January 8, 2009

Mr. Robert E. Brown
Senior Vice President, Regulatory Affairs
GE Hitachi Nuclear Energy
3901 Castle Hayne Road MC A-50
Wilmington, NC 28401

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 293 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION

Dear Mr. Brown:

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 301-415-6715 or Bruce.Bavol@nrc.gov or you may contact Amy Cubbage at 301-415-2875 or Amy.Cubbage@nrc.gov.

Sincerely,

/RA/

Bruce M. Bavol, 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

ADAMS ACCESSION NO. ML090070467

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SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 293 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION DATED JANUARY 8, 2009

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

RAI Number	Reviewer	Question Summary	Full Text
6.3-62 Supplement No. 1 (MFN 07-439, dated August 17, 2007)	Wang W	Decay heat relating to exposure and irradiation.	The response of RAI 6.3-62 (A) stated that "Conventionally a higher exposure means a higher fractional fission in plutonium relative to U-235, hence, less decay heat." Another sentence stated that "A longer irradiation means more fission and capture in the fuel, which leads to higher decay heat from fission products and actinides." The above statements are not consistent to the relationship between the exposure and irradiation time in the GEH documents TDP-0159. Provide clarification on decay heat used in the ESBWR LOCA calculation with respect to the fuel exposure and irradiation time.
21.6-92 Supplement No. 2 (MFN 08-607 dated July 31, 2008) **Reopened** as a result of the NRC TRACG Inspection 12/15/08 to 12/19/08.	Wang W	Code version summaries for FWTOD and Initial Core analysis	The response to RAI 21.6-92 S01 provided code versions for DCD safety analysis in a table. Provide a similar table for the code versions used for the LTR NEDO-33338, "ESBWR Feedwater Temperature Operation Domain Transient and Accident Analysis" and LTR NEDO-33337 "ESBWR Initial Core Transient Analysis".

Enclosure

21.6-96 Supplement No. 2 (MFN 08-644 Supplement 1, dated 8/26/2008) **Superseded** with additional information (underlined) from the NRC TRACG Inspection 12/15/08 to 12/19/08	Wagage H, Wang W	The PCCS is *not* over capacity starting at about 3 hours; include the response in a licensing document & Code qualification assessment and justification.	Part A: GEH's response to RAI 21.6-96 Supplement 1 states that "[f]or the long-term Passive Containment Cooling System (PCCS) operation, the PCCS is over capacity starting at about 3 hours . . . Under this overcapacity condition, the PCCS regulates the heat removal rate to match the decay heat by accumulating non-condensable (NC) gases in the lower part of the PCCS tubes." (a) The statement that "the PCCS is over capacity starting at about 3 hours" is misleading. Both GEH's TRACG and the staff's MELCOR results show that the PCCS does not operate at overcapacity: energy removal rate from the PCCS is below the decay heat generation leading to continuous containment pressurization and heat up for 72 hours after a LOCA. Each PCCS is designed to remove 11 MW at design conditions stated in ESBWR DCD Tier 2 Rev. 5 Table 6.2-10. It may appear that six PCCS would be able to remove 66 MW which is significantly higher than the decay power (e.g., 29 MW at 24 hours and 21 MW at 72 hours). (See ESBWR DCD Tier 2 Rev. 5 Figure 6.2-14c1.) The PCCS is unable to remove the design capacity power of 66 MW and arrest the containment pressurization during the first 72 hours after a LOCA because it operates at containment conditions which are less favorable than its design conditions. An example is that the design conditions include that the operation of PCCS at 100 percent steam environment but the presence of non-condensables in the drywell adversely affects the steam condensation rate, and thus, the efficiency of PCCS. Please clarify the statement "the PCCS is over capacity starting at about 3 hours."

			(b) Explain what physical conditions force the PCCS to regulate the heat removal rate to match the decay heat. (c) Update the DCD or a topical report incorporated by reference as appropriate to provide this technical description. NRC TRACG Inspection 12/15/08 to 12/19/08. The response to RAI 21.6-96 S01 provided assessment comparisons for TRACG04 V53 and TRACG04 V40 against test data. Because some assessment results were degraded (compared to the earlier versions) while some cases were improved, please provide an additional column with qualification justification in the tables listed in RAI 21.6-96 S01. Since the latest version of TRACG04 Level-2 code V57.11 was used for DCD safety analysis, provide a similar assessment for V 57.11 to RAI 21.6-96 S01.
RAI 21.6-106 Supplement No. 2 (MFN 08-877 dated November 11, 2008)	Haider S	Tracking the design of the PCC vent submergence length in the DCD; and applicability of the experimental condensation data used.	(A) In DCD Rev. 05 the selection of the PCC vent submergence length is not documented, or in the related GEH LTRs References [1, 2]. It is only discussed in "Supplemental Information for RAI 314.1" (MFN 03-115), which includes many relevant technical details regarding the PCCS performance during blowdown. It presents a dimensional analysis of the condensation efficiency data from Reference [3] to compute the submergence length to be around 0.75-1.00 m. It discusses PANTHERS test data to estimate the steam flow rates expected in ESBWR PCCS vents during the blowdown transient. It also describes that the PCCS vent submergence should be deep enough to avoid stratification, but not so deep that it would stop the vent function. GEH had to reproduce many of these details in their responses to RAI 21.6-106 and in RAI 21.6-106 S01, mainly because they are not documented elsewhere. Considering the critical nature of the PCCS vent submergence dimension, its design should be tracked within

			the DCD. Include the related details either in the DCD; or in a LTR and reference it in the DCD. (B) A key publication Reference [3] is only referenced in "Supplemental Information for RAI 314.1," but not in DCD, or in the LTRs References [1, 2]. The authors of the paper concluded that "one cannot guarantee the efficiency of condensation for much higher flow rates and vent diameters", and "the data obtained from the present medium scale facility cannot be directly applied to full-size suppression pools." The authors also observed that "Owing to the current lack of knowledge of the complex flow induced by venting of air and steam through large-diameter pipes, no proper scaling of the condensation process, in relation to a reference prototype is readily achievable." The maximum steam flow rate condensed in the LINX facility, used by the authors, was 50 gm/s through a 40 mm ID pipe, as compared to about 6 kg/s anticipated for ESBWR PCCS vents of 250 mm ID. In this backdrop, please justify using the dimensional analysis ("Supplemental Information for RAI 314.1" and RAI 21.6-106 response) to scale the LINX data up for ESBWR PCC vent design. (C) Reference [2], Section 7.11.5, reports "four" PCC heat exchanger units, which is incorrect. GEH should ensure that the related LTRs are consistent with the DCD. [1] NEDC-33083P, "TRACG Application for ESBWR," March 2005. [2] NEDE-32176P, Revision 4, "TRACG Model Description", January 2008 (MFN 08-072).

			[3] C. De Walsche and F. de Cachard, "Experimental Investigation of Condensation and Mixing during Venting of a Steam/Non-condensable Gas Mixture into a Pressure Suppression Pool," ICONE-8565, Proceedings of ICONE 8, 8th International Conference on Nuclear Engineering, April 2–6, 2000, Baltimore, MD, USA.

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