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MFN 07-462
Supplement 2

Docket No. 52-010

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U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Subject: **Response to Portion of NRC Request for Additional Information Letter No. 198 Related to ESBWR Design Certification Application – Site Characteristics – RAI Number 3.0-1 S02**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by NRC letter No. 198 (Reference 1) dated May 9, 2008. GEH response to RAI Number 3.0-1 S02 is addressed in Enclosure 1. The DCD Markup related to this response is also provided.

The original RAI 3.0-1 was received from the NRC on January 31, 2007 (Reference 3), and the GEH response was transmitted to the NRC on August 23, 2007 (Reference 2). GEH response to RAI 3.0-1 S01 was submitted November 21, 2007 (Reference 4) in response to an e-mail received from the NRC on July 10, 2007 (Reference 5).

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 5.

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LRO

If you have any questions or require additional information, please contact me.

Sincerely,

James C. Kinsey
Vice President, ESBWR Licensing

References:

1. MFN 08-471, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 198 Related to the ESBWR Design Certification Application* dated May 9, 2008

2. MFN 07-462, *Response to Portion of NRC Request for Additional Information Letter No. 93 – Classification of Structures, Systems and Components - RAI Number 3.0-1* dated August 23, 2007

3. MFN 07-106, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 93 Related to the ESBWR Design Certification Application* dated January 31, 2007

4. MFN 07-462 Supplement 1, *Response to Portion of NRC Request for Additional Information Letter No. 93 Related to ESBWR Design Certification Application – Classification of Structures, Systems and Components – RAI Number 3.0-1 S01* dated November 21, 2007

5. Email from NRC (Chandu Patel) dated July 10, 2007

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 198 Related to ESBWR Design Certification Application - RAI Number 3.0-1 S02

cc:	AE Cubbage	USNRC (with enclosure)
	RE Brown	GEH/Wilmington (with enclosure)
	DH Hinds	GEH/Wilmington (with enclosure)
	GB Stramback	GEH/San Jose (with enclosure)
	eDRF	0000-0070-1548, Revision 4

Enclosure 1

MFN 07-462
Supplement 2

Response to Portion of NRC Request for

Additional Information Letter No. 198

Related to ESBWR Design Certification Application

RAI Number 3.0-1 S02 Response

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 5.

For historical purposes, the original text of RAI 3.0-1, 3.0-1 S01 and the GE responses are included. These responses do not include any attachments or DCD mark-ups.

NRC RAI 3.0-1

For mechanical connections secured by threaded fasteners in ASME Code Class 1, 2, and 3 systems, the staff recently developed Standard Review Plan (SRP) Section 3.13, Revision 0, Threaded Fasteners - ASME Code Class 1, 2, and 3, as review guidance.

A. *Provide an outline of the criteria for design, material selection, mechanical testing, and inservice inspection for bolting to ensure compliance with GDCs 1, 4, 14, 30, and 10 CFR 50.55a.*

B. *Identify any control of fabrication practices and/or special processes used to mitigate stress corrosion cracking or other forms of material degradation in the bolting during service.*

C. *Provide a discussion, based on past industry operating experience, that demonstrates how the bolting practices for ESBWR systems/components effectively implements the lessons learned from the numerous failures in high strength bolting in the mid-1960s through 1980s.*

GEH Response

10 CFR 52.47 (a)(1)(i) applies the 10 CFR 50 technical information requirements for construction permits and operating licenses to standard design certifications. 10 CFR 50.34(h) states "Conformance with the Standard Review Plan (SRP). (1)(i) Applications for light water cooled nuclear power plant operating licenses docketed after May 17, 1982 shall include an evaluation of the facility against the Standard Review Plan (SRP) in effect on May 17, 1982 or the SRP revision in effect six months prior to the docket date of the application, whichever is later." The ESBWR was docketed on August 24, 2005, and thus, the SRPs in effect on February 24, 2005 apply to the ESBWR. SRP 3.13 went into effect in March 2007, and, as shown by its absence from Tier 2 Table 1.9- 20, the ESBWR has not voluntarily committed to address the original draft of SRP 3.13. Therefore, SRP 3.13 is not part of the licensing basis for the ESBWR and the ESBWR DCD is not required to address that SRP.

A. Compliance with GDCs 1, 4, 14 and 30, and 10 CFR 50.55a is provided by adherence to the ASME code requirements for threaded fasteners as well as adherence to RG 1.65.

The ASME code requirements which provide the design, material selection, mechanical testing, and inservice inspection for bolting will be added as Tier 2, Subsection 3.9.3.9, as provided in the attached markup.

Compliance with RG 1.65 is provided in DCD Subsection 5.3.1.7.

Specific material selection for bolting within the reactor vessel internals will utilize materials as listed in Table 4.5-1 of the DCD. Bolting materials utilized in other areas of the plant for engineered safety features are outlined in section 6.1.1 and Table 6.1-1 of the DCD.

B. For austenitic stainless steel materials, Mitigation of stress corrosion cracking and other detrimental effects during fabrication is achieved in two ways: (1) Cold-worked bolting material is not permitted; and (2) the contact of detrimental materials with the components under consideration is controlled. Sections 4.5.2.4 and 4.5.2.5 provide requirements placed on these materials for the reactor internals fabrication. For ferritic materials, the ultimate tensile strength and hardness are controlled, as discussed in DCD Subsection 5.3.1.7.

C. No NRC notices addressing high-strength bolting practices and that are applicable to the ESBWR design were found for the period mid 1960s through the 1980s.

For the high strength bolting in the ESBWR, the only significant degradation mechanism of concern is stress corrosion cracking of ferritic steel bolting. As discussed in the responses to (A) and (B) above, the material condition is controlled consistent with the requirements of RG 1.65.

DCD Impact

DCD Tier 2, Section 3.9.3.9 will be added as shown in the attached markup.

NRC RAI 3.0-1 S01

Revised RAI 3.0-1 (RAI Letter No. 93, January 31, 2007):

The NRC's original request in RAI 3.0-1, discussed in RAI Letter 93, requested the following: For mechanical connections secured by threaded fasteners in ASME Code Class 1, 2, and 3 systems, the staff recently developed Standard Review Plan (SRP) Section 3.13, Revision 0, Threaded Fasteners ASME Code Class 1, 2, and 3, as review guidance.

A. *Provide an outline of the criteria for design, material selection, mechanical testing, and inservice inspection for bolting to ensure compliance with GDCs 1, 4, 14, 30, and 10 CFR 50.55a.*

B. *Identify any control of fabrication practices and/or special processes used to mitigate stress corrosion cracking or other forms of material degradation in the bolting during service.*

C. *Provide a discussion, based on past industry operating experience, that demonstrates how the bolting practices for ESBWR systems/components effectively implements the lessons learned from the numerous failures in high strength bolting in the mid 1960s through 1980s.*

In addition to the above, please provide response to the following additional items:

D. *Justify use of lubricants and/or surface treatments in mechanical connections secured by threaded fasteners, and the compatibility of these materials with the threaded fasteners.*

E. *Include reference to Certified Material Test Reports.*

GEH Original Response

Items A, B, and C have been addressed in GE response to RAI 3.0-1.

Item D is addressed in DCD Tier 2, Section 3.9.3.9.2, Revision 4.

Item E is addressed in DCD Tier 2, Section 3.9.3.9.1, Revision 4.

DCD Original Impact

No DCD changes will be made in response to this RAI.

NRC RAI 3.0-1 S02

NRC Summary:

Revise DCD Section 3.9.3.9 to clarify material compatibility

NRC Full Text:

Revise the DCD to state that the threaded fasteners will be selected for compatibility with the materials of the component being joined and the piping system fluids. Also state that the selection process considered deterioration which may occur during service as a result of corrosion, radiation effects, or instability of material. The staff needs this information in order to reach a safety finding in accordance with GDC 4 that the thread fasteners are compatible with service conditions.

GEH Response

The selection of materials for bolting takes into consideration material compatibility with both the joined components and system fluids. Additionally, the selection of material considered potential deterioration due to corrosion, radiation effects, or material stability.

DCD Impact

DCD Tier 2, Section 3.9.3.9 will be revised as noted in the attached markup.

Active component supports are discussed in Subsection 3.9.3.5. The stress limits are per ASME-III, Subsection NF and Appendix F. The supports are evaluated for buckling in accordance with ASME-III.

3.9.3.9 Threaded Fasteners – ASME Code Class 1, 2 and 3

3.9.3.9.1 Material Selection

Material used for threaded fasteners complies with the requirements of ASME ~~Boiler and Pressure Vessel (B&PV)~~ Code Section III NB-2000, NC-2000, ND-2000 or NF-2000 as appropriate. Fracture toughness testing is performed in accordance with ASME B&PV Code Section III NB-2300, NC-2300 or ND-2300, as appropriate. For verification of conformance to the applicable Code requirements, a chemical analysis is required for each heat of material and testing for mechanical properties is required on samples representing each heat of material and, where applicable, each heat treat lot.

The criteria of ASME B&PV Code Section III NB-2200, NC-2200 or ND-2200 rather than the material specification criteria applicable to the mechanical testing shall be applied if there is a conflict between the two sets of criteria. For safety-related threaded fasteners, documentation related to fracture toughness (as applicable) and certified material test reports are provided as part of the ASME Code records that are provided at the time the parts are shipped, and are part of the required records that are maintained at the site.

Threaded fasteners are selected for compatibility with the materials of the component being joined and the piping system fluids. The selection process considers deterioration which may occur during service as a result of corrosion, radiation effects, or instability of material.

3.9.3.9.2 Special Materials Fabrication Processes and Special Controls

The design of threaded fasteners complies with ASME Code Section III NB-3000, NC-3000 or ND-3000, as appropriate. Fabrication of threaded fasteners complies with ASME Code Section III NB-4000, NC-4000 or ND-4000, as appropriate. Inspection of threaded fasteners complies with ASME Code Section III NB-2500, NC-2500 or ND-2500, as applicable.

Lubricants with deliberately added halogens, sulfur, or lead are not used for any ~~reactor coolant pressure boundary~~RCPB components or other components in contact with reactor water. Lubricants containing molybdenum sulfide (disulfide or polysulfide) are not to be used for any safety-related application. For ferritic steel threaded fasteners, conversion coatings, such as the Parkerizing process are suitable and may be used. If fasteners are plated, low melting point materials, such as zinc, tin, cadmium, etc., are not used.

3.9.3.9.3 Preservice and Inservice Inspection Requirements

Preservice Inspection (PSI) and ~~Inservice inspection~~ISI is performed in accordance with ASME Code, Section XI. The requirements for pressure retaining Class 1 bolting are addressed as Category B-G-1 for bolting greater than 2 inches in diameter and B-G-2 for bolting with diameters 2 inches and less. The Class 1 pressure retaining bolting sample is limited to the bolting on the heat exchangers, piping, pumps, and valve that are selected for examination in the ISI program.