September 10, 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. 368 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.

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 Leslie Perkins for/

Zahira Cruz Perez, 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.368 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION DATED SEPTEMBER 10, 2009

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Requests for Additional Information (RAIs)
ESBWR Design Control Document (DCD), Revision 6

RAI Number	Reviewer	RAI Summary	RAI Text
3.8-96 S05	Chakrabarti S	Additional Clarification on Sliding Analysis Methodology.	Please provide additional information against the items listed below: **Item C** The response is not adequate because it discusses the calculation for rotation of the foundation and concludes that the resulting maximum deformation from seismic loading is very small, and thus no passive pressures are developed. However, the evaluation of sliding stability in a number of locations requires the use of passive pressure on shear keys in order to satisfy the sliding stability safety factor. An example is page 35 of 42 of the RAI response which utilizes in equation (5) the term (kp–ka), where kp and ka are defined as full passive and active pressures respectively. It is not clear how the shear keys develop full passive pressure and still "ensure a non-slide condition." Also, please clarify the rationale for considering full passive pressure on the shear keys (F_r') and wall design lateral pressure (F_r) on the embedded wall in the sliding evaluation. **Item D** The response refers to a sliding evaluation approach presented at the end of the supplemental response. For all three structures (RB/FB, CB, and FWSC), GEH is requested to address the following items for this sliding evaluation: (a) The lateral resistance pressure along the foundation wall and basemat (Fr) perpendicular to the direction of motion is defined as the wall design lateral pressure, which consists of the at-rest static earth pressure and the dynamic seismic earth pressure from SASSI analysis and the ASCE 4-98 elastic solution. Since during a seismic event seismic forces will be acting on both sides of a given building, please clarify how this was considered in the evaluation of sliding stability. Also, please describe the criterion for selecting the dynamic seismic earth pressure calculated from the SASSI analysis and ASCE 4-98 elastic solution in the sliding evaluation. Was the same criterion used for both design of wall as well as for computing sliding resistance?

Enclosure

			(b) With the troughs added to the bottom of the mud mat and the use of shear keys beneath the basemat, the governing sliding interface may now be a horizontal plane in the soil at the elevation corresponding to the bottom of the shear keys. At this elevation there would no longer be any lateral resistance contribution from the surcharge of the building acting on the shear keys when calculating Fus' and Fr'. Explain whether another calculation was performed to determine the sliding factor of safety at the elevation of the bottom of the shear keys and describe the results of that evaluation. **Item E** The response stated that the vertical edges of the basemat do not use waterproofing membrane and instead sprayed with crystalline waterproofing material to ensure that the 0.7 coefficient of friction is achieved. It is not clear why surface preparation similar to the basemat was not necessary for the vertical edges of the shear keys and the basemat to ensure failure surface can only occur in the soil. **Item G** The response does not adequately address the question raised in the RAI. Based on the prior submittal of information, it was indicated that the crystalline material is effective up to 0.4 mm size cracks. Please describe if the crystalline material is used both in the mudmat concrete mix and also applied to the top surface of the mudmat. Also please explain how wide the contraction joints will be and how the contraction joints will be ensured to be waterproof. **Item H** The response identified the type, thickness and number of layers of the waterproofing membrane material applied to the exterior walls. The response also indicated that the waterproofing system is a sheet-applied barrier material as described in ACI 515.1R-79 (revised 1985). Since the use of the waterproofing membrane material is in accordance with the industry standard ACI 515.1R-79 (revised 1985), this item is technically acceptable. However, this information needs to be placed in the appropriate sections of the DCD. **Item I** The response provided the proposed markups to the various sections of the DCD. Since there are several other items still unresolved as discussed above, this Item I is still unresolved. GEH is requested to incorporate any additional revisions to the DCD resulting from the resolution of the other items.

3.9-254 S01	Wu J	Additional information about PISYS computer code	Please revise the RAI response and DCD to address the following items: • In the response (1), GEH should explain how Brookhaven National Library (BNL) benchmarked PISYS07 for the ABWR certification since The results documented in NUREG-1503, section 3.12.4.1 for ABWR design certification were completed in 1992, however, PISYS07 did not exist until after 1994. • In Response (4), the staff notes that PISYS07 was benchmarked to Reg. Guide 1.92, Rev.1 rather than to Reg. Guide 1.92, Rev. 2 dated July 2006 as NUREG/CR-6049 dated 1993 and the closed space modes with rigid mode effects relate to RG 1.92, Rev. 1. In order to validate PISYS07 for RG 1.92 Rev. 2 methods as stated in Section 3.7.3, GEH should benchmark results with NUREG/CR-6645 dated 1999.
3.9-255 S01	Wu J	Additional information about calculating the maximum strain rate	• GEH did not address how the maximum stress intensity range between load sets and how the maximum strain rate was calculate. • GEH indicated that the most conservative strain rate is assumed for ESBWR Fen calculation with the exception of dynamic cycles. Explain why "dynamic cycles" is mentioned associated with the Fen calculation. Provide an example regarding the "most conservative strain rate" for the calculation of the Fen factor. • Confirm whether the ANS17 assumes the maximum strain rate in calculating the Fen factor.
3.12-3 S05	Hsu R	Provide Justification for the use of ISM method	The staff reviewed GEH response to NRC RAI3.12-3 S04. The response did not address the staff's concern. The staff is requesting the applicant to provide technical justification to demonstrate that ESBWR proposed ISM method/criteria can be applied globally to all piping in all different locations (or in a limited set of locations, such as inside containment). In order to address this issue, the applicant has to demonstrate that the time histories from different support groups can be shown to be phase uncorrelated.

			The GEH response to RAI 3.12-3 S04 stated that the selections of piping systems for the response spectrum analysis, the time history analysis and the comparisons have been performed according to an agreement reached between NRC, BNL and GE. The staff's safety determination has to be based on technical justification. GEH had conducted a study based on a limited sample. The staff considered the applicant's analysis results and suggested adding 10 percent margin to SRSS method as a solution for the particular systems in the study. In order change the generic methodology, ESBWR has to provide a technical justification to allow use of the proposed ISM method globally (or in a limited application, such as inside containment). The analysis, as written, does not show how it applies globally (or in a limited application).
RAI 19.1-179	Pohida M	Update Section 19.2.4.1.1 to be consistent with Revision 4 of the ESBWR shutdown PRA	The staff has reviewed Revision 4 of the ESBWR Shutdown PRA and Revision 6 of Chapter 19 of the DCD. In Revision 3 of the PRA, pipe breaks below TAF constituted 90 percent of the shutdown internal events CDF. As shown in Revision 4 of the PRA, Table 16.6-1, Shutdown CDF by Initiating Event and by Mode of Operation**,** pipe breaks below TAF constitute 50 percent of the shutdown internal events CDF, and RPV leaks and diversions constitute another 30 percent of the shutdown internal events CDF. However, RPV leaks and diversions are not mentioned in Chapter 19 of the DCD, Section 19.2.4.1.1 Internal Events During Shutdown. Please update Section 19.2.4.1.1 of the DCD to include RPVS leaks and diversions to be consistent with Revision 4 of the ESBWR shutdown PRA.

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