July 10, 2017

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 NUMBER 13 RELATED TO CHAPTER 6 FOR GE-HITACHI NUCLEAR ENERGY ADVANCED BOILING-WATER REACTOR DESIGN CERTIFICATION RULE RENEWAL APPLICATION

Dear Mr. Head:

By letter dated December 7, 2010, GE Hitachi Nuclear Energy submitted for approval an application to renew the Advanced Boiling-Water Reactor design certification rule pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." 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 whether to grant the renewal application.

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. You are requested to respond within 45 days of the date of this letter.

If changes are needed to the design control document, the staff requests that the RAI response include the proposed wording changes. If you have any questions or comments concerning this matter, I can be reached at 301-415-4093 or by e-mail at adrian.muniz@nrc.gov.

Sincerely,

/RA/

Adrian Muñiz, Project Manager
Licensing Branch 3
Division of New Reactor Licensing
Office of New Reactors

Docket No.: 052-45

eRAI Tracking No. 8799

Enclosure: Request for Additional Information

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NUMBER 13 RELATED TO CHAPTER 6 FOR GE-HITACHI NUCLEAR ENERGY ADVANCED BOILING-WATER REACTOR DESIGN CERTIFICATION RULE RENEWAL APPLICATION DATED July 10, 2017

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***Approval captured electronically in the electronic RAI system. **via e-mail**

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Request for Additional Information 13
Application Title: GEH ABWR DC Renewal
Operating Company: GEH
Docket No. 52-045
Review Section: 06.03 - Emergency Core Cooling System

QUESTIONS:

06.03-4

General Design Criteria (GDC) 35, "Emergency Core Cooling," states, in part, that the emergency core cooling system (ECCS) safety function shall be to transfer heat from the reactor core following any loss of reactor coolant.

Appendix A, Tables A-4 through A-8 in NEDO-33878 (Public), Revision 1, dated May 2017, describe various ECCS flow paths that are credited during post-loss-of-coolant accident (LOCA) operation for the Advanced Boiling Water Reactor (ABWR) design. In the column titled Debris Ingestion Model, the applicant states that material will tend to settle out in low flow areas in piping. To support a finding under GDC-35, the applicant is requested to provide additional information to support its assessment that the settling of material in low flow areas in piping will not have adverse effects on system/component operation during the mission time. For example, the applicant is requested to address the quantity and type of material that will settle, locations where it will settle, and its impact on the performance of components in the applicable systems. Revise the design control document (DCD) or NEDO-33878P as applicable.

06.03-5

GDC 35 states, in part, that the ECCS safety function shall be to transfer heat from the reactor core following any loss of reactor coolant.

Appendix A, Tables A-4 through A-8 in NEDO-33878 (Public), Revision 1, dated May 2017, describe debris settling in instrument lines during post-LOCA operation for the ABWR design. In the column titled "Fluid Velocity through Component," the applicant states it is assumed that settling (instrument sensing lines/components) will occur when the flow velocity is less than the settling velocity for the debris type. The NRC staff evaluated debris settling in instrument lines as part of the review of the Pressurized Water Reactor Owner's Group topical report WCAP-16406-P, Revision 1, "Evaluation of Downstream Sump Debris Effects in Support of GSI-191". Section 3.2.18, "Basis for Settling Velocity Multiplier for Bottom Mounted Instrument Lines" of the NRC staff safety evaluation for WCAP-16406P (Agencywide Documents Access and Management System Accession No. ML073520295) describes a settling velocity multiplier of seven to determine that entrained debris will not settle in bottom mounted instrument lines. A bottom mounted instrument line is defined as a line installed below the pipe horizontal plane. The NRC staff safety evaluation concludes that there is no settling of debris in an instrument line installed above the horizontal plane. To support a finding under GDC-35, the applicant is requested to provide additional information to describe whether any instrument lines are installed below the horizontal. If instrument lines are installed below the horizontal, the applicant is requested to describe the settling velocity multiplier used to determine that entrained debris will not settle in bottom mounted instrument lines.

Revise the DCD or NEDO-33878 as applicable.

06.03-6

GDC 35 states, in part, that the ECCS safety function shall be to transfer heat from the reactor core following any loss of reactor coolant.

Appendix A, Tables A-4 through A-8 in in NEDO-33878 (Public), Revision 1, dated May 2017, describe the effect of post-LOCA debris on the residual heat removal (RHR), high-pressure core flooder (HPCF), and reactor core isolation coolant (RCIC) pumps during post-LOCA operation and concludes that the pumps will operate during post-LOCA conditions. For testing of safety-related pumps, ABWR DCD, Revision 6, Section 3.9.6.1 specifies the design conditions under which pumps will be required to function. However, the ABWR DCD, Section 3.9.6.1 does not specifically address post-LOCA debris conditions under which pumps will be required to function. Therefore, the staff requests the applicant to address design and qualification requirements for the pumps during post-LOCA operation in Section 3.9.6.1 of the DCD. One acceptable method to demonstrate that a pump (including mechanical seal) can perform its specified function under all design basis conditions including post-LOCA debris conditions is ASME Standard QME-1-2007 as endorsed by RG 1.100, Rev. 3 “Seismic Qualification of Electric and Mechanical Equipment for Nuclear Power Plants.” Revise the DCD as applicable.

06.03-7

GDC 35 states, in part, that the ECCS safety function shall be to transfer heat from the reactor core following any loss of reactor coolant.

Appendix A, Tables A-4 through A8 in NEDO-33878 (Public), Revision 1, dated May 2017, describe the effect of post-LOCA debris on the operation of the RHR heat exchangers. In the column titled Debris Ingestion Model, the applicant states the following:

The RHR heat exchanger tube ID is 17.22 mm. The ECCS strainer will restrict debris to less than 3.18 mm. Therefore, the RHR heat exchanger will not become clogged from debris passing downstream of the ECCS suction strainer.

However, the Auxiliary Equipment Evaluation column states that flow from the suppression pool is channeled through the shell side of the RHR heat exchangers and concludes that the heat exchangers will operate as designed during post-LOCA operation. To support a finding under GDC-35, the NRC staff requests the applicant to provide the following information and to specify vendor evaluation of the heat exchanger during the procurement process:

a. Describe the type, amount, and size of post-LOCA debris (if any) expected to pass through the RHR heat exchanger tubes.

b. For the shell side of the heat exchanger, the applicant is requested to specify that heat exchanger plugging, fouling, wear, and heat transfer performance during post-LOCA debris conditions (as specified in NEDO-33878) for the 100 day mission time is evaluated by the vendor during the procurement process and a certificate of compliance is provided to verify that the heat exchanger meets the design/procurement specifications.

Revise the DCD as applicable.

06.03-8

GDC 35 states, in part, that the ECCS safety function shall be to transfer heat from the reactor core following any loss of reactor coolant.

Appendix A, Tables A-4 through A8 in NEDO-33878 (Public), Revision 1, dated May 2017, describe the effect of post-LOCA debris on components and the applicant states that system wear for the mission time of 100 day is insignificant. To support a finding under GDC-35, the applicant is requested to provide the basis for stating that component wear for 100 days is insignificant. For example, describe wear rate evaluations performed for the individual components during the 100 days mission time and the determination that the final system flow rates are acceptable for post-LOCA operation. Revise the DCD or NEDO-33878 as applicable.

06.03-9

GDC 35 states, in part, that the ECCS safety function shall be to transfer heat from the reactor core following any loss of reactor coolant.

RG 1.82 revision 4 states downstream blockage is a concern for tight-clearance valves. The applicant does not address blockage due to valves that are not in the fully open position. To support a finding under GDC-35, the applicant is requested to provide the basis for determing that blockage is not a concern for tight-clearance valves (such as throttle and check valves) that are not in the fully open position during post-LOCA operation. Revise the DCD or NEDO-33878P as applicable.