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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 93 – Classification of Structures, Systems and Components - RAI Number 3.0-1**

Enclosure 1 contains GEH's response to the subject RAI transmitted via Reference 1.

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

Sincerely,

Kathy Sedney for

James C. Kinsey
Project Manager, ESBWR Licensing

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NRO

References:

1. MFN 07-106 – Letter from U.S. Nuclear Regulatory Commission to David H. Hinds, *Request for Additional Information Letter No. 93 Related to ESBWR Design Certification Application, January 31, 2007.*

Enclosure:

1. MFN 07-462, Response to Portion of NRC Request for Additional Information Letter No. 93 RAI Number 3.0-1

cc:	AE Cubbage	USNRC (with enclosures)
	RE Brown	GEH/Wilmington (with enclosures)
	GB Stramback	GEH/San Jose (with enclosures)
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	eDRF	0000-0070-1548

Enclosure 1

MFN 07-462

Response to Portion of NRC Request for Additional Information Letter No. 93 Related to ESBWR Design Certification Application

Threaded Fasteners

RAI Number 3.0-1

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.

GE 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.

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MARKUP

systems. For small bore pipe guides, it could be acceptable to cut the insulation around the support frame, although this must be indicated in the support specification.

(6) Special Engineered Pipe Supports — Shall not be used

3.9.3.7.2 Reactor Pressure Vessel Sliding Supports

The ESBWR RPV sliding supports are sliding supports as defined by section NF-3124 of the Code and are designed as an ASME Code Class 1 component support per the requirements of the Code, Subsection NF. The loading conditions and stress criteria are given in Tables 3.9-1 and 3.9-2, and the calculated stresses shall meet the Code allowable stresses at all locations for various plant operating conditions. The stress level margins assure the adequacy of the RPV sliding supports.

3.9.3.7.3 Reactor Pressure Vessel Stabilizer

The RPV stabilizer is designed as a safety-related linear type component support in accordance with the requirements of ASME Boiler and Pressure Vessel Code Section III, Subsection NF. The stabilizer provides a reaction point near the upper end of the RPV to resist horizontal loads caused by effects such as earthquake, pipe rupture, and RBV. The design loading conditions and stress criteria are given in Table 3.9-2, and the calculated stresses meet the Code allowable stresses in the critical support areas for various plant operating conditions.

3.9.3.7.4 Floor-Mounted Major Equipment

Because the major active valves are supported by piping and not tied to building structures, valve "supports" do not exist (Subsection 3.9.3.7).

The PCC and IC heat exchangers are analyzed to verify the adequacy of their support structure under various plant operating conditions. In all cases, the load stresses in the critical support areas are within ASME Code allowables.

3.9.3.8 Other ASME III Component Supports

The ASME III component supports and their attachments (other than those discussed in the preceding subsection) are designed in accordance with Subsection NF of the Code up to the interface with the building structure. The intermediate building structural steel component supports are designed in accordance with the codes as specified in section 3.8. The loading combinations for the various operating conditions correspond to those used to design the supported component. The component loading combinations are discussed in Subsection 3.9.3.1. 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.

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.

Lubricants with deliberately added halogens, sulfur, or lead are not used for any reactor coolant pressure boundary 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 and Inservice inspection 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 valves that are selected for examination in the ISI program

Category B-G-2 requires visual, VT-1, examination of the selected bolting. For Class 1, 2 and 3 systems, the bolted connections are examined for leakage (VT-2) during the system pressure tests required by ASME Section XI.

3.9.4 Control Rod Drive (CRD) System

This subsection addresses the Control Rod Drive system as discussed in SRP 3.9.4. The Control Rod Drive (CRD) system consists of the control rods and the related mechanical components that provide the means for mechanical movement. As discussed in General Design Criteria 26 and 27, the CRD system provides one of the independent reactivity control systems. The rods and the drive mechanism are capable of reliably controlling reactivity changes either under conditions of anticipated operational occurrences, or under postulated accident conditions. A positive means for inserting the rods is always maintained to ensure appropriate margin for malfunction, such as stuck rods. Because the CRD system is a safety-related system and portions of the CRD system are a part of the reactor coolant pressure boundary (RCPB), the system is designed, fabricated, and tested to quality standards commensurate with the safety functions to be performed. This provides an extremely high probability of accomplishing the safety functions either in the event of anticipated operational occurrences or in withstanding the