May 10, 2007

Mr. Robert E. Brown
General Manager, Regulatory Affairs
General Electric Company
3901 Castle Hayne Rd MC A-45
Wilmington NC 28401

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 97 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION

Dear Mr. Brown:

By letter dated August 24, 2005, General Electric Company (GE) submitted an application for final design approval and standard design certification of the economic simplified boiling water reactor (ESBWR) standard plant design pursuant to 10 CFR Part 52. The Nuclear Regulatory Commission (NRC) staff is performing a detailed review of this application to enable the staff to reach a conclusion on the safety of the proposed design.

The NRC staff has identified that additional information is needed to continue portions of the review. The staff's request for additional information (RAI) is contained in the enclosure to this letter. This RAI concerns Chapters 3, 4, 5, 6, 8, 9, 14, 15, 16, 17 and 19 of Tier 2 of the ESBWR Design Control Document.

Chapter 3:	3.8-110, 3.9-176
Chapter 4:	4.3-7 thru 4.3-9
Chapter 5:	5.4-59
Chapter 6:	6.2-155
Chapter 8:	8.3-56 thru 8.3-58
Chapter 9:	9.1-29, 9.1-30
Chapter 14:	14.2-81 thru 14.2-88
Chapter 15:	15.4-30, 15.4-31
Chapter 16:	16.2-120 thru 16.2-155
Chapter 17:	17.4-17
Chapter 19:	19.1-149

To support the review schedule, you are requested to respond to this RAI by June 18, 2007.

If you have any questions or comments concerning this matter, please contact Ilka Berrios at (301) 415-3179 or ixb3@nrc.gov, or me at (301) 415-2875 or aec@nrc.gov.

Sincerely,

/RA/

Amy Cubbage, Senior Project Manager
ESBWR/ABWR Projects Branch 1
Division of New Reactor Licensing
Office of New Reactors

Docket No. 52-010

Enclosure: As stated

cc: See next page

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ACCESSION NO. ML071230389

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DATE	5/10/2007	5/10/2007	5/10/2007

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Requests for Additional Information (RAIs)
ESBWR Design Control Document (DCD), Revision 3

Chapter 3. Design of Structure, Components, Equipment and Systems

RAI Number	Reviewer	Question Summary	Full Text
3.8-110	Chakrabarti S Jeng D	Use of ASME code in accordance with RG 1.57, Rev 1.	The applicant has referenced the 2004 edition of ASME Code Section III, Subsection NE. The staff notes that Regulatory Guide (RG) 1.57, Revision 1, entitled "Design Limits and Loading Combinations for Metal Primary Reactor Containment System Components," was officially issued in March 2007. This regulatory guide endorses the 2001 Edition of the ASME Code, Section III, Division 2, through the 2003 addenda, subject to the exceptions cited in Section C, Regulatory Position, of the RG. Since the staff has officially accepted the code, through the 2003 addenda, the applicant needs to identify any relaxations between the 2004 Code referenced for the ESBWR design and RG 1.57, Rev. 1, including the regulatory positions. Any deviation from the staff positions identified will require a technical justification. As an alternative, the applicant may choose to reference RG 1.57, Rev. 1 directly.
3.9-176	Scarbrough T	Use of the phrase "COL holder" in place of " COL applicant" in Section 3.9	GE is specifying in the DCD that some COL information may be submitted by the "COL holder" after receiving its COL. For example, DCD Section 3.9.6 states that details of the IST program, including test schedules and frequencies, shall be provided by the COL holder referencing the ESBWR design. This COL information needs to be provided as part of the COL application for NRC staff to review in order to prepare a safety evaluation to support COL issuance. There are also other instances in the DCD Section 3.9 (e.g. Section 3.9.9) where COL information needs to be submitted as part of the COL application, but is specified by GE as being provided by the COL holder. GE should address these issues and provide for appropriate revision of the DCD.

Chapter 4. Reactor

RAI Number	Reviewer	Question Summary	Full Text
4.3-7	Huang T	Stability: log term solution	All operating BWRs are required to implement an approved long term (L/T) stability solution. Section 4.3.3.6.2 "Thermal Hydraulic Stability" of the ESBWR DCD Rev. 3 indicates that a Detect and Suppress (D&S) solution is the preferred option for ESBWR. Please provide a detailed description of the stability solution chosen for ESBWR. Include in your description the following items: Which solution was chosen? Will the solution need to be reviewed by the staff, or is it a standard solution? Proposed technical specifications associated with the solution How will the setpoint calculation (if any) be reflected in technical specifications?
4.3-8	Huang T	Stability: armed region	All approved D&S solutions have an armed region. Typically, the solution is only armed for low-flow maneuvers, and this represents a small fraction of the cycle time. Since ESBWR operates at the equivalent of low-flow conditions at nominal conditions, one would expect that the D&S solution must remain armed for the complete cycle. Please provide a discussion of armed-region implications and the associated probability of false alarms.
4.3-9	Huang T	Stability: long term solution criteria	A future licensee may have the flexibility to deviate from the standard certification and choose a different L/T stability solution. Please specify criteria that must be met by ESBWR for L/T stability solutions.

Chapter 5. Reactor Coolant System and Connected Systems

RAI Number	Reviewer	Question Summary	Full Text
5.4-59	Thomas G Pohida M Jensen W	Concerning the modes of the RWCU/SDC, address thermal-hydraulic uncertainty and its impact on the ESBWR shutdown PRA.	Provide additional information regarding operation of the reactor water clean up/shutdown cooling (RWCU/SDC) system during Modes 5 and 6 (cold shutdown and refueling). (A) Provide a drawing of the ESBWR vessel showing the elevations of the feedwater (FW) nozzles and the RWCU/SDC piping penetrations inside and outside the shroud. (B) Include a discussion in the DCD regarding vessel level for normal RWCU/SDC operation in all modes, including Modes 4, 5, and 6. (C) Perform a calculation demonstrating under what temperatures and levels the RWCU/SDC system can adequately remove decay heat in Modes 4, 5, and 6 (with the RPV head installed) including any minimum and maximum temperatures and levels. (D) Include a discussion in the DCD regarding RWCU/SDC flow and mixing within the vessel and within the shroud. (E) Address thermal-hydraulic uncertainty. (F) Address the impact on the ESBWR shutdown PRA.

Chapter 6, Engineered Safety Features

RAI Number	Reviewer	Question Summary	Full Text
6.2-155	Forrest E	Identify the equipment important to safety and the provisions of the reactor building design that assure compliance with GDC 4.	The applicant did not provide sufficient information in DCD Tier 2, Revision 3, Section 6.2.3, to determine if the requirements of GDC 4 are met. GDC 4 requires that "structures, systems, and components important to safety shall be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents. These structures, systems, and components shall be appropriately protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit." Please identify the equipment important to safety and the provisions of the ESBWR reactor building design that assure compliance with GDC 4.

Chapter 8, Electric Power

RAI Number	Reviewer	Question Summary	Full Text
8.3-56	Rhow S	Fig. 8.1-4 should be revised to show those power feeders to "Scram solenoids" rather than "RPS."	Four divisions of safety-related UPS provide 120V AC power for the reactor protection systems (RPS). Fig. 8.1-4 in Revision 3 of DCD indicated that two RPS power feeders from division 1, two RPS power feeders from division 2, and none from divisions 3 and 4. During a public meeting on April 25 and 26, 2007, GE clarified that RPS instrumentation is powered by four divisions of power from Q-DCIS, but reactor trip solenoids are only powered by division 1 and division 2, due to the fail safe configuration (lost power to scram the reactor). Fig. 8.1-4 should be revised to show those power feeders to "Scram solenoids" rather than "RPS".
8.3-57	Rhow S	Identify power load groups.	According to Nonsafety-Related UPS System in page 8.3-5 of DCD Revision 3, a third load group's nonsafety-related UPS is normally supplied from a 480V AC power center, which can receive power from either of two power load groups. Identify the two power load groups.
8.3-58	Rhow S	Provide accurate description for I&C power supply system.	According to DCD Tier 2, Rev 3, Section 8.3.1.1.4, Instrumentation and Control Power Supply System, the instrumentation and control buses are each supplied independently from separate 480V AC power centers. In the second paragraph, instrumentation and control buses are supplied from the DCIS swing bus power center. It is not clear that the vendor describes two different I&C buses. Provide accurate description for I&C power supply system.

Chapter 9, Auxiliary Systems

RAI Number	Reviewer	Question Summary	Full Text
9.1-29	Sastre-Fuente E	Provide a more detailed description of the Spent Fuel Pool Cleanup System.	Please provide a more detailed description of the Spent Fuel Pool Cleanup System (e.g., type of demineralizer and filter to be used, capacity, system parameters, etc.). In addition please provide the basis for the system parameters.
9.1-30	Sastre-Fuente E	Provide a more detailed description of the Spent Fuel Pool Cleanup System.	Please provide a description of the provisions in place to preclude the inadvertent transfer of spent filter and demineralized media to any place other than the radwaste facility.

Chapter 14, Verification Programs

RAI Number	Reviewer	Question Summary	Full Text
14.2- 81	Dehmel JC	Address how field engineering design changes will be documented and reflected in the conduct of field tests and test acceptance criteria.	A review of DCD Tier 2, Rev. 3, Section 14.2.1 indicates that the objectives of construction tests do not consider the possibility of field engineering changes to SSC and do not identify how such changes will be documented and reflected in the conduct of field tests and test acceptance criteria. Accordingly, update the DCD to include a description of the process that will be used to address how field engineering design changes to SSC will be documented and reflected in the conduct of initial tests to ensure that the plant will be built and will operate in accordance with the design certification and comply with NRC regulations.
14.2- 82	Dehmel JC	Objectives of pre-operational tests do not consider operational programs and procedures.	A review of DCD Tier 2, Rev. 3, Section 14.2.1 indicates that the objectives of pre-operational tests do not consider operational programs and procedures as prerequisites before fuel loading and do not identify when such programs need to be approved and in place. In the context of controlling and monitoring radioactive effluents, the programs include the Radiological Effluent Technical Specifications (RETS) or Standard Radiological Effluent Controls (SREC), Offsite Dose Calculation Manual (ODCM), Process Control Program (PCP), and Radiological Environmental Monitoring Program (REMP). Accordingly, update the DCD to identify these program documents and state when such documents must be approved and operationally ready for the conduct of pre-operational tests for all associated systems as prerequisites before fuel loading.

RAI Number	Reviewer	Question Summary	Full Text
14.2- 83	Dehmel JC	DCD Section 14.2.8.1.15, scope of the pre-operational test is incomplete.	A review of DCD Tier 2, Rev. 3, Section 14.2.8.1.15 indicates that the scope of pre-operational tests is incomplete. In its description, the test only refers to “plant water systems” and does not identify plant systems designed to process and treat gaseous process and effluent streams. Accordingly, update the DCD to include in the scope of initial tests of systems that are designed to handle and treat liquid and gaseous process and effluent streams. Without this updated information, the staff cannot perform its evaluation and conclude, with reasonable assurance, that initial tests cover all systems and confirm that all design commitments have been fulfilled and that the plant will be built and will operate in accordance with the design certification.
14.2- 84	Dehmel JC	DCD Section 14.2.8.1.16, purpose of pre-operational tests is incomplete.	A review of DCD Tier 2, Rev. 3, Section 14.2.8.1.16 indicates that the purpose of pre-operational tests is incomplete. In its description, the test only refers to “process steams,” and does not include “liquid and gaseous effluent streams.” In addition, the listing of integrated subsystem tests fails to include a confirmation of the proper operation of remote control panels, including local audio visual alarms upon instrument trip responses and downscale or inoperative instrument conditions. Accordingly, update the DCD to include initial tests for liquid and gaseous effluent streams and update the scope of integrated subsystem tests to include the proper operation of all remote control panels.

RAI Number	Reviewer	Question Summary	Full Text
14.2- 85	Dehmel JC	DCD Section 14.2.8.1.40, scope of pre-operational tests is incomplete.	A review of DCD Tier 2, Rev. 3, Section 14.2.8.1.16 indicates that the scope of pre-operational tests is incomplete. In its description, the scope does not describe how the installation and operation of mobile waste processing systems will be integrated in the tests. Address the following as they relate to pre-operational tests for systems described in Sections 11.2 and 11.4 of the DCD: (A) Given that the processing of radioactive wastes relies on a combination of permanently installed plant systems and mobile waste treatment systems, the tests should consider operational interfaces between plant systems and mobile treatment systems and characteristics. Please discuss how these interfaces will be confirmed. (B) Provide definitions of tests and acceptance criteria, as they relate to the interface with the LWMS in controlling and monitoring liquid effluent releases described in DCD Sections 11.2 and 11.4. (C) Describe types and initial quantities of filtration and adsorbent media placed in components of permanently installed and mobile waste treatment systems described DCD Chapters 11.2 and 11.4. (D) Describe the process that will be used to confirm that the performance characteristics of the selected filtration and adsorbent media used for waste treatment will meet or exceed radioactivity or radionuclide decontamination factors or removal efficiencies described in DCD Sections 11.4 and 11.2 in complying with Part 20 effluent concentration and dose limits and Part 50 Appendix I dose objectives. Accordingly, update the DCD to include the conduct of initial tests in confirming the proper installation and operation of mobile liquid waste treatment systems and overall performance in controlling releases of radioactive materials in liquid effluent streams, as stated in DCD Sections 11.2 and 11.4.

RAI Number	Reviewer	Question Summary	Full Text
14.2- 86	Dehmel JC	DCD Section 14.2.8.1.48, scope of pre-operational tests is incomplete.	A review of DCD Tier 2, Rev. 3, Section 14.2.8.1.48 indicates that the scope of pre-operational tests is incomplete as they do not describe the process that will be used in confirming the proper selection and performance characteristics of the media to treat gaseous process, waste, and effluent streams. Address the following as they relate to the selection and installation of adsorbent media used to treat radioactive gaseous, process, waste, and effluent streams: (A) Describe the type and initial quantities of adsorbent media that will be placed in the guard and main charcoal beds described DCD Section 11.3. (B) Describe the process that will be used to confirm that the performance characteristics of the selected adsorbent media will meet or exceed radioactivity or radionuclide decontamination factors, removal efficiencies, or holding times described in DCD Section 11.3 in complying with Part 20 effluent concentration and dose limits and Part 50, Appendix I dose objectives. Accordingly, update the DCD to include descriptions of initial tests addressing the proper installation of adsorbent media.
14.2- 87	Dehmel JC	DCD Section 14.2.8.1.62, scope of pre-operational tests is incomplete.	A review of DCD Tier 2, Rev. 3, Section 14.2.8.1.62 indicates that the scope of pre-operational tests for the liquid and solid radioactive waste systems are incomplete. See applicable comments noted in RAI 14.2-85 above.

RAI Number	Reviewer	Question Summary	Full Text
14.2- 88	Dehmel JC	DCD Section 14.2.8.2.1, prerequisites for startup tests is incomplete.	A review of DCD Tier 2, Rev. 3, Section 14.2.8.2.1 indicates that the prerequisites for the startup tests is incomplete as they do not identify necessary operational programs and procedures providing the means perform radiological and radio-chemical measurements in assessing the performance of permanently installed plant systems and mobile waste treatment system used to control and monitor radioactive effluents. The relevant programs include the Radiological Effluent Technical Specifications (RETS) or Standard Radiological Effluent Controls (SREC), and the Offsite Dose Calculation Manual (ODCM). Accordingly, update the DCD to identify these program documents and state when such documents must be approved and operationally ready for the conduct of startup tests for all associated systems. In the discussion noting that radioactivity levels in gaseous and liquid effluents “must conform to license limitations,” the discussion should more appropriately refer to license conditions instead and the requirements of 10 CFR Parts 20.1301 and 20.1302 in complying with dose limits for members of the public in unrestricted areas, Part 20, Appendix B, Table 2, effluent concentration limits, and 10 CFR Part 50, Appendix I dose objectives.

Chapter 15. Safety Analyses

RAI Number	Reviewer	Question Summary	Full Text
15.4-30	Lee J	Please include ITAAC for assumed control room unfiltered air in leakage rates.	DCD Tier 2, Revision 3, Table 15.4-5, "Loss-of-Coolant Accident Parameters," specifies an assumed control room unfiltered air inleakage rate of 1.13E-2 cubic meter per minute. Please include this assumed control room unfiltered air inleakage rate (1) in DCD Tier 1, Table 2.16.2-1, "ITAAC for the Reactor Building HVAC," of Section 2.16.2, "Heating, Ventilating, and Air-Conditioning Systems," as an ITAAC item, and (2) in DCD Tier 2, Chapter 16, “Technical Specifications,” Section 3.7.2, ”Control room Habitability Area Heating, Ventilation, and Air Conditioning Subsystem,” as surveillance requirements in accordance with guidance provided in Technical Specification Task Force (TSTF) - 448 (dated July 1, 2003).
15.4-31	Lee J	Please state which set of control room χ/Q values are used for the control room radiological consequences and why.	In Revision 3 to the DCD, GE revised the control room χ/Q values in DCD Tier 1 Table 5.1-1 and Tier 2 Table 2.0-1, listing them as standard plant site design parameters. Two sets of control room χ/Q values are provided for reactor building, passive containment cooling system/reactor building roof, and turbine building release pathways; one set for unfiltered inleakage and the second set for the filtered air intake. Please state which set of control room χ/Q values are used for the control room radiological consequences and why.

Chapter 16. Technical Specifications

RAI Number	Reviewer	Question Summary	Full Text
16.2-120	Harbuck C	Significant digits correction.	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
16.2-121	Beltz T	Explain why TS 3.4.3, Action B omits the option of placing the unit in Mode 5 and discuss the available methods for decay removal when MSIVs are closed.	In standard technical specification (STS) 3.4.8 Condition B, reactor coolant specific activity > 4.0 µCi 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.

RAI Number	Reviewer	Question Summary	Full Text
16.2-122	Clark R Pal A	Battery cell temperature surveillance.	Limiting condition for operation (LCO) 3.8.3.D and SR 3.8.3.4 include Required Actions and Surveillance Requirements for battery room temperature. Explain basis for battery room temperature and why the DCD or TS Bases does not require continuous monitoring of the battery room temperature with alarms in the main control room when room temperature is below or above established design limits. Since battery cell temperature could change for reasons other than ambient conditions (e.g., power flow, resistivity issues/internal shorts, etc.), a new LCO should be specified for the battery pilot cells and connected cells. The surveillance frequency associated with these LCO's should specify that the battery pilot cell temperature measurements at the negative post be performed every 31 days and every 92 days for connected cells.
16.2-123	Clark R Pal A	Explain how battery room temperature will be maintained during loss of ac power.	Explain how battery room temperature will be maintained during loss of ac power. Battery performance is dependent on battery temperature. Provide assurance that the battery will perform its intended function without ac power to the battery room ventilation and AC systems. Discuss battery margins (i.e., aging margin, design margin, temperature correction factor, float current monitoring uncertainty for 100 percent state of charge) and potential for thermal runaway.
16.2-124	Clark R Pal A	Provide basis for not following IEEE Std 1188-2005 regarding battery capacity test interval.	SR 3.8.3.6 requires battery capacity verification every 60 months and 12 months when battery shows degradation or has reached 85 percent of expected life. IEEE Std. 1188- 2005, recommends that the performance test interval should not be greater than 25 percent of the expected service life or two years, whichever is less. Provide basis for not following IEEE Std 1188- 2005.

RAI Number	Reviewer	Question Summary	Full Text
16.2-125	Clark R	SR 3.8.3.2 and 3.8.3.6 should specify battery pilot cell float voltage to differentiate it from battery pilot cell open circuit voltage.	SR 3.8.3.2 and 3.8.3.6 should specify battery pilot cell float voltage to differentiate it from battery pilot cell open circuit voltage.
16.2-126	Clark R	Define fully charged condition for a battery in the LCO.	LCO 3.8.1, Required Action A2, states that if one or both required battery chargers are inoperable on one required division, the associated battery must be returned to the fully charged condition. Fully charged condition is specified in the Bases as either three consecutive hourly current readings change less than {0.5} amps or the float current is <{2} amps. LCO 3.8.1 must define fully charged condition, not the bases. In addition no technical justification was given for three consecutive hourly readings change of less than {0.5} amps in lieu of float current < than {2} amps.
16.2-127	Clark R	State if the rectifiers are safety-related.	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.
16.2-128	Clark R	State if the regulating transformers are safety-related.	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 safety-related. Please resolve this discrepancy.
16.2-129	Clark R	Include surveillance requirements to periodically verify that the blocking diodes are operable.	The bases for LCO 3.8.1, DC Sources, states that all safety-related Class 1E loads are isolated from the IPC buses by diodes on the output of both the nonsafety-related rectifiers and the 250 VDC bus associated with the DC sources. Explain why there are no surveillance requirements to periodically verify that the blocking diodes are operable.

RAI Number	Reviewer	Question Summary	Full Text
16.2-130	Harbuck C	Explain how the fuel will be protected from overheating in Modes 5 and 6 if the RWCU/SDC system becomes unavailable.	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.
16.2-131	Schulten C	Provide a report to document application of the 10 CFR 50.36(c)(2)(ii) criteria to the instrumentation technical specification LCOs.	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.
16.2-132	Schulten C	Confirm that ESBWR TS LCO Applicability for each Instrumentation Function is consistent with LCO Applicability of supported systems.	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.

RAI Number	Reviewer	Question Summary	Full Text
16.2-133	Schulten C	Justify allowance to use LCO 3.0.4.c for the Control Rod Block and Remote Shutdown System (RSS) instrumentation TSs, which is inconsistent with STS.	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.
16.2-134	Schulten C	Justify that loss of function in two of three required channels/divisions is a credible condition allowing a temporary relaxation of the required GDC design criterion.	The reduced safety system capability described by the condition "Capability Not Maintained" represents multiple failures of SSCs, which is a loss of two or three required channels/divisions of instrumentation out of four installed channels/divisions. This Condition would permit the plant to operate for up to one hour with the LCO not met due to a loss of the required safety system capability. Additional information is needed to justify that loss of two of three required channels/divisions is a credible condition for which a temporary (1-hour) relaxation of the required GDC design criterion should be approved. The response should include deterministic analysis, risk analysis and consider instrumentation self test and watch dog design features. The response should identify adverse consequences to safe operation of the plant that would result without an allowance to operate in the degraded condition.
16.2-135	Schulten C	Justify excluding from TS the controllers for automatic scram and air header dump initiation.	Equipment within an RPS division of trip actuators includes load drivers and controllers for automatic scram and air header dump initiation. Load drivers are addressed in LCO 3.3.1.2. Operability requirements for the controllers are not addressed within the ESBWR DCD TS. Justify excluding controllers for automatic scram and air header dump initiation from TS.

RAI Number	Reviewer	Question Summary	Full Text
16.2-136	Schulten C	Revise RPS Manual Actuation TS to add the number of channels required to be operable for each manual actuation feature.	The LCO for RPS Manual Actuation states that the Division 1 and 2 manual actuation channels and Mode Switch Actuation channels must be operable. Revise the ESBWR TS Section 3.3.1.3, "Reactor Protection System Manual Actuation," LCO to add the number of channels required to be operable for each manual actuation feature.
16.2-137	Schulten C	Clarify Actions Note for TS Section 3.3.1.3, "Reactor Protection System Manual Actuation," regarding the basis for separate condition entry.	In ESBWR TS Section 3.3.1.3, "Reactor Protection System Manual Actuation," the Actions Note permitting separate condition entry for each function does not match the per channel requirements in the LCO. Revise the specification to make the Note and LCO refer to the same basis for usage.
16.2-138	Schulten C	Justify why ESBWR TS Section 3.3.1.3 permits operation when more than one channel of each type of the ESBWR manual actuation channels are inoperable	In ESBWR TS Section 3.3.1.3, "Reactor Protection System Manual Actuation," for the Actions Condition of "One or more channels inoperable," the reduced functional capability of the degraded condition described represents a loss one or both required channels of instrumentation for one or both manual actuation items. This condition would permit the plant to operate for up to 12 hours with a loss of all required safety system RPS manual actuation instrumentation. Additional information is needed to justify that the loss of function condition is a credible condition for which a temporary relaxation of the required design basis should be approved. Justify why operation should be permitted with more than one channel of each type of ESBWR manual actuation channels inoperable. Note that NUREG-1434 permits only one RPS manual actuation functions channel to be inoperable.
16.2-139	Schulten C	Revise instrumentation LCOs to state the number of channels required to be operable for each division.	Instrumentation LCOs state the number of divisions required to be operable, whereas, associated Actions Conditions refer to required channels inoperable. Revise LCOs to state the number of channels required to be operable for each division.

RAI Number	Reviewer	Question Summary	Full Text
16.2-140	Schulten C	Revise the SR for Function 3.3.1.4.2.d, “APRM - Inop,” to include the limit of 40 LPRM	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.”)
16.2-141	Schulten C	Explain duplication of and differences in LCO and surveillance requirements for SRNM instrumentation functions in TS 3.3.1.4 and TS 3.3.1.6; eliminate duplication	SRNM instrumentation is required to be operable by LCO 3.3.1.6, "Startup Range Neutron Monitor Instrumentation," and LCO 3.3.1.4, NMS Instrumentation. The applicability requirements for both LCOs include Mode 6; however, surveillance requirements for these LCOs are not comparable. Explain the reasons for duplicating instrumentation requirements. Revise the TS to eliminate duplicate applicabilities. In terms of compliance with 10 CFR 50.36 and the instrumentation design basis, explain why LCO 3.3.1.4 Channel Calibrations require testing in accordance with the Setpoint Control Program whereas, LCO 3.3.1.6 does not.
16.2-142	Schulten C	Add Required Actions to place the plant in Mode 5 as the TS required end state in the Actions of TS 3.3.4.1, “RCS Leakage Detection Instrumentation.”	The proposed end state for RCS Leakage Detection Instrumentation LCO 3.3.4.1, LCO 3.3.6.3, Table 3.3.6.3-1, Function 13 (feedwater isolation instrumentation), and LCO 3.3.6.4, Table 3.3.6.4-1 Function 14 (Feedwater Isolation Valves) and Function 15 (Feedwater Pump Breakers) is Mode 3; whereas these Functions have Modes 1, 2, 3 and 4 applicabilities. Add Required Actions to place the plant in Mode 5 as the TS required end state. See RAI 16.0-7

RAI Number	Reviewer	Question Summary	Full Text
16.2-143	Schulten C	Explain why TS 3.3.6.1 and 3.3.6.2 permit penetration paths to be unisolated intermittently under administrative controls without MSIV isolation.	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.)
16.2-144	Schulten C	Delete unnecessary instruction to conform to accepted TS writing convention	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.

RAI Number	Reviewer	Question Summary	Full Text
16.2-145	Schulten C	Provide documentation to show that instrumentation TS surveillances will verify operability of the critical functions:	Channel operability based on allowable values (AVs), pre-defined as-found tolerance bands, and as-left tolerance bands as specified in the TS for the ESBWR are applicable only to analog protection systems using bistables. For the ESBWR digital protection systems, setpoints are controlled in the TS. The ESBWR TS require that the Nominal trip setpoint, embedded in the digital protection system, be equal to or conservative with respect to the LSSS. Provide documentation to show that TS will require surveillances to verify operability of the critical functions (1) internal diagnostic methods that can monitor the “health” of different processors/memory boards and perform software checks to ensure that the proper software is executing, and (2) power-up tests (RAM, EPROM, etc.) and error checking on the data links as well as tests by a transmitting channel to ascertain that the transmitted signal has been properly received by the receiving channels during the channel functional test. This information is needed to understand how the proposed Setpoint Control Program will ensure that the requirements of 10 CFR 50.36.(c)(ii)(A) are met.

RAI Number	Reviewer	Question Summary	Full Text
16.2-146	Schulten C	Provide additional explanation of how the setpoint control program will ensure that the requirements of 10 CFR 50.36.(c)(ii)(A) are met.	Specification 5.5.11, “Setpoint Control Program,” requires establishing and documenting Nominal Trip Setpoints (NTSPs), Allowable Values (AVs), and As-Found and Leave Alone Tolerance Bands, and the methodologies used to determine these values for technical specification instrumentation functions in the following TS Sections: 3.3.1.1, RPS; 3.3.1.4, NMS; 3.3.5.1, ECCS; 3.3.5.3, ICS; 3.3.6.1, MSIV; 3.3.6.3, Isolation; and 3.3.7.1, CRHAVS. For these instrumentation functions, Channel Calibration tests must evaluate a channel to verify it is functioning as required, before returning it to service, when the as-found channel setpoint is found conservative with respect to the Allowable Value but outside its predefined As-Found Tolerance Band. Define the terms NTSP, AV, and As-Found and Leave Alone Tolerance Bands for the instrument functions in the above list of Specifications, and justify why these methodology terms were chosen for establishing digital protection channel operability during a Channel Calibration. Explain qualitatively, what is meant by a Leave Alone Tolerance Band (Specification 5.5.11.b) for a digital protection channel. This information is needed to understand how the proposed SCP will ensure that the requirements of 10 CFR 50.36.(c)(ii)(A) are met.
16.2-147	Schulten C	Show that the self test report meets the requirements of a Channel Check without performing the required comparison of the parameter.	Provide data to show that the self test report meets the requirements of a Channel Check without performing the required comparison of the parameter.

RAI Number	Reviewer	Question Summary	Full Text
16.2-148	Schulten C	Show that the self test report meets the requirements of a CFT	Provide data to show that the self test report meets the requirements of a Channel Functional Test without performing a test to inject a simulated or actual signal into the channel as close to the sensor as practicable to verify OPERABILITY of all devices in the channel required for channel OPERABILITY.
16.2-149	Schulten C	Calibration in Accordance with the Setpoint Control Program	Provide analysis to show that elements of the Setpoint Control Program are sufficient to ensure that the requirements of 10 CFR 50.36(c)(3) will be met including an appropriate basis for Setpoint Design Basis for each instrumentation function with a specified instrument calibration performed in accordance with the Setpoint Control Program.
16.2-150	Schulten C	Revise SRs for response time testing, and actuation instrumentation LSF tests to delete Frequency references to the number of divisions that must be tested.	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.
16.2-151	Schulten C	Revise Staggered Test Basis SR Frequency by deleting references to the number of divisions that must be tested.	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.

RAI Number	Reviewer	Question Summary	Full Text
16.2-152	Schulten C	Add discussion to instrumentation TS Bases to identify all devices in the channel required to be tested by a CFT for each instrument function.	A Channel Functional Test (CFT) shall be the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify operability of all devices in the channel required for channel operability. Add Bases to ESBWR DCD Instrumentation TS to identify all devices in the channel required to be tested by a CFT for each instrument function.
16.2-153	Schulten C	Add discussion to instrumentation TS Bases to define logic circuit and identify the logic circuit devices tested by LSFT	ESBWR instrumentation TS require a Logic System Functional Test (LSFT) to be a test of all components required for operability of a logic circuit. Add Bases to ESBWR DCD Instrumentation TS to define logic circuit and identify the logic circuit devices tested by LSFT.
16.2-154	Schulten C	Identify all instrumentation devices required to accomplish safety functions and address required testing and calibration	Identify all ESBWR DCD TS LCO instrumentation devices required to be operable to ensure the LCO specified safety function can be met. Show that ESBWR DCD TS required testing and calibration will ensure the necessary quality of instrumentation devices is maintained.
16.2-155	McConnell M	VRLA Battery Service Life	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.

Chapter 17. Quality Assurance

RAI Number	Reviewer	Question Summary	Full Text
17.4-17	Alexander S	Revise third paragraph of DCD Section 17.4.2.	The second sentence of the third paragraph of DCD Tier 2, Rev. 3, Section 17.4.2 should be revised to read: "This information forms part of the basis for the high-safety-significant (HSS) category, as described in NUMARC 93-01, and as endorsed by RG 1.160, of the SSCs within the scope of the Maintenance Rule program, as prescribed by 10CFR 50.65(b)." A new third sentence that incorporates the remainder of the existing second sentence should be added thus: "The Maintenance Rule Program ensures... [remainder of the existing second sentence]." A new fourth sentence should be added: "The HSS category within the Maintenance Rule Program scope must encompass the SSCs in the RAP scope as modified for the operations phase if the Maintenance Rule Program is to be used along with the QA and maintenance and surveillance programs in implementation of the RAP in the operations phase."

Chapter 19, Testing and Computer Code Evaluation

RAI Number	Reviewer	Question Summary	Full Text
19.1-149	Pohida M	Provide additional information to address issues described in NUREG-1449	Please provide additional information to address issues described in NUREG-1449, "Shutdown and Low Power Operation at Commercial Power Plants in the U.S.," which was issued in September 1993. The staff recognizes that due to ESBWR's unique design, not all of the scenarios discussed in NUREG-1449 would be directly applicable to ESBWR; however many of the issues identified in the NUREG would be applicable. The staff requests a systematic evaluation of shutdown risk for ESBWR similar to those submitted by GE and Westinghouse in suppport of the ABWR (ABWR DCD Tier 2, Revision 4, Appendix 19Q) and AP600 (WCAP-14837, revision 3, March 1998) design certifications, respectively.

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