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Subject: **Response to Portion of NRC Request for Additional Information  
Letter No. 97 Related to ESBWR Design Certification Application -  
Technical Specifications - RAI Numbers 16.2-120, 16.2-121, 16.2-125,  
16.2-127, 16.2-128, 16.2-130, 16.2-131, 16.2-132, 16.2-133, 16.2-140,  
16.2-143, 16.2-144, 16.2-150, 16.2-151, and 16.2-155**

Enclosure 1 contains GE-Hitachi Nuclear Energy's (GEH'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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MRO

References:

1. MFN 07-292, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 97 Related to ESBWR Design Certification Application*, May 10, 2007

Enclosures:

1. MFN 07-393 – Response to Portion of NRC Request for Additional Information Letter No. 97 Related to ESBWR Design Certification Application - Technical Specifications - RAI Numbers 16.2-120, 16.2-121, 16.2-125, 16.2-127, 16.2-128, 16.2-130, 16.2-131, 16.2-132, 16.2-133, 16.2-140, 16.2-143, 16.2-144, 16.2-150, 16.2-151, and 16.2-155

cc: AE Cabbage USNRC (with enclosures)  
DH Hinds GEH (with enclosures)  
RE Brown GEH (w/o enclosures)  
eDRFs 69-9572, 69-9071, 69-3513, 69-3519, 69-3517, 71-4908, 69-9134,  
69-9140, 69-9595, 69-9147, 69-9153, 69-3518

**Enclosure 1**

**MFN 07-393**

**Response to Portion of NRC Request for**

**Additional Information Letter No. 97**

**Related to ESBWR Design Certification Application**

**- Technical Specifications -**

**RAI Numbers 16.2-120, 16.2-121, 16.2-125, 16.2-127, 16.2-128, 16.2-130, 16.2-131, 16.2-132, 16.2-133, 16.2-140, 16.2-143, 16.2-144, 16.2-150, 16.2-151, and 16.2-155**

**NRC RAI 16.2-120**

*In Surveillance Requirement (SR) 3.6.1.3.1, use accurate number of digits. If three significant digits, then 20.0 inches equals 508 mm exactly; or 500 mm equals approximately 19.7 inches.*

**GEH Response**

DCD Revision 3, Chapter 16, Surveillance Requirement (SR) 3.6.1.3.1 and the associated Chapter 16B Bases will be revised to present the purge line dimension in metric units only, consistent with DCD Revision 3, Chapter 6, Tables 6.2-36, 6.2-37, and 6.2-38.

**DCD Impact**

DCD Revision 3, Chapter 16, Surveillance Requirement (SR) 3.6.1.3.1 and the associated Chapter 16 B Bases will be revised as described above.

**NRC RAI 16.2-121**

*In standard technical specification (STS) 3.4.8 Condition B, reactor coolant specific activity > 4.0  $\mu\text{Ci gm}^{-1}$  DOSE EQUIVALENT I-131, or Required Action and Completion Time of Condition A not met, the unit must be placed outside the applicability of the LCO. The STS allows either isolating the main steam lines or placing the unit in STS Mode 4, Cold Shutdown (ESBWR TS Mode 5). ESBWR TS 3.4.3, Condition B omits the option of placing the unit in Mode 5. This option provides operational flexibility when main steam line isolation is not desired (e.g., due to the decay heat load).*

*A. Provide clearer justification for not including this option in ESBWR TS 3.4.3.*

*B. If the option is not adopted, describe the anticipated methods (i.e., ICS, FAPCS suppression pool cooling) for removing reactor decay heat with main steam lines isolated and a substantial existing power history.*

*C. Discuss benefit(s) in terms of risk and radiological consequences gained in utilizing the above decay heat removal methods compared to using the main condenser to achieve cold shutdown conditions.*

**GEH Response**

ESBWR DCD Tier 2, Chapter 16 Specification 3.4.3, "RCS Specific Activity," will be revised to include Actions to place the unit in cold shutdown (MODE 5). Required Action B.2 will be renumbered B.2.1 and be "OR"-d with Required Actions B.2.2.1 to "Be in MODE 3" in 12 hours and B.2.2.2 to "Be in MODE 5" in 36 hours. These actions to place the unit outside of the Applicability of the Specification are consistent with NUREG-1434, "Standard Technical Specifications General Electric Plants, BWR/6," Revision 3.1. In conjunction, the Bases (DCD Tier 2, Chapter 16B) will be revised to reflect these changes consistent with the Bases found in NUREG-1434.

**DCD Impact**

DCD Tier 2, Chapters 16 and 16B will be revised as described above as a result of this RAI.

**NRC RAI 16.2-125**

*SR 3.8.3.2 and 3.8.3.6 (sic) should specify battery pilot cell float voltage to differentiate it from battery pilot cell open circuit voltage.*

**GEH Response**

Surveillance Requirement (SR) 3.8.3.2 and SR 3.8.3.5 require periodic verification that the voltage across individual battery cells is greater than a specified minimum. As described in the Bases, these SRs “require verification that the cell float voltages are equal to or greater than the short-term absolute minimum voltage.” Therefore, GEH will revise SR 3.8.3.2 and SR 3.8.3.5 to clarify that the SR apply to the cell “float” voltage.

**DCD Impact**

DCD Tier 2, Chapters 16 and 16B, will be revised to include the following changes:

**Chapter 16, Specification 3.8.3 Changes:**

SURVEILLANCE		FREQUENCY
SR 3.8.3.2	Verify each required battery pilot cell float voltage is $\geq \{2.14\}$ V.	31 days
SR 3.8.3.5	Verify each required battery connected cell float voltage is $\geq \{2.14\}$ V.	92 days

**NRC RAI 16.2-127**

*Bases for LCO 3.8.4, Inverter-Operating, states that each inverter receives DC power from either the associated nonsafety-related rectifier or the associated 250 VDC bus that is supported by the battery charger. DCD Tier 2, Rev, 3, Section 3.8.2, does not clearly state if the rectifiers are safety-related. Please resolve this discrepancy.*

**GEH Response**

As described in Design Control Document (DCD) Tier 2, Section 8.3.1.1.3, the rectifiers are safety-related. GEH will revise Design Control Document (DCD) Tier 2, Section Chapter 16B, to replace the term "nonsafety-related" with "safety-related" for descriptions of the rectifiers in the following locations: Background section of the Bases for LCOs 3.8.4 and 3.8.6 and Action A.1 of the Bases for LCO 3.8.6.

**DCD Impact**

DCD Tier 2, Chapter 16 B, Revision 4, will include the changes described above.

**NRC RAI 16.2-128**

*The bases for LCO 3.8.4, Inverter-Operating, states that power to the safety-related UPS can be power directly from the associated IPC bus using the nonsafety-related regulating transformer. DCD Tier 2, Rev. 3, Section 8.3.1.1.3 states that the regulating transformers are safetyrelated. Please resolve this discrepancy.*

**GEH Response**

As described in Design Control Document (DCD) Tier 2, Section 8.3.1.1.3, the regulating transformers are safety-related. GEH will revise Design Control Document (DCD) Tier 2, Section Chapter 16B, to replace the term "nonsafety-related" with "safety-related" for descriptions of the regulating transformers in the following locations: Background section of the Bases for LCOs 3.8.4 and 3.8.6 and Action A section of the Bases for LCOs 3.8.4 and 3.8.6.

**DCD Impact**

DCD Tier 2, Chapter 16 B, Revision 4, will include the changes described above.

**NRC RAI 16.2-130**

*For one or more required AC, DC, or AC vital bus electrical power distribution subsystems inoperable, STS 3.8.10, Required Action A.2.5 requires declaring associated required shutdown cooling subsystem(s) inoperable and not in operation. The ESBWR TS 3.8.7 appropriately omits this action requirement because the ESBWR TS do not include an LCO for shutdown cooling, which is a part of the RWCU/SDC system, and which requires AC power from the associated PIP bus, which is powered by an offsite power circuit or a standby diesel generator. Explain how the fuel will be protected from overheating in Modes 5 and 6 if the RWCU/SDC system becomes unavailable.*

**GEH Response**

The responses to RAIs 16.2-73 and 16.2-74 (GE Letter MFN 07-022, dated January 19, 2007) and RAI 16.2-73, Supplement 1, (GE Letter MFN 07-022, Supplement 1, dated June 1, 2007), provide a detailed description of decay heat removal capability in Modes 5 and 6 following the unlikely loss of both of the redundant trains of the reactor water cleanup/shutdown cooling system.

**DCD Impact**

No DCD changes will be made as a result of this RAI.

**NRC RAI 16.2-131**

*Provide a report to document the application of the 10 CFR 50.36(c)(2)(ii) criteria to the instrumentation technical specifications LCOs included in the ESBWR DCD TS application. The report analysis should provide the specific justifications for application of the deterministic screening criteria and a risk assessment for each LCO which does not satisfy the screening criteria.*

**GEH Response**

GE performed a systematic and comprehensive evaluation of the ESBWR Design Control Document (DCD) to determine the ESBWR process variables, design features, operating restrictions, and structures, systems, or components (SSCs) that meet one or more of the four criteria in 10 CFR 50.36(c)(2)(ii). This evaluation was provided in response to RAI 16.0-1 in MFN 06-263 on 8/8/2006.

Additionally, the Technical Specification Bases (DCD Chapter 16B) for each instrumentation LCO provides a statement regarding application of specific Criterion of 10 CFR 50.36(c)(2)(ii).

**DCD Impact**

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

**NRC RAI 16.2-132**

*Instrumentation systems are explicitly assumed in the safety analyses. Approval of the applicability requirement for the instrumentation functions to be operable in the modes or other specified conditions listed in TS is open pending staff review of the support system LCO applicability requirements. Confirm that ESBWR TS LCO Applicability for each Instrumentation Function is consistent with LCO Applicability of supported systems.*

**GEH Response**

During a 6/25/2007 conference call with the NRC Staff, this RAI was clarified to be an internal NRC tracking /action item and that that no explicit response is expected.

**DCD Impact**

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

**NRC RAI 16.2-133**

*In the instrumentation TSs for the Control Rod Block and Remote Shutdown System (RSS), a Note to the Actions table permits using the provisions of LCO 3.0.4.c, thereby allowing entry into the applicable MODE while relying on the TS Required Actions. The ESBWR DCD TS application states that this allowance is acceptable since the probability of an event is low during the short seven-day Completion Time as stated in NEDO-33201. This allowance would permit startup with one of the two required Automated Thermal Limit Monitors, one of two Rod Worth Minimizer channels inoperable and all RSS Functions inoperable. The addition of LCO 3.0.4.c to the Rod Block and RSS instrumentation is a change to staff precedent in NUREG-1434. Acceptance of the deviation from NUREG-1434 is open pending staff assessment of the acceptability of the proposed relaxation to operational limits currently shown to meet 10 CFR 50.36. Provide justification for these deviations.*

**GEH Response**

NRC Request for Additional Information Letter No. 96 Related to ESBWR Design Certification Application, April 12, 2007 included RAI 16.2-115. RAI 16.2-115 noted the same issue with ESBWR DCD Tier 2, Chapter 16, Specifications 3.3.2.1, "Control Rod Block Instrumentation," and 3.3.3.2, "Remote Shutdown System." Refer to GE response in MFN 07-246, dated 5/14/07 for discussion indicating the Notes referring to LCO 3.0.4.c will be deleted.

**DCD Impact**

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

**NRC RAI 16.2-140**

*The Bases for Functions 3.3.1.4.2.a, "NMS APRM-Fixed Neutron Flux High, Setdown," 3.3.1.4.2.c, "APRM Fixed Neutron Flux - High," 3.3.1.4.2.d, "APRM - Inop," and 3.3.1.4.3, "Oscillation Power Range Monitor {Period-Based Trip}," state that in order to provide adequate coverage of the core at least {40} LPRM inputs are required to be operable. The basis is a statement of a limiting condition for operation that is not specified in the LCO. Revise the SRs for Function 3.3.1.4.2.d, "APRM - Inop," to include this limit. (SR 3.3.1.4.3, "Perform CHANNEL FUNCTIONAL TEST on each required channel.")*

**GEH Response**

For any average power range monitor (APRM) channel, when the minimum local power range monitor (LPRM) input requirement is not satisfied (see DCD Tier 2, Revision 3, subsection 7.2.2.3.1.3) or when the maximum allowed number of bypassed LPRMs has been exceeded (see DCD Tier 2, Revision 3, subsection 7.2.2.6.2), an inoperative trip is automatically generated by that APRM channel. The specific requirement for minimum number of LPRM inputs will be implemented in the final detailed design of the APRM system. As with other details of design (e.g., other conditions resulting in an APRM channel inoperable trip), the Technical Specifications do not explicitly include all design limitations. The minimum LPRM input requirement for APRM channel operability is presented in the Bases following the standard content and format of NUREG-1434, "Standard Technical Specifications General Electric Plants, BWR/6," Revision 3.1.

As required by Specification 3.3.1.5, "Neutron Monitoring System (NMS) Automatic Actuation," Surveillance Requirement (SR) 3.3.1.5.1 ("Perform LOGIC SYSTEM FUNCTIONAL TEST for each required division") confirms the designed logic of each division APRM and Oscillation Power Range Monitor.

**DCD Impact**

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

**NRC RAI 16.2-143**

*LCO 3.3.6.1 and LCO 3.3.6.2 require instrumentation Functions that isolate the main steam lines by closing the MSIVs. The associated Required Actions include restoring inoperable equipment, exiting the LCO applicability, and declaring the associated valves inoperable. An Action Note is provided which permits penetration paths to be un-isolated intermittently under administrative controls. Explain the application of the note allowance when required actions do not specify isolating main steam lines using MSIVs. (TS 3.6.1.3 also has this note and includes required actions to isolate the main steam lines.)*

**GEH Response**

DCD Revision 3, Chapter 16, Technical Specification (TS) 3.3.6.1, "Main Steam Isolation Valve (MSIV) Instrumentation," TS 3.3.6.2, "Main Steam Isolation Valve (MSIV) Actuation," and the associated Chapter 16B Bases will be revised to delete the Actions Table Note 1.

**DCD Impact**

DCD Revision 3, Chapter 16, Technical Specification (TS) 3.3.6.1, "Main Steam Isolation Valve (MSIV) Instrumentation," TS 3.3.6.2, "Main Steam Isolation Valve (MSIV) Actuation," and the associated Chapter 16B Bases will be revised as described above.

### **NRC RAI 16.2-144**

*Table 3.3.6.3-1, Function 1, Reactor Vessel Water Level - Low, Level 2 and Function 9, RWCU/SDC System Differential Flow - High (Per RWCU/SDC subsystem) have Mode 5 and 6 requirements that reference Condition H from Required Action C.1. Condition H contains Required Action H.1 (Initiate action to restore channel to OPERABLE status) and Required Action H.2 (Initiate action to isolate RWCU/SDC). Required Action H.1 should be deleted because a "restore" required action is an unnecessary instruction that is known to apply whenever equipment is declared inoperable. For writing technical specifications the accepted convention is to include "restore" required actions when it is the only specified required action.*

### **GEH Response**

During Mode 5 and 6 operations, the primary nonsafety-related normal means for decay heat removal is the reactor water cleanup/shutdown cooling (RWCU/SDC) system. DCD Tier 2, Chapter 16, Technical Specifications (TS) 3.3.6.3, "Isolation Instrumentation," provides requirements for automatic isolation of the RWCU/SDC system. TS Table 3.3.6.3-1, Function 1, "Reactor Vessel Water Level - Low, Level 2" and Function 9, "RWCU/SDC System Differential Flow - High (Per RWCU/SDC subsystem)" reference Condition H from Required Action C.1 for actions to be taken in the event of inoperable automatic isolation channels during Modes 5 and 6. Action H requires either Required Action H.1 ("Initiate action to restore channel to OPERABLE status") OR Required Action H.2 ("Initiate action to isolate RWCU/SDC").

Because operation of RWCU/SDC during Modes 5 and 6 for decay heat removal precludes challenges to safety-related systems, its continued operation, even with inoperable automatic isolation channels, can result in a less risk-significant plant configuration. As such, options have been allowed in the TS Actions to continue "restoration" actions in lieu of requiring the system be isolated (i.e., and taken out of service). If an optional Required Action H.1 were not provided, the only option for TS compliance would be to remove RWCU/SDC from service. The associated Bases (DCD Tier 2, Chapter 16B) for these actions support this option:

"If the affected instrumentation channel cannot be verified to be in trip within the specified Completion Time or if isolation capability cannot be restored within the specified Completion Time, the associated flow path should be isolated. However, if the RWCU/SDC function is needed to provide core cooling, these Required Actions allow the flow path to remain unisolated provided action is immediately initiated to restore the channel to OPERABLE status or to isolate the RWCU/SDC system (i.e., provide alternate decay heat removal capabilities so the flow path can be isolated). ACTIONS must continue until the channel is restored to OPERABLE status or the RWCU/SDC system is isolated."

This optional Actions presentation is supported by and consistent with the actions from NUREG-1434, "Standard Technical Specifications General Electric Plants, BWR/6," for inoperable isolation instrumentation associated with residual heat removal (RHR) shutdown cooling system (refer to Table 3.3.6.1-1, Function 5.c, "Reactor Vessel Water Level - Low, Level 3," and Action J).

### **DCD Impact**

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

**NRC RAI 16.2-150**

*Surveillance requirement frequencies related to response time testing, and actuation instrumentation logic system functional tests require four divisions to be tested whereas the LCO requires three divisions to be operable. The result of this discrepancy is that surveillance requirements are required to be met for instrumentation that is not required to be operable. Revise the related SR Frequency references to be equal to the number of divisions/channels required to be operable by the LCO.*

**GEH Response**

Surveillance Frequencies impose the periodicity of performing the Surveillance Requirement (in these cases "24 months on a Staggered Test Basis for four divisions"). The Frequency does not impose any acceptance criteria or direct operability requirement on systems, subsystems, or components (SSCs). The Surveillance Requirement specifies what SSCs are to be tested and what acceptance criteria are imposed to satisfy the Limiting Condition for Operation (LCO).

As such, Surveillance requirements related to response time testing (RTT), and actuation instrumentation logic system functional tests (LSFTs) state that each "required" division must be tested; and each division is then evaluated against the acceptance criteria in order to satisfy the LCO operability requirement. With the associated LCO requiring three divisions to be operable, these subject SRs only require satisfactory testing of the three "required" divisions. The non-"required" division has no explicit requirement imposed until it is elected to become a "required" (i.e., one of the three required) division.

The Frequency of performing testing on each required division is stated such that each division is tested every " $n$ " Surveillance Frequency intervals, where  $n$  is the total number of divisions. In these cases, with four divisions, the testing of a single division will be required every fourth 24-month interval. Imposing testing of divisions every third 24-month interval will necessitate testing two divisions during one interval to maintain all divisions tested. It is the intent to test each of the four divisions, one each 24-month interval, such that all divisions remain tested and available to be credited as "required" and to avoid testing multiple divisions in a single interval.

**DCD Impact**

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

**NRC RAI 16.2-151**

*Surveillance requirement frequencies related to staggered testing require four divisions to be tested whereas the LCO requires three divisions to be operable. The result of this discrepancy is that the surveillance requirement frequency credits surveillances for equipment not required to be operable. Revise the related SR to delete Frequency references to the number of divisions that must be tested.*

**GEH Response**

Surveillance Frequencies impose the periodicity of performing the Surveillance Requirement (in these cases "24 months on a Staggered Test Basis for four divisions"). The Frequency does not impose any acceptance criteria or direct operability requirement on systems, subsystems, or components (SSCs). The Surveillance Requirement specifies what SSCs are to be tested and what acceptance criteria are imposed to satisfy the Limiting Condition for Operation (LCO).

As such, the subject Surveillance requirements state that each "required" division must be tested; and each division is then evaluated against the acceptance criteria in order to satisfy the LCO operability requirement. With the associated LCO requiring three divisions to be operable, these subject SRs only require satisfactory testing of the three "required" divisions. The non-"required" division has no explicit requirement imposed until it is elected to become a "required" (i.e., one of the three required) division.

The Frequency of performing testing on each required division is stated such that each division is tested every " $n$ " Surveillance Frequency intervals, where  $n$  is the total number of divisions. In these cases, with four divisions, the testing of a single division will be required every fourth 24-month interval. Imposing testing of divisions every third 24-month interval will necessitate testing two divisions during one interval to maintain all divisions tested. It is the intent to test each of the four divisions, one each 24-month interval, such that all divisions remain tested and available to be credited as "required" and to avoid testing multiple divisions in a single interval.

**DCD Impact**

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

**NRC RAI 16.2-155**

*TS Section 8.3.2.1.1, states that "Batteries are sized for the DC load in accordance with IEEE std. 485 with an expected 20-year service life." In response to RAI 16.2-86, GE stated that VRLA batteries will be used. Provide basis for 20-year service life for VRLA batteries with operating experience.*

**GEH Response**

Design Control Document (DCD) Tier 2, Chapters 8 and 16, requirements related to safety related batteries were developed based on the use of "Absolyte XL" valve-regulated lead-acid batteries. The "Absolyte XL" batteries are manufactured by GNB Industrial Power, a division of Exide Technologies. The manufacturer's specifications for the "Absolyte XL" battery state that these batteries have a 20 year design life in float applications at 77°F/25°C, when using proper charge procedures. The ESBWR batteries will be used in a float application and maintained in accordance with the ESBWR Technical Specifications, the recommendations of the manufacturer, and the recommendations of IEEE Standard 1188-2005, "Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid Batteries for Stationary Applications." These requirements will ensure that the prerequisites for projected 20-year battery life are met.

ESBWR Surveillance Requirements (SR) 3.8.3.6 requires a battery performance test every 24 months (See response to RAI 16.2-124 (GE Letter MFN 07-306, dated June 4, 2007) and more frequently if the battery has reached 85% of its expected life or shows indications of degradation. This test, which is performed in accordance with IEEE 1188, Sections 6.3 and 7.5, is specifically designed to monitor battery degradation due to age or use. Performance of this SR at a 24 month frequency, rather than the 60 month frequency allowed for vented lead acid batteries, compensates for the reduce operating experience with VRLA batteries and will ensure timely identification and correction of a prematurely degraded battery.

**DCD Impact**

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