June 5, 2009

Mr. Jerald G. Head
Senior Vice President, Regulatory Affairs
GE Hitachi Nuclear Energy
3901 Castle Hayne Road MC A-18
Wilmington, NC 28401

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 348 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION

Dear Mr. Head:

By letter dated August 24, 2005, GE Hitachi Nuclear Energy (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 U.S. 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.

If you have any questions or comments concerning this matter, you may contact me at 301-415-3179 or Ilka.Berrios@nrc.gov or you may contact Amy Cubbage at 301-415-2875 or Amy.Cubbage@nrc.gov.

Sincerely,

/RA/

Ilka Berrios, 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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Dear Mr. Head:

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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.

If you have any questions or comments concerning this matter, you may contact me at 301-415-3179 or Ilka.Berrios@nrc.gov or you may contact Amy Cubbage at 301-415-2875 or Amy.Cubbage@nrc.gov.

Sincerely,

/RA/

Ilka Berrios, Project Manager
ESBWR/ABWR Projects Branch 1
Division of New Reactor Licensing
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Docket No. 52-010

Enclosure:
Request for Additional Information

cc: See next page

Distribution: See next page

ADAMS ACCESSION NO. ML091530399

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SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 348 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION DATED JUNE 5, 2009

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Requests for Additional Information (RAIs)
ESBWR Design Control Document (DCD), Revision 5

RAI Number	Reviewer	Question Summary	Full Text
RAI 5.4-65	Thomas G	Describe how the Isolation Condenser (IC) system meet the guidance in RG 4.21	Maintenance on the Liquid Control System (SLCS) and the Isolation Condenser (IC) will include the periodic replacement of leaking tubes in the Isolation Condenser. Since most of this maintenance will be performed during normal operation, there is a potential for significant radioactive leakage and radioactive contamination of the plant areas surrounding the Isolation Condenser. Describe in the appropriate portions of DCD Section 5.4.6 and/or Section 12.3.1.5 how the operation of the IC system (and the associated maintenance activities related to tube replacement) meet the guidance given in Regulatory Guide 4.21 with respect to minimizing leakage and spills and the associated contamination of plant structures.
RAI 9.2-26	Wheeler L	Address 10 CFR 20.1406 for the Plant Service Water System (PSWS)	Means must be provided for monitoring effluent discharge paths and the plant environs for radioactivity. 10 CFR 52.47(a)(6) and 10 CFR 20.1406, "Minimization of Contamination," require applicants for standard plant design certifications to describe how facility design and procedures for operation will minimize contamination of the facility and the environment. The staff's review criteria (NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," Section 9.2.1, "Station Service Water System," Paragraph III.3.D) specifies that provisions should be provided to detect and control leakage of radioactive contamination into and out of the plant service water system (PSWS). The design is considered to be acceptable by the staff if the PSWS Piping and Instrumentation Diagrams (P&IDs) show that radiation monitors are located on the PSWS discharge and at components that are susceptible to leakage, and if the components that are susceptible to leakage can be isolated. However, the staff noted that radiation monitors (including alarm functions) are not described in Design Control Document (DCD) Tier 2 Section 9.2.1 and are not shown on the P&ID for the PSWS and that the DCD does not describe that component which are susceptible to leakage can be isolated; the NRC regulations in this regard have not been adequately addressed. Therefore, the applicant needs to revise DCD Tier 2 Section 9.2.1 and the P&ID as appropriate to address the NRC requirements referred to above.

RAI Number	Reviewer	Question Summary	Full Text
RAI 9.2-27	Wheeler L	Address 10 CFR 20.1406 for the Reactor Component Cooling Water System (RCCWS)	Means must be provided for monitoring effluent discharge paths and the plant environs for radioactivity. 10 CFR 52.47(a)(6) and 10 CFR 20.1406, "Minimization of Contamination," require applicants for standard plant design certifications to describe how facility design and procedures for operation will minimize contamination of the facility and the environment. The design is considered to be acceptable by the staff if the RCCWS Piping and Instrumentation Diagrams (P&IDs) show that radiation monitors are located on the RCCWS components that are susceptible to leakage, and if the components that are susceptible to leakage can be isolated. However, the staff noted that radiation monitors (including alarm functions) are not described in detail in the Design Control Document (DCD) Tier 2 Section 9.2.2 and are not shown on the P&ID for the RCCWS and that the DCD does not describe that component which are susceptible to leakage can be isolated; the NRC regulations in this regard have not been adequately addressed. Therefore, the applicant needs to revise DCD Tier 2 Section 9.2.2 and the P&ID as appropriate to address the NRC requirements referred to above.
RAI 9.2-28	Wheeler L	Address 10 CFR 20.1406 for the Chilled Water System (CWS)	Means must be provided for monitoring effluent discharge paths and the plant environs for radioactivity. Also, 10 CFR 52.47(a)(6) and 10 CFR 20.1406, "Minimization of Contamination," require applicants for standard plant design certifications to describe how facility design and procedures for operation will minimize contamination of the facility and the environment. Section 9.2.7.1, "Design Bases" states, "the heat exchangers associated with the Offgas System (OGS) handle potentially radioactive material at an operating pressure lower than the pressure of the water that cools it. Any tube leakage, therefore, results in a flow from the chilled water system (CWS) to the OGS." a. Describe the pressures differences of the CWS and OGS (during normal and abnormal operations) and in the event of an OGS to CWS leak describe the process of determining that the CWS has been contaminated. b. Describe in Section 9.2.7 and the location on the piping and instrumentation diagrams (P&IDs) for any radiation monitors and or monitoring points (for example, grap samples).

RAI Number	Reviewer	Question Summary	Full Text
			c. Describe that component which are susceptible to leakage can be isolated
RAI 9.4-54	Forrest E	Address 10 CFR 20.1406 for HVAC	In consideration of Regulatory Guide 4.21 which provides guidance in meeting the objectives of 10 CFR Part 20.1406, provide, in the appropriate sections of 9.4 of the DCD, provisions that are made to monitor and collect condensate that may form at coolers or in HVAC ducts that may contain or may potentially contain contamination. Include provisions made for underground HVAC ducts and piping, if any, to monitor, contain, and control contaminated liquid and gaseous effluents that may form in or be carried through the system. Include any functions/commitments associated with the above issues that will be the responsibility of the COL applicant in DCD Sections 12.3.1.5 or 12.5, as appropriate.
RAI 10.4-17	Reddy D	Staff requests the Main Condenser Evacuation System (MCES) be added to RG 4.21	ESBWR DCD Section 10.4.2, "Main Condenser Evacuation System (MCES)," is designed to remove air and other power cycle noncondensable gases from the main condenser during plant startup, cool down, and power operation and exhaust them to the off-gas system (OGS) or turbine building compartment exhaust (TBCE) subsystem. Therefore, this system interfaces with the condenser and other systems that contain radioactive materials. Acceptance of the MCES is based on meeting the requirements of General Design Criteria (GDC) 4, as it relates to the MCES design for the control of releases of radioactive materials to the environment. Additionally, the system is designed to meet the requirements of GDC 64, as it relates to monitoring of releases of radioactive materials to the environment during normal operation, including anticipated operational occurrences. Since the MCES interfaces with the condenser and other systems that contain radioactive gases, specify, in accordance with the design objectives of RG 4.21, the design features associated with the MCES that both minimize leaks and spills of radioactive gases to the environment and provide for adequate leak protection capability fpr radioactive gases. On the basis of the design criteria and its interfacing with other systems that process radioactive materials, the staff requests the MCES to be added to RG 4.21 Design Objective -1, "Minimize Leaks and spills and provide containment in areas where such events may occur," since the MCES is designed to remove the hydrogen and oxygen produced by radiolysis of water in the reactor, and other power cycle noncondensable gases. Also, the MCES interfaces with systems that are identified in the "Review Interfaces" section of

RAI Number	Reviewer	Question Summary	Full Text
			Standard Review Plan Section 10.4.2.I, which contains radioactive materials. Further, the MCES needs to be added to RG 4.21 Design Objective - 2, "Provide for adequate leak detection capability….," for the above reasons.
RAI 12.7-5 S01	Hinson C	NRC staff found several concerns with the response to RAI 12.7-5.	After completing their initial review of GEH's response to RAI 12.7-5, the staff held a teleconference with GEH on March 16, 2009 to discuss GEH's response to this RAI and to identify several staff concerns with this response. Those staff concerns that were either not resolved or not discussed during this telecon are listed below: a. In part B) of GEH's response, GEH states that "Regulatory objectives that are operational or procedural in nature (item numbers 5, 6a, 8, and 9 above) will be addressed by the COL applicant." In GEH's proposed (Revision 6) modification to DCD Section 12.3.1.5, these four objectives appear as four bullets in subsection 12.3.12.5.2. In the DCD, add a fifth bullet to subsection 12.3.12.5.2 to read: "Establish and perform an onsite contamination monitoring program along the potential pathways from the release sources to the receptor points." b. In part C) of GEH's response (p. 5 of 6 and 6 of 6), GEH provided justification for the inclusion of some of the ESBWR design features listed in Table 12.3-18. Modify the proposed ESBWR DCD subsection 12.3.1.5 to include this justification (include the last two paragraphs of part C) in the DCD). c. In part D)(2) of GEH's response, GEH states that, although there will be no lines carrying radioactive waste that will be buried directly in the ground, there is a possibility that other buried piping carrying radioactive or potentially radioactive fluids will be routed outside the Radwaste Tunnels. Potentially radioactive fluids are normally nonradioactive fluids that could become contaminated with radioactive fluids through interfaces with radioactive systems. Some examples of how normally nonradioactive fluids that could become contaminated with radioactive fluids include leakage of radioactive fluids into nonradioactive fluids through leaks in heat exchanger

RAI Number	Reviewer	Question Summary	Full Text
			tubes and cross contamination of systems due to valving errors or other operating conditions (NRC Bulletin 80-10, "Contamination of Nonradioactive Systems and Resulting Potential for Unmonitored, Uncontrolled Release to the Environment" discusses nuclear industry operational experience concerning the contamination of nonradioactive systems). It is the staff's position that any buried piping carrying radioactive or potentially radioactive fluids should have features (e.g., double walled piping, piping located in trenches with leak detection systems) associated with it to minimize the potential for unmonitored, uncontrolled releases of radioactivity to the environment. In addition, any such piping should be located so that any potential leakage could be detected and monitored, as described in RG 4.21. i. Based on industry operating experience, the following are some of the SSCs which have experienced piping related occurrences which have resulted in unmonitored, uncontrolled releases of radioactivity to the environment; -condensate storage tank and associated piping, -radwaste/effluent discharge pipeline, and -cooling tower blowdown line. For each of these SSCs listed above, describe the associated design features which have been implemented to minimize the potential for unmonitored, uncontrolled releases of radioactivity to the environment from the SSC. Specify which of the above listed SSCs have associated buried piping and, for each of those SSCs, describe the piping features designed to minimize the potential for unmonitored, uncontrolled releases of radioactivity to the environment. ii. Provide a description of the use of any buried piping (not described in response to c.i above) that may potentially

RAI Number	Reviewer	Question Summary	Full Text
			contain radioactive fluids. For each description listed, verify that this piping will be designed to minimize leakage to the ground and describe the associated leak detection features that will be used to detect any potential leakage from the piping. Amend the appropriate portions of the ESBWR DCD to include the responses to items b.i. and b.ii. above. In addition, modify the proposed ESBWR DCD subsection 12.3.1.5 to state that any buried piping that may potentially contain radioactive fluids shall be designed to minimize leakage to the ground and shall have leak detection features to detect any potential leakage from the piping. d. The following items reflect staff concerns on various design features described in Table 12.3-18 i. (p.12.3-55) DCD subsection 3.4.1.2 refers to"flood and groundwater levels". Modify this description in the DCD to refer to "design basis maximum flood and groundwater levels". ii. (p.12.3-56) DCD subsection 3.7.3.13 states that "there are no Seismic Category I utilities i.e., piping, conduits, or auxiliary system components that are directly buried underground." Similarly on page 12.3-104, DCD subsection 3.8.4 states that "the ESBWR Standard Plant does not contain underground Seismic Category I pipelines or masonry wall construction." These statements are not correct. There is buried, Seismic Category I piping that goes from the fire protection system to FAPCS to provide long term makeup to pools in the Reactor Building. See proposed RAI response to RAI 9.1-16S03. Please modify the table to reflect the existence of this

RAI Number	Reviewer	Question Summary	Full Text
			buried Seismic Category I piping. Per item c. above, specify whether the buried, Seismic Category I piping that goes from the fire protection system to FAPCS to provide long term makeup to pools in the Reactor Building may potentially contain radioactive fluids. If so, verify that this piping will be designed to minimize leakage to the ground and describe the associated leak detection features that will be used to detect any potential leakage from the piping. iii. (p. 12.3-60) The table discusses the use of a water-tight room to contain any potential leakage from the condensate filter backwash receiving tank in the Turbine Building (see DCD subsection 6.5.2.5). List any other components containing radioactive fluids located in the Turbine Building which could potentially develop leaks and which should be provided with some sort of containment to meet Design Objective 1 of Table 12.3-18. iv. (p.12.3-69) DCD subsection 12.3.1.1.7 states that those floor drain lines having a potential for containing highly radioactive fluids are routed through pipe chases, shielded cubicles, or are embedded in concrete walls and floors. State if these floor drain lines having a potential for containing highly radioactive fluids are provided with shutoff valves to isolate the spill in the event of a spill of highly radioactive fluids into the drain line. If these lines are not provided with shutoff valves, state your reasons why shutoff valves are not used on these lines. v. (p. 12.3-70) DCD subsection 12.3.1.2.6 states that contaminated piping systems are welded to the most practical extent to minimize leaks through screwed or flanged fittings. Verify that contaminated piping systems which are embedded will also utilize welded joints to minimize leaks through screwed or flanged fittings.

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			vi. (p.12.3-76) DCD subsection 9.1.3.5 states that "all other pools (upper transfer pool, lower fuel transfer pool, cask pool, buffer pool, reactor well, …) have local, nonsafety-related, panel mounted level transmitters …" This statement is not correct. The buffer pool water level instrumentation is safety-related. Please modify Table 12.3-18, subsection 9.1.3.2 (p. 12.3-76) and subsection 9.1.3.5 (p. 12.3-76) to reflect the response given by GEH to RAIs 9.1-18 S03 and 9.1-20 S03. vii. (p. 12.3-82) The description of design features in DCD subsection 3.8.4.1.7 includes a description of the HVAC ducts being made of steel sheet metal and supported at intervals by hot or cold rolled steel sections. Explain how this description meets design objective 4 of DCD Table 12.3-18. viii. (p. 12.3-101) DCD subsection 12.3.1.1.5 states that radioactive piping may be embedded in concrete walls or floors. Describe what standards apply to the layout of embedded piping lines to minimize crud traps and facilitate access for cleaning and inspection (e.g. eliminate joints in embedded piping to minimize potential leakage, minimize the use of piping elbows to facilitate access for cleaning and inspection and minimize potential crud traps, minimize low spots which could become crud traps, and minimize high spots which could trap air). ix. (p. 12.3-104) DCD subsection 3.8.1.1.1 states that “The containment is a low-leakage reinforced concrete structure with an internal steel liner in the drywell and wetwell to serve as a leaktight membrane. The containment and the structures integrated with the containment are constructed of cast-in-place, reinforced

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			concrete." Explain how this description meets design objective 5 of DCD Table 12.3-18. x. (p. 12.3-104)) DCD subsection 3.8.4.1.1 states that "These structures are tied together by a system of internal concrete bearing walls and concrete floor slabs. Floor slabs are designed, in general, as composite structures supported by embedded beams during construction." Explain how this description meets design objective 5 of DCD Table 12.3-18. xi. (p. 12.3-104) Describe how the use of composite construction techniques (as discussed in DCD subsection 3.8.4.6.5) will facilitate the eventual decommissioning of the plant. xii. (p. 12.3-104) Provide some other examples of Seismic Category I structures where composite construction is used (see DCD subsection 3.8.4.6.5). xiii. (p. 12.3-106) DCD subsection 9.3.3.4 states that drainage piping is hydrostatically tested prior to embedment in concrete. It also states that potentially radioactive drainage piping is pressure tested in accordance with ASME B31.1. If the ESBWR design specifies that some potentially radioactive drainage piping will be embedded in concrete, describe your criteria for determining when such piping will be embedded in concrete and justify how the embedment of potentially radioactive drainage piping meets the RG 4.21 design objective of facilitating the eventual decommissioning of the plant by minimizing embedded and buried piping. For potentially radioactive piping that is embedded in concrete, describe what standards apply to the layout of the embedded piping lines to minimize crud traps and facilitate access for cleaning and inspection (e.g.

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			eliminate joints in embedded piping to minimize potential leakage, minimize the use of piping elbows to facilitate access for cleaning and inspection and minimize potential crud traps, minimize low spots which could become crud traps, and minimize high spots which could trap air). xiv. (p. 12.3-106) DCD subsections 11.2.2.3.4 and 11.2.2.3.5 state that the equipment and floor drain RO and mixed-bed demineralizer processing subsystems are designed and configured for installation ease and process reconfiguration. Describe those features of these systems which facilitate the removal of these systems during the eventual decommissioning of the plant. xv. (p. 12.3-107) DCD subsection 11.5.6.5 states that, to facilitate decommissioning, equipment will be provided, where feasible, that reduces the need for decontamination during the removal and disposal of the equipment. Provide some examples of such equipment that will be used to reduce the need for decontamination during the removal and disposal of equipment. e. In addition to the staff concerns on specific sections of DCD Table 12.3-18 which are listed in part d. above, the staff has the following general concerns with issues that don't seem to be addressed in DCD Table 12.3-18. State the location in the DCD where the following issues are addressed. If addressed in the DCD, include a summary of the description in DCD Table 12.3-18. If not addressed in the DCD, provide a reason why each issue is not addressed. i. Description of design features in place for the various pools in the containment building and the fuel building to contain the pool water to accommodate sloshing effects during a seismic event. ii. Description of waterproofing of walls below ground

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			elevation. iii. Design features (such as floor and wall coatings, curbs, drains, berms) for the Radwaste Building to contain radioactive materials inside the building in the event of spills or sprays of radioactive materials inside the building. iv. Description of design features to contain internal flooding. v. The DCD states that the pools outside of the RCCV have leak chase channels and a leak detection system. Describe the leak detection capability for the pools located inside the RCCV. f. There are several places places in GEH's response to RAI 12.7-5 where reference is made to functions/commitments that will be the responsibility of the COL applicant. For the items listed below, specify the mechanism (e.g., included in COL action item or operational program) that will be used to ensure that each of these functions/commitments will be performed/addressed by the COL applicant. i. (p. 6 of 6) In section D) (3) of GEH's response, GEH states that the criteria for visual inspections of the piping in the Radwaste Tunnel will be addressed by the COL applicant. ii. (p. 12.3-57) DCD Subsection 3.8.6.1 discusses foundation waterproofing. Verify that the COL applicant will be responsible for the sinking of wells in appropriate locations to monitor the location/movement of groundwater to detect for possible groundwater contamination from the facility. iii. (p. 12.3-78) DCD Subsection 11.2.3.2 discusses

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			provisions for sampling at important process points of the Liquid Waste Management System. Verify that the COL applicant will be responsible for the establishment of administrative controls to protect against accidental discharges from this system. g. The staff identified the following items where GEH's responses to RAI 12.7-5 could be clarified by modifying GEH's response to the RAI: i. (p. 12.3-14) In the first bullet on this page, explain why the word "(corrosion)" appears after the word "buildup". ii. (p. 12.3-14) In the second bullet on this page, replace the word "potential" with "the potential for" and replace "low" with "lower". iii. (p. 12.3-14) In the third bullet on this page, replace the word "water" with "the reactor coolant system". iv. (p. 12.3-14) In the fourth bullet on this page, add the words "cubicles with" after the word "numerous". v. (pp. 12.3-75 through 81) In the description of Design Objective 3 at the top of Table 12.3-18, replace the word "conduce" with "conduct". vi. (p. 12.3-97) In the sixth line of the description for DCD section 11.4.1, replace "Section 12.6" with "Section 12.3.1.5". vii. (p. 6 of 6) In the second line of section D)(3) replace the word "address" with "addressed". viii. (p. 6 of 6) The section of GEH's response entitled "DCD

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			Impact" states that Subsection 12.3.6 will be deleted as part of the response to this RAI. The actual Subsection deleted is 12.6, not 12.3.6.

cc:

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