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U.S. Nuclear Regulatory Commission
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Subject: **GEH Response to Portion of NRC Request for Additional Information Letter No. 111 Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Number 9.2-11 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 dated October 15, 2007, Reference 1. The previous supplemented response was submitted via Reference 2 in response to Reference 3. The original RAI response was submitted to the NRC via Reference 4 in response to Reference 5. GEH response to RAI Number 9.2-11 S02 is addressed in Enclosure 1.

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

Sincerely,

James C. Kinsey

James C. Kinsey
Vice President, ESBWR Licensing

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NRO

References:

1. MFN 07-556, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, Senior Vice President, Regulatory Affairs, Request for Additional Information Letter No. 111 Related to the ESBWR Design Certification Application, October 15, 2007.
2. MFN 06-417 Supplement 3 - Response to Portion of NRC Request for Additional Information Letter No. 62 - RAI Number 9.2-11 Supplement 1.
3. E-mail from L. Quinones (NRC) to F. White (GE) dated February 2, 2007.
4. MFN 06-417, Letter from David Hinds to the U.S. Nuclear Regulatory Commission, Partial Response to NRC Request for Additional Information Letter No. 62 Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Number 9.2-11, December 1, 2006.
5. MFN 06-380, Letter from U.S. Nuclear Regulatory Commission to David Hinds, Manager ESBWR, Request for Additional Information Letter No. 62 Related to the ESBWR Design Certification Application, September 29, 2006.

Enclosure:

1. GEH Response to Portion of NRC Request for Additional Information Letter No. 111 Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Number 9.2-11 S02

cc: AE Cubbage USNRC (with enclosure)
GB Stramback GEH/San Jose (with enclosure)
RE Brown GEH/Wilmington (with enclosure)
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Enclosure 1

MFN 06-417, Supplement 5

Response to Portion of NRC Request for

Additional Information Letter No. 111

Related to ESBWR Design Certification Application

Auxiliary Systems

RAI Number 9.2-11 S02

For historical purposes, the original text of RAIs 9.2-11 and 9.2-11 S01 and the GHNEA responses are included.

NRC RAI 9.2-11

Discuss the potential for water hammer as well as operating and maintenance procedures for avoidance of water hammer in the PSWS and RCCWS.

GHNEA Response

The system is designed to minimize the potential for water hammer with features to mitigate water hammer should it occur. Specifically, water hammer is mitigated through the use of various system design and layout features, including:

- Minimize high points in the system
- Provide for venting at all high points
- Procedural requirements ensuring proper line filling prior to system operation and following maintenance operations will be addressed by the COL applicant.
- Valve actuation times that are slow enough to prevent water hammer.
- Use of check valves at pump discharge to prevent backflow into the pump.

DCD Impact

DCD Subsections 9.2.1 and 9.2.2 will be revised in the next revision to state PSWS and RCCWS meets GDC 4 with respect to water hammer.

NRC RAI 9.2-11 S01

The response is acceptable, but cannot be considered "resolved" until the staff sees the DCD revision (a DCD markup was not provided with the RAI response)

GHNEA Response

DCD Tier 2, Revision 3, Subsections 9.2.1.1, 9.2.1.2 and 9.2.2.1 provide a discussion of the design features to minimize water hammer events for the PSWS and RCCWS.

Please note that because of the design differences between the RCCWS and PSWS, the DCD write-ups are different for the following reasons.

Design features to minimize water hammer differ between open and closed-loop water systems. For the ESBWR conceptual design, the PSWS is an open-loop system, while the RCCWS is a closed-loop system. The use of Air Release/Vacuum valves is common in open-loop systems such as Service Water (or Circulating Water) systems

with cooling towers or once-through design. Service Water systems are typically filled by starting their pumps. The Air Release/Vacuum valves are automatic and function to vent the system when these service water pumps are started.

Unlike open-loop systems, closed-loop systems, such as the RCCWS, are filled in a slower manner with makeup water systems. High point vents are controlled manually to allow filling and venting.

Additionally, "proper valve actuation times" "and check valves at the pump discharge" are applied to Service Water systems, which have cooling components at high elevations and provide long legs (risers) of drain down back to the basin or cooling pond at lower elevations.

Because the RCCWS is a closed-loop system, the mechanism and flow path for drain down of risers is not available for a properly filled and vented system. Proper system engineering design of closed-loop systems precludes system pressure from falling below vapor pressure of the fluid being transported. Surge tanks are also used per DCD Tier 2, Revision 3, Subsection 9.2.2.2 within the RCCWS, which provide NPSH to the RCCWS pumps and maintain system above vapor pressure to mitigate voiding.

NRC RAI 9.2-11 S02

In RAI 9.2-11, the staff asked the applicant to discuss the potential for water hammer as well as operating and maintenance procedures for avoidance of water hammer in the PSWS and RCCWS. In its response, the applicant listed provisions to mitigate water hammer and included in DCD tier 2 Revision 3. The staff finds the above responses acceptable. However, the applicant has not identified a COL holder Item in the DCD to address the procedures discussed in the DCD.

The staff looked into DCD Section 13.5.3, a COL information item for plant operating procedures; it refers to Section 13.5.3.4 of the DCD, which refers to the procedures as delineated in ANSI/ANS-3.2. RG 1.33 endorses ANS-3.2, and its Appendix A listed typical safety-related activities that should be covered by written procedures. Service water system and component cooling water system are listed in the Appendix A to RG 1.33.

However, the PSWS and RCCWS in ESBWR are not safety-related, so the above generic COL information item may not cover the nonsafety-related systems such as PSWS and RCCWS in the ESBWR. If GEH decides to refer the generic COL information in DCD Section 13.5.3 as the resolution to RAI 9.2-11, some clarification or modification of DCD Section 13.5.3.4 would be needed to ensure the general plant operating procedures will include the PSWS and RCCWS.

GEH Response

The original RAI response to 9.2-11, in regards to operational and maintenance procedures, stated the following:

- Procedural requirements ensuring proper line filling prior to system operation and following maintenance operations will be addressed by the COL applicant.

This original response was misleading, suggesting that a COL item was to be provided.

DCD Tier 2 Sections 9.2.1.1 and 9.2.2.1, PSWS and RCCWS respectively, state that operation and maintenance procedures are used as part of measures to avoid water hammer. Consequently, any applicant, incorporating the DCD Tier 2 Sections 9.2.1.1 and 9.2.2.1 standard design by reference, must have operation and maintenance procedures in place to assure that water hammer is avoided, in addition to the design measures provided.

Therefore, a COL Holder Item to address procedures for avoidance of water hammer is not required. Additionally, clarification of DCD Tier 2 Section 13.5.3.4 is not required.

DCD Impact

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