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MFN 08-916

Docket No. 52-010

December 1, 2008

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

Subject: **Response to Portion of NRC Request for Additional Information Letter No. 244 Related to ESBWR Design Certification Application RAI Number 14.3-131 S03**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) Response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by NRC letter 244 dated August 21, 2008 (Reference 1).

Enclosure 1 contains the GEH response to RAI Number 14.3-131 S03.

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 6.

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

Sincerely,

Richard E. Kingston  
Vice President, ESBWR Licensing

DOGB  
HRO

References:

1. MFN 08-664, Letter from U.S. Nuclear Regulatory Commission to Mr. Robert E. Brown, GEH, *Request For Additional Information Letter No. 244 Related To ESBWR Design Certification Application*, dated August 21, 2008.
2. MFN 08-435, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 169 Related To ESBWR Design Certification Application*, dated April 18, 2008.
3. Response to Portion of NRC Request for Additional Information Letter No. 169 Related to ESBWR Design Certification Application DCD Tier 1 RAI Number 14.3-131 S02.
4. MFN 07-266, Response to Portion of NRC Request for Additional Information Letter No. 93 Related to ESBWR Design Certification Application – Chapter 14 – Selection of Tier 1 Criteria and Processes – RAI Number 14.3-131.
5. Response to Portion of NRC Request for Additional Information Related to ESBWR Design Certification Application, NRC Meeting Dated October 18, 2007 – Chapter 14 – Selection of Tier 1 Criteria and Processes – RAI Number 14.3-131 S01.
6. MFN 07-106, Letter from U.S. Nuclear Regulatory Commission to David Hinds, GEH, *Request For Additional Information Letter No. 93 Related To ESBWR Design Certification Application*, dated January 31, 2007.

Enclosures:

1. Response to Portion of NRC Request for Additional Information Letter No. 244 Related to ESBWR Design Certification Application DCD Tier 1 RAI Number 14.3-131 S03.
2. Attachment 1, DCD Tier 1 Revision 6 Markups

cc: AE Cabbage      USNRC (with enclosure)  
RE Brown        GEH/Wilmington (with enclosure)  
DH Hinds        GEH/Wilmington (with enclosure)  
eDRF            0000-0094-1022 (RAI) 14.3-131 S03

**MFN 08-916**

**Enclosure 1**

**Response to Portion of NRC Request for  
Additional Information Letter No. 244  
Related to ESBWR Design Certification Application**

**DCD Tier 1**

**RAI Number 14.3-131 S03**

- \* Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 6.

For historical purposes, the original text of RAI 14.3-131 and Supplements 1 and 2 and the GEH responses are included, except for any attachments or DCD mark-ups.

**NRC RAI 14.3-131**

*The staff has identified inadequacies in Tier 1, Revision 2, ITAAC. Examples include:*

- A) *The NRC staff expects that any system that contains ASME Code Class 1, 2, and 3 components, has inspection, tests, analyses, and acceptance criteria (ITAAC) to ensure that the as-built systems meet the applicable ASME Code requirements. The ITAAC should include a description of the type of documentation that is required to satisfy the ITAAC.*

*The ITAAC for the Reactor Pressure Vessel (RPV) Listed in Table 2.1.1-2 includes the following Inspections, Tests, Analyses (ITA) :*

- 1. Inspections of the as built system will be performed.*
- 2. Inspections of the ASME Code required documents will be conducted.*
- 3. A hydrostatic test will be conducted on those components of the system required to be hydrostatically tested by ASME Code.*
- 4. Inspections of the system fabrication records will be conducted. The aforementioned ITA should be applicable to all ASME Code Class 1, 2, and 3 components.*

*In Tier 1, Revision 2, ITA 1 and 3 are listed with ITAAC for ASME Code Class 1, 2, and 3 components. ITA 2 and 4 above are not currently listed.*

*Although Section 1.2.2.1 (1) "Verification for Basic Configuration for Systems discusses the ITA 1 above, it only applies to as-built pressure boundary welds. The staff considers the applicants ITAAC for several systems to be incomplete and vague. The staff's expectation is that all metallic components and systems have clearly defined ITAAC to ensure that (a) the as-built system is inspected against the functional arrangement of the system and (b) inspections are conducted of the as-built ASME Code Section III piping, welds, and components against ASME Code Section III design, fabrication and testing requirements. The staff expects the ITAACs to reflect appropriate documentation for the inspections and satisfaction of the ASME Code Section III design, fabrication, and testing requirements. Below is a list of some but not all of the systems that contain ASME Code Class 1, 2 or 3 piping and components that should have very similar ITAAC.*

- 2.1.2 Nuclear Boiler System (NBS)*
- 2.2.2 Control Rod Drive System*
- 2.2.4 Standby Liquid Control System*
- 2.4.1 Isolation Condenser System*
- 2.4.2 Emergency Core Cooling System - Gravity-Driven Cooling System*

- 2.6.1 Reactor Water Cleanup/Shutdown Cooling System
- 2.6.2 Fuel And Auxiliary Pools Cooling System
- 2.11.1 Turbine Main Steam System

- B) *In Table 2.1.2-2 ITAAC for the NBS under the ITA for ITAAC number 2, the applicant states that ASME Code Data Reports will be reviewed and inspections of Code stamps will be conducted for ASME components in the NBS. The applicant should include a requirement to compare the data reports with the actual as-built system. The acceptance criteria for ITAAC 2 should include a report which concludes that the ITA has been performed and that the ITAAC 2 acceptance criteria has been met.*
- C) *The Design Commitment in ITAAC number 5 states The ASME Code portions of the NBS retain their integrity under internal pressure that will be experienced during service. The staff believes that this ITAAC should state "The ASME Code portions of the NBS retain their pressure boundary integrity at design pressure values. The staff requests that the applicant develop ITAAC that address the issues identified above and apply those ITAAC to all systems that contain ASME Code Class 1, 2, 3 and safety significant pressure retaining piping and components in the ESBWR design.*

#### **GE Response**

- A) Refer to the response to RAI 3.9-107, which describes "Design Reports" which are required under ASME Code, Section III. All ASME piping and components are designed, fabricated, installed, and tested in accordance with the requirements in ASME Code, Section III. It is the responsibility of the owner to review the Design Reports for conformance with these requirements.

This requirement can be incorporated as a general ITAAC item for all systems containing ASME Code Class 1, 2, or 3 piping and components. The wording of the ITAAC should be similar to the one that has already been applied to the Nuclear Boiler System (See Table 2.1.2-2, Item 2).

A description will be added to Tier 1 Section 3.1, similar to that added in Tier 2 Subsection 3.9.3 as a result of RAI 3.9-107. A generic ITAAC item shall be added to Tier 1 Table 3.1-1 to require the inspection of all ASME Section III piping and components. The corresponding NBS ITAAC (Tier 1, Table 2.1.2-2, Item 2) will be deleted.

- B) Tier 1 Table 2.1.2-2, Item 2 has been deleted and replaced with a generic ITAAC for all systems as described in Part A above. This generic ITAAC has been updated to specify the design reports will be compared with the "as-built" system.
- C) The ITAAC items related to conducting hydrostatic testing are taken almost word for word from the ABWR ITAAC tables. The rationale for using this wording is that the ASME Code contains the testing requirements and the Code is referenced in the acceptance criteria. Therefore it is not necessary to specify the requirements a second time in Tier 1.

**DCD Impact**

- A) Tier 1, Section 3.1 shall be revised as shown in the attached DCD markup to specify a generic ITAAC for all ASME Section III components.
- B) Tier 1, Table 2.1.2-2 shall be modified as shown in the attached DCD markup to delete Item 2 (which is redundant after the changes described in Part A)
- C) No DCD impact.

**NRC RAI 14.3-131 SUPPLEMENT 1**

*As a result of a Tier 1 Meeting with the NRC on October 18, 2007 the following issues need to be addressed in Tier 1, Section 3.1, Design of Piping Systems and Components, and Table 3.1-1, ITAAC for the Design of Piping Systems and Components:*

- *Add components to the DAC scope and requirements to meet ASME code requirements.*
- *Include details for DAC closure in the applicable Tier 2 sections.*
- *Include ITAAC for piping design reports, pipe break hazards analysis, piping as built reconciliation, component design reports, and component reconciliation.*

**GEH RESPONSE, RAI 14.3-131 SUPPLEMENT 1**

- A) All ASME piping and components are designed, fabricated, installed and tested in accordance with the requirements in ASME Code, Section III.

Tier 1, Section 3.1, Design Descriptions, will be clarified to address additional DAC scope as discussed with the NRC staff on October 18, 2007.

Tier 1, Table 3.1-1, ITAAC for the design of piping systems and components, will be clarified to address piping design reports, pipe break hazards analysis, piping as built reconciliation, component design reports and component reconciliation.

Also related to the completion of the system piping analysis is the work associated with the evaluation of pipe breaks. To assure that protection against pipe breaks has been provided in the plant, ITAACs are identified to confirm the completion of the pipe break analysis and that protection devices have been installed. Correspondingly, the COL information item contained in section 3.6.5-1-A of the DCD has been removed since it currently only refers to one of the ITAACs associated with the pipe break analysis, and does not contain any action to be completed by the COL applicant.

- B) ESBWR DCD Section 3.6.5 contains COL information item 3.6.5-1-A requiring the applicant to provide a pipe break evaluation report as described in Section 3.6.2.5. The information required by the COL information item 3.6.5-1-A is met and satisfied by the closure of Tier 1, Table 3.1-1 ITAAC Criteria as discussed in item A above.
- C) A review of DCD (Rev 4) Tier 2, Section 3.9.2, Dynamic Testing and Analysis of Systems, Components and Equipment, and Section 3.9.3, ASME Code Class 1, 2, 3 Components, Component Supports and Core Support Structures, indicates that the details for DAC closure are adequately addressed in these sections.

**DCD Impact, 14.3-131, SUPPLEMENT 1**

- A) Revise the DCD (Rev 4) Tier 1, Section 3.1 and Table 3.1-1 ITAAC. See the attached proposed revisions to Tier 1, Section 3.1 and Table 3.1-1 ITAAC.
  
- B) Revise DCD Section 3.6.5 to delete COL applicant information item 3.6.5-1-A since this requirement is adequately addressed with the closure of ITAAC Table 3.1-1, Item 3. See the attached proposed revisions to DCD (Rev 4) Tier 2 Section 3.6.5 and Table 1.10-1.

**NRC RAI 14.3-131, SUPPLEMENT 2**

*In its letter of November 29, 2007, GEH provided revisions to DCD Chapter 14 to address Piping DAC in response to a discussion on the same topic from a meeting with the NRC on October 18, 2007. NRC staff met with GEH on February 14, 2008 to discuss the changes. During this meeting, staff explained three points that would be needed to address DAC in the DCD: 1) a description of the subject area for which DAC is being used and the approach to be taken to complete the design in Tier 2 of the DCD; 2) Design ITAAC; and 3) marking of the methodology to be used as Tier 2\* prior to certification. Considering the need for the aforementioned three points to address DAC and after reviewing the proposal provided in the response to RAI 14.3-131 S01, the NRC has the following supplemental questions:*

- 1 In its letter of November 29, 2007, GEH responded to NRC RAI 14.3-131 S01 by stating that all ASME piping and components are designed, fabricated, installed and tested in accordance with the requirements in ASME Code, Section III. GEH also stated that DCD Tie 1, Section 3.1, Design Descriptions, will be clarified to address additional DAC scope as discussed with the NRC staff on October 18, 2007. In reviewing the content of the aforementioned Tier 1, Section 3.1, as attached to the above GEH letter, the staff did not find information on how components associated with piping will be considered when completing the work to close the piping DAC.*
- 2 In its letter of November 29, 2007, GEH responded to NRC RAI 14.3-131 S01 by stating that a review of DCD (Revision 4) Tier 2, Section 3.9.2 and Section 3.9.3 indicates that the details for DAC closure as related to attached components are adequately addressed in these two sections. In reviewing DCD Tier 2, Section 3.9.2 and Section 3.9.3, however, the staff could not locate where such details for DAC closure are addressed. Further, similar details are not provided for the piping design and pipe break hazard analysis. GEH is requested to provide such information and to revise Tier 2 to address DAC closure.*
- 3 In its letter dated November 29, 2007, GEH responded to NRC RAI 14.3-131 S01 pertaining to pipe break hazards analysis. GEH stated that ESBWR DCD Section 3.6.5 contains COL Information Item 3.6.5-1-A requiring the applicant to provide a pipe break evaluation report as discussed in Section 3.6.2.5. GEH also stated that the information required by the COL Information Item 3.6.5-1-A is met and satisfied by the closure of Tier 1, Table 3.1-1 ITAAC criteria and the COL Information Item 3.6.5-1-A is deleted. Subsequently, during the discussion with the NRC staff in a meeting on February 14, 2008, GEH indicated that the staff's concerns raised in RAI 14.3-212 concerning the deletion of COL Information Item 3.6.5-1-A by the closure of Tier 1, Table 3.1-1 ITAAC criteria is therefore, addressed. In its response to RAI 14.3-212 dated March 20, 2008, GEH modified ITAAC 3.1-1 Item 3 to apply to the "as designed" rather than the "as-built" pipe analysis. The write-up refers to ITAAC 1 through 6, but only five ITAACs were included.*

*Based on its review of the information provided by the applicant, the staff determined that the ITAAC, as provided in the March 20, 2008, response should state, "as-designed pipe break analysis results," as opposed to "pipe analysis." This change should also be made under Inspections, Tests, and Analysis to refer to the report call out in Section 3.6.2.5 of the DCD. Further, Item 6 should remain and be modified to address reconciliation with the report called out in Section 3.6.2.5.*

*Furthermore, the staff disagreed with the applicant's response to a related RAI 14.3-210. The staff maintains that either a description of the as designed pipe break hazards analysis completion schedule or an action item to provide the schedule as part of the COL application is needed because of the proposed deletion of COL Information Item 3.6.5-1-A from ESBWR DCD. If the COL information item remains and since the delay is related to piping DAC, the applicant will either have to provide the requested information, in accordance with RG 1.206 Section C.III.5.1, or to provide the NRC with a schedule for completion of the detailed design and propose a method for final closure, in accordance with Section C.III.4.3. GEH is, therefore, requested to include information for both as designed and as-built pipe break hazards analysis in ITAAC Table 3.1-1, and to provide a description pertaining to the closure schedule of the as designed pipe break hazards analysis in DCD Tier 2 section and a similar description for the piping design given the deletion of the COL information item related to design reports and specifications.*

- 4 *In its letter dated November 29, 2007, GEH responded to NRC RAI 14.3- 131 S01 by revising the ITAAC. In ITAACs 1 and 2 in Table 3.1-1, GEH modified the ITA and AC columns to include ASME Code Design Reports in lieu of the ASME Code Certified Stress Report. For clarification, in order to meet the Code requirements, the ITAACs should state that the ASME Code Design Reports are in accordance with the requirements of ASME Section III, Subarticle NCA-3550.*

#### **GEH RESPONSE RAI 14.3-131, SUPPLEMENT 2**

GEH interacted with the NRC Staff regarding resolution of the concerns discussed in this RAI and, based on those interactions, changes included in Revision 5, and the attached corrected pages for Revision 5, the November 29, 2007, response is superseded. While it was GEH's intent that the revisions to resolve this issue be included in Revision 5 of the Design Control Document submitted June 1, 2008, we have identified that certain ITAAC tables in Tier 1 were not complete due to an integration error when inserting the revised ITAAC. However, the items were listed in the Design Description of the applicable sections of Tier 1. Modifications made to Tier 1, Sections 2.1.1, 2.4.1, 2.4.2, 2.6.1, 2.11.1, 2.15.1, 2.15.4, and 3.1 were correctly integrated. The corrected ITAAC for Sections 2.1.2 (ITAAC b1, b2, and b3), 2.2.2 (ITAAC a3), 2.2.4 (ITAAC b2), and 2.6.2 (ITAAC a3) are provided in the attached pages from

Revision 5 Reconciliation, which will be included in the next revision to the Design Control Document (DCD).

Also see GEH's response to RAI 14.3-210, Supplement 1, in MFN-08-086, Supplement 55, submitted July 9, 2008, for additional information regarding the process for Design Acceptance Criteria ITAAC development and their closure.

**DCD IMPACT RAI 14.3-131, SUPPLEMENT 2**

The DCD is corrected as shown on the attached marked-up pages, designated as "Rev. 05 Reconciliation." These pages show the corrected ITAAC for Revision 5, and will be appropriately integrated in the next revision of the DCD.

**NRC RAI 14.3-131 S03**

*Revise ITAAC Table 3.1-1*

*In RAI 14.3-131 S02, Question 4, the staff requested the applicant to provide modification to the ITAAC Table 3.1-1. Specifically, the ITAAC, as provided in the GEH's response to RAI 14.3-131 S01 dated March 20, 2008, should state, "as-designed pipe break analysis results," as opposed to "pipe analysis." This change should also be made under Inspections, Tests, and Analysis to refer to the report call out in Section 3.6.2.5 of the DCD. Further, Item 6 of ITAAC Table 3.1-1 should remain and be modified to address reconciliation with the report called out in Section 3.6.2.5.*

*By a letter dated July 9, 2008, GEH provided its response to RAI 14.3-131S02. Based on its review of that RAI response as well as the information provided in Revision 5 of the DCD, the staff found that the "as-built" was changed to "as-designed" in Revision 5 of the DCD ITAAC Table 3.1-1. In addition, the staff found that Item 6 has been included in that table. However, the staff identified that GEH did not address the staff's concern pertaining to the wording, "pipe analysis", of the ITAAC table. As written, the new ITAAC calls for a report that documents that the as-designed pipe analysis concludes that for each postulated piping failure, the reactor can be shut down safely and that the reports document the results of the analyses to determine where protection features are necessary to mitigate the consequences of a pipe break. The COL Information Item required that the applicant provide the information identified in DCD Subsection 3.6.2.5. DCD Subsection 3.6.2.5 called for a pipe break evaluation report that will be completed in conjunction with closure of ITAAC 3.1-1. The report was to include:*

- A summary of the dynamic analyses applicable to high-energy piping systems in accordance with Subsection 3.6.2.5 of RG 1.70 including sketches of applicable piping systems showing the location, size and orientation of postulated pipe breaks and the location of pipe whip restraints and jet impingement barriers and a summary of the data developed to select postulated break locations including calculated stress intensities, cumulative usage factors and stress ranges as delineated in BTP 3-4.*
- For failure in the moderate-energy piping systems, descriptions showing how safety-related systems are protected from the resulting jets, flooding and other adverse environmental effects.*
- Identification of protective measures provided against the effects of postulated pipe failures for protection of each of the systems listed in Tables 3.6-1 and 3.6-2.*
- The details of how the MSIV functional capability is protected against the effects of postulated pipe failures.*
- Typical examples, if any, where protection for safety-related systems and components against the dynamic effects of pipe failures include their enclosure in suitably designed structures or compartments (including any additional drainage system or equipment environmental qualification needs).*

- *The details of how the feedwater line check and feedwater isolation valves functional capabilities are protected against the effects of postulated pipe failures.*

*The ITAAC should call for the same level of detail as the deleted COL information item. Therefore, the staff determined that the wording of the current ITAAC fails to fully address the COL Information Item and the applicant is requested to provide modification to the ITAAC Table to address the above staff's concern.*

### **GEH Response**

DCD Tier 1, Section 3.1, Item 3 and Item 6 of ITAAC Table 3.1-1, ITAAC For The Design of Piping Systems and Components, will be revised to address the NRC staff's concern stated in first paragraph of this RAI.

NRC Staff has also asked GEH to provide in Tier 1, ITAAC Table 3.1-1 the same level of detail as deleted COL Information item of DCD Tier 2, Section 3.6.5. The DCD Tier 2 Subsection 3.6.2.5 provides the above information (all six bulleted items in paragraph 2 of this RAI). It provides the detail of information required in pipe break evaluation report on pipe break analysis results and protection methods. Therefore it is not necessary to specify the detail of report in DCD Tier 1, ITAAC Table 3.1-1.

NRC guidance in Section 14.3 of NUREG-0800 explains that the NRC makes its safety finding on the information in Tier 2 and that information in Tier 1 must be supported by Tier 2. In particular, the Design Acceptance Criteria in Tier 1 must be supported by Tier 2. Therefore, it is appropriate to explain the details of the pipe break analysis in Tier 2 rather than include that information in Tier 1. That is, consistent with NRC guidance, more detailed information on the performance of the pipe break analysis ITAAC are in Tier 2 rather than Tier 1. As further explained in DCD Tier 2, Section 14.3A, the content of the report is as discussed in DCD Tier 2, Subsection 3.6.2.5:

For completing the pipe break analysis Design Acceptance Criteria ITAAC, the analyses will document that structures, systems, and components (SSCs) which are required to be functional during and following a safe shutdown earthquake have adequate high-energy and moderate-energy pipe break mitigation features. The pipe break analysis report verifies that the criteria used to postulate pipe breaks, the analytical methods used to analyze pipe breaks, and the method to confirm the adequacy of the results of the pipe break analyses are appropriate. The pipe break analysis report provides assurance that the high-energy and moderate-energy line break analyses have been completed. The content of the report is discussed in Subsection 3.6.2.5 of the ESBWR Tier 2 DCD.

### **DCD Impact**

DCD Tier 1, Section 3.1, Item 3 and Item 6 of ITAAC Table 3.1-1 will be revised as noted in the attached markup.

**Attachment 1**

**RAI Number 14.3-131 S03**

**Tier 1 – DCD Markups**

**Table 3.1-1  
ITAAC For The Design of Piping Systems and Components**

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. Deleted. See system ITAAC for piping requirements.		
2. Deleted. See system ITAAC for component requirements.		
3. Systems, structures, and components, that are required to be functional during and following an SSE, shall be protected against or qualified to withstand the dynamic and environmental effects associated with analyses of postulated failures in Seismic Category I and nonsafety-related piping systems.	<p>Inspections of the <u>as designed pipe break analysis results report</u> will be conducted.</p> <p>Pipe break events involving high-energy fluid systems are analyzed for the effects of pipe whip, jet impingement, flooding, room pressurization, and temperature effects. Pipe break events involving moderate-energy fluid systems are analyzed for wetting from spray, flooding, and other environmental effects, as appropriate. {{Design Acceptance Criteria}}</p>	<p><del>A Report(s) documents that of the as-</del>  <u>designed pipe break analysis</u> exist and concludes that for each postulated piping failure, the reactor can be shut down safely. Reports document the results of the analyses to determine where protection features are necessary to mitigate the consequences of a pipe break. {{Design Acceptance Criteria}}</p>
4. Deleted.		
5. Deleted.		

Table 3.1-1  
ITAAC For The Design of Piping Systems and Components

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>6. On an individual component and/or system basis, the as-built systems, structures, and components shall be reconciled with the analyses results of the postulated failures in Seismic Category I and nonsafety-related piping systems..</p>	<p>A reconciliation analysis using the as-designed pipe break analysis report and as-built information will be performed. Inspect the as-built piping systems and equipment to identify that the features that protect against dynamic effects of pipe failures, such as whip restraints, equipment shields, drainage systems, and physical separation of piping, equipment, and instrumentation are installed as defined in the design analyses.</p>	<p>On an individual component and/or system basis, a report(s) documents exist and conclude that the protective features are installed in the as-built plant as described in the design and reconciliation analysis.</p>