August 3, 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 10 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 10 open items for SER Chapter 10 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.

This open item letter is based on the staff's review of the ESBWR Design Control Document (DCD) Revision 3, Request for Additional Information (RAI) responses and other submittals received to date. The staff will continue its review as additional RAI responses and other deliverables are submitted, including future DCD Revisions. The staff will inform cognizant GEH staff of any resulting changes to the status of Chapter 10. If you have any questions, please contact Eric Oesterle at (301) 415-1365 or ero1@nrc.gov or Manny Comar at (301) 415-3863 or mmc1@nrc.gov.

Sincerely,

/RA/

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

Docket No. 52-010

Enclosure: As stated

cc: See next page

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GE-Hitachi Nuclear Energy Americas LLC (GEH) ESBWR
Preliminary Open Items
Chapter 10
Steam and Power Conversion System

RAI 10.2-18 Supplement No.1, 3/6/2007, ML070670050

ESBWR design control document (DCD) Section 10.2.2.4 describes the functionality and protection provided by the primary and emergency trip systems, including provisions for redundancy and reliability. In RAI10.2-18, the staff requested that the applicant describe how the overspeed protection system provides diversity (e.g., mechanical trip device) as recommended in Standard Review Plan (SRP) Section 10.2.

In General Electric (GE) letter MFN-06-154, dated June 12, 2006, the applicant stated the following: A triple and redundant system, as described in Subsection 10.2.2.4, paragraphs 3, 4, and 5 replace the mechanical trip device. The diversity is provided through the primary and emergency systems. Redundancy is further provided for by using three (3) separate speed signals for the primary trip and speed control systems, and three (3) additional speed signals for the emergency trip system.

The response to Request for Additional Information (RAI) 10.2-18 is not acceptable as the proposed design exhibits redundancy but not diversity. In operating plants, the mechanical trip provides a diverse trip mechanism, which eliminates common cause failures associated with electrical components, and thereby increases reliability of the turbine overspeed function. Therefore, the applicant's proposed deviation from the criterion specified in SRP Section 10.2, Rev. 2 must be justified if any structures, systems or components (SSCs) important to safety are vulnerable to turbine missiles, or if the turbine missile effects could otherwise pose a challenge to plant operators in achieving and maintaining safe shutdown conditions. For example, a situation that could pose a challenge to plant operators is a turbine missile strike on a hazardous chemical or flammable liquid storage tank.

The applicant's justification should include the following information:

1. A complete listing of turbine missile vulnerabilities that exist of the nature described above, including a diagram showing locations relative to the turbine placement to facilitate NRC review.

2. Potential consequences of turbine missile strikes on the SSCs identified in item 1 above.

3. A comparison of the reliability of the proposed turbine overspeed trip protection capability to the reliability that is afforded by the diverse capability that exists in operating plants.

4. Provide a failure modes and effects analysis for the proposed turbine overspeed protection equipment. Specifically identify and address any common mode or common cause failure vulnerabilities that exist.

5. Compare the likelihood of generating turbine missiles with the turbines to be used in the new plants, with the likelihood of turbine missile generation in current plants that have diverse turbine overspeed trip capability.

6. Provide a summary discussion of what the overall consequences are of eliminating the diverse turbine overspeed trip capability on plant safety, taking into consideration the above factors.

Status: GEH responded on 6/7/2007, MFN-06-154, Supplement 2
GEH response is under staff review

RAI 10.2-20, 5/29/2007, ML071450138

DCD Tier 2, Rev. 2, Section 10.2.5 stated that the details of the turbine inservice test and inspection program (as requested in SRP 10.2.3) will be provided in a combined license (COL) final safety analysis report (FSAR) update, after the turbine has been purchased. However, this COL holder item was removed in DCD Revision 3. Provide a justification for its removal.

Status: *GEH* responded on 8/2/2007, MFN-07-400.
GEH response is under staff review.

RAI 10.2-21, 5/29/2007, ML071450138

DCD Tier 2, Rev. 3, Section 10.2.5.1 states that the COL holder will provide an evaluation of the probability of turbine missile generation using criteria in accordance with NRC requirements. The probability of turbine missile generation should be completed prior to license issuance so that the staff can verify whether the probability of turbine missile generation is within NRC requirements. This means that the COL applicant should provide the information, not the COL holder. Justify the use of “the COL holder” in lieu of “the COL applicant” in Subsection 10.2.5.1.

Status: *GEH* responded on 8/2/2007, MFN-07-400.
GEH response is under staff review.

RAI 10.2-22, 5/29/2007, ML071450138

In DCD, Tier 2, Revision 0, several COL action items were specified. Specifically, Subsection 10.2.5.1 specifies that the COL applicant will provide turbine material property data and assure sufficient turbine warmup time. Subsection 10.2.5.2 specifies that the COL applicant will provide the basis for the turbine overspeed. Subsection 10.2.5.3 specifies that the COL applicant will provide the turbine inservice test and inspection requirements. However, none of these three subsections is shown in Section 10.2.5 of Revision 3.

The staff noticed that the overspeed basis report and the inservice test and inspection report are incorporated in Section 10.2.3.4 (page 10.2-11). However, it is not clear in Section 10.2.3.4 who provides these reports and when. Also, the submission of turbine material property data and warmup time is not specified in Section 10.2.3. Therefore, GEH needs to either reinstate all three COL action items, or state in Subsection 10.2.3.4 that the COL applicant will submit the relevant documents.

Status: *GEH* responded on 8/2/2007, MFN-07-400.
GEH response is under staff review.

RAI 10.2-23, 5/29/2007, ML071450138

DCD Tier 2, Rev. 3, Section 10.2.3.1 (Page 10.2-10, third paragraph) states that the fracture appearance transition temperature will be no higher than +30 degrees F; and that the control valve (Cv) energy at the minimum operating temperature will be at least 45 ft-lbs for a large integral rotor. Justify these two design limits because they are not consistent with SRP 10.2.3.II.1.

Status: *GEH has committed to respond by 8/6/2007.*

RAI 10.2-24, 5/29/2007, ML071450138

DCD Tier 2, Rev. 3, Section 10.2.3.2 is not consistent with SRP 10.2.3.II.2 because it is not clear how fracture toughness properties of the turbine rotor are obtained. SRP 10.2.3.II.2 specifies four methods (a, b, c, and d) for obtaining fracture toughness properties for the turbine rotor. Discuss the method that will be used in accordance with SRP 10.2.3.II.2.

Status: *GEH has committed to respond by 8/6/2007.*

RAI 10.2-25, 5/29/2007, ML071450138

DCD Tier 2, Rev. 3, Section 10.2.3.5 (Page 10.2-11) describes the specific codes or standards to which the pre-service examinations (ultrasonic and surface) of forgings will be adhered as recommended in SRP 10.2.3.II.3. Discuss whether pre-service visual examinations of forgings will be conducted.

Status: *GEH has committed to respond by 8/6/2007.*

RAI 10.3-1 and 10.3-7 Supplement No. 1, 2/2/2007, ML070670449

Reference: GE Response Letter MFN-06-219, dated July 19, 2006, which addressed NRC RAI Letter No. 36, dated June 22, 2006.

In its response to RAI 10.3-1, the applicant stated that the portion of the main steam piping inside the containment, including the inboard main steam isolation valves (MSIVs), the containment penetrations, outboard MSIVs and piping up to the seismic restraints is classified as seismic Category I. The applicant also stated that the technical manual specifications and standards (TMSS) piping portion of the main steam piping (i.e., downstream of the seismic restraint) is a non-safety system, located in a non-safety building that is designed to seismic Category II, and is analyzed to demonstrate structural integrity under safe shutdown earthquake (SSE) loading conditions. The staff finds this acceptable.

However, the applicant also stated that the American Society of Mechanical Engineers (ASME) authorized nuclear inspector (ANI) and ASME Code stamping is not required for these portions of the system. In its response to RAI 3.2-1, GEH agreed to include ANI and ASME Code stamping for all ASME Class 1, 2, and 3 piping. The staff finds this acceptable. The staff

requests GEH to revise the response to RAI 10.3-1 and the DCD to acknowledge the commitment made by the applicant in response to RAI 3.2-1.

Status: GEH responded on 4/18/07, MFN 06-219, Supplement 1.
GEH's response is under staff review and will be resolved pending resolution of RAI 3.2-1.

RAI 10.3-4 Supplement No. 2, 7/20/07, ML072010246

Reference: GE response Letter MFN-06-219, Supplement 2, dated May 18, 2007, which addressed NRC RAI Letter No. 36, dated June 22, 2006.

(a) DCD Tier 2, Section 10.3.6, Revision 3 does not list weld filler metal specifications and classifications, and the applicant did not provide this information in its responses to RAIs 10.3-4 and 10.3-4 S01. In order for the staff to complete its review and evaluate the applicant's compliance with 10 CFR 50.55a and General Design Criterion 1, the applicant must provide the staff with a list of the weld filler material specifications and classifications used in Class 2 Main Steam (MS) and Feedwater (FW) systems.

(b) In a teleconference between the staff and GE on June 7, 2007, to discuss the applicant's response to RAI 10.3-4 S01, the staff informed GE that its reference to fracture toughness requirements in Section 10.3.6 must include all Class 2 MS and FW piping and components. Revision 3 of DCD Tier 2, Section 10.3-6 lists fracture toughness for the TMSS but not the Class 2 FW system. In order for the staff to complete its review, the staff requests that the applicant modify the DCD to include the fracture toughness requirements for all ASME Code Class 2 piping and components in the MS and FW systems.

(c) In response to RAI 10.3-4 S01, the applicant indicated that low alloy steel will be used in the Class 2 portion of the FW system. Accordingly, the staff requests that the applicant modify the DCD to indicate if the ESBWR design follows NRC guidance provided in Regulatory Guide (RG) 1.50. The staff notes that the applicant provided a description of its alternative to RG 1.50 for reactor coolant pressure boundary (RCPB) and engineered safety feature (ESF) materials in responses to RAI 5.2-44 (GE Letter MFN-06-260, August 7, 2006, (ML062260103)) and RAI 6.1-4 (GE Letter MFN-06-365, October 4, 2006, (ML062890039)).

In order for the staff to complete its review of the DCD, the staff requests that the applicant modify the DCD to include any alternatives to RG 1.50 as it applies to all Class 1, 2, and 3 piping and components. In addition, the staff requests that the applicant modify the DCD to include its response to RAI 6.1-4, in which it states that the ASME Boiler and Pressure Vessel (B&PV) Code, Section III, Appendix D, Article D-1000, minimum preheat recommendations will be applied to all ASME Code, Section III, Class 1, 2, and 3 carbon

steel and low alloy steel components in the ESBWR design. The two aforementioned requested DCD modifications should be included in DCD Subsections 5.2.3, 6.1.1 and 10.3.6. Alternatively, the applicant could modify one of the subsections and provide references in the remaining two sections which provide a pointer to the subsection that contains the information.

Status: GEH has committed to respond by 8/31/07.

RAI 10.3-6 Supplement No. 2, 7/20/07, ML072010246

Reference: GE response Letter MFN-06-219, dated July 19, 2006, which addressed NRC RAI Letter No. 36, dated June 22, 2006.

In RAI 10.3-6, Supplement 1, the staff requested that the applicant provide the material specifications and grades for all main steam, feedwater and condensate system piping (ASME Code Class and non-Code piping). In the applicant's response (MFN-06-219, Supplement 2) dated May 18, 2007, GE stated that SRP Section 10.4-7 indicates that the evaluation of feedwater materials is performed under SRP Section 10.3.6. The applicant further stated that because SRP Section 10.3.6 only applies to ASME Code Section III Class 2 and 3 piping, non-ASME Code, Section III, Code Class 1, 2, and 3 feedwater piping is not addressed in the DCD.

During a teleconference between the NRC staff and GE on June 7, 2007, GE indicated that the design of non-ASME Code Section III systems is not yet complete. In order for the staff to determine the ESBWR's conformance with General Design Criteria 4 (GDC), the staff requests that the applicant modify the DCD to include a combined license (COL) Applicant Action Item to include materials specifications and grades for non-ASME Code Section III main steam, feedwater and condensate piping and components that could potentially be susceptible to final acceptance criteria (FAC) and discuss a basis for the materials that have been selected.

Status: GEH has committed to respond by 8/31/07.

cc:

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