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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 291 Related to ESBWR Design Certification Application ESBWR RAI Number 19.2-121 S01**

Enclosure 1 contains the GE Hitachi Nuclear Energy (GEH) response to the subject NRC RAI transmitted via the Reference 1 letter.

RAIs and previous responses were transmitted in References 2 and 3.

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

Sincerely,

Richard E. Kingston

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Vice President, ESBWR Licensing

Reference:

1. MFN 09-013, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 291 Related To ESBWR Design Certification Application*, dated January 6, 2009.

2. MFN 08-649, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 222 Related To ESBWR Design Certification Application*, dated August 20, 2008.

3. MFN 08-910 Response to Portion of NRC Request for Additional Information Letter No. 222 Related to ESBWR Design Certification Application ESBWR RAI Numbers 19.1-178, 19.2-120 and 19.2-121, dated November 18, 2008.

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 291 Related to ESBWR Design Certification Application Probabilistic Risk Assessment RAI Number 19.2-121 S01

Attachment 1 DCD Tier 2, Revision 6 Markup

cc:	AE Cubbage	USNRC (with enclosure)
	JG Head	GEH/Wilmington (with enclosure)
	DH Hinds	GEH/Wilmington (with enclosure)
	eDRFSection	0000-0099-6948 RAI 19.2-121 S01

Enclosure 1

MFN 08-910, Supplement 1

Response to Portion of NRC Request for

Additional Information Letter No. 291

Related to ESBWR Design Certification Application

EBWR Probabilistic Risk Assessment

[1] Original Responses previously submitted under MFN 08-336 and 08-336 Supplement 1 are included without DCD updates to provide historical continuity during review

NRC RAI 19.2-121 (original)

The staff compared the assumptions in DCD Section 19.2.4.1.6, Shutdown PRA Assumptions, to DCD Rev. 5 Table 19.2-3, Risk Insights and Assumptions. In the DCD, it states: "It is assumed that both RWCU/SDCS trains are running, because the time periods in which only one is running occurs when the reactor well is flooded. Consequently, failure of one of the trains is not considered an initiating event." This statement appears to be inconsistent with the RTNSS evaluation assumptions. The following, regarding RWCU/SDC operation, is stated in Table 19.2-3: "during shutdown conditions, in preparation for refueling, both trains of RWCU/SDC are functional while the unit is in either Mode 5 or Mode 6 until the reactor cavity is flooded. While one train may be removed from service when decay heat levels dictate, it is advantageous to maintain that train as functional for backup capability." The shutdown baseline PRA evaluation and the RTNSS evaluation did not consider that one train of RWCU/SDC can be removed from service when decay heat levels dictate. Please revise Table 19.2-3 to be consistent with section 19.2.4.1.6 of the DCD Revision 5, or re-quantify the baseline and RTNSS shutdown PRAs assuming only one train of RWCU/SDC is in operation.

GEH Response

DCD Table 19.2-3 will be revised to provide clarification on RWCU/SDC pump operation consistent with DCD subsection 19.2.4.1.6.

The intent of the operational requirement in Table 19.2-3 is for the licensee to consider having the second RWCU/SDC available as a functional backup to the running train during the cooling down period when only one RWCU/SDC heat exchanger and pump are needed.

The intent of shutdown PRA discussion in DCD section 19.2.4.1.6 is to acknowledge that both RWCU/SDC pumps are running when decay heat levels are high. If one of the two running RWCU/SDC pumps trips during this condition, the other pump is still running and shutdown cooling is maintained. Thus, the failure of one of the trains is not considered to be a loss of shutdown cooling initiating event.

Accordingly, it is not necessary to re-quantify the baseline or RTNSS shutdown PRAs assuming only one train of RWCU/SDC is in operation. Either both trains are running, or one train is running with the other train functionally available.

DCD Impact

DCD Table 19.2-3 will be revised as shown in the attached mark-up.

NRC RAI 19.2-121 S01

The staff reviewed the GEH's response to RAI 19.2.121 regarding RWCU/SDC operating mode. The staff compared the assumptions in DCD Section 19.2.4.1.6, Shutdown PRA Assumptions, to GEH's proposed risk insight on RWCU/SDC operation in Revision 6 of the DCD Table 19.2-3. In DCD Section 19.2.4.1.6, it states, "It is assumed that both RWCU/SDC trains are running, because the time periods in which only one is running occurs when the reactor well is flooded. Consequently, failure of one of the trains is not considered an initiating event." This statement still appears to be inconsistent with GEH's proposed risk insight on RWCU/SDC operation, in Revision 6 of the DCD Table 19.2-3. The revised DCD markup states, "during shutdown conditions, in preparation for refueling, both trains of RWCU/SDC are functional while the unit is in either Mode 5 or Mode 6 until the reactor cavity is flooded. When the reactor cavity is flooded and the decay heat rate is sufficiently low, one train of RWCU/SDC may be removed from service."

The shutdown baseline PRA evaluation and the RTNSS evaluation assumed that both trains of RWCU/SDC were running during Modes 5 and 6 until the reactor cavity is flooded. This assumption is necessary so that the failure of one operating RWCU/SDC train does not result in a shutdown initiating event. The failure of the operator to start the standby RWCU/SDC train given a loss of the operating RWCU/SDC train was not considered in the shutdown baseline PRA and the RTNSS evaluation. Also, failure of the standby RWCU/SDC pump to start was not considered in the RTNSS evaluation.

Please revise DCD Table 19.2-3 to indicate that both trains of RWCU/SDC will be running in Modes 5 and 6 until the cavity is flooded or re-quantify the baseline shutdown PRA and RTNSS assuming only one train of RWCU/SDC is running and in operation.

GEH RESPONSE

The two statements cited in this RAI are consistent because they are made for different purposes. In the first cited statement, DCD Section 19.2.4.1.6 states, "It is assumed that both RWCU/SDC trains are running, because the time periods in which only one is running occurs when the reactor well is flooded." This assumption is made to simplify the combinations of pump operational conditions in order to estimate the loss of shutdown cooling initiating event frequency due to the loss of both RWCU/SDC trains. The second cited statement, in DCD Table 19.2-3 states, "during shutdown conditions, in preparation for refueling, both trains of RWCU/SDC are functional while the unit is in either Mode 5 or Mode 6 until the reactor cavity is flooded. When the reactor cavity is flooded and the decay heat rate is sufficiently low, one train of RWCU/SDC may be removed from service." This statement is a risk insight that reflects the expected operational conditions during preparation for refueling.

GEH recognizes the need to maintain high reliability for the RWCU/SDC trains in Modes 5 and 6. The ESBWR Shutdown PRA model considers the loss of both RWCU/SDC pumps in PRA Modes 5, 5-Open, and 6-Unflooded. PRA Mode 6-Flooded does not consider loss of RWCU/SDC to be a significant initiating event because of the extremely large heat sink available in the flooded reactor cavity. RWCU/SDC is not credited in the RTNSS evaluation.

The failure of the operator to start the standby RWCU/SDC train is explicitly considered as a risk insight in DCD Table 19.2-3:

> An important recovery action during shutdown is to recover at least one train after loss of both operating RWCU/SDCS trains. This is the primary method of residual heat removal. In the limiting case of loss of cooling, there are approximately 4 hours before boiling would occur. Therefore, there is ample time to restore RWCU/SDC or its supporting systems, such as Service Water or Reactor Component Cooling Water.

This risk insight is an Operational Program – Procedure Development, which will require specific procedural guidance.

Revision 5 of DCD Table 19.2-3 also includes an Operational Program requirement to ensure that both trains of RWCU/SDC will be available in Modes 5 and 6 until the cavity is flooded:

> During shutdown conditions, in preparation for refueling, both trains of RWCU/SDC are functional while the unit is in either Mode 5 or Mode 6 until the reactor cavity is flooded. When the reactor cavity is flooded and the decay heat rate is sufficiently low, one train of RWCU/SDC may be removed from service. It is advantageous to maintain that train as functional for backup capability.

This risk insight is also an Operational Program – Procedure Development, which will require specific procedural guidance. It states that both RWCU/SDC trains should be "functional," as compared to "running". However, to address this RAI, the wording on this risk insight will be revised to indicate that both trains of RWCU/SDC will be running in Modes 5 and 6 until the reactor cavity is flooded.

DCD Impact

DCD Tier 2 Chapter 19, Table 19.2-3 will be revised as indicated in the attached mark-up.

Table 19.2-3
Risk Insights and Assumptions

Insight or Assumption	Disposition
It is assumed that, during shutdown, manual and automatic depressurization (ADS) of the vessel are available while the vessel head is in place.	Operational Program - Technical Specification LCO 3.5.3
It is assumed that the actuation of the GDCS due to an RPV Level 1 water level signal is available during the entire shutdown period.	Operational Program - Technical Specification LCO 3.5.3
Procedures have provisions to prohibit coincident removal of the control rod and CRD of the same assembly.	Operational Program – Procedure Development
Contingency procedures provide core and spent fuel cooling mitigative actions during FMCRD replacement with fuel in the vessel.	Operational Program – Procedure Development
During shutdown conditions, in preparation for refueling, both trains of RWCU/SDC are ~~functional~~ running while the unit is in either Mode 5 or Mode 6 until the reactor cavity is flooded. ~~While one train may be removed from service when decay heat levels dictate, it is advantageous to maintain that train as functional for backup capability.~~	Operational Program – Procedure Development
The outage planning and control program is consistent with NUMARC 91-06.	Operational Program – Procedure Development
The FAPCS vessel injection manual isolation valve is a locked-open valve. While its open position is assured by administrative controls, it is an important valve whose failure to remain open could disable two active low pressure injection functions: FAPCS and FPS through FAPCS.	Operational Program – Human Factors Engineering
The PCCS pool drain line maintenance valves are locked-open manual valves with position indication in the Main Control Room.	Operational Program – Human Factors Engineering