

September 25, 2014

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 2  
RELATED TO CHAPTERS 1, 2, AND 12 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. 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 30 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](mailto: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 Nos. 7653, 7668 and 7583

Enclosure: Request for Additional Information

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**ADAMS Accession No.: ML14267A352**

**NRO-002**

<b>OFFICE</b>	DSRA/BPFP	DSRA/BPFP/BC	DSEA/RHM1	DSEA/RHM1/BC
<b>NAME</b>	RHernandez	ADias	BHarvey	CCook
<b>DATE</b>	8/14/14*	8/19/14*	9/10/14*	9/15/14*
<b>OFFICE</b>	DSEA/RPAC	DSEA/RPAC/BC	DNRL/LB3/LA	LPM:DNRL/LB3
<b>NAME</b>	EStutzcage	McCoppin	SGreen	AMuniz
<b>DATE</b>	8/13/14*	8/13/14*	9/24/14	9/25/14

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

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**Request for Additional Information 2**  
**Issue Date: 09/23/2014**  
**Application Title: GEH ABWR DC Renewal**  
**Operating Company: GEH**  
**Docket No. 52-045**  
**Review Section: 01.05 - Other Regulatory Considerations**

QUESTIONS

**01.05-1**

On March 12, 2012, the Commission issued an Order to licensees and holders of construction permits in active or deferred status requiring provisions for reliable spent fuel pool (SFP) instrumentation (EA-12-051). This Order stated that the SFP level instrumentation at U.S. nuclear power plants is typically narrow range and, therefore, only capable of monitoring normal and slightly off-normal conditions. The Order also stated that, although the likelihood of a catastrophic event affecting nuclear power plants and the associated SFPs in the U.S. remains very low, beyond design-basis external events could challenge the ability of existing instrumentation to provide emergency responders with reliable information on the condition of SFPs. Reliable and available indication is essential to ensure plant personnel can effectively prioritize emergency actions. The Commission determined that the SFP instrumentation required by the Order represents a significant enhancement to the protection of public health and safety and is an appropriate response to the insights from the Fukushima Dai ichi accident. The Commission stated that while this consideration is qualitative in nature, the Commission has long taken the position that the determination as to whether proposed backfits represent a substantial safety improvement may be qualitative in nature. The Commission decided to administratively exempt this Order from the Backfit Rule and the issue finality requirements in 10 CFR 52.63 and 10 CFR Part 52, Appendix D, paragraph VIII. These backfit and issue finality requirements are similar to the provisions in 10 CFR 52.59(b). In addition, the Commission's determination that the requirements of the Order represent a significant enhancement to the protection of the public health and safety and are an appropriate response to the insights from the Fukushima Dai-ichi accident apply to the ABWR design. Therefore, the Commission's technical basis for administratively exempting itself from the Backfit Rule and the issue finality requirements in 10 CFR 52.63 and 10 CFR Part 52, Appendix D, paragraph VIII, also applies to the ABWR DC renewal application.

In SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami" dated February 17, 2012 (ADAMS Accession No. ML12039A103), the Commission was informed of the NRC staff plans to assure that the Commission-approved Fukushima actions are addressed in design certifications prior to certification. This represents the NRC staff's policy of ensuring that design certifications under review address the design-related aspects of Commission-approved Fukushima actions. On March 9, 2012, the Commission approved (with certain modifications), the recommendations of SECY-12-0025 as documented in the SRM on SECY-12-0025 (ADAMS Accession No. ML120690347).

Therefore, consistent with SECY-12-0025 and the Commission's basis for issuing Order EA-12-051, the staff requests GEH to address the design-related aspects of Fukushima Recommendation 7.1 regarding enhanced spent fuel instrumentation as outlined in Attachment 2 of the Order.

**Request for Additional Information 2**  
**Issue Date: 09/23/2014**  
**Application Title: GEH ABWR DC Renewal**  
**Operating Company: GEH**  
**Docket No. 52-045**  
**Review Section: 02 - Site Characteristics and Site Parameters**

QUESTIONS

**02-1**

Nuclear plants must be designed so that they remain in a safe condition under extreme meteorological events, including those that could result in the most extreme wind events (tornadoes and hurricanes) that could reasonably be predicted to occur.

10 CFR Part 50, Appendix A, General Design Criteria (GDC) 2, "Design bases for protection against natural phenomena," (1997) requires SSCs important to safety to be designed to withstand the effects of natural phenomena such as tornadoes and hurricanes without loss of capability to perform their safety function. GDC 4, "Environmental and dynamic effects design bases," (1997) requires SSCs important to safety to be appropriately protected against the effects of missiles that may result from events and conditions outside the nuclear power unit. The regulations concerning the content of a DC application (Subpart B to 10 CFR Part 52) state that DC applications must include the site parameters postulated for the design and an analysis and evaluation of the design in terms of those site parameters (10 CFR 52.47(a)(1)) (1997).

Prior to 2007, the general engineering assumption was that tornado phenomena controlled design with respect to wind loads and wind generated missiles and that tornadoes bounded hurricane wind loads and hurricane missiles. Revision 1 to Regulatory Guide (RG) 1.76, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants," which was released in March 2007, resulted in a decrease in tornado wind speeds due to the adoption of the Enhanced Fujita scale for classifying tornado intensity. Since design-basis tornado wind speeds were decreased as a result of the analysis performed to update RG 1.76, it was no longer clear that the revised tornado design-basis wind speed would bound design-basis hurricane wind speeds in all areas of the United States. This prompted an investigation into extreme wind gusts during hurricanes and their relations to design-basis hurricane wind and missiles, which resulted in the issuance of RG 1.221, "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants," in October 2011. The study of extreme wind gusts during hurricanes concluded that it is possible that the wind speeds from the design-basis tornado may not be bounding for certain locations along the United States Gulf Coast and the southern Atlantic Coast. The study of missile speeds during hurricanes concluded that, because of assumed differences between the tornado and hurricane wind fields, airborne missiles can fly faster in a hurricane wind field having the same 3-second gust wind speed at 10 meters (33 feet) above ground as a tornado wind field. Missiles in a hurricane wind field may have higher maximum velocities than in a tornado wind field because hurricane missiles are subject to high wind speeds throughout their trajectory. Additional information on the Staff's review of DC renewal applications with respect to hurricane wind and hurricane missile site parameters can be found in the final interim staff guidance (ISG), DC/COL-ISG-024, "Implementation of

Regulatory Guide 1.221 on Design-Basis Hurricane and Hurricane Missiles,” issued May 2013 (ADAMS Accession No. ML13015A693).

If a nuclear power plant using the ABWR certified design is located at a site where the hurricane loads and/or the hurricane-generated missile spectra are not bounded by tornado loads and tornado missile spectra, then safety-related structures may not be able to withstand hurricane loads and hurricane-generated missiles as required. Therefore, the nuclear power plant would not be in compliance with GDC 2 and GDC 4, and adequate protection to public health and safety against hurricanes of credible intensity would not be demonstrated.

Therefore, in accordance with 10 CFR 52.59(a) and (b) (2014); 10 CFR 52.47(a)(1) (1997); and 10 CFR Part 50, Appendix A, GDC 2 and GDC 4 (1997):

- 1) Add hurricane wind speed (e.g., 3-second gust at 10 m above ground in open terrain) and hurricane missile spectra (including missile dimensions, mass, and velocity) to the list of site parameter values presented in Tier 1, Section 5.0, and Tier 2, Section 2.0 of the GE-Hitachi ABWR Design Control Document.
- 2) Revise and provide markups of affected sections of the GE-Hitachi ABWR Design Control Document to show how structures, systems, and components important to safety are protected from the effects of hurricane winds and missiles.

**Request for Additional Information 2**  
**Issue Date: 09/23/2014**  
**Application Title: GEH ABWR DC Renewal**  
**Operating Company: GEH**  
**Docket No. 52-045**  
**Review Section: 12.02 - Radiation Sources**  
**Application Section: 12.2 and 12.3-12.4**

QUESTIONS

**12.02-1**

10 CFR 52.57(a) requires that an application for design certification renewal contain all information necessary to bring up to date the information and data contained in the previous application. The NRC staff views this requirement as including the correction of known errors. 10 CFR 52.59(a) also requires, in pertinent part, a finding of compliance with the regulations in effect at the time of original certification in order to issue a renewed design certification. As required by the regulations in effect at the time the ABWR DC was originally issued, the ABWR DC application must contain "[t]he technical information which is required of applicants for construction permits and operating licenses by 10 CFR part 20, part 50 and its appendices, and parts 73 and 100, and which is technically relevant to the design and not site-specific." 10 CFR 52.47(a)(1)(i). In 1997, operating license Final Safety Analysis Reports (FSARs) were required by 10 CFR 50.34(b)(3) to include "[t]he kinds and quantities of radioactive materials expected to be produced in the operation and the means for controlling and limiting radioactive effluents and radiation exposure within the limits set forth in part 20 of this chapter."

GEH ABWR DCD, Tier 2, Table 12.2-3b "Gamma Ray Source Energy Spectra – Post Operation Gamma Sources in the Core" and Table 12.2-3c "Gamma Ray Source Energy Spectra – Gamma Ray Sources External to the Core During Operation," contain errors. The source terms in both of these tables are approximately a million times lower than comparable source term tables in currently operating BWRs and in the comparable Economic Simplified Boiling-Water Reactor (ESBWR) DC application. The NRC staff also notes that the text in GEH ABWR DCD, Tier 2, Sections 12.2.1.2.1.1.4 and 12.2.1.2.8 associated with the aforementioned tables contains different units than the units provided in the tables. (For example, Table 12.2-3b uses units of pJ/W.s, but Section 12.2.1.2.1.1.4 indicates that the gamma ray energy spectrum is provided in J/s/W, which also does not appear appropriate for Table 12.2-3b).

Correct source term information is necessary to ensure compliance with 10 CFR 20.1101, 10 CFR 20.1201, 10 CFR 20.1601, and 10 CFR 20.1602 (1997). If the incorrect source term information in GEH ABWR DCD Tables 12.2-3b and 12.2-3c were to be used during plant design, significant design errors in the plant shield design could result. This could lead to an underestimation of area dose rates and higher worker doses could result. In this case, compliance with 10 CFR Part 20 would not be ensured because the potential design errors could result in a facility that is not designed in accordance with the principles of as low as is reasonably achievable (ALARA) (10 CFR 20.1101) and could also potentially result in workers receiving doses in excess of the worker dose limits (10 CFR 20.1201). Furthermore, if the

incorrect source term information provided in the tables was utilized, potential high and very high radiation areas may not be properly identified (10 CFR 20.1601 and 10 CFR 20.1602).

Therefore, in accordance with 10 CFR 52.57 and 10 CFR 52.59 (2014), and 10 CFR 52.47(a)(1)(i), 10 CFR 50.34(b)(3), and 10 CFR Part 20 (1997):

- 1) Correct the core source term data in Tables 12.2-3b and 12.2-3c and provide calculations or other documentation demonstrating the accuracy of the revised source terms.
- 2) Update the text in Chapter 12, as appropriate, to ensure that units used in referencing Tables 12.2-3b and 12.2-3c are accurate.
- 3) Ensure that the errors in the aforementioned tables did not result in any other errors or inaccuracies in any other areas of the DCD, including but not limited to, facility design, shielding design (including the shielding design of the fuel transfer tube), radiation zoning, dose assessment, and equipment qualification. If any additional errors are identified, correct them. Please provide justification for your response.

### **12.02-2**

10 CFR 52.59(a) requires, in pertinent part, a finding of compliance with the regulations in effect at the time of original certification in order to issue a renewed design certification. As required by the regulations in effect at the time the ABWR DC was originally issued, the ABWR DC application must contain [t]he technical information which is required of applicants for construction permits and operating licenses by 10 CFR part 20, part 50 and its appendices, and parts 73 and 100, and which is technically relevant to the design and not site-specific." 10 CFR 52.47(a)(1)(i). In 1997, operating license FSARs were required by 10 CFR 50.34(b)(3) (1997) to include "[t]he kinds and quantities of radioactive materials expected to be produced in the operation and the means for controlling and limiting radioactive effluents and radiation exposure within the limits set forth in part 20 of this chapter."

10 CFR 20.1101(b) (1997) requires that the licensee use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to member of the public that are as low as is reasonably achievable.

The GEH ABWR DCD Section 9.2.9.2 indicates that water can be sent to the condensate storage tank (CST) from several sources that could potentially be contaminated, including the control rod drive system and the radwaste disposal system. However, the DCD does not contain any source term information for the CST nor does it describe any controls to limit effluent releases or radiation exposure from the CST during normal operations or anticipated operational occurrences, as required by 10 CFR 50.34(b)(3) and 10 CFR 20.1101(b).

Therefore, in order to ensure compliance with 10 CFR 52.59 (2014) and 10 CFR 52.47(a)(1)(i), 10 CFR 50.34(b)(3), and 10 CFR 20.1101(b) (1997):

- 1) Update Chapter 12 of the GEH ABWR DCD to provide source term information (including source geometry) and shielding information for the CST.
- 2) Update Chapters 11 and 12 of the GEH ABWR DCD, as appropriate, to describe any procedures or engineering controls used to control radioactive effluents and radiation

exposure from the CST, such as provisions to prevent CST overflow or design features to contain radioactive material if a leak or overflow were to occur.

3) Update Chapters 11 and 12 of the GEH ABWR DCD, as appropriate, to describe the locations, functions, and design features of piping routed to and from the CST in order to ensure that radioactive effluents and radiation exposure is being adequately controlled. Include any design features to detect or prevent leakage from outdoor pipes in order to ensure control of effluent releases from the site.

4) Update the Chapter 12 radiation zone drawings of the GEH ABWR DCD, to include the location of the CST, including radiation zoning for the CST.

### **12.02-3**

10 CFR 52.57(a) requires that an application for design certification renewal contain all information necessary to bring up to date the information and data contained in the previous application. The NRC staff views this requirement as including the correction of known errors. 10 CFR 52.59(a) also requires, in pertinent part, a finding of compliance with the regulations in effect at the time of original certification in order to issue a renewed design certification. 10 CFR 20.1301(d)(1997) requires that the applicant comply with the standards in 40 CFR Part 190. GEH ABWR DCD Tier 2, Section 12.2.2.4 states, "For complete evaluations for compliance to 40 CFR Part 190, gamma shine evaluations are not contained in this document, since adequate detail for skyshine evaluations from the turbine complex are required in DAC Table 3.2." However, in reviewing Tier 1, Table 3.2, all of the items in Table 3.2 are designated as "Acceptance Criteria", including Table 3.2a, item 4, which is the item in Table 3.2 associated with 40 CFR 190 compliance, instead of "Design Acceptance Criteria". Other DAC in the GEH ABWR DCD specifically include the designation, "Design Acceptance Criteria" in order to differentiate DAC from other types of ITAAC. Please change the designation of Table 3.2a Item 4 to correct this discrepancy.