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Subject: **GEH Proposed Resolution of Item # 18a - Seismic/Structural Analysis for Reactor Core of NRC Suggested U.S. Advanced Boiling Water Reactor Design Changes**

References:

1. Letter from R.E. Kingston, GEH to USNRC, Subject: ABWR Standard Plant Design Certification Renewal Application Design Control Document, Revision 5, Tier 1 and Tier 2, December 7, 2010.
2. Letter from USNRC to Jerald G. Head, GEH, Subject: GE-Hitachi Nuclear Energy – United States Advanced Boiling-Water Reactor Design Certification Renewal Application, July 20, 2012.
3. Letter from Jerald G. Head, GEH, to USNRC, Subject: Response to NRC Letter: GE Hitachi Nuclear Energy – United States Advanced Boiling-Water Reactor Design Certification Renewal Application (July 20, 2012), September 17, 2012.

GEH submitted a Design Certification Renewal application for the U.S. Advanced Boiling Water Reactor (ABWR) in Reference 1 pursuant to the requirements of Subpart B, "Standard Design Certifications," of Title 10 of the Code of Federal Regulations (10 CFR) Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."

In Reference 2, the NRC suggested design changes to address issues that the agency considered to be regulatory improvements or changes that could meet the 10 CFR 52.59(b) criteria. In addition, the NRC requested that GEH implement the Fukushima Near-Term Task Force recommendations contained 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. Collectively, these items are termed the "28-item backfit list".

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In Reference 3, GEH responded to Reference 2 and committed to address the "28-item backfit list".

In public and private meetings the that NRC held with GEH on May 7th, 2015, GEH reviewed the closure plan for the "28-item backfit list" for those items that GEH would not receive any additional Requests for Additional Information. During that meeting, Item #18a of the "28-item backfit list" was discussed. GEH has reviewed our closure plan for item #18a and has taken the staff's feedback into consideration.

Please find GEH's proposed resolution to Item #18a of the "28-item backfit list" transmitted in Reference 2. Enclosure 1 contains the complete response, while Enclosure 2 contains the Design Control Document markups associated with this response.

If you have any questions concerning this letter, please contact Hugh Upton at 408-314-8499.

I declare under penalty of perjury that the foregoing information is true and correct to the best of my knowledge, information, and belief.

Sincerely,



Jerald G. Head
Senior Vice President, Regulatory Affairs

Commitments: No additional commitments are made in this response.

Enclosures:

1. GEH Response to Item #18a - Seismic/Structural Analysis for Reactor Core
2. GEH Response to Item #18a - Seismic/Structural Analysis for Reactor Core - ABWR DCD DRAFT Revision 6 Markups

cc: Adrian Muniz, NRC
David Sledzik, GEH
Peter Yandow, GEH
Patricia Campbell, GEH
Shailesh R. Sheth, GEH
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Enclosure 1

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**GEH Response to Item #18a - Seismic/Structural Analysis for
Reactor Core**

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NRC Suggested Design Change Item #18a – Seismic/Structural for Reactor Core

Seismic/Structural Analysis:

- (a) *Provide analysis of reactor core combined seismic and LOCA loading to demonstrate conformance to the structural acceptance requirements described in Appendix A of SRP Section 4.2 (DCD Tier-2, 4.2.3.1.2 (1)).*

GEH's Response:

In (Reference 1), the NRC requests an analysis of the reactor core combined seismic and LOCA loading to demonstrate conformance to the structural acceptance requirements described in Appendix A of SRP Section 4.2. The ABWR Design Control Document (DCD) references the SSAR, Appendix 4D, "Reference Fuel Design Compliance with Acceptance Criteria," which references the NRC approval of NEDE-24011-P, Amendment 7 to Revision 6, "General Electric Standard Application for Reactor Fuel," U.S. NRC, March 1, 1985 (Reference 4D-4). In the NRC Safety Evaluation documented in this referenced NRC approval, the NRC states the following:

"The entire seismic-and-LOCA loads evaluation (including design limits) has been described by GE in the approved topical report NEDE-21175-3 to which GESTAR II makes reference. We conclude that the criteria for fuel assembly structural damage from external forces in NEDE-21175-3 are acceptable for GESTAR II."

The NRC concluded in the ABWR FSER, Section 4.1, that "these elements of the core design [for the first cycle and for the system response analysis] meet criteria approved by the Nuclear Regulatory Commission (NRC) as presented in SSAR Appendices 4B, 4C, and 4D."

Following this same basis in later fuel designs, current GNF production fuel assemblies are designed to be capable of withstanding seismic and LOCA loading using a fuel acceleration profile that is bounding for most BWR plants. It is expected that this profile will also bound the fuel accelerations at a future ABWR U.S. site. Once a COL applicant selects an ABWR and a specific site is identified, the site-specific ground motion will be known and a plant-specific reactor core combined seismic and LOCA loading analysis will be performed to determine whether the new fuel load acceleration profile is bounded by the standard design or if additional analyses or design changes are necessary. This plant-specific analysis is required by the ABWR DCD, Section 4.2.3.1.2(1)² (Reference 2) which states:

- (1) *[The license/applicant must provide a plant-specific analysis of combined seismic and LOCA loading using NRC-approved methodology or another acceptable method to demonstrate conformance to the structural acceptance requirements described in Appendix A of Standard Review Plan Section 4.2...]*

Item (1), above, is Tier 2* material and cannot be changed without prior NRC approval. This ensures that as a condition for licensing, for the reference fuel design (GEH P8x8R design) or a different fuel design addressed in the COL application, an applicant will provide to the NRC an analysis of reactor core combined seismic and LOCA loading to demonstrate conformance to the structural acceptance requirements described in Appendix A of SRP Section 4.2.

NUREG – 1503³ (Reference 3), the FSER Related to the Certification of the Advanced Boiling Water Reactor Design concluded:

“The specific fuel, control rod, and core designs presented in SSAR Chapter 4 will constitute ... an approved design that may be used for the COL first cycle core loading, without further NRC staff review. If any other design is requested for the first cycle, the COL applicant for an ABWR will be required to submit for staff review that specific fuel, control rod, and core design analysis and corresponding safety analysis described in SSAR Chapters 6 and 15.”

Based on the conclusions of NUREG-1503, GEH believes that the DCD need not be revised at this time and that the requirements of SRP 4.2, Appendix A, are directly satisfied by the requirement in ABWR DCD Tier 2, Chapter 4, Section 4.2.3.1.2(1).

However, in order to ensure clarity in the ABWR DCD concerning the COL applicant's responsibility to perform an analysis of reactor core combined seismic and LOCA loading to demonstrate conformance to the structural acceptance requirements described in Appendix A of SRP Section 4.2, GEH will add the following COL Information Item to Section 4.2.5, “COL License Information,” as shown on the attached markups:

“4.2.5.1 - Reactor Core Seismic and LOCA Structural Acceptance

The COL applicant shall provide the NRC a confirmatory plant-specific analysis of the reactor core combined seismic and LOCA loading using NRC-approved methodology or another acceptable method to demonstrate conformance to the structural acceptance requirements described in Appendix A of Standard Review Plan, Section 4.2, for the fuel referenced in the COL application. This analysis will use as input the site-specific ground motion and the fuel characteristics of the plant's initial core load.”

References:

1. Letter from USNRC to Jerald G. Head, GEH, Subject: GE-Hitachi Nuclear Energy – United States Advanced Boiling-Water Reactor Design Certification Renewal Application, July 20, 2012 (ML12125A385)
2. ABWR Design Control Document, Rev 5 (25A5675AF), Chapter 4, Section 4.2.3.1.2, pg. 4.2-6 (ML110040270),
3. NUREG-1503, “Final Safety Evaluation Report [FSER] Related to Certification of the Advanced Boiling Water Reactor Design” July 13, 1994 (ML080670560).

Impact on the DCD

The ABWR DCD, Tier 2, Subsection 4.2.5 and Table 1.9-1 will be revised as a result of GEH's response to Item #18a. The ABWR DCD Revision 5 marked up pages are provided in Enclosure 2.

Enclosure 2

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GEH Response to Item #18a - Seismic/Structural Analysis for Reactor Core

ABWR DCD DRAFT Revision 6 Markups

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**Table 1.9-1 Summary of ABWR Standard Plant
COL License Information (Continued)**

Item No.	Subject	Subsection
3.28	ASME Class 2 or 3 Quality Group Components with 60-Year Design Life	3.9.7.2
3.29	Pump and Valve Testing Program	3.9.7.3
3.30	Audits of Design Specifications and Design Reports	3.9.7.4
3.31	Not Used	3.9.7.5
3.32	Not Used	3.9.7.6
3.33	Not Used	3.9.7.7
3.34	Not Used	3.9.7.8
3.35	Not Used	3.9.7.9
3.36	Not Used	3.9.7.10
3.37	Equipment Qualification	3.10.5.1
3.38	Dynamic Qualification Report	3.10.5.2
3.39	Qualification by Experience	3.10.5.3
3.40	Environmental Qualification Document (EQD)	3.11.6.1
3.41	Environmental Qualification Records	3.11.6.2
3.42	Surveillance, Maintenance, and Experience Information	3.11.6.3
3.43	Radiation Environment Conditions	3I.3.3.1
4.1	4.1a Reactor Core Seismic and LOCA Structural Acceptance	4.2.5.1
4.2	Power/Flow Operating Map	4.4.7.1
4.3	Thermal Limits	4.4.7.2
4.4	CRD Inspection Program	4.5.3.1
4.5	CRD and FMCRD Installation and Verification During Maintenance	4.6.6.1
5.1	Conversion of Indicators	5.2.6.1
5.2	Plant Specific ISI/PSI	5.2.6.2
5.3	Reactor Vessel Water Level Instrumentation	5.2.6.3
5.4	Fracture Toughness Data	5.3.4.1
5.5	Materials and Surveillance Capsule	5.3.4.2
5.6	Plant Specific Pressure-Temperature Information	5.3.4.3
5.7	Testing of Mainsteam Isolation Valves	5.4.15.1
5.8	Analyses of 8-hour RCIC Capability	5.4.15.2
5.9	ACIWA Flow Reduction	5.4.15.3

4.2.3.2 Control Rods

4.2.3.2.1 Evaluation Results

The control rod evaluations described in Section 4C.3 have been completed for the reference control rod. The evaluations demonstrate that the criteria of Appendix 4C are satisfied for the reference B₄C control rod.

4.2.4 Testing, Inspection, and Surveillance Plans

GEH has an active program of surveillance of fuel, both production and developmental. [*The NRC has reviewed the GEH program and approved it in Reference 4.2-3.*]*

4.2.56 References

4.2.5 COL License Information

4.2.5.1 - Reactor Core Seismic and LOCA Structural Acceptance

The COL applicant shall provide the NRC a confirmatory plant-specific analysis of the reactor core combined seismic and LOCA loading using NRC-approved methodology or another acceptable method to demonstrate conformance to the structural acceptance requirements described in Appendix A of Standard Review Plan Section 4.2 for the fuel referenced in the COL application. This analysis will use as input the site-specific ground motion and the fuel characteristics of the plant's initial core load.

4.2-3 [Letter, L. S. Rubenstein (NRC) to R. L. Gridley (GE), "Acceptance of GE Propo Fuel Surveillance Program", June 27, 1984.]

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