

January 14, 2008

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: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 134 RELATED TO  
ESBWR DESIGN CERTIFICATION APPLICATION

Dear Mr. Brown:

By letter dated August 24, 2005, GE-Hitachi Nuclear Energy Americas, LLC (GEH) submitted an application for final design approval and standard design certification of the economic simplified boiling water reactor (ESBWR) standard plant design pursuant to 10 CFR Part 52. The Nuclear Regulatory Commission (NRC) staff is performing a detailed review of this application to enable the staff to reach a conclusion on the safety of the proposed design.

The NRC staff has identified that additional information is needed to continue portions of the review. The staff's request for additional information (RAI) is contained in the enclosure to this letter.

To support the review schedule, you are requested to provide the requested additional information within 45 days of the date of this letter.

If you have any questions or comments concerning this matter, you may contact me at 301-415-3863 or mmc1@nrc.gov or you may contact Eric Oesterle at (301) 415-1365 or ero@nrc.gov.

Sincerely,

**/RA/**

Manny M. Comar, Project Manager  
ESBWR/ABWR Projects Branch 1  
Division of New Reactor Licensing  
Office of New Reactors

Docket No. 52-010

Enclosure:  
Request for Additional Information

cc: See next page

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Distribution: See next page

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SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 134 RELATED TO  
ESBWR DESIGN CERTIFICATION APPLICATION

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**Requests for Additional Information (RAIs)  
ESBWR Design Control Document (DCD), Revision 4**

RAI Number	Reviewer	Question Summary	Full Text
14.2-96	Dehmel JC	DCD Tier 2, Revision 4, Section 14.2.8.2.1 reveals incomplete descriptions of the scope of filter performance associated with radiochemical measurements.	DCD Tier 2, Revision 4, Section 14.2.8.2.1 reveals incomplete descriptions of the scope of filter performance associated with radiochemical measurements. Specifically, Section 14.2.8.2.1 does not include charcoal media and should clarify that filters include “HEPA” filters used for the purpose of controlling airborne radioactive effluent discharges. In addition, the description should include filters and strainers and reverse osmosis sub-processing system used to process liquid effluents. Accordingly, revise DCD Tier 2, Section 14.2.8.2.1 (Description) to include HEPA filters, charcoal media, filters and strainers, and reverse osmosis subsystems in the discussion about performance
14.3-391	Dehmel JC	DCD Tier 2, Revision 4, Section 14.3.2 on ITAAC design descriptions and selection criteria against DCD Tier 2, Revision 4, Section 11.5.1 and DCD Tier 1, Revision 4, Section 2.3.1 indicates an inconsistent approach in applying ITAACs to the main steam line radiation monitor.	DCD Tier 2, Revision 4, Section 14.3.2 on ITAAC design descriptions and selection criteria against DCD Tier 2, Revision 4, Section 11.5.1 and DCD Tier 1, Revision 4, Section 2.3.1 indicates an inconsistent approach in applying ITAACs to the main steam line radiation monitor. Specifically, DCD Tier 1, Revision 4, Section 2.3.1, Table 2.3.1-1 states that the main steam line radiation monitor is safety related, but DCD Tier 2, Revision 4, Sections 11.5.1 and 11.5.3.1.1 identify the same monitor as non-safety related. Accordingly, revise DCD Tier 1, Section 2.3.1 to change the safety and ITAAC status of the main steam line radiation monitor in Tables 2.3.1-1 and 2.3.1-2.

Enclosure

RAI Number	Reviewer	Question Summary	Full Text
16.2-134 S01	Harbuck C	Editorial corrections to the Actions Conditions of generic technical specifications (GTS) 3.3.1.1, 3.3.1.4, 3.3.1.5, 3.3.6.1, 3.3.6.3, and 3.3.6.4	<p>References:</p> <ul style="list-style-type: none"> <li>• Chapter 16 Revision 3 to Revision 4 Change Items 16, 21, 32, 38, 53, 57, 59 (MFN 07-533, 10/15/2007, GEH response to RAI 16.2-134)</li> <li>• Revision 4 DCD Tier 2 Chapter 16, ACTIONS Conditions for GTS 3.3.1.1, 3.3.1.4, 3.3.1.5, 3.3.6.1, 3.3.6.3, and 3.3.6.4</li> </ul> <p>Although the associated instrumentation tables were revised to reference both Required Actions B.1 and C.1, the remaining Actions Conditions were not revised to also reference Required Action B.1. Please correct this editorial oversight.</p>
16.2-156	Harbuck C	Type of instrumentation settings, for determining operability, in generic technical specifications (GTS) for instrumentation functions; and justification for GTS instrumentation function channel calibration surveillance frequencies.	<p>In Revisions 3 and 4 of DCD Tier 2, Chapter 16, each background section of the generic technical specifications (GTS) bases for the instrumentation specifications describes how to determine the operability of an instrument channel with respect to its trip setpoint compared to the allowable value. “A channel is inoperable if its actual trip setpoint is non-conservative with respect to its required Allowable Value.” Details are to be included in a Setpoint Control Program (SCP) proposed for Section 5.5 of the GTS administrative controls chapter. As of the issuance of Revision 4, the applicant had not formally stated what kind of setpoint values the GTS instrumentation function tables will state (i.e., Allowable Values, Trip Setpoints, Setting basis, etc.). Revision 4 retained the proposed SCP specification in the GTS. Please revise GTS limiting condition for operation (LCO) instrumentation function tables to include the type of setpoint value for each function that is consistent with the ABWR/ESBWR setpoint methodology (currently under staff review) and acceptable to the staff.</p> <p>The various channel calibration surveillance frequencies are consistent with the STS for equivalent instrument functions. However, the technical basis for applying these frequencies to ESBWR instrumentation functions is an open issue pending NRC approval of {NEDO-33201, “ESBWR Design Certification Probabilistic Risk Assessment”}, which is referenced</p>

			in the GTS bases. Revise the GTS Bases to state, or include as a numbered reference, the NRC-approved justification for the channel calibration surveillance frequencies.
16.2-157	Harbuck C	Justify excluding selected instrumentation components from generic technical specifications (GTS) response time testing.	In Revisions 3 and 4 of DCD Tier 2, Chapter 16, the generic technical specifications (GTS) bases for the RPS, ECCS, and isolation system instrumentation response time testing surveillance requirements (SRs) describe conditions for excluding selected components from response time testing, and refer to two licensing topical reports (LTRs), which are enclosed in curly brackets, ({NEDO-32291-A, "System Analyses for the Elimination of Selected Response Time Testing Requirements," October 1995} and {NEDO-32291-A, Supplement 1, "System Analyses for the Elimination of Selected Response Time Testing Requirements," October 1999}). Please provide information that describes and justifies application of these LTRs to ESBWR instrumentation functions, for each selected component.
16.2-158	Harbuck C	Justification for the generic technical specifications (GTS) acceptance criteria for response time testing of RPS, ECCS, and isolation system instrumentation and actuation functions.	In Revisions 3 and 4 of DCD Tier 2, Chapter 16, the various acceptance criteria for RPS, ECCS, and isolation system response time tests in the generic technical specifications (GTS) are based on curly-bracketed references in the GTS bases for RPS, ECCS, and isolation system response time SRs. Please provide justification for the GTS acceptance criteria for response time testing of RPS, ECCS, and isolation system instrumentation and actuation functions. Replace the bracketed reference in the GTS Bases with an NRC-approved reference, or remove the reference and include justification in the GTS Bases for each response time test surveillance requirement.
16.2-159	Harbuck C	Express reactor coolant system (RCS) pressure Safety Limit as reactor steam dome pressure instead of reactor vessel bottom pressure.	Reference: Chapter 16 Revision 3 to Revision 4 Change Item 12  In Revision 4 of the ESBWR DCD Chapter 16, the generic technical specifications (GTS), GEH changed the Reactor Coolant System (RCS) Pressure Safety Limit (SL), SL 2.1.2, from "Reactor steam dome pressure shall be $\leq$ {9.211} MPaG ({1336} psig)" to "Reactor vessel bottom pressure

			<p>shall be <math>\leq 9.481</math> MPaG (1375 psig)” to make it consistent with the SL intent and overpressure analysis acceptance criteria used in DCD 5.2.2.3.3. While the noted consistency is correct, this change is inconsistent with STS (NUREG-1434, Rev 3.1, “STS for GE Plants BWR/6”) RCS Pressure SL 2.1.2, which states, “Reactor steam dome pressure shall be <math>\leq 1325</math> psig.” The STS bases recognizes that this SL relates directly to a reactor protection system (RPS) instrumentation function (reactor vessel steam dome pressure - high), but also accounts for the maximum reactor vessel bottom pressure allowed. Revise the GTS to be consistent with the presentation in STS SL 2.1.2 and the level of detail (regarding the specific RPS instrumentation function) in the STS Bases discussion of applicable safety analyses.</p> <p>The last sentence in the GTS Bases and STS Bases discussion of applicable safety analyses states “The RCS pressure SL is selected to be the lowest transient overpressure allowed by the applicable codes.” It appears that “lowest” should be replaced by “highest.”</p>
16.2-160	Harbuck C	<p>Applicability of GTS 3.3.1.1.12, reactor protection system (RPS) instrumentation Function 12, Main Condenser Pressure – High.</p>	<p>Reference: Chapter 16 Revision 3 to Revision 4 Change Item 19</p> <p>In Revision 4 of the ESBWR DCD Chapter 16, the generic technical specifications (GTS), GEH changed the Applicability of GTS 3.3.1.1 Function 12, Main Condenser Pressure – High, by deleting MODE 2 to be consistent with DCD Subsection 7.2.1.5.2.1, which states,</p> <p style="padding-left: 40px;">Main steam TSV closure and steam governing TCV fast closure trip bypasses: These permit continued reactor operation at low-power levels when the TSVs or TCVs are closed. The main steam TSV closure and the steam governing TCV fast closure scram trip functions are automatically bypassed when the APRM simulated thermal power of the NMS is below 40% of the rated thermal power output.</p> <p>Revision 4 of the GTS Bases for this Function states,</p>

			<p>The Main Condenser Pressure - High Function is provided to help ensure the fuel cladding integrity Safety Limit is not exceeded by reducing the core energy in anticipation that the high condenser pressure will also trip the main turbine and prevent bypass valve operation. The Main Condenser Pressure - High Function is the primary scram signal for the loss of condenser vacuum event analyzed in Reference 12. For this event, the reactor scram reduces the amount of energy required to be absorbed by the main condenser and helps to ensure the fuel cladding integrity Safety Limit is not exceeded by reducing the core energy prior to the fast closure of the turbine stop valves. The reactor scram at Main Condenser Pressure - High will initiate to shut off steam flow to the main condenser to protect the main turbine and to avoid the potential for rupturing the low-pressure turbine casing.</p> <p>. . . The Analytical/Design Limit was selected to reduce the severity of a loss of main condenser vacuum event by anticipating the transient and scrambling the reactor at a higher vacuum than the setpoints that close the turbine stop valves and bypass valves.</p> <p>. . . [This] Function is required in MODE 1 2 since, in this MODE, a significant amount of core energy can be rejected to the main condenser.</p> <p>Please clarify how DCD Subsection 7.2.1.5.2.1 justifies not requiring the Main Condenser Pressure – High RPS instrumentation function to be Operable in Mode 2, and correct the apparent editorial error in the third quote from the GTS Bases.</p>
16.2-161	Harbuck C	Justify placing limiting safety system setting (LSSS) for Oscillation Power Range Monitor	<p>References:</p> <ul style="list-style-type: none"> <li>• Chapter 16 Rev 3 to Rev 4 Change Item 34</li> <li>• Section 4D.3 of Chapter 4 of DCD Tier 2 Rev 4</li> <li>• Chapter 16B, Rev 4, Bases for GTS 3.3.1.4 Function 3, OPRM</li> </ul>



		(OPRM) - Upscale instrumentation function in the Core Operating Limits Report (COLR), and not in GTS TS 3.3.1.4, Table 3.3.1.4-1, for Function 3.	<p>Upscale</p> <p>Please clarify the phrase in Change Item 34 “for consistency with DCD Chapter 4, Section 4D.3.” Revision 4 of Section 4D.3 replaced three COL information items with “none.” Also, provide additional explanation for stating the setpoint for the Neutron Monitoring System (NMS) Oscillation Power Range Monitor (OPRM) - Upscale instrumentation function in the Core Operating Limits Report (COLR), even though this function protects a fuel cladding integrity Safety Limit? The Bases for GTS 3.3.1.4, Function 3, state “The Analytical / Design Limit specified in the COLR is based on preventing safety thermal limit violation and fuel damage in response to core neutron flux oscillation conditions and thermal-hydraulic instability.” Limiting Safety System Settings (LSSS) are required to be stated in the GTS by 10 CFR 50.36(d)(1)(ii), not in the GTS-required COLR.</p>
16.2-162	Harbuck C	Clarify relationship between channels, divisions, and trains in GTS 3.3.5.3 and GTS 3.3.7.1.	<p>References:</p> <ul style="list-style-type: none"> <li>• Chapter 16 Rev 3 to Rev 4 Change Item 48</li> <li>• DCD Tier 2 Rev 4, Chapter 16, GTS 3.3.5.3, GTS 3.3.7.1</li> </ul> <p>Condition A of GTS 3.3.5.3 states “One or more Functions with one required channel inoperable.” Required Action A.1 states “Verify instrumentation division in trip.” Required Actions B.1 and C.1 state “Declare associated ICS trains inoperable.” The ACTIONS of GTS 3.3.7.1 are stated similarly. Clarify the relationship between channels, divisions, and trains in the LCOs and ACTIONS of GTS 3.3.5.3 and GTS 3.3.7.1.</p>
16.2-163	Harbuck C	GTS 3.7.6 should explicitly state the Selected Control Rod Run-In (SCRRI) and Selected Rod Insertion (SRI) instrumentation functions and associated LSSS.	<p>References:</p> <ul style="list-style-type: none"> <li>• Chapter 16 Rev 3 to Rev 4 Change Item 92</li> <li>• DCD Tier 2 Rev 4, Chapter 16, GTS 3.7.6</li> </ul> <p>In Revision 4 of the DCD Tier 2 Chapter 16, GTS 3.7.6, “Selected Control Rod Run-In (SCRRI) and Selected Rod Insertion (SRI) Functions,” a Channel Calibration surveillance requirement was added for the SCRRI and SRI instrumentation functions; however these functions are not explicitly stated in the LCO. Explain why these instrumentation functions</p>

			are not specified in the LCO or in an associated table (i.e., GTS Table 3.7.6-1) with their setpoints, which are LSSS, as required by 10 CFR 50.36(d)(1)(ii).
16.2-164	Marshall M	Finalize information, which is denoted by curly and square brackets in DCD Chapter 16, Rev 4, that does not satisfy the NRC's criteria for use of brackets in the generic technical specifications and bases; and provide the NRC a schedule for doing so.	<p>In Revision 4 of the ESBWR DCD Chapter 16, GEH proposes to change the definition of a curly bracket from a value, parameter, or information that will be provided by the design certification applicant to a value, parameter, or information that will be provided by the combined license (COL) holder. This proposed change is unacceptable. All the curly brackets need to be removed during the design certification review unless the information is closely associated with design acceptance criteria (DAC) or is site specific. In the latter two cases, the brackets can be changed to square brackets.</p> <p>Please provide a schedule for revising the generic technical specifications (GTS) and Bases so they do not contain any curly brackets. For curly brackets associated with DACs, modify the DCD to include an appropriately worded proposed COL Information item for the COL applicant or holder, depending on the wording of the DAC; and for curly brackets associated with site specific information please modify the DCD to include an appropriately worded proposed COL Information item for the COL applicant.</p>
16.2-138 S01	Harbuck C	Revise GTS 3.3.1.3 ACTIONS.	<p>References:</p> <ul style="list-style-type: none"> <li>• Chapter 16 Rev. 3 to Rev 4. Change Item 24</li> <li>• MFN 07-533, 10/15/2007, GEH response to RAI 16.2-138</li> </ul> <p>In RAI 16.2-138, the NRC staff stated:</p> <p style="padding-left: 40px;">In ESBWR TS Section 3.3.1.3, "Reactor Protection System Manual Actuation," for the Actions Condition of "One or more channels inoperable," the reduced functional capability of the degraded condition described represents a loss of one or both required channels of instrumentation for one or both manual actuation items. This condition would permit the plant to operate for up to 12 hours with a loss of all required safety system RPS manual actuation</p>

			<p>instrumentation. Additional information is needed to justify that the loss of function condition is a credible condition for which a temporary relaxation of the required design basis should be approved. Justify why operation should be permitted with more than one channel of each type of ESBWR manual actuation channels inoperable. Note that NUREG-1434 permits only one RPS manual actuation functions channel to be inoperable.</p> <p>In its response letter (MFN 07-533, October 15, 2007), GEH stated that it had revised the DCD, Chapter 16, Technical Specifications (TS) 3.3.1.3, "Reactor Protection System Manual Actuation," in Revision 4 to eliminate the 12-hour allowance to operate with all required safety system RPS manual actuation instrumentation inoperable. The DCD, Chapter 16B TS Bases associated with TS 3.3.1.3 were also revised in Revision 4. In Revision 4 of the ESBWR DCD, Chapter 16, the generic technical specifications (GTS), GEH changed the Actions of GTS 3.3.1.3, "RPS Manual Actuation," as part of its response to RAI 16.2-138. The NRC staff find Actions A and B acceptable, but note that they could be combined in the same Action. Action C is not acceptable because it does not clearly state the expected action for the Condition of two inoperable channels in one manual actuation function. It seems that in all such cases, the choice (described in the Bases) would be to immediately enter Condition D or Condition E as appropriate, because placing both channels in trip would cause a scram. Please revise the GTS 3.3.1.3 Actions as indicated below, and make suitable changes to the GTS Bases.</p>
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**Recommended ACTIONS for GTS 3.3.1.3, as referred to by RAI 16.2-138, Supplement 1**

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. Manual scram Function with one channel inoperable.</p> <p><u>OR</u></p> <p>Reactor Mode Switch - Shutdown Position Function with one channel inoperable</p>	<p>A.1 Verify affected channel in trip.</p>	<p>12 hours</p>
<p>B. Manual scram Function with one channel inoperable in MODE 1 or 2.</p> <p><u>AND</u></p> <p>Reactor Mode Switch - Shutdown Position Function with one channel inoperable in MODE 1 or 2.</p>	<p>B.1 Verify affected channels in trip.</p> <p><u>OR</u></p> <p>B.2 Enter Condition D.</p>	<p>Immediately</p> <p>Immediately</p>
<p>C. Manual scram Function with one channel inoperable in MODE 6.</p> <p><u>AND</u></p> <p>Reactor Mode Switch - Shutdown Position Function with one channel inoperable in MODE 6.</p>	<p>C.1 Verify affected channels in trip.</p> <p><u>OR</u></p> <p>C.2 Enter Condition E.</p>	<p>Immediately</p> <p>Immediately</p>

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>D. Manual scram Function with two channels inoperable in MODE 1 or 2.</p> <p><u>OR</u></p> <p>Reactor Mode Switch - Shutdown Position Function with two channels inoperable in MODE 1 or 2.</p> <p><u>OR</u></p> <p>Required Action and associated Completion Time of Condition A or B not met in MODE 1 or 2.</p> <p><u>OR</u></p> <p>As required by Required Action B.2.</p>	<p>D.1 Be in MODE 3.</p>	<p>12 hours</p>

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>E. Manual scram Function with two channels inoperable in MODE 6.</p> <p><u>OR</u></p> <p>Reactor Mode Switch - Shutdown Position Function with two channels inoperable in MODE 6.</p> <p><u>OR</u></p> <p>Required Action and associated Completion Time of Condition A or C not met in MODE 6.</p> <p><u>OR</u></p> <p>As required by Required Action C.2.</p>	<p>E.1 Initiate action to fully insert all insertable control rods in core cells containing one or more fuel assemblies.</p>	<p>Immediately</p>

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(Revised 1/3/08)

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