and the effectiveness of the passive and active features in providing a mixed atmosphere in the design-basis and significant beyond design-basis events. If non-safety related systems are relied upon for mixing, the availability of these systems in the frequency-dominant beyond design-basis events and any "special treatment" requirements for these systems should also be addressed.

Status: *GEH responded on 8/8/07, MFN 07-283.*
GEH’s response is under staff review.

<u>RAI 6.2-139, 11/2/06, ML063060321</u>

Explain how the ESBWR design complies with 10 CFR 50, Appendix A, Criterion 38.
DCD, Tier 2, Revision 1, Section 6.2.2.3 states that "In conjunction with the pressure suppression containment (Subsection 6.2.1.1), the PCCS [passive containment cooling system] is designed to remove heat from the containment to comply with 10 CFR 50, Appendix A, Criterion 38." However, Criterion 38 requires that the containment heat removal system "safety function shall be to reduce rapidly, consistent with the functioning of other associated systems, the containment pressure and temperature following any loss-of-coolant accident and maintain them at acceptably low levels." The PCCS does not reduce rapidly the containment pressure and temperature as evident from the TRACG results presented in the DCD.

Status: *GEH committed to provide a response by 8/17/07*.
No response has been submitted as of the date of this letter.

<u>RAI 6.2-140, Supplement No. 1, 9/19/07, ML072560700</u>

In response to RAI 6.2-140, GEH provided results of containment pressure following a loss of coolant accident that were predicted using TRACG analysis extending up to 7 days. The containment pressure predicted was below the design value for 7 days under the assumptions that the isolation condenser (IC)/passive containment cooling (PCC) pool refill occurred at 3 days and the radiolytic gas production ceased after 3 days. However, the containment pressure appeared to be continuing to rise and could exceed design pressure after 7 days. Further, staff confirmatory analyses also show containment pressure continues to rise and could exceed design pressure before 7 days depending on the bypass leakage that is assumed.

10 CFR 50 Appendix A, General Design Criterion 50 requires that the containment shall be designed to accommodate, without exceeding the design leakage rate with sufficient margin, the calculated pressure and temperature conditions resulting from any loss-of-coolant accident.

Describe how the ESBWR design meets General Design Criterion 50. Show that resulting containment pressure and temperature following a LOCA can be mitigated sufficiently to reduce and control pressure for the long term. In addition, discuss appropriate treatment of all non-safety systems credited to provide this function after 72 hours, consistent with SECY 94-084.

Status: *GEH has not committed to a response date.*

<u>RAI 6.2-144, Supplement No. 1, 8/16/07, ML072150469</u>

GE's response to RAI 6.2-144 is satisfactory except for the final statement, "No DCD changes will be made in response to this RAI." The information provided in the response is necessary to be incorporated in the DCD for the staff to issue a reasonable assurance finding for Standard Review Plan Section 6.2.1.5.

Revise the DCD to incorporate the response to 6.2-144. Please include the figures.

Status: *GEH has not committed to a response date.*

RAI 6.2-145, Supplement No. 1, 6/13/07, ML071640395

Appendix A to Section 6.2.1.1.C of the Standard Review Plan (SRP) states, "The Mark II and Mark III acceptance criteria for both the high and low pressure leakage tests shall be a measured bypass leakage which is less than 10% of the capability of the containment ..." In response to RAI 6.2-145, GE proposed an acceptance criterion for bypass leakage of 2 cm^2 (2.16E-03 ft^2) ($A/\sqrt{k}$) and stated that "DCD Tier 2, Revision 3, Subsection 6.2.1.1.5.1 contains additional information from the latest bounding design basis accident calculations that assume a bypass leakage size of 2 cm^2 (2.16E-03 ft^2) ($A/\sqrt{k}$)."

DCD Tier 2, Rev 3, Section 6.2.1.1.5.1, states that "the bounding design basis accident calculation assumes a bypass leakage of 1 cm2 (1.08E-03 ft^2), ($A/\sqrt{k}$). Table 6.2-5 shows these results in acceptable containment pressures. Additional bounding design basis accident calculations show also that with a bypass leakage assumption of 2 cm^2 (2.16E-03 ft^2), ($A/\sqrt{k}$) the containment pressures continue to be below the design pressure and with a bypass leakage assumption of 14 cm^2 (1.51E-02 ft^2), ($A/\sqrt{k}$) the containment pressures remain below the ultimate pressure capability of the drywell head (1.204 MPag) (see reference 6.2-6) with ample margin." Reliance on the containment ultimate strength for justification of the acceptance criterion is not acceptable to the staff.

A. It is not clear to the staff whether the design leakage is 1 cm2 (1.08E-03 ft^2), ($A/\sqrt{k}$) or 2 cm^2 (2.16E-03 ft^2), ($A/\sqrt{k}$). Please confirm that the results provided in DCD Tier 2, Rev 3, table 6.2-5 are based on 1 cm^2 (1.08E-03 ft^2), ($A/\sqrt{k}$) bypass leakage area. If so, please provide the containment peak pressure results using 2 cm^2 (2.16E-03 ft^2), ($A/\sqrt{k}$) as the assumed bypass leakage, and provide the margin to the containment design pressure.

B. The purpose of the bypass leakage test acceptance criterion is to provide reasonable assurance that the ESBWR bypass leakage area will not exceed the value assumed in the design basis containment peak pressure analysis in between test intervals. GE should propose a bypass leakage test acceptance criteria less that is less than the design basis assumption for bypass leakage and justify that the selected acceptance criterion will provide reasonable assurance that the plant's bypass leakage area will not exceed the value assumed in the plant's safety analyses during postulated design basis accidents.

Status: *GEH committed to provide a response by 12/20/07*.

RAI 6.2-146, 1/19/2007, ML070080448

DCD, Tier 2, Revision 2, Section 6.2.1.1.5.4.3 states that the acceptance criterion for the bypass leakage area for the leakage tests will be 10 percent of 1 cm^2 ($A/\sqrt{k}$) (i.e. 0.1 cm^2 ($A/\sqrt{k}$)). Surveillance Requirement 3.6.1.1.2 given in DCD, Tier 2, Revision 2, Chapter 16 is to "[v]erify drywell to wetwell bypass leakage is less than 1 cm^2 ($A/\sqrt{k}$)." Please correct this discrepancy.

Status: *GEH responded on 6/7/07, MFN 07-310.*
The resolution of this RAI is dependent on RAI 6.2-145, Supplement No. 1, which GE has committed to respond to by 12/20/07.

RAI 6.2-148, 1/19/2007, ML070080448

DCD, Tier 2, Revision 2, Section 6.2.1.1.2 states that “On the upstream side of the vacuum breaker, a DC solenoid operated isolation valve designed to fail-close is provided.” Please state what type of a valve it is and how the fail-close function is provided.

Status: *GEH committed to provide a response by 9/7/07*.
No response has been submitted as of the date of this letter.

RAI 6.2-150, Supplement No. 2, 5/22/2007, ML071430342

In response to RAI 6.2-150 Supplement 1, MFN 07-009 Supplement 1, dated May 21, 2007, GEH proposed a revision to the DCD. In addition to the proposed revision, please include the following statement to the DCD. {This statement was provided by GE in the original RAI response, MFN 07-009, dated April 4, 2007.}

“For the feedwater line and main steam line break scenarios, the analyses assume that the manual drywell spray injection is initiated at the worst possible time, which is the point in time when there is a low air content in the drywell relative to the wetwell.”

Status: *GEH committed to provide a response by 12/7/07*.

RAI 6.2-151, Supplement No. 1, 5/22/2007, ML071430342

The information provided in this response is necessary to support the basis for a reasonable assurance finding. Thus, please update DCD Tier 2 Section 6.2.1.3 to include information provided in response to RAI 6.2-151.

Status: *GEH committed to provide a response by 10/21/07*.

RAI 6.2-154, Supplement No. 1, 9/6/2007, ML072410422

The information provided in this response is adequate and necessary to support the basis for a reasonable assurance finding. Thus, please update DCD Tier 2 to include information provided in response to RAI 6.2-154.

Status: *GEH has not committed to a response date.*

RAI 6.2-155, 5/10/2007, ML071230389

The applicant did not provide sufficient information in DCD Tier 2, Revision 3, Section 6.2.3, to determine if the requirements of GDC 4 are met. GDC 4 requires that “structures, systems, and components important to safety shall be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents. These structures, systems, and components shall be appropriately protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit.”

Please identify the equipment important to safety and the provisions of the ESBWR reactor building design that assure compliance with GDC 4.

Status: *GEH responded on 8/8/07, MFN 07-366.*
GEH's response is under staff review.

RAI 6.2-156, 5/29/07, ML071450138

DCD Tier 2, Rev. 3, Section 6.2.2.2.2 states: "The system is designed as a passive system with no components that must actively function, and it is also designed for conditions that equal or exceed the upper limits of containment reference severe accident capability." This appears to be a editorial mistake for which the author made a note to "reference the severe accident capability." Please clarify this sentence.

Status: *GEH committed to provide a response by 8/31/07*.
No response has been submitted as of the date of this letter.

RAI 6.2-157, 5/30/07, ML071490166

DCD, Tier 2, Revision 3, contains a new table, Table 6.2-47, "Containment Penetrations Subject to Type A, B, and C Testing." The staff compared this table with Tables 6.2-15 through 6.2-42, which were to provide "pertinent data for the containment isolation valves" (DCD Tier 2, Revision 3, subsection 6.2.4.2), presumably in a comprehensive way. However, Table 6.2-47 includes many containment piping penetrations (approximately 122) which are not covered in Tables 6.2-15 through 6.2-42 or elsewhere in DCD Tier 2, Revision 3, Section 6.2.4, "Containment Isolation Function." Further, Table 6.2-47 contains virtually no information on the containment isolation provisions for these lines, other than incomplete information on leakage rate testing.

Most of these penetrations are designated by numbers ending in "TBD," apparently meaning "To Be Determined." Many of the lines are instrument lines and many are part of systems whose larger lines are addressed in Tables 6.2-15 through 6.2-42. However, some are systems which are not covered at all in Tables 6.2-15 through 6.2-42:

Control Rod Drive System
Gravity Driven Cooling System
Makeup Water System
Service Air System
Containment Monitoring System
Equipment and Floor Drain System

A. Is the design of the containment isolation provisions for the approximately 122 penetrations to be performed by COL applicants? If so, provide a COL Item in DCD subsection 6.2.8. If not, provide the missing information in the DCD. Also, are there any other containment penetrations which are not listed in Table 6.2-47?

B. Table 6.2-47 also lists the containment air locks and hatches, which are not addressed elsewhere in section 6.2.4. Provide in the DCD containment isolation design information for the containment air locks and hatches.

Status: *GEH committed to provide a response by 2/21/08*.

RAI 6.2-158, 5/30/07, ML071490166

During the ABWR review, the staff expressed concerns regarding the scaling loads used by GEH for developing the load definition. To resolve this concern GEH conducted ABWR-specific subscale (SS) and partial full-scale (FS) tests. The staff found this approach acceptable for the ABWR. However, it appears that GEH has not demonstrated the applicability of the scaled test data to the ESBWR design.

Address the use of the scaled SS and FS test data as applied to the ESBWR containment load definition and incorporate a discussion of the applicability of this data to the ESBWR in the DCD.

Status: *GEH committed to provide a response by 12/26/07*.

RAI 6.2-159, 5/30/07, ML071490166

During the ABWR review, the staff expressed concerns regarding GEH's statement proposing complete elimination of suppression pool temperature limits as applied to the safety relief valve (SRV) load evaluation. However, pending completion of the supporting analysis, GEH committed itself to follow suppression pool temperature criteria documented in the NUREG-0783, "Suppression Pool temperature limits for BWR Containments." The ESBWR Technical Specification 3.6.2.1, "Suppression Pool Average Temperature," includes temperature thresholds of 110 °F, 120 °F and 130 °F, for the reactor scram and reactor depressurization.

A. Are these temperature thresholds consistent with the NUREG-0783 guidance? If not, explain any inconsistencies.

B. Provide a description of the effect of pool temperature on the SRV load evaluation in the DCD.

Status: *GEH committed to provide a response by 12/26/07*.

RAI 6.2-160, 5/30/07, ML071490166

NEDE-33261P implies that GE used the PICSM computer code to compare Mark III suppression pool swell test data from the pressure suppression test facility (PSTF) with analytical predictions. The code, described in GE technical report NEDE-21544, was not reviewed and approved by the staff.

A. If the PICSM code was used, what liquid and froth impacts were predicted to occur on the vacuum breaker (VB) valves? If impact loads are predicted, then what design features are included providing structural shielding of VB valves from pool swell loads?

B. If liquid and froth impacts are not predicted, provide a discussion of the minimum height between the pool surface and the VB to ensure that structural protection is not necessary.

C. Provide an ITAAC to verify the minimum height between the pool surface and the VB.

D. If the PICSM computer code was not used, how were potential challenges to the VBs and horizontal diaphragm evaluated?

Please include the pertinent information requested above in the DCD.

Status: *GEH committed to provide a response by 12/6/07*.

RAI 6.2-161, 5/30/07, ML071490166

GEH applies the Mark II hydrodynamic loads to the ESBWR design. The staff documented its evaluation of the definition of the Mark II design containment hydrodynamic load in NUREG-0808. In the evaluation of the pool swell phenomena (discussed in Section 2.1 of the NUREG report), the staff relied on comparisons with a substantial amount of data from tests conducted by both GEH and Japan Atomic Energy Research Institute. These tests were directly applicable to the Mark II design. GE developed a computer program PSAM to be used as part of the Mark II hydrodynamic load evaluation program. The staff has reviewed the Mark II program and approved the methodology and PSAM in NUREG-0808. However, it did not find GEH's methodology within PSAM acceptable. Rather, the staff based its acceptance on the favorable comparisons with the database. As a result, the use of the program for configurations other than those encompassed by the test data would not be accepted without further comparisons with applicable test data. Please, clarify the methodology used and provide a comparison with applicable test data as applied to the ESBWR.

Status: *GEH committed to provide a response by 12/26/07*.

RAI 6.2-162, 5/30/07, ML071490166

DCD, Tier 2, Revision 3, Figure 5.2-2 does not appear to correspond to the description in Chapters 6.3 and 5.2.2 of the DCD.

A. Revise Figure 5.2-2 to reflect the current automatic depressurization system (ADS) arrangement as described in Section 6.1 of NEDE-33261P and Chapters 6.3 and 5.2.2 of the DCD.

B. Include the final arrangement of the safety relief valves(SRVs), safety valves (SVs), and depressurization valves (DPVs) in the DCD.

C. Provide an associated ITAAC to verify the number, elevation and location for the final arrangement of SRVs, SVs and DPVs.

Status: *GEH committed to provide a response by 10/19/07*.

RAI 6.2-164, 5/30/07, ML071490166

A. Demonstrate that the suppression pool and its associated structure, system and components (SSCs) can withstand the hydrodynamic loads described in Appendix 3 B of the DCD and structural vibrations resulting from steam discharges into the suppression pool. This information is needed to satisfy the guidance provided in Standard Review Plan, Section 6.2.1.1.C.

B. Provide an associated ITAAC for the above.

Status: GEH committed to provide a response by 11/5/07.

RAI 6.2-165, 5/30/07, ML071490166

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 percent 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.

Status: GEH committed to provide a response by 12/6/07.

RAI 6.2-166, 5/30/07, ML071490166

DCD, Tier 2, Revision 3, Section 6.2.3 the applicant states that GDC 43 is not applicable and states that “the ESBWR does not need, and thus has no filter system that performs a safety-related function following a design basis accident, as discussed in Subsection 6.5.1." The staff believes that GEH's reference to Subsection 6.5.1 is not relevant since it refers to Containment Spray Systems (drywell containment sprays) that are non-safety-related and not part of the reactor building (RB).

The staff's determination regarding the applicability of GDC 43 depends on the acceptability of the mixing and RB leakage assumptions addressed in RAI 6.2-165 and the results of the design basis analyses.

In addition to the question regarding applicability of GDC 43, the staff is concerned for the potential buildup of radioactivity in the RB.

The potential for radioactivity build up in the RB should be accounted for in the environmental qualification of safety related components located in the RB.

Status: *GEH committed to provide a response by 10/5/07*.
No response has been submitted as of the date of this letter.

RAI 6.2-167, 5/30/07, ML071490166

In DCD, Tier 2, Revision 3, Section 6.2.3, the ESBWR reactor building (RB) should be subject to periodic functional testing. 10 CFR 50, Appendix J, Option A, states in IV.B that other structures of multiple barrier or subatmospheric containment (e.g. secondary containment for boiling water reactors and shield buildings for pressurized water reactors that enclose the entire primary reactor containment or portions there of) shall be subject to individual test in accordance with the procedure established in the technical specifications, or associated bases. Please provide information on the type of test that will be used to bound the RB leakage, the conditions under which the test would be run, the degree to which these conditions would reflect worst case accident conditions, the frequency of such test, and the establishment of a test criteria. This information may be coordinated with the response to RAI 6.2-165 regarding reactor building leakage.

Status: *GEH committed to provide a response by 12/6/07*.

RAI 6.2-168, 5/30/07, ML071490166

In DCD, Tier 2, Revision 3, Section 6.2.3, the applicant states because the containment is located entirely within the reactor building (RB), multiple structural barriers exist between the containment and the environment. Therefore, fission product leakage from the RB is mitigated. The staff is reviewing the degree of mitigation provided by the RB in connection with RAI's on mixing assumptions and building leakage. Building leakage is especially important because of its impact on the effectiveness of the building being a barrier to the release of radioactivity to the environment. DCD, Tier 1, Section 2.16.5 states that "offsite dose requirements are met assuming a 100 percent volume change out per day in the RB volume outside of the RCCV." This is inconsistent with the assumption used in the design basis analyses of 50 percent volume per day in Chapter 15, Table 15.4-5. Please explain the difference and make corrections to the appropriate sections of the DCD.

Status: *GEH committed to provide a response by 9/5/07*.
No response has been submitted as of the date of this letter.

<u>RAI 6.2-169, 5/30/07, ML071490166</u>

Concerning the DCD Tier 2, Revision 3, Section 6.2.2, in the pressure differential mode, a pressure build-up in the drywell (DW), caused by insufficient steam condensation inside the passive containment cooling (PCC) condenser, will force flow through the passive containment cooling system (PCCS) pushing the non-condensible gases and the non-condensed steam into the suppression pool and potentially reestablishing the condensing mode of operation. This pressure build up has to be greater than the submergence of PCCS vent pipes, but not sufficient to clear the main vents. For that reason, the elevation of the PCC vent line relative to the upper horizontal main vents is a critical elevation.

A. State this elevation and its importance in the DCD, Chapter 6.2.2.

B. Provide an ITAAC to verify the elevation of the PCC vent line relative to the upper horizontal main vents.

Status: *GEH committed to provide a response by 8/31/07*.
No response has been submitted as of the date of this letter.

<u>RAI 6.2-173, 6/21/07, ML071590313</u>

ESBWR relies on the Passive Containment Cooling System for providing water to the Gravity Driven Cooling System for core cooling and for providing containment heat removal for 72 hours after a loss-of-coolant accident. Beyond 72 hours, ESBWR relies *also* on the Fuel and Auxiliary Pools Cooling System: DCD Tier 2 Revision 3, Table 19A-2 identifies that Fuel and Auxiliary Pools Cooling System operating in suppression pool cooling and low pressure coolant injection modes is a Regulatory Treatment of Non-Safety Systems function.

However, DCD Tier 2 Revision 3, Table 1C-1 states that NRC Bulletin 95-02, “Unexpected Clogging of a Residual Heat Removal (RHR) Pump Strainer While Operating in Suppression Pool Cooling Mode,” is not applicable to ESBWR because it does not have a safety-related suppression pool cooling system. The same table states that the following NRC Bulletins do not apply to ESBWR because it provides emergency core cooling by GDCS and that the GDCS pools do not have the debris transport mechanisms that the Suppression Pool is subject to:

- 93-02, “Debris Plugging of Emergency Core Cooling Suction Strainers”
- 93-02 Supplement 1, “Debris Plugging of Emergency Core Cooling Suction Strainers”
- 96-03, “Potential Plugging of Emergency Core Cooling Suction Strainers by Debris in Boiling-Water Reactors”
- 98-04, “Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System After a Loss-of-Coolant Accident Because of Construction and Protective Coating Deficiencies and Foreign Material in Containment.”

Please explain why debris plugging issues described in the above bulletins should not be applied to the debris plugging of the suppression pool suction strainer for operation of the Fuel and Auxiliary Pools Cooling System to ensure proper operation beyond 72 hours after a loss-of-coolant accident.

Status: *GEH committed to provide a response by 8/31/07*.
No response has been submitted as of the date of this letter.

RAI 6.2-174, 6/21/07, ML071590313

DCD, Tier 2, Revision 3, Table 6.2-6 lists the RPV nominal water level as "NWL." However, NWL is not defined in the Global Abbreviations and Acronyms List, and its value is not given in DCD Tier 2. Please define NWL in the Global Abbreviations and Acronyms List and provide its value in the DCD.

Status: *GEH committed to provide a response by 9/24/07*.
No response has been submitted as of the date of this letter.

RAI 6.2-175, 6/21/07, ML071590313

DCD, Tier 2, Revision 3, does not describe a chronology of progression of a loss-of-coolant accident (LOCA), how it affects the containment and its systems, and how containment systems operate to mitigate the consequences of a LOCA. Please add this information to the DCD Section 6.2.1.1.3.

Status: *GEH committed to provide a response by 9/24/07*.
No response has been submitted as of the date of this letter.

RAI 6.2-176, 6/21/07, ML071590313

DCD, Tier 2, Revision 3, many figures incorrectly refer to noncondensible gas as "Air". Staff notes Figures 6.2-9, 6.2-10, 6.2-11, 6.2-12, 6.2-13, and 6.2-14 all refer to "...GDCS Air Pressures." Please revise.

Status: *GEH committed to provide a response by 9/24/07*.
No response has been submitted as of the date of this letter.

RAI 6.2-177, 6/21/07, ML071590313

DCD, Tier 2, Revision 3, Section 6.2.1.1.3.5 states that "[t]he peak drywell pressure for the bounding case is below the containment design pressure." Table 6.2-5 lists peak drywell pressure and peak wetwell pressure. However, the TRACG analysis results provided in the DCD shows no peak drywell or wetwell pressures for the limiting FWLB and MSLB design base accidents. Instead, the pressure continues to rise and reaches its maximum value for the duration of analysis at 72 hours as stated in RAI 6.2-140. See for example, Figures 6.2-13a1 and 6.2-14a1. Please correct this discrepancy.

Status: *GEH committed to provide a response by 10/21/07*.

RAI 6.2-178, 7/23/07, ML071830286

DCD, Revision 3, Tier 2, subsection 6.2.5.4.1, makes these two statements addressing containment structural integrity:

– The pressure capability of the ESBWR containment vessel is such that it will not be exceeded by any design basis or special event.

– The pressure capability of the containment's limiting component is higher than the pressure that results from assuming 100 percent fuel clad-coolant reaction. There is sufficient margin to the containment pressure capability such that there is no need for an automatic containment overpressure protection system.

These statements are not specific enough for the staff to be able to determine whether the structural integrity of the containment design is acceptable. First, it is unclear as to what is meant by a "special event." Second, the DCD does not provide the actual pressure that results from assuming 100 percent fuel clad-coolant reaction, and most especially does not indicate whether the assumption of 100 percent fuel clad-coolant reaction includes hydrogen burning, as required by 10 CFR 50.44(c)(5). It may be that the inerted condition of the containment would preclude burning for many or most accidents, but there may be beyond design-basis accident sequences in which sufficient oxygen is generated by radiolysis of water to support combustion.

Provide in the DCD a description of which "special events" were considered in the analysis. Provide the actual pressure that results from assuming 100 percent fuel clad-coolant reaction, and whether the assumption of 100 percent fuel clad-coolant reaction includes hydrogen burning. If no hydrogen burning was assumed for any accident, justify this assumption, with consideration of beyond design-basis accident information from DCD, Tier 2, Chapter 19.

Status: *GEH committed to provide a response by 10/1/07*.
No response has been submitted as of the date of this letter.

RAI 6.2-179, 9/6/2007, ML072410422

The governing regulation for TMI Action Plan Item II.E.4.4, Containment Purging During Reactor Operation, is 10 CFR 50.34(f)(2)(xv), which states:

> Provide a capability for containment purging/venting designed to minimize the purging time consistent with ALARA principles for occupational exposure. Provide and demonstrate high assurance that the purge system will reliably isolate under accident conditions. (II.E.4.4)

The DCD entry on this generic issue, in Table 1A-1, "TMI Action Plan Items," simply asserts that the ESBWR design complies with these requirements, without explanation or justification.

What follows is a discussion of the bases for the generic issue.

The first requirement of the regulation refers to a situation that generally does not occur in a plant with an inerted containment atmosphere, which is unwarranted or excessive containment purging. The NRC established this generic issue because it had found that some (non-inerted) plants were purging/venting their containments for sizable fractions of the plant's operating time, or even continuously. The NRC recognized that an open purge/vent line constitutes a sizable hole in the containment boundary, which is intrinsically a less safe condition than having all purge/vent valves closed, in case an accident occurred. One legitimate reason for purging while the reactor is operating is to reduce the concentration of airborne radioactive material in the containment atmosphere, which would reduce personnel occupational exposure for personnel who enter containment. The regulation, then, calls for minimizing purging time, consistent with ALARA principles for occupational exposure. However, personnel do not enter containments while they are inerted, so there is no need to purge for this reason. In general, plants with inerted containment will naturally minimize purge/vent time (except when inerting or de-inerting) because of the cost of the nitrogen gas needed to replace that which is expelled from containment. Also, as mentioned before, personnel exposure during containment entries is not a factor.

The second requirement of the regulation, to provide and demonstrate high assurance that the purge system will reliably isolate under accident conditions, is explained in more detail in NUREG-0737, item II.E.4.2, subpart (6) and Attachment 1. The staff had found that some purge/vent valves in operating plants, typically butterfly valves, were not capable of closing if a design bases (DB) loss-of-coolant accident (LOCA) occurred while the valves were open.

In a DB LOCA, containment pressure increases so rapidly that the containment atmosphere rushes out through open purge/vent valves before they can begin to close. Some valves were found to be incapable of closing against the aerodynamic forces induced by the rapidly moving gas; in fact, some valves would even be damaged by the transient so that they would be stuck open and incapable of closing again until repaired. The regulation, therefore, requires the applicant to demonstrate, by analysis and/or testing, that the purge/vent valves would be capable of closing under these conditions. An alternative to such demonstration is to assure that purge/vent valves will never be open while the plant is operating, by including a requirement in the Technical Specifications (TS) that they must be locked or sealed closed in Modes 1 through 4, with no exception for even momentary opening of a purge/vent line while in Modes 1 through 4. The TS SR 3.6.1.3.1 indicates that the ESBWR purge/vent valves will not be sealed closed.

Note that this issue extends beyond the 500 mm (20 in) purge valves covered by TS SR 3.6.1.3.1. Other systems which may purge/vent the containment, regardless of what they are called, must be included. Some or all of the valves in the containment inerting system, for example, will be opened to purge/vent the containment in Modes 1 through 4 and must also be demonstrated to reliably isolate under accident conditions.

Provide the following information:

A. Provide a discussion in the DCD which presents arguments or justifications to demonstrate compliance with the requirement of 10 CFR 50.34(f)(2)(xv) to provide a capability for containment purging/venting designed to minimize the purging time consistent with ALARA principles for occupational exposure.

B. Provide and demonstrate in the DCD high assurance that the purge system will reliably isolate under accident conditions, or provide TS which require purge/vent valves to be sealed closed in Modes 1 through 4.

C. Identify in the DCD all purge/vent valves. This includes all containment isolation valves (CIVs) in lines that perform a purging or venting function - meaning transferring gas between the containment atmosphere and the outside atmosphere. This may include some or all of the CIVs in the containment inerting system, and perhaps others. All purge/vent valves are subject to the requirements of 10 CFR 50.34(f)(2)(xv).

Status: *GEH has not committed to a response date.*

RAI 6.2-180, 9/19/07, ML072560700

DCD, Tier 2, Revision 3, Section 6.2.1.1.2 states that "[f]or a postulated DBA, the calculated maximum DW temperature and absolute pressure remain below their design values, shown in Table 6.2-1." However, DCD Table 6.2-5 shows that the "short-term" drywell temperature exceeding the design value for the following accidents: (1) main steam line break and bottom head drain line based on standard TRACG evaluation model and (2) feedwater line break for based on both standard TRACG evaluation model and bounding values model. This table also shows that the short-term peak drywell temperature predicted for the main steam line break based on the standard TRACG evaluation model (174.7°C (346.8°F)) is more limiting than that based on the bounding values model (170.8°C (339.6°F)).

A. Please correct or explain this apparent discrepancy in the DCD. Also, please explain why it is acceptable for the drywell temperature to exceed its design value.

B. Please explain why the short-term peak drywell temperature for the main steam line break predicted by the standard TRACG evaluation model is more limiting than that based on the bounding values model.

Status: *GEH has not committed to a response date.*

RAI 6.3-10, Supplement No. 2, 10/15/07, ML072690278

GEH lowered the emergency core cooling system (ECCS) initiation signal to Level 1 from Level 1.5. Staff was concerned that since there is a delay in ECCS initiation, that the results may be non-conservative for events, such as a steam line break, where the core experiences level swell and the setpoint will be realized at a later time. In response, GEH performed a sensitivity study on the main steamline break size and provided the control logic for the level 1 setpoint in the TRACG model.

A. In response to part B of RAI 6.3-10, Supplemental No. 1, GEH provided a study of the main steam line break and varied the size from 100% down to 10% of the double-ended guillotine break size. Staff has the following additional questions:

   (1) The figure of merit used for the study is described as "Minimum Chimney Static Head Level Above Vessel Zero." In the DCD this is calculated by collapsing the level in the chimney and adding it to the elevation of the bottom of the chimney such that the void fraction of the core is not accounted for in the calculation. Please clarify if "Minimum Chimney Static Head Level Above Vessel Zero" used in the RAI response accounts for the void fraction in the core.

   (2) Although the smallest value of the "Minimum Chimney Static Head Level Above Vessel Zero" is at 100% break size, there is a trend where it is decreasing as the break size gets smaller from 40%, 20% down to 10%. Provide additional information justifying that breaks smaller than 10% are not limiting. What is the maximum sized break that will not exceed the make-up system?

B. In response to part C of RAI 6.3-10, Supplemental No. 1, GEH states that "The control logic used to model Level 1 setpoint in TRACG is a pure time delay, where the performance specified time delay for the installed control logic and the confirmation time delay are considered in TRACG analysis." Please define a performance time delay and a confirmation time delay.

Status: *GEH has not committed to a response date.*

RAI 6.3-13, Supplement No. 1, 2/7/07, ML070390176

This RAI asks GE to include the reactor pressure vessel (RPV) injection line nozzle and equalizing line nozzle throat lengths in ITAAC to ensure that the L/D remains within the applicability range of the TRACG code flow choking model for loss-of-coolant accident (LOCA) calculations. NEDE-32176P Rev. 3, "TRACG Model Description, April 2006, contains a description of the TRACG04 choked flow model in Section 6.3. Section 6.3.3 gives a description of the calculation of the sonic velocity. In this section (page 6-51), GE states the simplifying assumptions used to calculate the sonic velocity. Under this list, GE states (1 and 2) that they assume equilibrium conditions. GE states that "Under certain circumstances, the equilibrium assumption may break down. In particular, for break assemblies of very short length, non-equilibrium transport behavior may be important."

The following are supplemental questions for GE to address the applicability of the TRACG04 flow choking model to the ESBWR RPV injection line and equalizing line nozzles:

A. Does TRACG04 have a sub-cooled choking model to account for small L/D throat conditions?

B. Provide the nozzle throat L/D applicability range for the TRACG04 choking model. Provide the nozzle throat L/D for the pressure suppression test facility critical flow tests and the Edwards Blowdown Tests used to qualify TRACG critical flow model.

C. State how you will ensure that the L/D for the ESBWR nozzle throats will remain within the TRACG qualification range.

D. Add the minimum throat diameter of the RPV injection line nozzles to Tier 1 and provide an ITAAC.

Status: *GEH committed to provide a response by 11/28/07*.

RAI 6.3-18, Supplement No.2, 9/6/2007, ML072410422

GEH's response did include the proposed ITAAC (items 2 a, b) the as-built flow loss coefficient (K/A^2) for the GDCS injection and the equalizing line. However, the proposed ITAAC does not include the flow loss coefficient values assumed in the TRACG analyses. Include the flow loss coefficient values assumed in the TRACG analyses in the Acceptance Criteria.

Status: *GEH has not committed to a response date.*

RAI 6.3-24, Supplement No. 2, 9/6/2007, ML072410422

GEH's response stated that the DCD, Tier 1, Subsection 2.4.2, Design Description, includes a statement that “All GDCS safety-related components are qualified to withstand the harsh environments postulated for design basis accidents.” This requirement is not included in the ITAAC Table 2.4.2-1. Include the requirement in the ITAAC Table 2.4.2-1 for verification.

Status: *GEH has not committed to a response date.*

RAI 6.3-40, Supplement No. 1, 7/27/07, ML072080241

Staff is uncertain on why the minimum reactor pressure vessel (RPV) water level values stated in the response to RAI 6.3-40 do not correspond with the values provided in Table 6.3-5, “Summary of ECCS-LOCA Performance Analyses” of the DCD. Please explain. Also, please revise the DCD to include the response to RAI 6.3-40.

Status: *GEH has not committed to a response date.*

RAI 6.3-41, Supplement No. 3, 6/7/2007, ML071590012

In response to RAI 6.3-41 Supplement 1 part (A) GEH provided fuel assembly inlet orifice diameter and GDCS injection line diameter. This information needs to be in the DCD to show that the perforated plate has holes that are small enough to prevent debris sizes that could form blockages from entering. Please update the DCD.

Status: *GEH committed to provide a response by 11/23/07*.

RAI 6.3-42, Supplement No. 1, 5/22/2007, ML071430342

The information provided in this response is necessary to support the basis for a reasonable assurance finding. Thus, please update DCD Tier 2 to include information provided in response to RAI 6.3-42.

Status: *GEH committed to provide a response by 8/31/07*.
No response has been submitted as of the date of this letter.

RAI 6.3-45, Supplement No. 1, 10/15/07, ML072690278

RAI 6.3-45 requested GEH to provide the differences between the TRACG input decks used to calculate minimum water levels and perform containment peak pressure analyses. GEH’s response states:

“The table below lists the difference between the TRACG input decks used for the analyses presented in Chapter 6.2 of DCD, Tier 2, Revision 2 and Revision 3. These items are judged to have no impact on the minimum water levels, since they take effect at later stage of a loss-of-coolant accident (LOCA) event”

Provide justification that even though the input deck for calculating minimum water level lacks the modifications applied to the containment input deck, that the results are still accurate and conservative for the long-term core cooling analysis.

Status: *GEH has not committed to a response date.*

RAI 6.3-46, Supplement No. 1, 5/8/2007, ML072490317

A. 10 CFR 50.46(a)(1)(i) states in part that:

> “emergency core cooling system (ECCS) cooling performance must be calculated in accordance with an acceptable evaluation model and must be calculated for a number of postulated loss-of-coolant accidents of different sizes, locations, and other properties sufficient to provide assurance that the most severe postulated loss-of-coolant accidents are calculated.”

In response to RAI 6.3-46, MFN 07-049, GE provides the minimum chimney static head for additional break locations that are not presented in the DCD. GE states that “[t]he results show that the limiting cases are the main steam line (MSL) and gravity drain line (GDL) breaks.” Table 6.3-46-1 indicates that the IC return line break has a lower chimney static head than the GDL line break. Provide additional information justifying that the GDL is more limiting than the Isolation Condenser (IC) return line break.

B. GEH analyzes a break spectrum for the GDL break. For the nominal conditions, the 80 percent size break was the most limiting. GEH then analyzes the 100 percent and the 80 percent cases using bounding assumption and determined that the 100 percent was more limiting. Explain why when using bounding assumptions the 80 percent case is not limiting like in the nominal. Explain why GEH did not perform calculations for the rest of the spectrum using the bounding conditions. Provide the plots of the static head in the chimney versus time for this break spectrum study.

C. Justify the selection of the GDL break for the size study. Since the IC return line break includes a loss of an additional high pressure injection source, a small break in this line may be more limiting than a small GDL break.

D. The break spectrum analyzed only goes down to 20 percent of the maximum size. In a teleconference with the NRC staff regarding this RAI response, GEH stated that they would provide a qualitative argument on why very small breaks are not limiting. Please provide this.

Status: *GEH committed to provide a response by 8/21/07*.
No response has been submitted as of the date of this letter.

RAI 6.3-52, 10/10/2006, ML062770002

GEH submittal MFN 05-096 “Summary of September 9, 2005 NRC/GE Conference Call on TRACG LOCA SER Confirmatory Items,” dated September 20, 2005, states for item 7 that the scram time delay was incorporated into the DCD Chapter 6 LOCA cases. What is the scram time delay used? How was it incorporated into the TRACG input decks? Justify the delay time.

Status: *GEH committed to provide a response by 10/12/07*.
No response has been submitted as of the date of this letter.

RAI 6.3-54, 10/10/2006, ML062770002

Section C.1.4.1 of NEDE-32176P, “TRACG Model Description,” Revision 3, states that the correlation for thermal conductivity used in TRACG04 for UO2 with and without Gadolinia has been updated to be compatible with the model used in PRIME03. PRIME03 has not been reviewed and approved by the NRC staff. Provide justification for using this model.

Status: *GEH committed to provide a response by 8/31/07*.
No response has been submitted as of the date of this letter.

RAI 6.3-55, 10/10/2006, ML062770002

Provide justification for using gas gap conductivity and fuel thermal conductivity from two different analysis codes (GSTRM for gap conductivity and PRIME03 for fuel thermal conductivity).

Status: *GEH committed to provide a response by 8/31/07*.
No response has been submitted as of the date of this letter.

RAI 6.3-56, 10/10/2006, ML062770002

Provide more details on the sequence of events than the information that is provided in DCD Tier 2, Revision 1, Tables 6.3-7 through 6.3-10. Include trip signals and set-points for all reactor protection system (RPS) actions. Include actions necessary for long-term core cooling.

Status: *GEH committed to provide a response by 11/16/07*.

RAI 6.3-62, 1/19/2007, ML070080448

DCD Tier 2, Revision 2, Section 6.2.1.3 states that “Calculations of the energy available for release from the above sources are done in general accordance with the requirements of 10 CFR 50, Appendix K, paragraph I.A. However, additional conservatism is included to maximize the energy release to the containment during the blowdown and reflood phases of a LOCA.” Please provide:

A. A list of the conservative assumptions applied to the calculation of the decay heat for the ESBWR. Where applicable, quantify these conservative assumptions (e.g., if a reactor scram delay of 1 second is conservatively assumed, the additional heat load on the containment is given by the integrated reactor power over this interval). If an increase in core average exposure is applied to ensure conservatism in the decay heat, verify that the plutonium fission, and hence fractional decay heat contribution, was not artificially increased by providing the irradiation time and exposure assumptions for the analysis.

B. A justification of the application of the same decay heat curve to both small and large break LOCAs. Particularly, provide an analysis demonstrating that the assumptions used to calculate the fission power during rod insertion and fission power from delayed neutrons are conservative for a full spectrum of LOCAs. If a TRACG analysis is used to demonstrate the conservatism, fully describe the calculation; including the specific decay heat option used, the initiator for the SCRAM signal, the evolution of the core average void fraction, and any assumptions regarding blade insertion time or axial load.

C. A description of the heat sources considered in the decay heat analysis. If an evaluation of the decay heat model after ~100 seconds was performed to ensure that the ANS 1994 standard included sufficient conservatism to neglect the integrated effects of heat from other sources, describe the evaluation process and results. Otherwise, justify not including those sources.

D. A description the distribution of the decay heat in the TRACG core model. Is the decay heat distribution based on the initial flux shape or the initial power shape?

E. A comparison of the ESBWR specific design values for the hydraulic control unit valve deenergization and stroke time, instrument and logic delay time, and control blade insertion time to those values assumed in the calculation of the decay heat curve.

F. An explanation of the reference to the 1979 ANS standard in DCD Tier 2, Revision 2, Table 6.3-11.

G. A section in the next revision to the DCD that describes the assumptions in the shutdown power calculation that ensure that the power is conservative for a full spectrum of LOCAs for the ESBWR.

Status: *GEH responded on 8/17/07, MFN 07-439.*
GEH's response is under staff review.

RAI 6.3-63, 1/19/2007, ML070080448

DCD, Tier 2, Revision 2, Page 6.2-3 states that: "During a [loss-of-coolant accident] LOCA, when the vacuum breaker opens and allows the flow of gas from the [wetwell] WW to the [drywell] DW to equalize the DW and WW pressure and subsequently does not completely close as detected by the proximity sensors, a control signal will close the upstream isolation valve to prevent extra bypass leakage due to the opening created by the vacuum breaker and therefore maintain the pressure suppression capability of the containment." How does the control system determine that there is extra leakage due to the vacuum breaker not closing? What is the leakage threshold? What is the time delay signal for the closing of the isolation valve? Given the allowed leakage and time delay of the isolation valve, what is the impact on the passive containment cooling system performance? How does this effect containment pressure and reactor pressure vessel level calculations?

Status: *GEH committed to provide a response by 9/7/07*.
No response has been submitted as of the date of this letter.

RAI 6.3-64, Supplement No. 1, 6/12/07, ML071630437

The original RAI 6.3-64 is repeated below for reference:

"*Show plots of the core level demonstrating that the core remains covered for 72 hours for the limiting break. Justify that the input deck assumptions used for calculating long term core level are conservative*."

GEH's response, MFN 07-269 dated 5/14/07, is repeated below (except for the figure) for reference:

"TRACG prediction of the collapsed level in chimney for Gravity Driven Cooling System (GDCS) line break with 1 depressurization valve (DPV) failure is shown in Figure 6.3-64-1. The predictions show that the core remains covered for 72 hours. The assumptions used to develop the core model of TRACG input for the 72 hour analysis are the same as the assumptions used for Emergency Core Cooling Systems (ECCS) performance analysis (nominal case) reported in DCD Tier 2, Revision 3, Section 6.3."

Staff's Followup:

Staff requested that the applicant demonstrate the core remains covered for 72 hours for the limiting break. GEH's response infers (it was not directly stated) that TRACG predicted the most limiting break for long term cooling is a GDCS line break with 1 DPV failure. DCD, Section 6.3.3.7.9, with results displayed in Table 6.3-5, states that "the GDCS injection line break with a GDCS injection valve failure results in the lowest minimum chimney static head above vessel zero." Thus, the Staff would have expected that the RAI response provided plots of this limiting break. GEH provided no explanation in the RAI response.

A. Explain how GEH came to the conclusion that the GDCS injection line break with 1 DPV failure (nominal case) is the most limiting break given the information provided in Table 6.3-5. Staff is also unclear why GEH provided a plot of the nominal conditions rather than the bounding conditions for the GDCS Line break with 1 DPV failure. Include the appropriate information in the DCD.

B. Concerning the input deck assumptions, where are the non-condensible gases during the life of the transient? Staff is not convinced TRACG can accurately calculate the movement of non-condensible gases (reference RAI 21.6-96). Therefore, explain, and include in the DCD additional information regarding the treatment of non-condensible gases. Demonstrate that the treatment of non-condensible gases are conservative for long-term PCCS operation. Provide plots that show PCCS power versus time and, on the same plots, decay heat versus time.

C. Provide a qualitative discussion and results of the ESBWR long-term core cooling system response similar to that submitted in MFN 05-105 (Reference 1) in the DCD. The collapsed chimney level response shown in Figure 6.3-64-1 in MFN 07-269 for the GDL line break is different from that shown in Figure 7 in MFN 05-105 (Reference 1). Provide a discussion of the differences.

D. Concerning the input deck assumptions, there may be steam condensation on drywell surfaces that will cause steam to condense and not return to the vessel via the PCCS. Provide a discussion on how this is accounted for or, if not accounted for, justify that the calculation is still conservative without this consideration.

Reference:

1. Letter from D.H. Hinds (GEH) to NRC, MFN 05-105

2. Letter from David H. Hinds to U.S.Nuclear Regulatory Commission, TRACG LOCA SER Confirmatory Items (TAC # MC868), Enclosure 2, Reactor Pressure Vessel (RPV) Level Response for the Long Term PCCS Period, Phenomena Identification and Ranking Table, and Major Design Changes from Pre-Application Review Design to DCD Design, October 6, 2005. (ADAMS Accession No. ML053140223)

Regulatory Justification

10 CFR 50.46 states in part that the "emergency core cooling system (ECCS) … must be designed so that its calculated cooling performance following postulated loss-of-coolant accidents conforms to the criteria set forth in paragraph (b) of this section."

Paragraph (b)(5) states requirements for Long-term cooling. It states: "After any calculated successful initial operation of the ECCS, the calculated core temperature shall be maintained at an acceptably low value and decay heat shall be removed for the extended period of time required by the long-lived radioactivity remaining in the core."

Commission Paper SECY-94-084, "Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems in Passive Plant Designs" states that "passive systems should be able to perform their safety functions, independent of operator action or offsite support, for 72 hours after an initiating event."

Status: *GEH committed to provide a response by 11/26/07*.

RAI 6.3-65, Supplement No. 1, 6/12/07, ML071630437

This RAI asked GEH to evaluate the consequences of the standby liquid control system line break. The response states that the break flow was at least an order of magnitude smaller than the isolation condenser (IC) flow into the vessel, well under that of the isolation condenser system (ICS), and that none of the other emergency core cooling systems actuate. How many isolation condensers (ICs) were available during the analysis of this event? Since the passive containment cooling sytems does not operate, describe the long-term (i.e., 72-hour) plant response for this event. What happens after the ICS drains? Is the break size small enough for the reactor water cleanup to provide sufficient make-up?

Status: *GEH committed to provide a response by 11/26/07*.

RAI 6.3-68, 1/19/2007, ML070080448

Include figures of reactor power versus time for the breaks in Chapter 6.3 of the DCD.

Status: *GEH committed to provide a response by 10/12/07*.
No response has been submitted as of the date of this letter.

RAI 6.3-70, 1/19/2007, ML070080448

Update the DCD to state that the figures represented on pages 6.3-48 through 6.3-79 are nominal or bounding cases.

Status: *GEH committed to provide a response by 10/12/07.*
No response has been submitted as of the date of this letter.

RAI 6.3-72, 1/19/2007, ML070080448

In DCD, Revision 2, the x-axis on Figures 6.3-8a, 6.3-9a, 6.3-16a, 6.3-17a, 6.3-25a is labeled as time in hours. The staff believes this to be a typographical error. If so, please correct these typographical errors in the next revision of the DCD.

Status: *GEH committed to provide a response by 10/12/07.*
No response has been submitted as of the date of this letter.

RAI 6.3-78, 4/12/2007, ML070920099

In DCD Tier 2, Revision 3, Section 6.3.2.7.2, the “Biased open check valve” name is changed to “GDCS check valve,” and Figure 6.3-3, which was showing the “Biased Open Check Valve,” is deleted. The Description of Change provided with DCD Revision 3 states: “Revised description of GDC check valve.” It does not explain why the valve design was changed, although it seems there was a significant change in the design of the check valve. The check valve will be normally open instead of biased-open. Please address the following:

A. Describe the design differences between the old and the new design.

B. Add the typical check valve figure in the DCD as before.

C. Confirm that the check valves used for injection and equalization are of different types.

D. Provide additional information demonstrating that the core remains covered considering failure of GDCS check valves as the single active failure for design basis LOCA events. Provide this information for the cases where reactor vessel pressure is higher than that of the GDCS and the check valve fails to close.

Status: *GEH committed to provide a response by 10/12/07.*
No response has been submitted as of the date of this letter.

RAI 6.3-79, 4/12/2007, ML070920099

The Standard Review Plan (SRP), Section 6.3, Draft Rev. 3, April 1996, in Chapter III, “Review Procedures”, No. 20, states that “the long term cooling capacity is adequate in the event of failure of any single active or passive component of the ECCS.”

Please state if the ESBWR design takes credit for any passive component during long term post LOCA (i.e., beyond 72 hours) cooling. If so, confirm that the ESBWR design meets the requirements of the reference given above.

Status: *GEH responded on 8/24/07, MFN 07-377.*
GEH’s response is under staff review.

RAI 6.3-80, 4/12/2007, ML070920099

In DCD, Tier 2, Revision 3, Chapter 6.3, the decay heat curve presented in Figure 6.3-39 changed from that presented in Revision 2 of the DCD. GEH indicated that the reason for this is that GE “updated the ANS decay heat standard.” Please address the following:

A. Explain why the ECCS performance analyses presented in Figures 6.3-7a to 6.3-38b and summarized in Table 6.3-5 and Figure 6.3-6 are unchanged.

B. The staff reviewed your decay heat model in detail during an audit of TRACG as applied to ESBWR LOCA in December 2006. Provide a detailed explanation of the differences between the method used to generate the decay heat curve used for the ECCS performance analyses in Revision 3 of the DCD Tier 2 and the method which the staff audited in December 2006.

Status: *GEH committed to provide a response by 11/16/07*.

RAI 6.3-81, 5/29/2007, ML071450138

The staff noted in the safety evaluation report pertaining to the applicability of TRACG to the LOCA in the ESBWR design that an uncertainty analysis had not been performed. The staff noted this as a confirmatory item to be addressed at the design certification phase. The staff noted in the acceptance letter pertaining to the ESBWR Design Certification Document that the confirmatory items had not been addressed for the LOCA analysis.

Please demonstrate how the LOCA analysis performed in support of the ESBWR design certification complies with the requirement of 10 CFR 50.46(a)(1)(i) that reads in part:

ECCS cooling performance must be calculated in accordance with an acceptable evaluation model ...and uncertainties in the analysis method and inputs must be identified and assessed so that the uncertainty in the calculated results can be estimated. This uncertainty must be accounted for, so that, when the calculated ECCS cooling performance is compared to the criteria set forth in paragraph (b) of this section, there is a high level of probability that the criteria would not be exceeded.

The analysis that has been provided in the design certification document is based on a single calculation assuming limiting nominal conditions.

Status: *GEH committed to provide a response by 10/21/07*.

RAI 6.4-5, 7/23/2007, ML071830286

DCD, Tier 2, Revision 3, Section 12.3.3.2.1, Control Room Ventilation, references bottled air as being supplied during the first 72 hours and that the Control Building is maintained at 0.5 inches Hg.

Staff’s understanding is that main control room bottled system has been completely removed from the design. Please reconcile this discrepancy in the DCD. Also, confirm the 0.5 inches Hg value.

Status: *GEH committed to provide a response by 10/1/07*.
No response has been submitted as of the date of this letter.

RAI 6.4-6, 7/23/2007, ML071830286

DCD, Tier 2, Revision 3, Chapter 3, Table 3.2-1, U77, item number 4 states, "Main control room bottled air system." Staff's understanding is that main control room bottled system has been completely removed from the design. Please reconcile this discrepancy in the DCD.

Status: *GEH committed to provide a response by 10/1/07*.
No response has been submitted as of the date of this letter.

RAI 6.4-7, 7/23/2007, ML071830286

DCD, Tier 2, Revision 3, Section 6.4.3, states that the heat sink "consists of the thermal mass of concrete that makes up the ceilings and walls of these rooms" in the control room habitability area (CRHA).

This RAI requests additional information on the role of the heat sink after 72 hours into the design basis accident.

A. Thoroughly discuss in the DCD how the temperature in the control room is to be maintained for the entire 30 day design basis accident period. Include the initial temperature assumptions and CRHA heat loads that are assumed in the heat sink calculation. Identify the equipment and their power sources necessary to maintain the temperature (heat sink, recirculation air handling units (AHUs), chillers, cooling water pumps, etc) for the full 30-day period.

B. After 72 hours into the design basis accident, will the operation of the chillers, cooling water pumps, and recirculation AHUs be needed so that the heat sink is not needed? Are these items powered from the same portable non-safety diesel generator units used to power the EFU's after 72 hours? Are connections established to allow rapid hook up of the portable diesel generators?

C. Identify in the DCD the non-safety-related components included in the regulatory treatment of non-safety systems (RTNSS) program that are needed to maintain CRHA temperature.

D. Change number 125 to Section 8 for Rev. 3 of the DCD states "The transportable AC generator referenced has been deleted from the ESBWR design." Are the portable generators part of the ESBWR design? Are these the same portable non-safety diesel generator units used to power the EFU's after 72 hours as described in Section 6.4.4, Emergency Mode? If these portable diesel generators have been removed from the ESBWR design, what have they been replaced with?

Status: *GEH committed to provide a response by 10/1/07*.
No response has been submitted as of the date of this letter.

RAI 6.4-8, 7/23/2007, ML071830286

What surveillance requirements will ensure that the initial temperature assumptions on the heat sink are below acceptable limits? How often will these surveillances be performed? How are the effects of the following items accounted for in the surveillances:

(1) external temperatures such as 95 degree Fahrenheit day and
(2) heat loads in adjoining rooms and passageways?

The temperature of the CRHA is not necessarily the temperature of the heat sink because of the temperatures on the outside surface of the heat sink (concrete wall, ceilings, and floors) may be higher than the temperature in the control room.

Status: *GEH committed to provide a response by 10/1/07*.
No response has been submitted as of the date of this letter.

RAI 6.4-9, 7/23/2007, ML071830286

DCD, Tier 2, Revision 3, Section 6.4.4 under Emergency Mode states that a constant air flow, sufficient to pressurize the CRHA boundary, is maintained. Standard Review Plan (SRP) Section 6.4, Revision 3, March 2007*, in Acceptance Criteria Item 3 for Pressurization Systems, paragraph B states:

> "Systems having pressurization rates of less than 0.5 and equal to or greater than 0.25 volume changes per hour should have identical testing requirements as indicated in acceptance criteria [A] above. In addition, at the construction permit (CP), combined license, or standard design certification stage, an analysis should be provided (based on the planned leaktight design features) that ensures the feasibility of maintaining the tested differential pressure with the design makeup airflow rate."

Provide the analysis underlined above so that the staff can evaluate the adequacy of make up flow rate. Include the results of the analysis in the DCD.

*Note: Same criteria same as 1981 and 1996 versions of SRP Section 6.4

Status: *GEH committed to provide a response by 10/1/07*.
No response has been submitted as of the date of this letter.

RAI 6.4-10, 7/23/2007, ML071830286

DCD, Tier 2, Revision 3, Section 6.4.3 under Component Descriptions, states that the emergency filter units (EFUs) are designed to ASME AG-1 but addenda AG-1a-92 is not mentioned. Addenda AG-1a-92 is part of acceptance criterion no. 4 in Standard Review Plan (SRP) Section 6.4, Revision 3, March 2007, and was also included in SRP Section 6.4, Draft Revision 3, June 1996.

Refer to the addenda in the DCD or provide a reason why it is not applicable.

Status: *GEH committed to provide a response by 10/1/07*.
No response has been submitted as of the date of this letter.

RAI 6.4-11, 7/23/2007, ML071830286

Refer to DCD, Tier 2, Revision 3, Figures 1.2-4 and 1.2-11 that show the location of the heating, ventilation and air conditioning (HVAC) supply louvers:

A. Identify which of these louvers services the emergency filter unit (EFU) system and which services the normal HVAC supply to the control room habitability area (CRHA).

B. Are these control room ventilation inlets consistent with the values suggested in acceptance criterion no. 5A in Standard Review Plan (SRP) Section 6.4, Revision 3, March 2007?*:

(1) Are they separated from potential release points by 100 feet laterally and 50 feet vertically, and;
(2) Are the actual minimum distances based on the dose analyses?

Include the information requested above in the DCD.

*Note: Same criteria as the 1981 and 1996 versions of SRP Section 6.4

Status: *GEH committed to provide a response by 10/1/07*.
No response has been submitted as of the date of this letter.

RAI 6.4-12, 7/23/2007, ML071830286

DCD, Tier 2, Revision 3, Section 6.4.1.1 states that control room habitability area (CRHA) requirements are satisfied without the need for individual breathing apparatus.

A. Concerning acceptance criterion no. 5B in Standard Review Plan (SRP) Section 6.4, Revision 3, March 2007*, provide information in the DCD on the ability of the CRHA systems to protect during a toxic gas event without individual breathing apparatus. Specifically, if the CRHA is isolated in a toxic gas event, would the emergency filter unit (EFU) be operational and effective for all potential toxic gases? Is there any event where self contained breathing apparatus would be required? If this is the case, how many are provided and where are they stored?

B. SRP 6.4, Section III, Item 2*, “Control Room Personnel Capacity” states that for a control room designed with complete isolation capability from the outside air, a 100,000 cubic feet CRHA would be satisfactory for 5 operators for 6 days from the build up of carbon dioxide. If the ESBWR CRHA had to be totally isolated, how long would the anticipated number of operators be protected in an 88,000 cubic foot control room from the build up of carbon dioxide?

*Note: Same criteria as the 1981 and 1996 versions of SRP Section 6.4

Status: *GEH committed to provide a response by 10/1/07*.
No response has been submitted as of the date of this letter.

RAI 6.4-13, 7/23/2007, ML071830286

DCD, Tier 2, Revision 3, Section 6.4.3 under "Component Descriptions" lists tornado dampers. The staff requests additional information to assure that appropriate protection is provided to the various intakes or discharge paths of the control room habitability area heating, ventilation and air conditioning (CRHAVS).

A. Identify in the DCD the location and quantity of the tornado dampers.

B. Identify in the DCD the supply louvers are considered safety-related and protected by tornado dampers.

C. Discuss the potential for the control building or control room habitability area to experience a sudden drop in pressure due to a tornado event as a result of an unprotected louver?

Status: *GEH committed to provide a response by 10/1/07*.
No response has been submitted as of the date of this letter.

RAI 6.4-14, 7/23/2007, ML071830286

DCD, Tier 2, Revision 3, Section 6.4.3 under "Leak Tightness" states that the control room habitability area (CRHA) utilizes internal air handling units (AHUs) that preclude any AHU ductwork external to the CRHA envelope.

Include a discussion in the DCD of any ductwork external to the CRHA associated with emergency filter unit (EFU) supply, normal outside air supply, and smoke purge paths. Please be specific in referencing components such as AHU's and use the same terminology on figures, tables and in the text.

Status: *GEH committed to provide a response by 10/1/07*.
No response has been submitted as of the date of this letter.

RAI 6.4-15, 7/23/2007, ML071830286

DCD, Tier 2, Revision 3, Section 6.4.4 states that operation of the emergency habitability portion of the control room habitability area heating, ventilation and air conditioning (CRHAVS) system is automatically initiated by either of the following conditions:

– High radioactivity in the main control room supply air duct
– Extended loss of AC power

Is the emergency habitability portion also automatically initiated and an EFU started by a toxic gas event? Please explain the duration that qualifies as an extended loss of AC power.

Status: *GEH committed to provide a response by 10/1/07*.
No response has been submitted as of the date of this letter.

RAI 6.4-16, 7/23/2007, ML071830286

DCD, Tier 2, Revision 3, Section 6.4.4 states that during the first two hours of a station blackout (SBO). Most of the equipment in the main control room (MCR) remains powered by the non-1E battery supply.

A. For a design basis accident with loss of power is any of the equipment in the MCR powered from the non-1E battery supply. What credit is taken for cooling and the operation of an AHU during this two hour period with respect to temperature rise in the MCR for the first 72 hours and ultimately for the duration of the accident period (30 days). If credit is taken for cooling, please justify the use of non-safety batteries during the design basis accident mitigation and recovery period.

B. What manual actions are required during a LOCA with a LOOP to isolate non-safety heat loads due to the potential unavailability of non-1E battery supply? This would be of particular concern during the early stages (first two hours) of the accident. Have these manual actions been identified and evaluated in the analysis?

Status: *GEH committed to provide a response by 10/1/07*.
No response has been submitted as of the date of this letter.

RAI 6.4-17, 7/23/2007, ML071830286

DCD, Tier 2, Revision 3, Section 6.4.9 states that the COL applicant will provide the testing frequency for main control room (CRHA) inleakage testing. Please state in the DCD (1) that the test requirements and the testing frequency will be consistent with the guidance of Regulatory Guide 1.197 which establishes an in service test program and (2) that the test requirements are presented in Chapter 16, Technical Specifications, Section 5.5.12, Control Room Habitability Area (CRHA) Boundary Program.

Status: *GEH committed to provide a response by 10/1/07*.
No response has been submitted as of the date of this letter.

RAI 6.4-18, 9/6/2007, ML072410422

A. DCD, Tier 2, Revision 3, Table 1.9-9 states for SRP Section 9.4.5 "The engineered safety features described in Chapter 6 do not require a separate ventilation system. This section is not applicable to ESBWR." Please make the appropriate correction in the DCD to account for the addition of the EFU system in DCD Revision 3.

B. DCD, Tier 2, Revision 3, Table 1.9-6 states that SRP Section 6.5.1 is not applicable to the ESBWR. Please make the appropriate correction in the DCD to account for the addition of the EFU system in DCD Revision 3.

C. DCD, Tier 2, Revision 3, Table 1.9-20 states that SRP Section 6.5.1 is not applicable to the EWBWR and comments that there is no standby gas treatment. Please make the appropriate correction in the DCD to account for the addition of the EFU system in DCD Revision 3.

Status: *GEH has not committed to response date*.

<u>RAI 6.6-8, 5/30/2007, ML071490166</u>

DCD, Tier 2, Revision 3, Section 6.6.3.1 indicates that all of the items selected for inservice examination will receive a preservice examination in accordance with ASME Section XI, IWC-2200 and IWD-2200 with the exception of the examinations specifically excluded by ASME Section XI from preservice examination. For the aforementioned exception to preservice examination, the applicant provides examples such as the visual VT-2 examinations for Category C-H and D-A. DCD, Tier 2, Revision 3, Section 5.2.4 indicates that the design to perform preservice inspection is based on the requirements of ASME Code, Section XI, as specified in Table 1.9-22. Table 1.9-22 indicates that the above referenced Code is the ASME Code, Section XI, 2001 Edition through the 2003 Addenda. The 2001 Edition through 2003 Addenda of ASME Code, Section XI, IWD-2200, Preservice Examination, states that all examinations required by this Article (with the exception of Examination Category D-B of Table IWD-2500-1) shall be performed completely, once, as a preservice examination requirement prior to initial plant startup.

It appears that the applicant has made references to the 1989 Edition of ASME Code, Section XI, regarding examination Category D-A. The staff notes that there have been other instances where the applicant referenced examination categories from the 1989 ASME Code. In RAI 5.2-56, the staff requested that the applicant update references to examination categories that were apparently referenced from the 1989 Code.

Given that GEH has indicated that the information it has supplied is based on the 2001 Edition, through the 2003 Addenda of ASME Section XI:

A. Revise the DCD, Tier 2, Section 6.6 to reference the appropriate examination categories for the 2001 Edition through the 2003 Addenda.

B. Verify that a complete review has been conducted of the DCD Sections 5.2.4 and 6.6 to ensure that all references to ASME Section XI are consistent with the 2001 edition through the 2003 Addenda of ASME Section XI.

Status: *GEH committed to provide a response by 11/5/07*.

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