May 26, 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. 339 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION

Dear Mr. Head:

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

Pursuant to 10 CFR 2.390, we have determined that the enclosed RAIs contain proprietary information. We have prepared a non-proprietary version of the RAIs (Enclosure 1) that does not contain proprietary information. The proprietary information is indicated in brackets and underlined in Enclosure 2. We will delay placing this document in the public document room for a period of ten (10) working days from the date of this letter to provide you with the opportunity to comment on the proprietary aspects only. If you believe that any additional information in the enclosure is proprietary, please identify such information line by line and define the basis pursuant to the criteria of 10 CFR 2.390 before the public release date.

If you have any questions or comments concerning this matter, you may contact me at 301-415-3808 or zahira.cruz@nrc.gov, or you may contact Amy Cubbage at 301-415-2875 or amy.cubbage@nrc.gov.

Sincerely,

/RA/

Zahira Cruz Perez, Project Manager
ESBWR/ABWR Projects Branch 1
Division of New Reactor Licensing
Office of New Reactors

Docket No. 52-010

Enclosure:
1. Request for Additional Information (Non-Proprietary)
2. Request for Additional Information (Proprietary)

cc: See next page (w/o enclosure 2)

If you have any questions or comments concerning this matter, you may contact me at 301-415-3808 or zahira.cruz@nrc.gov, or you may contact Amy Cubbage at 301-415-2875 or amy.cubbage@nrc.gov.

Sincerely,

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

RAI Number	Reviewer	RAI Summary	RAI Text
3.9-206 S01	Sekerak P	Additional information regarding steam dryer load and flow velocities.	A) In the response to RAI 3.9-206, GEH states that the [[ ]]. Therefore, GEH will apply load definitions that bound the ABWR test data when extrapolated for a 15 percent steam flow increase. The extrapolation will be based on power law trends developed from the measured test data from the ABWR power ascension. (a) GEH is requested to confirm that the ESBWR dryer load will be obtained from extrapolating the ABWR at OLTP by an appropriate power law of the factor 1.15, although the steam velocity in some components (e.g., the MSLs) remains similar to that in the ABWR. (b) GEH is requested to explain the method which will be used to scale the dryer load to the larger size dryer of the ESBWR. B) Since [[ ]], GEH is requested to provide additional information to assure the staff that no flow-induced vibration mechanisms would be initiated at these higher flow velocities.
3.9-211 S01	Sekerak P	Include final load definitions in LTR NEDE-3312P.	GEH is requested to include their final dryer load definition(s), over key portions of the dryer surfaces, in a revised version of LTR NEDE-33312P, "ESBWR Steam Dryer Acoustic Load Definition." All bias errors and uncertainties should be clearly explained in the load definition.
3.9-212 S01	Sekerak P	Additional information regarding details of the stress evaluation of steam dryer.	For the stress evaluation of steam dryer in the prototype ESBWR plant, GEH plans to use the method described in Section 3L.5.5.3 of Revision 5 of ESBWR DCD, Appendix 3L. According to this method, GEH will install a population of [[ ]]. GEH is requested to provide an explanation about the number of [[ ]]

			that will be installed at each location identified in Table 3L-4 of Appendix 3L. GEH is also requested to confirm whether it will employ [[ ]].
3.9-214 S01	Sekerak P	Additional information regarding [[ ]].	GEH states that the [[ ]]. The staff requests that GEH identify (a) whether [[ ]]; (b) the criteria that would be used to identify high stress locations; and (c) the [[ ]]. GEH is also requested to discuss what may be the [[ ]].
3.9-215 S01	Sekerak P	Information summarizing the results of the metallurgical evaluations and stress concentration factor (SCF) that may be used with finite element analysis.	A) In Section 3.1 of the GENE report, DRF GE-NE 0000-0092-7093-1P, Class II, April 2005, "recommended Weld Quality and Stress Concentration Factors for use in the Structural Analysis of Exelon Replacement Steam Dryer," (i) GEH states, "[[ ]]." GEH is requested to provide information summarizing the results of the metallurgical evaluations which support these conclusions. (ii) GEH further states that in the ESBWR steam dryer, as in the replacement dryers, the [[ ]]. However, [[ ]]. GEH is requested to explain whether a [[ ]]. B) The GENE report provides the stress concentration factor (SCF) that may be used with finite element analysis to obtain the peak stress at the fillet weld using one of the following three approaches:

			(a) [[ ]], the SCF of 4 is applied [[ ]]. (b) [[ ]], the SCF of 1.8 is applied [[ ]]. (c) [[ ]], the SCF of 1.8 is applied [[ ]]. GEH is requested to further discuss the technical bases of these approaches by providing the following: (i) For Approach (a), GEH defines the [[ ]]. GEH is requested to explain how the [[ ]]. (ii) In Section 2.3 of the report, GEH claims that the fatigue stress calculated using Approach (b) is equal to or higher than the one using Approach (a). GEH is requested to provide a technical justification for this claim. In Section 3.2, GEH further states that the various studies have shown that the calculated fatigue stress using Approach (a) correlates reasonably well with that using Approach (b). GEH is requested to provide a summary of the results of these studies and confirm whether it supports the claim made in Section 2.3. (iii) GEH is also requested to provide data showing how well the fatigue stress calculated using Approach (c) compare with that calculated using Approaches (a) and (b). (iv) GEH also needs to explain whether the three approaches mentioned above are applicable to fillet welds mainly subject to bending stresses or they are equally applicable to the welds mainly subject to membrane stresses alone, or subject to both bending and membrane stresses.

			C) In Section 2.3 of the report, GEH states that the [[ ]]. GEH is requested to explain the meaning and significance of the terms "[[ ]]." What may be the recommended values of SCFs, if Approach (b) or (c) is used to obtain the [[ ]]? D) GEH states that it will treat the [[ ]]. The staff agrees with GEH that this is a conservative method to assess fatigue damage. However, this particular method should be included in LTR NEDE-33313P. In addition, the LTR should be revised to include a summary and conclusions of the GENE report, DRF GE-NE 0000-0092-7093-1P, Class II, April 2005.
3.9-216 S01	Sekerak P	Additional information about mesh size used for modeling.	GEH states that [[ ]]. GEH should quantify the [[ ]]. How has the [[ ]]? Also, does the [[ ]]? If [[ ]]? Also, GEH is asked to submit the [[ ]], along with a benchmark study proving the conservatism of the procedure.
3.9-217 S01	Sekerak P	Provide the uncertainties and bias errors associated with their finite element structural models of the steam dryer.	The staff finds the GEH response to RAI 3.9-217 partially acceptable, but incomplete. GEH should provide the uncertainties and bias errors associated with their finite element structural models of the steam dryer, and substantiate them with existing results for finite element models benchmarked against instrumented dryers that include strain gages and accelerometers.

3.9-219 S01	Sekerak P	Include discussion addressing the length of the pressure time history considered in performing steam dryer stress and high cycle fatigue analyses.	The NRC staff finds the response to NRC RAI 3.9-219 acceptable, but requests that GEH update LTR NEDE-33313P by including the RAI response discussion addressing the length of the pressure time history considered in performing steam dryer stress and high cycle fatigue analyses.
3.9-220 S01	Sekerak P	Include table comparing flow rates and geometric properties of the ABWR, ESBWR, and currently operating BWRs.	The NRC staff finds the response to NRC RAI 3.9-220 acceptable, but requests that GEH update LTR NEDC-33408P, Supplement 1 by including the table presented in the RAI response which compares flow rates and geometric properties of the ABWR, ESBWR, and currently operating BWRs.
3.9-221 S01	Sekerak P	Explain how uncertainty levels are implemented in the steam dryer load definition, and also to elaborate on the maximum expected local uncertainty level compared to the spatially averaged values.	The sensitivity analysis given in Supplement 1 of Report NEDC-33408P shows [[ ]]. Table 13 of the above mentioned document shows also that the [[ ]]. GEH is requested to explain how these uncertainty levels are implemented in the steam dryer load definition, and also to elaborate on the maximum expected local uncertainty level compared to the spatially averaged values.
3.9-225 S01	Sekerak P	Additional information regarding elements per wavelength.	In the response to RAI 3.9-225, GEH states that the [[ ]]. However, Report NEDC-33408 and Supplement 1 imply that all the [[ ]]. GEH is requested to revise Report NEDC-33408P and its Supplement 1 to indicate the regions where this requirement can be relaxed. The applicant is also requested to provide the minimum acceptable number of elements per wavelength in these regions and to substantiate the adequacy of the recommended minimum number of elements.

3.9-244 S01	Sekerak P	Include explanation of weld quality and fatigue factors in the topical report, NEDE-33313P.	In its response to NRC RAI 3.9-244, GEH states that the statement in Section 4.0 was only intended to apply to the design article of ASME Subsection NG with an exception to the weld quality and fatigue factors as explained in Subsections 4.1 and 7.1 of the LTR (NEDE-33313P). However, the staff finds that neither Subsection 4.1 nor 7.1 explains weld quality factor. The staff also notes that the weld quality factor and fatigue factor for use in the steam dryer analysis are explained in the GENE Report DRFGE-NE 0000-0092-7093-1P, Recommended Weld Quality and Stress Concentration Factors for Use in the Structural Analysis of Exelon Replacement Steam dryer. The staff requests that GEH include this explanation of weld quality and fatigue factors in the topical report, NEDE-33313P.
3.9-245 S01	Sekerak P	Explain whether the radiation-induced loss of fracture toughness of the internals materials and stress-relaxation of the bolts would challenge the integrity of ESBWR reactor internals during the design life of 60 years.	The staff agrees with GEH that the susceptibility of the reactor internal components to IGSCC, IASCC and thermal aging would be low during the ESBWR design life of 60 years because of the proposed water chemistry control, specified chemical composition of the structural materials, and the proposed fabrication processes. However, in Sections 4.5.2 and 5.2.3.2 of the DCD, GEH does not address the issue of radiation-induced loss of fracture toughness of the internals materials, e.g., austenitic stainless steels and nickel-based alloys, and stress-relaxation of the bolts used to fasten the reactor internal components. GEH is requested to explain whether the radiation-induced loss of fracture toughness of the internals materials and stress-relaxation of the bolts would challenge the integrity of ESBWR reactor internals during the design life of 60 years.
3.9-246 S01	Sekerak P	Include discussion of conclusions from NEDC-33408P, Supplement 1 in Appendix 3L of the DCD, and include NEDE-33408P, Supplement 1 in its reference section.	The staff accepts the GEH response to RAI 3.9-246, but requests that GEH also discuss the importance of conclusions from NEDC-33408P, Supplement 1-ESBWR Steam Dryer Plant Based Load Evaluation Methodology – Additional Benchmarking, in Appendix 3L of the DCD, and include NEDE-33408P, Supplement 1 in its reference section.

cc:

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