September 4, 2008

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. 251 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 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 301-415-6256 or Dennis.Galvin@nrc.gov or you may contact Amy Cubbage at 301-415-2875 or Amy.Cubbage@nrc.gov.

Sincerely,

/RA/

Dennis Galvin, 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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Sincerely,

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Dennis Galvin, Project Manager
ESBWR/ABWR Projects Branch 1
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cc: See next page

Distribution: See next page

ACCESSION NO.: ML082470681 NRO-002

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SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 251 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION DATED SEPTEMBER 4, 2008

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

RAI Number	Reviewer	Question Summary	Full Text
RAI 3.1-1	Talbot F Galvin D	Ensure that the DCD Tier 2 Section 3.1 references all applicable system functions and associated DCD chapters or subsections.	RG 1.70 identifies that DCD Tier 2, Section 3.1, Conformance with NRC General Design Criteria, should reference in the discussion of each criterion, the sections of the "DCD" where more detailed information is presented to demonstrate compliance with or exceptions to the criterion. Similar guidance is presented in RG 1.206 Part 1, Section C.I.3.1. The staff has identified two representative examples of subsections of the DCD which have not been referenced and requests that GEH review the DCD in a global manner to address this guidance: • DCD Tier 2 Section 6.5.4, Suppression Pool as a Fission Product Cleanup System, identifies that the suppression pool complies with GDC 41. This section should be referenced in DCD Section 3.1.4.12, Containment Atmospheric Cleanup, GEH Evaluation Against Criterion 41, page 3.1-38. This example is representative since Section 6.5, Atmospheric Cleanup Systems, and Section 6.5.4, in particular, is directly associated with GDC 41 and is not referenced in Section 3.1. • DCD Tier 2, Section 9.4.6 Reactor Building HVAC System (RBVS) identifies that the Contaminated Area HVAC Subsystem (CONAVS) and the Refueling and Pool Area HVAC Subsystem (REPAVS) comply with GDC 61. This section should be referenced in DCD Section 3.1.6.1, Control of Releases of Radioactive Materials to the Environment, GEH Evaluation Against Criterion 60, page 3.1-48. This example is representative since Section 3.1.6.1 currently references systems that control releases during normal operations but not necessarily systems required during anticipated occurrences (e.g., systems that isolate the reactor building on high radiation alarms.)

RAI Number	Reviewer	Question Summary	Full Text
			The staff considers these examples to be representative and requests that GEH perform a global review of all GDCs to ensure that all applicable system functions and associated DCD chapters or subsections, as applicable, are referenced in DCD Tier 2 Section 3.1.
7.1-102	Rhow S	NEDE-33304P should provide justification for the application of a one-sided distribution to the ESBWR setpoint methodology.	GEH applies one-sided distribution to GEH ABWR/ESBWR Setpoint Methodology, NEDE-33304P, Revision 0, October 2007, without justification for using one-sided distribution to calculate the setpoints. The General Electric Instrument Setpoint Methodology, NEDC-31336P-A also utilizes single-sided distributions in the development of trip setpoints and allowable values. The staff transmitted it safety evaluation report (SER) for NEDC-31336P-A in a letter from Bruce A. Boger (NRC) to Robert A. Pinelli (BWROG) dated November 6, 1995. NEDC-31333 states that trip units act independently and utilize single-sided distributions for drift analysis. However, the use of a single-sided test for additional loop instrumentation has not been justified in NEDC-31333 or by the BWROG for channels that provide trips in both the increasing and decreasing directions. The staff SER states that this methodology is acceptable provided that a channel approaches a trip in one direction. This condition is applicable to NEDE-33304P. NEDE-33304P should provide clear and detailed justification for the application of a one-sided distribution to the ESBWR setpoint methodology.
7.1-103	Ashcraft J	Identify for each nonsafety-related system that the requirements of 10 CFR 50.55a(h), namely IEEE Std 603-1991 Criteria 5.6.3 and 6.3, are applicable.	Section 7.4.3.3.1, under 10 CFR 50.55a(h): bullet states “RWCU/SDC is nonsafety-related and is not applicable”. However, SRP 7.4 states “For safe shutdown systems that are not safety systems as defined by IEEE Std 603-1991 and that are isolated from safety systems, the applicable requirements of 10 CFR 50.55a(h) are IEEE Std 603-1991 Clause 5.6.3, ‘Independence Between Safety Systems and Other Systems;’ and IEEE Std 603-1991, Clause 6.3, ‘Interaction Between the Sense and Command Features and Other Systems.’ ”

RAI Number	Reviewer	Question Summary	Full Text
			Comparable language is provided in SRPs 7.5, 7.6, 7.7, and 7.8 for nonsafety-related accident monitoring instrumentation and interlock, control, and diverse actuations systems, respectively. Identify for each nonsafety-related system that the requirements of 10 CFR 50.55a(h), namely IEEE Std 603-1991 Criteria 5.6.3 and 6.3, are applicable.
7.1-104	Eagle E	Clarify the applicability of regulatory requirements for systems designated as both Q and N.	In ESBWR DCD Tier 2, Revision 5 changes to Table 7.1-1, I&C Systems Regulatory Requirements Applicability Matrix, changed the column heading for the NBS so that it now applies to both Q (safety-related) and N (nonsafety-related) portions of the NBS, indicating the nonsafety-related NBS I&C conforms to the same requirements as the safety-related NBS I&C. DCD Tier 2 Section 7.7.1.3.1 states conformance of safety-related portions of the NBS are designed to conform to IEEE Std. 603, implying GEH may not have committed to conformance for the nonsafety-related NBS I&C, which contradicts DCD Tier 2, Revision 5, Table 7.1-1. This comment is applicable to LD&IS, RSS, PAM, CMS, and PRMS also listed in Table 7.1-1. Clarify the applicability of regulatory requirements for systems designated as both Q and N.
7.1-105	Li H	Explain design basis of the Vacuum Breaker (VB) Isolation Function	DCD Tier 2, Revision 5, Section 7.1.2.8.7 states that the VB isolation function is implemented on independent logic controllers and uses equipment different from the RPS, NMS, and SSLC/ESF equipment. Please explain why the VB isolation function needs to be handled by a third diverse platform (diverse from NUMAC and TRICON). Identify any affects on the topical report NEDO-33251, “ESBWR I&C Diversity and Defense-in-Depth Report,” analyses?
7.1-106	Li H	Explain the Vacuum Breaker (VB) isolation valve control detailed design	DCD Tier 2, Revision 5 Section 7.1.3 states that the safety-related VDUs provide data display for RTIF, NMS, and SSLC/ESF safety-related systems but manual control capability only for the SSLC/ESF. DCD Tier 2 Section 7.3.6.2, VB System Description, states that manual controls are independent for each VB isolation valve and are hard-wired to be independent of the VB isolation valve automatic control logic. Explain the VB isolation valves detailed control design and its interface with the SSLC/ESF system. Identify whether the VB isolation valve control by safety-related VDU or not?

7.1-107	Li H	Explain the exception to RG 1.62 Position C4 and C5	DCD Tier 2, Revision 5, Section 7.1.6.4 states that an exception to RG 1.62 Regulatory Position C4 and C5 is taken for the two of four divisional manual trip switches for ADS (SRV and DPV), GDCS, ICS, and SLC manual initiation. Provide simplified schematic diagrams to demonstrate the difference between the ESBWR design and the RG 1.62 guidance and justify these exceptions.
7.1-108	Li H	Update References 7.1-10 and 7.1-12 in Tier 2 Section 7.1.8	DCD Tier 2 Section 7.1.8 References 7.1.10 and 7.1-12 document titles are different from Tier 1 Section 3.2. These titles should be consistent (i.e. SQAPM and SMPM).
7.2-67	Eagle E	Clarify the function of the low control rod drive HCU accumulator charging header pressure scram	DCD Tier 2 Section 7.2.1.2.4.2 identifies a low control rod drive HCU accumulator charging header pressure scram, which is further described as "an anticipatory scram because it initiates a scram before the HCUs have time to depressurize the reactor." However, DCD Tier 2 Section 4.6 identifies that the low control rod drive HCU accumulator charging header pressure scram ensures the capability to scram and shutdown the reactor before the HCU accumulator pressure can degrade to the level where scram performance is adversely affected following the loss of charging header pressure. DCD Tier 2, Revision 5, added, the words, "the reactor" to the phrase in DCD Tier 2 Section 7.2.1.2.4.2, which now makes it inconsistent with DCD Tier 2 Section 4.6. Clarify the function of the low control rod drive HCU accumulator charging header pressure scram to ensure it is consistently described in Chapters 4 and 7.
7.3-14	Li H	Clarify the applicability of GDC 29 to ESFAS.	SRP Section 7.3 (both revisions 4 and 5) identifies that GDC 29 is applicable to engineered safety features actuation systems (ESFAS). However, DCD Tier 2, Table 7.1-1 and Section 7.3 do not identify that GDC 29 is applicable to any ESFAS. DCD Tier 2 Table 1.9-7 does not identify this as a difference with SRP 7.3. Clarify the applicability of GDC 29 to ESFAS. Note that DCD Tier 2, Section 3.1.3.10 references DCD Tier 2, Section 7.3
7.4-8	Ashcraft J	Clarify the applicability of RG 1.209 to the RSS.	DCD Tier 2 Table 7.1-1 identifies that RG 1.209 is applicable to the Remote Shutdown System (RSS). However, conformance to RG 1.209 is not identified in DCD Tier 2 Section 7.4.2.3.3. Clarify the applicability of RG 1.209 to the RSS.
7.4-9	Ashcraft J	Clarify the design bases of the RWCU/SDC System I&C.	Clarify the design bases of the Reactor Water Cleanup (RWCU)/ Shutdown Cooling (SDC) System I&C as described in DCD Tier 2, Section 7.4.3.1.3. DCD Tier 2, Section 7.4.3.1.3 identifies six power generation design bases which partially corresponds to the four basic plant functions described in DCD Tier 2

			Section 7.4.3.2.1 and the seven major activities identified in DCD Tier 2 Section 5.4.8. DCD Tier 2 Section 5.4.8.1.1 identifies six power generation design bases for the RWCU function and DCD Tier 2 Section 5.4.8.2.1 identifies three power generation design bases and three Post-LOCA bases for the SDC function. Section 7.4.3.1.3 does not identify any Post-LOCA bases. Also, the significantly different wording of the bases and descriptions precludes the staff from verifying that the appropriate bases have been identified for the RWCU/SDC system I&C.
7.4-10	Ashcraft J	Clarify the RWCU/SDC System interlocks.	DCD Tier 2 Section 7.4.3.1.3 identifies that there is an interlock to prevent the opening of a regenerative heat exchanger (RHX) bypass valves during reactor power operation. This interlock is not identified in DCD Tier 2 Section 5.4.8. DCD Tier 2 Section 5.4.8.1.2 identifies that interlocks are provided to prevent inadvertent opening of the demineralizer resin addition and backflushing valves during normal operation. This interlock is not identified in DCD Tier 2 Section 7.4.3. A change was made in DCD Rev. 5 in Section 7.4.3.1.3 to state that the RWCU/SDC Shutdown Cooling function modes are interlocked with reactor power operation to prevent increase in core reactivity; however a corresponding change was not made in section 5.4.8.1.1. Clarify the RWCU/SDC System interlocks in the DCD.
7.4-11	Ashcraft J	Clarify the safety-related RWCU/SDC instrumentation to detect system pipe breaks outside the containment.	DCD Tier 2 Section 5.4.8.1.3 refers to DCD Tier 2 Section 7.4.3 for the discussion of safety-related RWCU/SDC instrumentation to detect system pipe break outside the containment. DCD Tier 2 Section 7.4.3.1.2 identifies that the RWCU/SDC system provides safety-related instrumentation for detection of system breaks outside the containment, but provides no further information or reference. DCD Tier 2 Section 5.2.5 does describe some RWCU/SDC leakage detection instrumentation but this section does not reference Section 7.4.3 nor vice versa. Clarify the safety-related RWCU/SDC instrumentation to detect system pipe breaks outside the containment.
7.5-7	Li H	Clarify the applicability of BTP 7-10 to the PAM Instrumentation.	DCD Tier 2 Section 7.5.1.3.5 discusses of conformance of the post accident monitoring instrumentation to BTP HICB-10. The section references RG 1.97, Revision 4, Section A, which states that, “Branch Technical Position HICB 10 will require updates for consistency with Revision 4 of RG 1.97. Conformance to these requirements is addressed during the detailed design phase.”

			The discussion of conformance BTP HICB-10 is no longer applicable as BTP 7-10 was issued in March 2007 to address RG 1.97, Revision 4, Section A. DCD Tier 2 Section 7.5.1.3.5 should be updated to reference and describe conformance to BTP 7-10. BTP HICB-10, Revision 4, is still referenced in Table 1.9-20. The reference should also be updated to BTP 7-10 Revision 5. Since the ESBWR is conforming to the latest version of RG 1.97, the DCD should discuss conformance to the corresponding version of BTP 7-10. The DCD statement that discussion of conformance to BTP 7-10 is addressed in the detailed design phase is inappropriate. Include in the DCD discussion of conformance to the design and qualification criteria supplemental to RG 1.97 identified in BTP 7-10.
7.6-3	Li H	Revise DCD Tier 2 Section 19 and Table 19A-2, RTNSS Functions to include HP/LP Interlock System	DCD Tier 2, Revision 5, Section 7.6.1.3, Safety Evaluation, identifies the HP/LP interlock system (provide protection to the low pressure FAPCS from the high pressure RWCU system) is nonsafety-related within the scope of Regulatory Treatment of Non-Safety System (RTNSS). However, this HP/LP interlock system is not included in the Chapter 19 Appendix A on RTNSS systems. Address this interlock in Chapter 19 Appendix A.
7.7-7	Eagle E	Revise DCD Tier 2 Section 7.7.1 to completely address the safety-related portions of the NBS.	ESBWR DCD Tier 2, Revision 5, Section 7.7.1.1.1, Safety Design Basis, identifies the reactor pressure vessel (RPV) water level and RPV pressure measurements and associated instruments as the safety-related portions of the nuclear boiler system (NBS) I&C. These instruments monitor process conditions to provide inputs to the reactor protection system (RPS) to initiate reactor scrams. DCD Tier 2, Revision 5, Section 7.2.1.2.4.2 identifies six scram initiating circuits associated with NBS. Three of these scram initiating circuits correspond to the discussion of the safety-related portions of the NBS in DCD Tier 2 Section 7.7: • High reactor pressure (NBS), • Low reactor pressure vessel (RPV) water level (Level 3) decreasing (NBS), • High RPV water level (Level 8) increasing (NBS),

			However, the remaining three scram initiating circuits are not addressed in DCD Tier 2 Section 7.7: • Main steam line isolation valve (MSIV) closure (Run mode only) (NBS), • High simulated thermal power (feedwater temperature biased) (NBS and neutron monitoring system (NMS)), • Feedwater temperature exceeding allowable simulated thermal power vs. feedwater temperature domain (NBS), DCD Tier 2, Revision 5, Section 7.2.1.2.4.2 further identifies that the eight MSIVs and the 16 position switches supplied with these valves (for RPS use) and the eight temperature sensors (four on each FW line) associated with the feedwater temperature biased simulated thermal power scram are components of the NBS. Revise DCD Tier 2 Section 7.7 to address the safety-related portions of the NBS, including the items identified above. As appropriate, some safety related portions of the NBS may be addressed by referring to other sections of the DCD.
7.7-8	Eagle E	Revise DCD Tier 2 Section 7.7 to address inaccurate introductory statement as a result of Rev. 5 changes.	In ESBWR DCD Tier 2, Revision 5, Section 7.7, the first sentence states, "This section describes the Instrumentation and Control (I&C) systems for normal plant operation that do not perform plant safety-related functions." However, in the next paragraph, following Revision 5 changes, the first bullet specifically indicates that the Nuclear Boiler System (NBS) has safety-related subsystems which are described in DCD Tier 2, Revision 5, Section 7.7. Revise ESBWR DCD Tier 2 Section 7.7 to correct this inaccuracy.
7.8-8	Fredette T	Clarify Diverse Instrumentation and Control System consistency with Generic Letter 85-06.	DCD Tier 2 Section 7.8 describes the non-safety related Anticipated Transient Without Scram/Alternate Rod Insertion (ATWS/ARI) mitigation system and the Diverse Protection Systems (DPS) as part of the Diverse Instrumentation and Control System. SRP 7.8 states that Generic Letter 85-06 provides acceptable guidance for the quality assurance of diverse I&C systems and components. Additionally, SRP 7.8 states that the applicant should identify the test, maintenance, surveillance, and calibration procedures and that these procedures should be consistent with the guidance of Generic Letter 85-06. DCD Tier 2 Table 1.9-7 does not identify any differences with SRP 7.8. However, the DCD does not incorporate the guidance for DICS quality, system testing, and surveillance provided in Generic Letter 85-06 "Quality Assurance Guidance for

			ATWS Equipment That Is Not Safety-Related." While DCD Tier 2 Table 3.2-1 includes notes for Component C-12, Item 10 and component C-41, Item 7 stating, "A quality assurance program that meets or exceeds the guidance of NRC Generic Letter 85-06 is applied to all Nonsafety-Related ATWS equipment," no comparable note is provided for component C-72, the DPS. Identify in the DCD how GEH plans to address the equipment qualification (EQ), quality assurance, and procedure guidance of Generic Letter 85-06 for the Diverse Instrumentation and Control System?
9.5-93	Vettori R	Clarify the fire brigade communications systems.	DCD Section 9.5.2 does not fully address the guidance provided in RG 1.189 Sections 3.5.1.3 and 4.1.7 including both the on-site fire brigade radio and offsite mutual aid requirements. DCD Section 9.5.2 does not clearly identify the portable radio communications system used by the fire brigade. If the onsite brigade uses the Plant Radio System, the Plant Radio sub-section should specifically state that the Plant Radio System will be the fire brigades primary portable communications onsite. In addition, DCD Section 9.5.2 should identify the RG 1.189 Position 4.1.7 performance requirements applicable to the portable radio communications systems (e.g. no dead zones, protected repeaters, must not interfere w/ security, frequencies will not affect relay actuations, etc.). DCD Section 9.5.2 does not clearly identify the onsite fixed communications system for use by the fire brigade. DCD Section 9.5.2 should state whether the onsite fixed communications system is independent of the normal plant comm. system and state which stations (locations) will receive the fixed communication consistent with RG 1.189 Position 4.1.7. DCD Section 9.5.2 does not clearly identify the offsite communications system for use by the fire brigade. DCD Section 9.5.2.2, in the discussion of 'Emergency Communication Systems,' identifies that the Fire Brigade Radio System provides communication capability and consists of a base unit, mobile units, and portable units in accordance with BTP SPLB 9.5-1, Position C.5.g(4). However, it is unclear if the Fire Brigade Radio System is (1) is the communications link with the offsite mutual aid, (2) is separate from the Plant Radio System with a fire brigade channel, and (3) provides for both onsite and

			offsite communications or are there multiple systems. Clarify the use of the Fire Brigade Radio System in the DCD. Additionally, the applicable BTP SPLB 9.5-1, Rev 4, position is C.7.1.8, not C.5.g(4) as referenced in the DCD. Also, 9.5.2.2 states "… [the 3 voice communication systems] are designed and installed to provide assurance that any single event does not cause a complete loss of intraplant communication." Does “any single event” include any single fire event? Does “a complete loss” include a partial loss such as a fire taking out a single repeater thus causing a dead zone but not taking down the whole system? Any other communication systems that are to be used (either primary or back-up) by the onsite fire brigade should be identified as such and explained as to when the fire brigade would use them (e.g. the Plant Radio System goes down due to loss of power, or fire). Communication system descriptions should include the type of system (portable, fixed, telephone, radio, etc.), who will be using it, when it will be used, if this is a primary or back-up system, listing of all relevant BTP and RG 1.189 requirements, and how each system relates to other systems. Clarify the potential effects a single fire can have on the fire brigade communications systems. Can a single fire take out the diverse nonsafety-related power supplies that power the PA/PL telephone, PABX, and plant radio systems in such a way as to not have communication in any given fire area? Can a single fire affect cabling from the above systems in such a way as to not have communication in any given fire area? Does every fire area including containment have the above system capabilities? Are the sound powered phones credited for fire and are they in every fire area and can a single fire adversely affect this system and any other communication system credited for fire in such a way as to not have communication in any given fire area?
18.7-7 Supplement 4 (MFN 08-481, July 2, 2008)	Bongarra J	Provide RI human action list.	The response to Supplement 3 and NEDO 33267, Rev. 3, (the Human Factors Engineering (HFE) Human Reliability Analysis (HRA) Implementation Plan (IP)) now provides acceptable criteria for determining the risk-important (RI) human actions (HAs). The staff also reviewed the actual list of RI HAs/human interactions referenced in the RAI response and based on NEDO-33201, Rev. 3

			(the ESBWR Certification Probabilistic Risk Assessment (PRA)). This list is not clearly or fully specified in the DCD, the IP, the PRA, or in NEDO-33411, "Risk Significance of Structures, Systems and Components for the Design Phase of the ESBWR," Revision 0. Please provide (or reference) the current list of all HAs including their importance measures. Provide list(s) ordered by risk achievement worth (RAW) and Fussell Vesely (FV) values for each PRA analysis, namely internal and external events PRAs, and the shutdown PRA, using both core damage frequency (CDF) and large release frequency (LRF) importance. Also indicate which HA meet the criteria for risk importance. This should be based on the latest revision of the PRA. It is understood that the PRA will later be updated and that the RI HA list may change as the PRA and HRA evolve with the ESBWR design.

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