



GE Energy

James C. Kinsey  
Project Manager, ESBWR Licensing

PO Box 780 M/C J-70  
Wilmington, NC 28402-0780  
USA

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

MFN 06-523  
Supplement 1

Docket No. 52-010

April 14, 2007

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

**Subject: Supplemental Response to Portion of NRC Request for Additional Information Letter No. 43 Related to ESBWR Design Certification Application - Supplement 1 –ESBWR Containment Fragility- RAI Number 19.2-63 S1 and 19.2-65 S1.**

Enclosure 1 contains GE's response to the subject NRC RAI transmitted via the Reference 1 questions and from the NRC Seismic Fragility Audit of February 5, 2007.

If you have any questions or require additional information regarding the information provided here, please contact me.

Sincerely,

James C. Kinsey  
Project Manager, ESBWR Licensing

Reference:

1. MFN 06-237, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 43 Related to ESBWR Design Certification Application*, July 18, 2006.
2. MFN 06-523, Response to Portion of NRC Request for Additional Information Letter No. 43 Related to ESBWR Design Certification Application –ESBWR Containment Fragility- RAI Numbers 19.2-56, 19.2-63, and 19.2-65. December 15, 2006.

Enclosures:

1. MFN 06-523 Supplement 1, *Partial Response to RAI Letter No. 43 Related to ESBWR Design Certification Application (Previously Submitted<sup>1</sup> Under MFN 06-428 and Supplement 1 and Supplement 2 Containment Fragility- RAI Number 19.2-63 S1, and 19.2-65 S1.*

cc: AE Cabbage                    USNRC (with enclosures)  
George Stramback            GE/San Jose (with enclosures)  
RE Brown                        GE/Wilmington (with enclosures)  
EDRF Section 0000-0066-8975

**ENCLOSURE 1**

**MFN 06-523 Supplement 1**

**Partial Response to RAI Letter No. 43**

**Related to ESBWR Design Certification Application  
(Previously Submitted<sup>1</sup> Under MFN 06-523)**

**ESBWR Containment Fragility- RAI Number 19.2-63 S1  
and 19.2-65 S1**

<sup>1</sup> Original Response previously submitted under MFN 06-523  
The original responses are included to provide historical continuity during review.

**NRC RAI 19.2-63**

*In PRA, Revision 0, Section 21.4.5, GE described the prediction of failure probability for EVE-induced failures of pedestal and liner, as well as the BiMAC device. GE did not provide a detailed description of how these failure probabilities were calculated. Provide:*

- a) a description of the calculations performed to obtain the failure probability, based on the LS-DYNA3D analyses, for EVE-induced pedestal failure, liner failure, and BiMAC device failure, and RPV support failure;*
- b) a description of the structural performance of pedestal and RPV support, given failure of BiMAC and continued core-concrete interactions.*

**GE Original Response:**

The information requested is provided in Section 21 of NEDO-33201 Rev 1. A description of the calculations performed to support an estimate of reactor pedestal and BiMAC pipes fragility to steam explosion loads, based on DYNA3D analyses, are provided in Section 21.4.4.4 of NEDO-33201 Rev 1. The estimations of failure probability for pedestal and BiMAC pipes are described in Section 21.4.4.5 of NEDO-33201 Rev 1.

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

**NRC RAI 19.2-63, Supplement 1**

**NRC Assessment Following the February 5, 2007 Audit**

**Staff Assessment:**

- a) See staff assessment for RAI Number 19.2-65.*
- b) No information from GE's response can be used to determine the structural performance of pedestal and RPV support, given the failure of BiMAC and continued core-concrete interactions. GE needs to answer part (b) in a supplemental response to this RAI.*

**Audit Interest**

*Discuss the technical issue addressed by part (b) of the RAI.*

**Status Update/Resolution of RAI**

*b) Response provided in RAI 19.2-32. Sacrificial concrete below the RPV, under the BiMAC, may need to be constructed with basaltic aggregates and to be potentially verified by ITAAC. GE will provide the corrected response to this RAI (19.2-32).*

**GE Response**

The corrected version of 19.2-32 was provided in MFN 07-013 S01.

Based on the analysis presented in the response to RAI 19.2-32, there are no requirements for a specific type of concrete to be used under the BiMAC.

**NRC RAI 19.2-65**

*EVE-DAM EVE relates to the failure of the pedestal for water levels between 0.7 m and 1.5 m; the probability of pedestal failure is stated as  $1E-3$  for physical unreasonable events. Provide the detailed calculation that was used to arrive at this probability value.*

**GE Original Response:**

The information requested is provided in Section 21 of NEDO-33201 Rev 1. Related details on quantification of loads are described in Section 21.4.4.3, quantification of fragility is described in Section 21.4.4.4 and the prediction of failure probability is described in Section 21.4.4.5 of NEDO-33201 Rev1. This physically unreasonable term (EVE-DAM) we will set it to Zero in Rev 2 of NEDO-33201 and will include a sensitivity study to show the effects of other values. The range of these values will be based on the proximity of the load and fragility curves presented in Section 21 of NEDO-33201 Rev 1.

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

**NRC RAI 19.2-65, Supplement 1**

**NRC Assessment Following the February 5, 2007 Audit**

**Staff Assessment:**

*Section 21.4.4.5 of NEDO-33201 Rev 1 simply presented the failure probability for pedestal and BiMAC, and did not explain how they were calculated. Further, it did not describe how the load and capacity (what is the failure criteria applied in capacity calculations) information developed in Section 21.4.4.3 and Section 21.4.4.4, respectively, were utilized in the calculation of CCLPs and CFP.*

**Audit Interest**

*Discuss how the load and capacity information developed in Section 21.4.4.3 and Section 21.4.4.4 were utilized in the calculation of CCLPs and CFP. Obtain a better understanding of the rationale for setting (EVE-DAM) failure probability to Zero in the Rev 2 of NEDO-33201, and the associated sensitivity results.*

**Status Update/Resolution of RAI**

*GE will revise the response to describe that CCPL as the bounding value for all cases. GE will explain the construction of the CFP in the response.*

**GE Response**

The statement in 21.4.4.5 of NEDO-33201 Rev 1 is:

“The results of the previous two sections on pedestal loads and fragility are juxtaposed in Figure 21.4.4.5-1. The loads from 1 and 2 m deep, highly sub-cooled pools are taken to bound loads from shallow, saturated pools. There is a huge margin in this bound, and as the figure shows there an extra huge margin to failure even given this bounding of loads. Thus we conclude that in 99% of the Class I severe accidents in ESBWR pedestal failure by an EVE is physically unreasonable.”

In other words, the margin to obtaining any intersection between the load and fragility curves is so great as to dwarf uncertainties in estimating both of these quantities. This margin is a robust basis for stating that such failure is “physically unreasonable”. Moreover, the load estimates are representative of past experience with such problems. New, more advanced simulations of fragility have revealed a significantly enhanced capacity of such pedestal walls to withstand steam explosions. A perspective from past experience with less massive (and less reinforced) walls indicate that the non-intersection is a robust result of the analysis.

**DCD Impact**

No DCD or NEDO-33201 change is required as a result of this RAI.