



GE Energy

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**Subject: Response to NRC Request for Additional Information Letter No. 3
Related to ESBWR Design Certification Application – Chapter 19 –
PRA & Severe Accident**

In Reference 1, the NRC provided a Request for Additional Information (RAI) regarding Chapter 19 of the GE ESBWR Design Certification Application. Enclosure 1 contains GE responses to three of those NRC RAIs, 19.0.0-4, 19.0.0-5, and 19.2.4-1.

Reference 1 included a total of 19 RAIs and noted GE's commitment to provide a response to each by December 30, 2005. GE has submitted the reply to RAI 19.0.0-1 in Reference 2, December 19, 2005. With these 3 responses enclosed herein, 15 RAIs will remain outstanding. GE is working to complete the remaining 15 responses; however, due to the complexity of the RAI issues GE is unable to finalize them by the original December 30, 2005 due date. Therefore, by January 16, 2006 GE will provide a revised schedule to respond to the outstanding 15 RAIs.

If you have any questions about the information provided here, please let me know.

Sincerely,

A handwritten signature in black ink, appearing to read 'David H. Hinds', on a light-colored background.

David H. Hinds
Manager, ESBWR

References:

1. MFN 05-156, Letter from U. S. Nuclear Regulatory Commission (NRC) to David Hinds (GE), *Request for Additional Information Letter No.3 for the ESBWR Design Certification Application*, December 8, 2005
2. MFN 05-165, Letter from David Hinds (GE) to NRC, *Response to NRC Request for Additional Information Letter No. 3 for the ESBWR Design Certification Application - PRA -RAI Number 19.0.0-1*, December 19, 2005

Enclosure:

1. GE Responses to NRC RAIs 19.0.0-4, 19.0.0-5, and 19.2.4-1

cc: WD Beckner USNRC (w/o enclosures)
AE Cabbage USNRC (with enclosures)
LA Dudes USNRC (w/o enclosures)
GB Stramback GE/San Jose (with enclosures)
eDRFs 0000-0049-3358, 0000-0049-3102

ENCLOSURE 1

MFN 05-169

**GE Responses to NRC RAIs 19.0.0-4, 19.0.0-5,
and 19.2.4-1**

RAI Letter No. 3 Related to ESBWR Design Certification

Application – Chapter 19 – PRA & Severe Accident

RAI 19.0.0-4, Address BiMAC issues.

The Basemat Internal Melt Arrest and Coolability (BiMAC) device appears to have been developed only to a conceptual level. For example, based on discussions in DCD Section 19.3.5 and PRA Section 21.5, the top plate, refractory plate, and grating that will cover the BiMAC have not been finalized, the BiMAC sacrificial material and its thickness have not yet been specified, the positioning and dimensioning of the cooling jacket and the angle of inclination have not been established, and the testing of BiMAC needed for confirmation and optimization has not yet been performed. Also, BiMAC actuation relies on squib valves operated from thermocouples embedded in the drywell floor, or on additional valves that would be passively actuated through melting of eutectic alloys exposed to high temperatures in the LDW. The design details of the thermocouple actuation system and eutectic-based valves, as well as the process for establishing the assumed $1E-3$ failure frequency for the BiMAC system are not provided. In the absence of further design information and experimental validation, the credit taken in the Level 2 PRA for BiMAC arresting core melt progression (assumed to be 99 percent effective) is questionable. Without credit for BiMAC, it appears that events that proceed to reactor vessel breach will result in either containment venting or over-pressure failure at about 15 hours, thereby substantially impacting the results of the Level 2 and 3 PRA analyses. Please address these BiMAC issues.

GE Response

Revised Section 21, which was provided as enclosure 1 of MFN 05-165, dated December 19, 2005, provides the design specification details. The key parameters for the BiMAC, including those requested, have been specified in Section 21.5.2. GE believes the design specification details provide the necessary information to fully evaluate the performance of the BiMAC.

The failure probability of 10^{-3} per demand is not an assumed value for the deluge valves; rather it is a design requirement. It specifies the maximum acceptable mean failure probability of the deluge system for credible severe accident sequences (i.e., greater than 10^{-11} per year). This value must be met with full consideration of any dependence on support systems whose potential failure in respective scenarios may lead to core damage.

Design optimization and testing of BiMAC have been specified in Section 21.6 as COL actions and will be included in Revision 1 of DCD Chapter 19. ESBWR DCD Revision 1 is to be submitted in accordance with the schedule provided in GE Letter, MFN 05-139, dated November 22, 2005. The reliability of the deluge valves would be analyzed during design optimization. It is expected that fault tree analysis would be used to determine the reliability of the deluge valves, although other methods may also be acceptable. The confirmatory information would be submitted as part of the COL application.

We wish to clarify the performance of the ESBWR containment and the purpose of the BiMAC device. Without BiMAC, the characteristics of the ESBWR LDW are essentially the same as those of the ABWR. The ABWR containment design was certified based on cooling solely from an overlying pool of water, which prevents Core-Concrete Interaction

(CCI) and the associated overpressurization threat. The water pool is provided by a similar arrangement of deluge valves (although not a diverse set). GE added the BiMAC to the design of the ESBWR to improve the containment performance by completely eliminating the uncertainties concerning the threat of overpressurization due to CCI. Based on the previous NRC approval of the ABWR LDW containment design, it is inconsistent to conclude, this early in the NRC review process, containment venting and over-pressure failure of the similar ESBWR LDW design and the effect on PRA analyses.

RAI 19.0.0-5, Protection of the LDW sumps by the BiMAC Cooling Jacket

The protection of the LDW sumps by the BiMAC cooling jacket is only briefly mentioned (e.g., PRA p. 21.5-9, DCD p. 19.3-20). Also, a corium splash shield is identified in PRA Figure 4.18-1, but is not mentioned or discussed anywhere in the DCD or PRA. Provide a more detailed discussion and evaluation of these features.

GE Response

Revised Section 21.5.2, which was provided as enclosure 2 of MFN 05-165, dated December 19, 2005, provides a more detailed description of the protection of the LDW sumps by the BiMAC device.

The corium splash shield is not part of the ESBWR design. A revised Figure 4.18-1, with the corium splash shield removed, will be provided in revision 1 to the PRA. The schedule for the issuance of Revision 1 of the PRA is provided in GE Letter, MFN 05-140, dated November 22, 2005.

RAI 19.2.4-1, Accident Management Program

Provide a discussion or commitment (combined operating license action item) regarding the accident management program under which guidance and training would be provided on the use of such features as containment venting, drywell sprays, and AC-independent fire pumps for isolation condenser make-up.

GE Response

Revision 1 to the ESBWR DCD Chapter 19 will contain a list of COL Applicant commitments that includes the following text:

“The COL Applicant referencing the ESBWR certified design will develop and implement severe accident management guidance, along with the required procedures and training, using the framework provided in DCD Chapter 18, Appendix A.”

ESBWR DCD Revision 1 is to be submitted in accordance with the schedule provided in GE Letter, MFN 05-139, dated November 22, 2005.