



HITACHI

GE Hitachi Nuclear Energy

James C. Kinsey
Vice President, ESBWR Licensing

PO Box 780 M/C A-55
Wilmington, NC 28402-0780
USA

T 910 675 5057
F 910 362 5057
jim.kinsey@ge.com

MFN 08-165

Docket No. 52-010

February 26, 2008

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. 128 Related to ESBWR Design
Certification Application – TMSS and Feedwater System - RAI
Number 10.3-4 S03.**

Enclosure 1 contains GEH's response to the subject RAI transmitted via Reference 1 which is a third supplemental request to the RAI. The second supplemental request was transmitted via Reference 2 for which response was provided in Reference 3. The first supplemental request was transmitted via Reference 4 for which response was provided in Reference 5. The original RAI was transmitted via Reference 6 for which response was provided to the NRC via Reference 7.

Should you have any questions about the information provided here, please contact me.

Sincerely,

James C. Kinsey
Vice President, ESBWR Licensing

DO68
NRO

References:

1. MFN 07-714, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 128 Related to the ESBWR Design Certification Application – TMSS and Feedwater System – RAI 10.3-4 S03*, December 28, 2007.
2. E-mail from NRC dated July 20, 2007.
3. MFN 06-219, Supplement 3, Letter from GE to U.S. Nuclear Regulatory Commission, *Response to Portion of NRC Request for Additional Information Letter No. 36 Related to ESBWR Design Certification Application – TMSS and Feedwater System – RAI Numbers 10.3-4 S02 and 10.3-6 S03*, August 31, 2007.
4. E-mail from NRC dated March 6, 2007.
5. MFN 06-219, Supplement 2, Letter from GE to U.S. Nuclear Regulatory Commission, *Response to Portion of NRC Request for Additional Information Letter No. 36 Related to ESBWR Design Certification Application – Steam and Power Conversion System – RAI Numbers 10.3-4 S01 and 10.3-6 S01*, May 18, 2007.
6. MFN 06-200, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 36 Related to the ESBWR Design Certification Application*, June 22, 2006.
7. MFN 06-219, Letter from GE to U.S. Nuclear Regulatory Commission, *Response to Portion of NRC Request for Additional Information Letter No. 36 Related to ESBWR Design Certification Application – Steam and Power Conversion System and Radioactive Waste Management – RAI Numbers 10.3-1 through 10.3-9 and 11.1-1 through 11.1-3*, July 19, 2006.

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 128 Related to ESBWR Design Certification Application – TMSS and Feedwater System - RAI Number 10.3-4 S03.

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 0000-0081-2972

Enclosure 1

MFN 08-165

**Response to Portion of NRC Request for
Additional Information Letter No. 128
Related to ESBWR Design Certification Application
TMSS and Feedwater System
RAI Number 10.3-4 S03**

For historical purposes, the original texts and the GE responses of RAI 10.3-4, RAI 10.3-4 S01, and RAI 10.3-4 S02 are included. The original attachments and DCD mark-ups are not included to prevent confusion.

NRC RAI 10.3-4

Section 10.3.6 indicates that the steam and feedwater component materials that are within the reactor coolant boundary (RCPB) are addressed in Section 5.2 but the material specifications and grades for the steam and feedwater system components that are outside of the RCPB are not listed in 10.3.6 nor 10.4.7. Please provide a complete list of all material specifications and grades that are used in steam, feedwater and condensate systems by component types including weld filler metal. Specify the Code Class for all portions of both systems.

GE Response

Please refer to DCD Chapter 1, Table 1.7-1 for the material types used in the steam, feedwater and condensate system. Code classifications, if applicable, are listed in Table

3.2-1. Weld filler material, as agreed during our telephone conversation, will not be specified in the DCD/COLA but will be identified in the site construction contractors welding program.

DCD Impact

No Tier 2 change will be made in response to this RAI.

NRC RAI 10.3-4 Supplement 1

*Received from an email dated March 6, 2007 from Marlayna Vaaler (NRC):
Reference: GE response Letter MFN-06-219, dated July 19, 2006, which addressed
NRC RAI Letter No. 36, dated June 22, 2006. [ACN: ML070670050]*

Section 10.3.6 of the DCD indicates that the steam and feedwater component materials that are within the reactor coolant pressure boundary (RCPB) are addressed in Section 5.2. The staff noted that the material specifications and grades for steam and feedwater system components that are outside of the RCPB are not listed in Section 10.3.6 nor Section 10.4.7. In RAI 10.3-4, the staff requested that the applicant list material specifications and grades, including weld filler material, for steam and feedwater components outside of the RCPB.

The applicant's response to RAI 10.3-4, in GE letter MFN 06-219, dated July 19, 2006, is incomplete for the following reasons:

- 1. The response refers the staff to DCD Chapter 1, Table 1.7-1 for material types used in the aforementioned systems. However, Table 1.7-1 does not list material specifications and grades for Class 2 feedwater and main steam components.*
- 2. In response to RAI 10.3-6, the applicant references Section 5.2 and Table 5.2-4. Neither Section 5.2 or Section 10.3.6 state that Class 2 main steam and feedwater specifications are listed in Table 5.2-4.*

The staff requests that the applicant clarify whether the material specifications and grades for Class 2 components are the same as for Class 1 components. If so, modify DCD Section 10.3.6 to provide clarification.

Additionally, clearly identify in Section 10.3.6 the material specifications and grades for Class 2 and Class 3 (if applicable) piping and components (including weld filler material) of steam and feedwater piping systems, rather than making references to other sections of the DCD.

Although the piping and components referred to in Section 10.4.7 of the DCD are non-ASME Code Class 1, 2 or 3, the staff requires that the material specifications be discussed in Section 10.4.7 as part of the applicant's explanation of the steps taken in the ESBWR design to mitigate the effects of material degradation due to erosion/corrosion. See supplemental RAI 10.3-6.

GE Response

Feedwater system materials classified as ASME Section III Class 2 are the same as those specified for Class 1 components. These materials are listed in Table 5.2-4. However, in order to address this specific request, the material specifications and grades for Class 1 and Class 2 piping and components of steam and feedwater piping are to be identified in DCD Tier 2, Revision 4, Subsection 10.3.6 and Table 10.3-2. There is no ASME Section III Class 3/Quality Group C piping in ESBWR steam, feedwater, or condensate system piping.

Refer to the original response in RAI 10.3-4 for the previously agreed upon position on weld filler materials. See the response to RAI 10.3-6 Supplement 1 for information on non-ASME Code Class piping.

DCD Impact

DCD Tier 2 Subsection 10.3.6 and Table 10.3-2 are to be revised in DCD Revision 4 as noted in the attached markup.

NRC RAI 10.3-4 Supplement 2

(a) DCD Tier 2, Section 10.3.6, Revision 3 does not list weld filler material specifications and classifications, and the applicant did not provide this information in its responses to RAIs 10.3-4 and 10.3-4 S01. In order for the staff to complete its review and evaluate the applicant's compliance with 10 CFR 50.55a and General Design Criterion 1, the applicant must provide the staff with a list of the weld filler material specifications and classifications used in Class 2 Main Steam (MS) and Feedwater (FW) Systems.

(b) In a teleconference between the staff and GE on June 7, 2007, to discuss the applicant's response to RAI 10.3-4 S01, the staff informed GE that its reference to fracture toughness requirements in Section 10.3.6 must include all Class 2 MS and FW piping and components. Revision 3 of DCD Tier 2, Section 10.3.6 lists fracture toughness for the TMSS but not for the Class 2 FW System. In order for the staff to complete its review, the staff requests that the applicant modify the DCD to include the fracture toughness requirements for all ASME Code Class 2 piping and components in the MS and FW Systems.

(c) In response to RAI 10.3-4 S01, the applicant indicated that low alloy steel will be used in the Class 2 portion of the FW System. Accordingly, the staff requests that the applicant modify the DCD to indicate if the ESBWR design follows NRC guidance provided in Regulatory Guide (RG) 1.50. The staff notes that the applicant provided a description of its alternative to RG 1.50 for RCPB and ESF materials in responses to RAI 5.2-44 (GE letter MFN 06-260, August 7, 2006 (ML062260103) and RAI 6.1-4 (GE letter MFN 06-365, October 4, 2006 (ML062890039)).

In order for the staff to complete its review of the DCD, the staff requests that the applicant modify the DCD to include any alternatives to RG 1.50 as it relates to all Class 1, 2, and 3 piping and components. In addition, the staff requests that the applicant modify the DCD to include its response to RAI 6.1-4, in which it states that the ASME Boiler and Pressure Vessel (B&PV) Code, Section III, Appendix D, Article D-1000, minimum preheat recommendations will be applied to all ASME Code, Section III, Class 1, 2, and 3 carbon steel and low alloy steel components in the ESBWR design. The two aforementioned requested DCD modifications should be included in DCD Subsections 5.2.3, 6.1.1, and 10.3.6. Alternatively, the applicant could modify one of the subsections and provide references in the remaining two subsections which provide a pointer to the subsection that contains the information.

GEH Response

RAI 10.3-4 S02 (a) GEH agrees that the weld filler material should be specified. Revision 4 to Section 10.3.6 proposes, "Weld filler materials for the Class 2 portions of the TMSS and Feedwater Systems are the same as those specified in Table 6.1-1 for Engineered Safety Features component materials." The feedwater system is specified as SA-335 P22 pipe with SA-336 F22 fittings. The ASME Code Section IX gives the welding P number for P22 pipe and F22 forgings as P5A. The row for weld filler material for P5A is in the Table 6.1-1 revision discussed in RAI 6.1-4 S01 as transmitted under MFN 06-365 Supplement 1. The revised Table 6.1-1 is proposed to be included in revision 4 to the DCD.

RAI 10.3-4 S02 (b) GEH agrees the fracture toughness for the Class 2 portions of the Feedwater System need to be referenced in Section 10.3.6. The feedwater system piping is proposed to be included in 10.3.6.1 as shown in the attached markup. This change is proposed to be incorporated in Revision 5 of the DCD.

RAI 10.3-4 S02 (c)

GEH does not propose using any alternative to Regulatory Guide 1.50 in the Main Steam or Feedwater systems. Wording is proposed to be added to Subsection 10.3.6.2 to point to Subsection 5.2.3.3.2 for discussion on compliance with Regulatory Guide 1.50 as shown in the attached markup of 10.3.6. This change is proposed to be included in revision 4 to the DCD.

To implement the RAI 6.1-4 statement referred to in RAI 10.3-4 S02 (c), the proposed revision to Subsection 5.2.3.3.2 includes ASME Boiler and Pressure Vessel (B&PV) Code, Section III, Appendix D, Article D-1000 as supplemented by Regulatory Guide 1.50. See the attached markup. This change is proposed to be incorporated in Revision 5 of the DCD.

DCD Impact

DCD Tier 2, Section 10.3.6, 10.3.6.1, 10.3.6.2, and 5.2.3.3.2 will be revised as noted in the attached markups.

NRC RAI 10.3-4 Supplement 3

(a) DCD, Revision 4, states that "Weld filler materials for the Class 2 portions of the TMSS and Feedwater Systems are the same as those specified in Table 6.1-1 for Engineered Safety Features components materials." By letter dated December 10, 2007 (MFN 06-365 Supplement 2), GEH provided a response to RAI 6.1-2 S02 which includes a proposed revision to Table 6.1-1. In the proposed revision to Table 6.1-1, to be included in Revision 5 of the DCD, GEH eliminated their weld filler material specifications for welding Grade SA-335 P22/SA-335 F22 materials. As a result, the proposed GEH revised Table 6.1-1 will no longer list appropriate weld filler materials for welding feedwater piping. The staff requests that the applicant list filler materials used in the steam and feedwater systems in Table 10.3-2 or reference a table (such as Table 5.2-4) that includes the appropriate weld filler materials.

(b) [There is no (b) section to this RAI Supplement 3.]

(c) Although the applicant appropriately addressed RG 1.50, the applicant's modifications to DCD, Tier 2, Revision 4, did not include the applicant's response to RAI 6.1-4 as requested by the staff in RAI 10.3-4 (c) S02. The applicant's response to RAI 6.1-4 states that the ASME Boiler and Pressure Vessel (B&PV) Code, Section III, Appendix D, Article D, minimum preheat recommendations will be applied to all ASME Code, Section III, Class 1, 2, and 3 carbon steel and low alloy steel components in the ESBWR design. The staff requests that the applicant make the appropriate modifications described above to the DCD.

GEH Response

(a) The table referenced in DCD Tier 2, Subsection 10.3.6, for steam and feedwater systems weld filler material will be changed to Table 10.3-2. The feedwater piping weld filler material will be removed from DCD Tier 2, Table 6.1-1 as noted in the GEH response to RAI 6.1-2, Supplement 2, MFN 06-365, Supplement 2, dated December 10, 2007 . A weld filler metals section will be added to Table 10.3-2.

(b) [There is no (b) section to this RAI Supplement 3]

(c) DCD Tier 2, Subsection 5.2.3.3.2, will be revised in Revision 5 of the DCD to include the requested modification. The proposed revision to Subsection 5.2.3.3.2 was previously provided to the NRC in the GEH response to RAI 10.3-4, Supplement 2 (MFN 06-219, Supplement 3, dated August 31, 2007).

DCD Impact

DCD Tier 2, Subsection 10.3.6 and Table 10.3-2 will be revised in Revision 5 as noted in the attached markup pages.

10.3.6 Steam and Feedwater System Materials

Steam and feedwater component materials that are within the Reactor Coolant Pressure Boundary are addressed in Section 5.2. There are no austenitic stainless steel or nickel-based materials in ASME Code Section III Class 2 portions of the TMSS or Feedwater System piping.

Material specifications for the ASME Code Section III Class 2 portions of the TMSS and Feedwater Systems are listed in Table 10.3-2. Material properties associated with both ASME Code and non-ASME Code components are consistent with ASTM/ASME specifications for the listed materials. Weld filler materials for the Class 2 portions of the TMSS and Feedwater Systems are ~~the same as those specified in Table 10.3-26.1-1 for Engineered Safety Features component materials.~~

The TMSS and Feedwater Systems are potentially subject to the effects of Flow Accelerated Corrosion (FAC). Applicable operating experience and recommendations provided in NRC Generic Letter 89-08 and NUREG-1344 are applied to their design and operation. The TMSS and Feedwater Systems are designed with pipe wall thicknesses that incorporate a conservative corrosion allowance commensurate with a 60-year design life. Where required by analysis to meet the design life, FAC-resistant materials are utilized.

TMSS piping is routed to allow for thermal growth and flexibility with a minimum bend radius of twice the pipe's nominal diameter ($2 \times D$). Downstream of the seismic restraint interface, the TMSS piping transitions to a larger nominal pipe size. This increase in pipe size limits the steam velocity during normal operation to less than 45.7 meters per second (150 feet per second) to minimize the effects of FAC.

A FAC monitoring and inspection program is required to evaluate the actual loss of wall thickness in piping that is sensitive to FAC in an operating plant. Therefore, systems identified in NRC Generic Letter 89-08 are subject to an Augmented Inservice Inspection Program. The FAC (erosion-corrosion) portion of the Augmented Inservice Inspection program is based on EPRI guidelines provided in NSAC-202L-R2 and is described in Subsection 6.6.7.

10.3.6.1 Fracture Toughness of Class 2 Components

The materials in the ASME Code Section III, Class 2, portions of the TMSS and Feedwater systems meet the fracture toughness requirements of NC-2300, "Fracture Toughness Requirements for Material". The Class 2 portions of the TMSS and Feedwater systems are is defined in Figure 3.2-1, Figure 3.2-2, and Table 3.2-3.

10.3.6.2 Materials Selection and Fabrication

The materials specified for use in Class 2 components comply with Appendix I to ASME Code Section III, and to Parts A, B, and C of Section II of the ASME Code.

Material specifications for the ASME Code Section III Class 2 portions of the TMSS and Feedwater Systems are listed in Table 10.3-2.

Conformance with the applicable regulatory guides is described in Subsection 1.9.2.

Regulatory Guide 1.50, "Control of Preheat Temperature Employed for Welding of Low Alloy Steel," applies to low-alloy materials, including those that are part of the Feedwater System. Conformance with this Regulatory Guide is addressed in Subsection 5.2.3.3.2.

Table 10.3-2

ASME Section III Class 2 Steam and Feedwater System Piping Materials

Component	Form	Material	Specification (ASTM/ASME)
Main Steam System			
Steam Pipe	Seamless	Carbon Steel	SA-333, Grade 6
Steam Pipe Fittings	Forgings	Carbon Steel	SA 350, Grade LF2 or SA-508, Grade 1
	Fittings	Carbon Steel	SA-420, Grade WPL-6
Feedwater System			
Pipe	Seamless	Low Alloy	SA-335, Grade P22
Fittings	Forging	Low Alloy	SA-336, Grade F22
<u>Welding Filler Metals</u>			
<u>Base Metal</u>	<u>Filler Metal Type</u>	<u>SFA Number</u>	<u>AWS Classification</u>
<u>Carbon Steel</u> <u>P1, G1</u>	<u>Covered</u> <u>Electrodes</u> <u>or Filler</u> <u>Wire</u>	<u>SFA-5.1</u> <u>SFA-5.18</u>	<u>E7018</u> <u>ER70S-2</u> <u>ER70S-3</u> <u>ER70S-6</u>
<u>Carbon Steel</u> <u>P1, G2</u>	<u>Covered</u> <u>Electrodes</u> <u>or Filler</u> <u>Wire</u>	<u>SFA-5.1</u> <u>SFA-5.18</u> <u>SFA-5.28</u>	<u>E7018</u> <u>ER70S-2</u> <u>ER80S-D2</u>
<u>Low Alloy</u> <u>Steel</u> <u>P5A, G1</u> <u>(2¼ CR, 1Mo)</u>	<u>Covered</u> <u>Electrodes</u> <u>or Filler</u> <u>Wire</u>	<u>SFA-5.5</u> <u>SFA-5.1</u> <u>SFA-5.28</u> <u>SFA-5.18</u>	<u>E9016-B3</u> <u>E9018-B3</u> <u>E7018</u> <u>ER90S-B3</u> <u>ER70S-2</u>