



GE Energy

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**Subject: Response to Portion of NRC Request for Additional Information
Letter No. 40 Related to ESBWR Design Certification Application -
ESBWR Probabilistic Risk Assessment - RAI Numbers 19.1-26, 19.1-
35 and 19.2-28**

Enclosure 1 contains GE's response to the subject NRC RAIs transmitted via the Reference 1 letter.

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

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Reference:

1. MFN 06-222, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 40 Related to ESBWR Design Certification Application*, July 5, 2006

Enclosures:

1. MFN 07-148, Response to Portion of NRC Request for Additional Information Letter No. 40 Related to ESBWR Design Certification Application - ESBWR Probabilistic Risk Assessment - RAI Numbers 19.1-26, 19.1-35 and 19.2-28.

cc: AE Cabbage USNRC (with enclosures)
David Hinds GE/Wilmington (with enclosures)
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Enclosure 1

MFN 07-148

Response to Portion of NRC Request for

Additional Information Letter No. 40

Related to ESBWR Design Certification Application

Probabilistic Risk Assessment

RAI Numbers 19.1-26, 19.1-35 and 19.2-28

NRC RAI 19.1-26

It is stated in NEDO-33201, Section 2.3.3.4: "The interfacing LOCAs are of negligible frequency in the ESBWR design due to the numerous means of separation (i.e., check valves and air operated valves in the closed position, their opening interlocked with reactor pressure) between high and low pressure piping." The staff needs more detailed information that identifies important design and operational features of the ESBWR design which make the frequency of the interfacing LOCAs to be negligible. Please list all highlow pressure interfaces and for each such interface discuss how specific design and operational features (e.g., physical barriers, redundancy, diversity, pressure relief capability, interlocking, technical specifications (TS) or administrative controls) prevent interfacing LOCAs and justify the conclusion that the frequency of interfacing LOCAs is negligible. Please address conditions related to different possible plant configurations, system re-alignments and testing.

GE Response

An analysis of Intersystem Loss of Coolant Accidents for the ESBWR is included in Design Control Document/Tier 2 Appendix 3K, 26A6642AN Rev. 02. This analysis concludes the ESBWR is in full compliance with the NRC staff's new guidance cited in references listed in Appendix 3K.

The systems evaluated in Appendix 3K are:

1. Control Rod Drive System (CRD).
2. Standby Liquid Control System (SLC).
3. Reactor Water Cleanup/Shutdown Cooling System (RWCU/SDC).
4. Fuel and Auxiliary Pools Cooling System (FAPCS).
5. Nuclear Boiler System (NBS).
6. Condensate and Feedwater System (C&FS).

This appendix describes the ultimate rupture strength boundaries, downstream interfaces that could be exposed to reactor pressure, and low-pressure piping systems and components designed to ultimate rupture strength pressure for each system. This analysis supports the conclusion that the frequency of interfacing LOCAs is negligible based on a design pressure of at least the ultimate rupture strength (URS) design pressure and pipe having a minimum wall thickness equal to standard grade providing an adequate margin with respect to the full reactor operating pressure with the exception of the FAPCS system.

Appendix 3K states: The low pressure side of LPCI line and the rest of FAPCS piping are not required to be designed to the URS pressure because they are properly protected by the interlock closed isolation valves described above and by a relief valve installed on the LPCI line that protects the line from the overpressure condition, in case of leakage from the RWCU/SDC

system side through the isolation valves. It should be noted that the LPCI line connects to the RWCU/SDC line, which connects to the Feedwater line upstream of the Feedwater line check valves.

The Revision 2 of the ESBWR PRA will include a re-evaluation of Interfacing Systems Loss of Coolant Accidents including the FAPCS LPCI line. Event tree(s) will be developed as required.

DCD Impact

No DCD changes are expected made in response to this RAI.

NRC RAI 19.1-35

The Steam Suppression System has vacuum breakers (VBs) that must open when during a LOCA the pressure in the wetwell (WW) is greater than the pressure in the drywell (DW) to protect containment integrity and prevent back-flooding of the suppression pool water into the DW. However, all VBs must close and be leak tight to maintain a small pressure differential between the DW and the WW required for passive containment cooling system (PCCS) effectiveness. It appears that a new feature of the ESBWR design is an option to command the VBs to seal, in order to maintain such differential pressure. Was the potential to compromise the vacuum breaking function, by commanding the valves closed, investigated? Please discuss when, during the various phases of a LOCA accident, the vacuum breaking function should be available and the potential to be compromised.

GE Response

Compromising the vacuum breaking function is investigated in the Negative Pressure Design Evaluation for the wetwell and drywell included in Design Control Document/Tier 2 Section 6.2.1.1.4, Revision 2. This evaluation describes the following events that may cause containment depressurization:

- Post-LOCA DW depressurization caused by the ECCS (GDCS, CRD, etc.) flooding of the RPV and cold water spilling out of the broken pipe or cold water spilling out of broken GDCS line directly into DW;
- The DW sprays are inadvertently actuated during normal operation or during post-LOCA recovery period.
- The combined heat removal of the ICS and PCCS exceeds the rate of decay heat steam production.

The detailed design of the vacuum breaker isolation valves has not been completed at this time. The following details are specified:

- Each vacuum breaker has a position indicator system to provide the plant operators with continuous surveillance of the vacuum breaker position.
- The vacuum breaker isolation valve has position indication and a remote manual switch in the main control room.

The Negative Pressure Design Evaluation assumes only one of the three vacuum breaker valves is available to provide the vacuum relief function between the wetwell and the drywell. This evaluation determined the maximum Wetwell-Drywell differential pressure is within the design capability. Therefore, all three vacuum breakers must fail to open to fail the vacuum relief function.

DCD Impact

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

NRC RAI 19.2-28

Identify which of the features mentioned in the response to RAI 19.2-19 through 27 will be covered by RTNSS, ITAAC, or COL action items.

GE Response

Identify which of the features mentioned in the response to RAI 19.2-19 through 27 will be covered by RTNSS, ITAAC, or COL action items.

GE Response

The features mentioned in the response to RAI 19.2-19 through 27 are related to the BiMAC device. The BiMAC device is in the RTNSS program, but is not risk-significant. Therefore, it is treated by regulatory availability controls, as described in DCD Tier 2 Section 19A, and no ITAACs are required.

RAI Number	Design Feature	Treatment
19.2-19	GDCS Deluge downcomer piping	No action required. RAI concern was addressed in the response.
19.2-20	BiMAC refractory layer, cooling channel piping	To be covered in LTR on BiMAC Design.
19.2-21	BiMAC cooling channel piping	To be covered in LTR on BiMAC Design.
19.2-22	BiMAC cooling channel piping	To be covered in LTR on BiMAC Design.
19.2-23	BiMAC test program for design certification	To be covered in LTR on BiMAC Design.
19.2-24	BiMAC cover plate	No action required. Design detail does not affect functionality.
19.2-25	BiMAC design interface with drywell sumps	No action required. RAI concern was addressed in the response.
19.2-26	BiMAC operation	RTNSS regulatory availability controls.
19.2-27	Drywell water level instrumentation	No action required. Not required for RTNSS.

DCD Impact

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