October 28, 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. 380 RELATED TO DESIGN CONTROL DOCUMENT (DCD) REVISION 6

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.

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 301-415-6256 or Dennis.Galvin@nrc.gov or you may contact Amy Cubbage at 301-415-2875 or Amy.Cubbage@nrc.gov.

Sincerely,

Dennis Galvin, 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 301-415-6256 or Dennis.Galvin@nrc.gov or you may contact Amy Cubbage at 301-415-2875 or Amy.Cubbage@nrc.gov.

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

RAI Number	Reviewer	Question Summary	Full Text
3.11-40	Pal A	Clarify the definition of equipment qualification in DCD Tier 1.	DCD Tier 2 Section 3.11.3.1 includes electromagnetic interference/radio frequency interference (EMI/RFI) in the environmental design basis for environmental qualification. DCD Tier 1 Section 3.8-1 provides ITAAC for equipment qualification of safety-related digital I&C equipment for the environmental design bases. However, the definition of "Equipment Qualification" in DCD Tier 1, Section 1.1.1, includes, "Safety-related equipment located in a mild environment will be qualified for their environmental conditions through specifications and certifications to the environments; however, for a mild environment, only safety-related digital instrumentation and control equipment will be addressed by ITAAC. Additionally, Electromagnetic Interference (EMI) susceptibility and emissions qualification is performed by type testing for the safety-related digital instrumentation and control equipment and is not specifically addressed in an ITAAC. ITAAC address analyses of material data for safety-related mechanical equipment located in a harsh environment. ITAAC are located in Section 3.8 to cover instrumentation and control equipment. Environmental qualification of electrical and mechanical equipment is covered in Section 3.8 ITAAC." This implies EMI is not covered by ITAAC which would be inconsistent with Tier 2. Revise this statement to clarify that EMI susceptibility and emissions qualification by type testing for the safety-related digital instrumentation and control equipment is covered by Section 3.8 ITAAC and that it is part of the environmental design basis.

7.3-18	Li H	Revise DCD Tier 2 Table 7.3-4 to include the GDCS Equalization function initiation signal.	DCD Tier 2, Sections 6.3.2.7.2, 7.3.1.2.2, and Table 15.2-23 identify that the Gravity Driven Cooling System (GDCS) Equalization valves will open at Reactor Pressure Vessel (RPV) Level 0.5 after a sustained RPV Level 1 signal and various time delays. However, DCD Tier 2, Table 7.3-4, Gravity Driven Cooling System Parameters does not discuss the RPV Level 0.5 parameter and thus is inconsistent with these sections. The staff notes that DCD Revision 6 includes changes in Section 7.3.1.2.2 involving the RPV Level 0.5 parameter but corresponding changes were not made to Table 7.3-4. Revise DCD Table 7.3-4 to include the RPV Level 0.5 parameter consistent with the other sections of the DCD.
18.11-26 Supplement 2 (MFN 09-418, July 7, 2009)	Pieringer P	Use of Tech Spec safety limits as acceptance criteria Documentation of RAI response in NEDE.	1. GEH has modified NEDE-33276P, Section 5.4.4.1, Plant-Core Thermal-Hydraulic Condition, to include [[ ]] as performance measures. [[ ]] are identified as supplemental measures and not as pass/fail criteria. It is the staff's position that [[ ]] should be included as pass/fail criteria since they define important parameters for defining the safety of plant operations. Please include or explain why [[ ]] should be supplemental measures. 2. With respect to criteria for situation assessment, MFN 09-418 indicated that: [[ ]] While this is an acceptable response the information was not included in the NEDE. Please include or explain why this information is should not be included in the NEDE.

9.1-77 S02 (MFN 09-550, August 22, 2009)	Gilmer J	Provide fuel assembly and storage rack dimensions and tolerances. Also provide a complete description and justification of the method used to establish the criticality safety for the spent fuel storage racks.	In response to RAI 9.1-77 S01, NEDC-33374P, Rev. 2 (LTR) now includes dimensions and tolerances for designs of the fuel assembly, the new fuel storage racks, and the spent fuel storage racks. 1. During an audit at the GEH offices in Washington, DC, on September 29 and 30, 2009, GEH drawings and specifications were reviewed to confirm dimensional information provided in the LTR. While most data of the LTR appeared consistent with GEH design documents, tolerances for the fuel pellet density and enrichment presented in the LTR do not appear to be consistent with tolerances provided in the GEH fuel pellet specifications. • To support completion of the review, provide the following: [[ ]]
9.1-78 S02 (MFN 09-550, August 22, 2009)	Gilmer J	Include complete specification of all normal conditions. Include revised evaluation of an assembly located adjacent to a fresh fuel storage rack.	In response to RAI 9.1-78 S01, NEDC-33374P, Rev. 2 (LTR) now includes most normal-condition dimensional and material details for the fuel assemblies and storage racks. 1. For completeness [[ ]] the following should be specified:[[ ]] 2. Rev. 2 of the LTR is near-complete in addressing normal and abnormal conditions. However, analysis presented during the September 29-30 audit indicated the LTR results

			(computed k_{eff}) for an assembly placed laterally adjacent to the fresh fuel storage rack did not represent worst-case conditions. If the nearest fuel assembly within the rack is repositioned off-center of its storage compartment (toward the external assembly but within storage rack confines), the computed k_{eff} value for this abnormal condition would increase by [[ ]] above the value currently reported in the LTR. Although this off-normal condition remains well within requirements for subcriticality, • The revised model and result for a fuel assembly placed lateral to a fresh fuel storage rack should be incorporated into the LTR.
9.1-81 S02 (MFN 09-499 Rev. 1, July 28, 2009)	Gilmer J	Establish design features, installation criteria, and performance functions that are relied on by the LTR for conclusions of subcriticality.	In response to RAI 9.1-81 S01, NEDC-33374P, Rev. 2 (LTR) now identifies most model geometry, material, and tolerance data that are important to validity of the criticality analysis. However, much of this information is implicit to the document, and is not explicitly summarized and may be needed by later users of the LTR (e.g., for purposes such as the ITAAC licensing verification process, for later evaluation of proposed design or operational changes that potentially affect criticality safety of fuel storage). As an example, for the spent fuel racks, no upper tolerance for separation of the rack modules is provided by the LTR. The DCD (Rev. 6, Section 9.1.2.1) states that the spent fuel racks will be spaced sufficiently close together so that a fuel assembly cannot be inserted between racks, but neither the DCD nor the LTR provides a dimensional specification. Although the DCD states the spacing is "less than one fuel assembly apart," the minimum dimension should consider not just two adjacent racks, but also the corner region between four adjacent racks. To preclude insertion of an unchanneled fuel assembly at a four-corner location (with the assembly rotated 45 degrees relative to the rack orientation), the rack spacing should be less than 70.7 percent of the edge dimension of an unchanneled fuel assembly. The above example highlights a need for the following: • Specific definition/summary of equipment design features, installation criteria, and performance functions that are relied on by the LTR for conclusion that subcriticality criteria of 10 CFR 50.68(b)(4) are met.

			Design features important to the LTR analysis conclusion include dimensional values and material specifications for the fuel assemblies, the new fuel racks, and the spent fuel racks. Installation criteria important for validity of the LTR conclusion include relative spacing of new fuel racks and spent fuel racks, pool structures, and pool equipment (e.g., fuel preparation machines). Example performance functions include LTR assumptions that [[ ]] The LTR should: • Summarize the design features, installation criteria, and assumed performance functions that are essential to the conclusion that subcriticality criteria of 10 CFR 50.68(b)(4) are met.
9.1-89 S02 (MFN 09-550, August 22, 2009)	Gilmer J	Provide additional information related to (a) verification of the computational method and (b) derivation of terms for 95% confidence, 95% probability determination	Most issues identified by RAI 9.1-89 S01 are no longer relevant, because the entire validation presented by NEDC-33374P, Rev. 1 was replaced by a new validation effort in NEDC-33374P, Rev. 2 (LTR). This supplemental RAI focuses on mathematical/statistical processing of benchmark results, analysis tolerances, and analysis biases for subcriticality verification at a "95% confidence, 95% probability" level. [[

			]] 4. Processing of the individual k_{eff} values for the benchmark results treats each benchmark as if the desired computed result (for a "zero" computed bias) should be unity. However, the benchmark-model k_{eff} values [[ ]] are not equal to unity, [[ ]] Table 16 incorrectly lists the benchmark model k_{eff} values ("Benchmark Eigenvalue") [[ ]] as "1."

			Each critical experiment benchmark model (regardless of whether the benchmark model k_{eff} value is unity or not) has some uncertainty associated with its benchmark model k_{eff} value. [[ ]] Table 16 does not tabulate known (or estimated) uncertainty values for the benchmark model k_{eff} values. NUREG/CR-6698 provides guidance for use of benchmark models for which the benchmark model k_{eff} values are not equal to unity, and for treatment of uncertainties for benchmark model k_{eff} values. Other valid methods for inclusion of these factors in bias and bias uncertainty determinations may exist. • In determination of the computational method bias and bias uncertainty, the LTR should address usage of benchmark models for which k_{eff} is not equal to unity, and the LTR should address uncertainties in the benchmark model k_{eff} values. 5. The last line of page 44 of the LTR takes credit for a non-conservative bias (critical experiment $k_{calculated} > k_{expected}$) in that the bias uncertainty is reduced by the predicted value of the non-conservative bias. Generally, this is not considered acceptable for NRC licensees. Instead, the bias is usually reassigned a value of "zero," and the bias uncertainty is retained (unmodified) as representing the variability of the computational method in predicting critical conditions (reference NUREG/CR-6698). • The LTR should be revised so that no credit is taken for a non-conservative computational method bias.
9.1-90 S02 (MFN 09-550, August 22, 2009)	Gilmer J	Selection of critical benchmarks for validation purposes	[[ ]]

9.1-91 S01 (MFN 09-550, August 22, 2009)	Gilmer J	Additional information needed regarding actinide and fission product modeling	[[ ]]
9.1-129	Gilmer J	Restore Technical Specification 4.3.1.2.c to address new fuel storage requirements.	In DCD Revision 5, GEH deleted Technical Specification 4.3.1.2.c, which addresses physical dimensions of the new fuel storage in the buffer pool. The rationale provided by GEH was that requirements in Specifications 4.3.1.2.a and 4.3.1.2.b establish criteria that limit adequately reactivity. This rationale is inadequate for several reasons. 1. It does not address why the ESBWR should depart from the standard technical specifications which includes criticality controls such as physical dimensions. 2. NEDE-33374 Revision 2 relies on storage spacing and neutron poison material as key design features to limit reactivity for new fuel storage. 3. During an audit at the GEH offices in Washington, DC, on September 29 and 30, 2009, GEH identified that the criticality control method using the beginning-of-life (BOL) lattice k-infinity in the normal reactor core configuration at cold conditions is directly linked to the rack design, which as noted in item 2 above, has storage spacing and neutron poison material as key design features. Revise the technical specifications to include Technical Specification 4.3.1.2.c.
14.3-457	Gilmer J	Identify the parameters important to criticality that should be included as ITAAC	The staff has identified certain parameters in the new and spent fuel pool criticality safety analyses that significantly affect the k_{eff} result and should be verified by the ITAAC. These include the rack spacing credited in the analyses (in-rack pitch, between rack pitch, wall separation, and separation between racks and equipment to be stored) and also the boron content of the steel plates which comprise the racks. Acceptance criteria for rack spacing should be nominal dimensions $\mp$ tolerance. For the borated steel plates, the manufacturer's material certification report would satisfy the acceptance criteria. Also, the ITAAC should include tests, analyses, or test and analyses to show that the new fuel storage rack doors will remain closed during credible events. GEH should evaluate if

			additional parameters important to criticality should be included in the ITAAC. Provide a list of the parameters important to criticality safety that should be included as Tier 1 ITAAC and specify the acceptance criteria to be considered. Additionally, please designate the topical report, NEDC-33374P as a Tier 2* document.
9.1-50 S04 (MFN 09-427, June 25, 2009)	Hinson C	Provide justification for how the estimated dose rate to a person on the fuel handling machine meets the dose rate criteria listed in ANSI/ANS-57.1-1992	In the response to RAI 9.1-50 S03, GEH states that the estimated dose rate to a person standing on a fuel handling machine platform during the handling of a fuel assembly will be [[ ]] mrem/h at 2 meters above the surface of the spent fuel pool water. In the recent response to RAI 12.2-27, GEH stated that, using the revised fuel element source term calculated in response to supplement 2 of RAI 12.2-19, "the resulting radiation level on the fuel transfer machine increases from [[ ]] mrem/h at 2 meters to [[ ]] mrem/h at 2 meters." DCD Tier 2 Table 1.9-22, "Industrial Codes and Standards Applicable to ESBWR" lists ANSI/ANS-57.1-1992 as being applicable to the ESBWR design. Paragraph 6.3.4.1.5 of ANSI/ANS-57.1-1992 states that "Fuel handling equipment shall be designed so that the operator will not be exposed to >2.5 mrem/hr from an irradiated fuel unit, control component, or both, elevated to the up-position interlock with the pool at normal operating water level." Provide justification of how the estimated dose rate of [[ ]] mrem/h on the ESBWR fuel handling machine during the handling of a fuel assembly meets the criteria stated in this ANSI/ANS standard for a maximum dose rate of 2.5 mrem/h to the operator for fuel handling equipment.

cc:

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