January 13, 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. 294 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 301-415-6256 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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Distribution: See next page

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SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 294 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION DATED JANUARY 13, 2009

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

RAI Number	Reviewer	Question Summary	Full Text
9.2-24	Wheeler L	Generic RAI for ESBWR Systems that are Relied Upon for Plant Cooldown or Regulatory Treatment of Non-Safety Systems Functions	Regulatory guidance related to the ESBWR passive plant design and regulatory treatment of non-safety systems (RTNSS) systems and plant cooldown functions can be found in; (1) memorandum from the NRC Associate Director for Advanced Reactors and License Renewal to the Docket File dated July 24, 1995, "Consolidation of SECY 94-084 and SECY 95-132" (ML003708048); (2) SECY-96-128 dated June 12, 1996, "Policy and Key Technical Issues Pertaining to the Westinghouse AP600 Standard Passive Reactor Design," (aka SECY 96-128) (ML003708224); and (3) memorandum from the NRC Executive Director for Operations to the Commissioners dated June 23, 1997, "Implementation of Staff Position in SECY 96-128, 'Policy and Key Technical Issues Pertaining to the Westinghouse AP600 Standard Pressurized Reactor Design,' Related to Post-72 Hour Actions" (ML003708229). From these memoranda, the NRC staff documented its policy that systems subject to RTNSS, including their support systems, and systems that are relied upon for achieving and maintaining cold shutdown conditions should be highly reliable. Non-safety-related (NSR) active systems must be relied upon in order to achieve cold shutdown conditions in accordance with Technical Specification requirements, and these systems should be highly reliable and capable of achieving and maintaining cold shutdown conditions and there should be no single failure of these systems which would result in inability to terminate use of the passive safety related systems and achieve cold shutdown. In addition to the considerations discussed in the above memoranda, these NSR systems should be capable of cooling the plant to Mode 5 conditions within 36 or 37 hours in order to satisfy ESBWR Technical Specification requirements. Numerous Technical Specification Section required Mode 5 entry which includes; TS 3.0.3, TS 3.1.7. TS 3.3.4.1, TS 3.3.6.3, TS 3.3.6.4, TS 3.3.8.1, TS 3.4.1, TS 3.4.2, TS 3.4.3, TS 3.4.4, TS 3.5.1, TS 3.5.2, TS 3.6.1.1, TS 3.6.1.2, TS 3.6.1.3, TS 3.6.1.4, TS 3.6.1.5, TS 3.6.1.6, TS 3.6.1.7, TS 3.6.2.1, TS 3.6.2.2, TS 3.6.3.1, TS 3.7.1, TS 3.7.2, TS 3.7.3, TS 3.8.1, TS 3.8.4, and TS 3.8.6. NSR systems

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			that are designated as RTNSS (including their support systems) are subject to enhanced design, quality, reliability, and availability provisions and are relied upon for performing functions as discussed in Tier 2 of the Design Control Document (DCD), Appendix 19A, "Regulatory Treatment of Non-Safety Systems." Sufficient information needs to be included in Tier 1 and Tier 2 of the DCD in order to demonstrate that these systems are adequate for achieving and maintaining cold shutdown conditions (i.e., cooldown from Mode 4 to Mode 5) and for performing RTNSS functions and that applicable design consideration have been satisfied. The following RAIs are written for the plant service water system. Comparable concerns should be addressed as applicable for the reactor component cooling water system (RCCWS) and nuclear island chilled water subsystem (NICWS) as well; a. Although the plant service water system (PSWS) is non-safety related, it is relied upon to achieve cold shutdown. While this function is an important part of the PSWS design bases, they are not fully described in Design Control Document (DCD) Tier 2 Section 9.2.1, "Plant Service Water System." Instead, Section 9.2.1 refers to DCD Tier 2 Appendix 19A, "Regulatory Treatment of Non-Safety Systems," for information concerning PSWS functions that are subject to regulatory treatment of non-safety systems (RTNSS). In particular, the PSWS supports the normal capability of removing reactor and spent fuel decay heat. Furthermore, because the PSWS is relied upon for achieving cold shutdown and as expressed by the Electric Power Research Institute (EPRI) in its Utility Requirements Document for advanced light water reactors, the PSWS should be highly reliable and no single active failure should result in the inability to terminate use of passive safety-grade systems and achieve cold shutdown. RTNSS functions and cold shutdown provisions are important elements of the PSWS design bases and they need to be described in Design Control Document (DCD) Tier 2 Section 9.2.1. This is especially important for establishing appropriate Tier 1 inspections, tests,

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			analyses, and acceptance criteria requirements for the PSWS, as well as for establishing appropriate quality assurance and design reliability assurance program specifications. Consequently, DCD Tier 2 Section 9.2.1 needs to be revised to fully describe the RTNSS functions and cold shutdown provisions that pertain to PSWS. b. The staff reviewed the plant service water system (PSWS) description and piping and instrumentation diagram (P&ID) to confirm that the design bases, flow paths, and components have been identified and described in sufficient detail to enable a complete understanding of the system design and operation. The staff found that additional information is needed in this regard and Design Control Document (DCD) Tier 2 Section 9.2.1 needs to be revised to address the following considerations: • The most limiting conditions upon which the plant service water system (PSWS) design is based need to be described (e.g., shutdown/cooldown with maximum core decay heat and maximum allowed spent fuel pool heat load, capability to perform plant cooldown within specified criteria, single failure and loss of power considerations). The amount of excess margins that are included in the design to account for uncertainties, component wear and aging effects, fouling of heat transfer surfaces and spray nozzles, strainer debris collection, etc., need to be described and why the specified margins are considered to be adequate need to be explained. Finally, specific values or ranges of values chosen as the bounding conditions for the design need to be specified and explained (e.g., limiting temperatures; wet bulb, and dry bulb); both the specified design and minimum required capability of heat exchangers, cooling towers, and pumps based on excess margin considerations; minimum required water level in the service water basins to satisfy inventory and net positive suction head requirements). Note that combined license

RAI Number	Reviewer	Question Summary	Full Text
			(COL) information items and interface requirements should be established as appropriate. • Nominal pipe sizes for the main flow paths need to be shown on the system drawings and PSWS flow rates through individual coolers need to be specified. • Train designations for cross-connect valves need to be shown on the system drawings. • The PSWS header temperature and pressure detectors need to be shown on the system drawings. • The PSWS pump minimum flow recirculation lines need to be shown on the system drawings. • A description of the air system interface needs to be provided for the air-operated valves and shown on the system drawings. Also, an explanation of how train separation is maintained, a description of valves, filters, and other components that are included in the design, as well as design provisions that assure the reliability of this arrangement need to be discussed. • Valve failure modes need to be described. • Provisions to prevent freezing and damage of PSWS piping, components, and basin areas (especially near the surface), as well as interfacing systems such as cooling tower makeup and blowdown, need to be described.

RAI Number	Reviewer	Question Summary	Full Text
			• A description is needed for how the water in the service water basin is replenished when the discharge is being directed to the normal power heat sink. Also, the minimum required makeup rates for the service water basin need to be specified for when the PSWS discharge is directed to the normal power heat sink and for when it is directed to the service water basin, along with the basis for the makeup rates that are specified. • The system drawing for the PSWS shows a single shared service water basin whereas DCD Tier 2 Table 9.2-2 indicates that there are two separate service water basins and clarification is needed. Also, if a single shared basin is used, justification for not providing redundancy is needed. If separate service water basins are used, additional explanation is needed for how water levels are maintained when operating in a cross-connected configuration. • The PSWS description indicates that valves will be provided with hard seats to withstand erosion where needed. Additional explanation is necessary to better define and specify when valves with hard seats need to be used, and an information item is needed for COL applicants to identify where such valves will be installed to satisfy the specified criteria. • A more detailed description of how the PSWS detects gross leakage is needed, and the instrumentation that is credited needs to be specified. • A description is needed for how the PSWS pumps are protected from large debris that can end up in the service water basin either from makeup water sources or due to basin or cooling tower degradation, and how clogging due to silt accumulation is prevented from occurring (see Information Notice 2006-17, Recent Operating Experience of Service Water Systems Due to External Conditions," dated July 31, 2006).

RAI Number	Reviewer	Question Summary	Full Text
			• Nominal screen mesh size for the service water strainers need to be specified and explained. • Although the description indicates that vacuum breakers will be installed at high points in system piping, none are shown on the system drawings. The system drawing needs to be revised to indicate where the high points are and to show the vacuum breakers, including where vacuum breakers are located in the heat rejection facility piping. Furthermore, an information item needs to be established for COL applicants to include vacuum breakers in the plant-specific heat rejection facility piping. • DCD Tier 2 Section 9.2.1.5, “Instrumentation Requirements,” indicates that with one PSWS pump operating, the respective standby pump starts automatically upon detection of a low system pressure signal in that train, loss of electric power to the operating pump, or an operating pump trip signal. This section also indicates that starting a PSWS pump automatically opens a flow path through the RCCWS and TCCWS heat exchangers. However, no description is provided under the operation discussion in Section 9.2.1.2, “System Description,” about these operating features, and there is no discussion about operation of the self-cleaning strainers. • DCD Tier 2 Table 9.2-1 needs to indicate which alignment is for a 24-hour cooldown and which is for a 36 hour cooldown to cold shutdown conditions. c. In order to satisfy system flow requirements, the plant service water system (PSWS) design should assure that the minimum net positive suction head (NPSH) for the PSWS pumps is satisfied for all postulated conditions, including vortex formation considerations. The system description indicates that the PSWS pumps have sufficient available NPSH under worst case conditions, and that the water levels in the service water basins are monitored

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			to ensure sufficient NPSH. However, the specific NPSH requirements for the PSWS pumps; the minimum required service water basin water level that is necessary to satisfy NPSH requirements and the basis for this determination and limiting assumptions that were used (e.g., water level, maximum temperature, maximum flow rate, number of pumps operating, vortex effects); how this minimum required water level compares to the minimum water level that is maintained in the service water basins to satisfy excess margin and inventory considerations; and how combined license (COL) applicants will know to periodically confirm that adequate levels exist in the service water basins were not described. Therefore, the Design Control Document (DCD) Section 9.2.1 needs to be revised to include this information and to establish COL information items and interface requirements as appropriate. d. The plant service water system (PSWS) description indicates that the potential for waterhammer is mitigated through the use of various system design and layout features, such as automatic air release/vacuum valves installed at high points in system piping and at the pump discharge, proper valve actuation times to minimize water hammer, procedural requirements ensuring proper line filling prior to system operation and after maintenance operations, and the use of a check valve at each pump discharge to prevent backflow into the pump. While these design features and provisions are considered to be appropriate and may be adequate, Design Control Document (DCD) Tier 2 Section 9.2.1 needs to be revised to address the following additional considerations: • The amount of back leakage through the pump check valves that is considered to be excessive needs to be specified and explained, and how excessive check valve back leakage or system voiding will be prevented from occurring over time needs to be described.

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			• A description is needed for how proper operation of the automatic air release/vacuum valves will be assured over time. • Valve actuation/stroke times that are considered to be appropriate (especially with respect to the air-operated valves) need to be specified and explained, and how these times will be maintained as the plant ages needs to be described. • The initial test program to demonstrate that automatic actuation of a standby loop or actuation of both loops following a loss of power will not result in a significant waterhammer event with the PSWS return aligned to either the natural draft or mechanical draft cooling towers needs to be described in the appropriate FSAR Chapter (Chapters 9 or 14).
9.2-25	Wheeler L		DCD Tier 2 Section 3.2.1, "Seismic Classification," refers to Appendix 19A, Table 19A-1, "Initiating Events Assessment for RTNSS," for a list of SSCs that are designated as RTNSS. This is incorrect in that Table 19A-1 has been deleted and the correct reference is Table 19A-2, "RTNSS Functions." Consequently, DCD Tier 2 Section 3.2.1 needs to be revised to cite Table 19A-2 for a listing of structures, systems, and components (SSCs) that are designated as RTNSS.

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