June 22, 2006

Mr. David Hinds, Manager, ESBWR
General Electric Company
P.O. Box 780, M/C L60
Wilmington, NC 28402-0780

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 34 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION

Dear Mr. Hinds:

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 the "Engineered Safety Features," Chapter 6, and the "Auxiliary Systems," Chapter 9, of Tier 2 of the ESBWR design control document. The RAI regarding Chapter 6, RAI 6.3-3 - 6.3-34, was sent to you via electronic mail on April 17, 2006, and resent on May 22, 2006. The RAIs were discussed with you during a telecon on May 15, 2006. The RAI regarding Chapter 6, RAI 6.3-35 - 6.3-37, was sent to you via electronic mail on May 30, 2006 and resent on June 10, 2006. The RAIs were discussed with you during a telecon on May 30, 2006. You agreed to respond to this RAI by July 21, 2006.

The RAI regarding Chapter 9 was sent to you via electronic mail on May 10, 2006. The RAIs were discussed with you during a telecon on May 30, 2006. You agreed to respond to this RAI on the following schedule:

June 30, 2006:	RAI 9.3-3 through 9.3-10, 9.3-12 through 9.3-24
July 28, 2006:	RAI 9.3-11, 9.3-25, and 9.3-26

If you have any questions or comments concerning this matter, you may contact me at (301) 415-2007 or lnq@nrc.gov, Amy Cubbage at (301) 415-2875 or aec@nrc.gov, Lawrence Rossbach at (301) 415-2863 or lwr@nrc.gov, or Martha Barillas at (301) 415-4115 or mcb@nrc.gov.

Sincerely,

/RA/

Lauren Quinones, Project Manager
ESBWR/ABWR Projects Branch
Division of New Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 52-0010

Enclosure: As stated

cc: See next page

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ACCESSION NO. ML061720019

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REQUESTS FOR ADDITIONAL INFORMATION (RAIs)
ESBWR DESIGN CONTROL DOCUMENT (DCD) CHAPTER 6

RAI Number	Reviewer	Question Summary	Full Text
6.3-3	Thomas G	Gravity driven cooling system (GDCS) P&ID	Submit the P&ID for the GDCS.
6.3-4	Thomas G	GDCS process diagram	Even though some of the design basis parameters for GDCS are given in Table 6.3-2, it is not complete. Provide a diagram showing the GDCS design and operating parameters: pressure, temperature and flow rates. Submit the GE standard process diagram.
6.3-5	Thomas G	GDC 17 compliance	A more detailed description is required to explain compliance with GDC 17. GDC 17 states: "An on-site electric power system and an off-site electric power system shall be provided to permit functioning of systems important to safety. The safety function of each system (assuming the other system is not functioning) shall be to provide sufficient capacity and capability ..." Confirm that the emergency core cooling systems (ECCS) have alternate sources of electric power as required by GDC 17, and must be able to withstand a single failure, with either of the power source. In the discussion about GDC-17, add a paragraph explaining the on-site or off-site power aspects related to ECCS. The discussion should include all ECCS including GDCS, standby liquid control system (SLCS), depressurization valves (DPVs) and automatic depressurization system (ADS).
6.3-6	Thomas G	Separation criteria	Confirm that the GDCS, isolation condenser system (ICS), SLCS and ADS are physically, mechanically and electrically are separated. Address potential impact of fire and flood.

RAI Number	Reviewer	Question Summary	Full Text
6.3-7	Thomas G	Separation criteria	Identify components shared between the ECCS and other systems (e.g. pools, coolant make up systems, etc.) that satisfy engineered safeguard feature design requirements and confirm that the ECCS function is not diminished as a result of sharing these components. For example, two of the four GDCS lines share one of the GDCS Pools. There may be other systems which share supporting systems.
6.3-8	Thomas G	Reliability	DCD Tier 2, Section 6.3.1.1.2, Reliability Requirements (a) Since GDCS and SLCS are being used as ECCS for the first time, a failure mode and effects analysis of the ECCS should be submitted for staff review. (b) Identify the functional consequence of each possible single failure including the effects of any single failure or operator error that can cause any valve to move to a position that could adversely affect safety. (c) Discuss the reliability requirements for the biased open check valve, squib actuated injection valve and the DPV. (d) We understand that magnetically linking to a DC-torque motor is a unique design. Is there any test performed to verify that this design will perform as designed? (e) We understand that squib actuated motor operated valves are used in the standby liquid control system for operating reactors. Describe the operating experience with the squib actuated valves, and its applicability to the squib valves that are used in the ESBWR design (GDCS, DPVs, and SLCS). Address design differences between ESBWR squib valves and operating reactor squib valves.

RAI Number	Reviewer	Question Summary	Full Text
6.3-9	Thomas G	SLCS	DCD Tier 2, Section 6.3.1.2 Since the SLCS system is part of the ESBWR ECCS, the likelihood of inadvertent SLCS actuation during normal plant operation may be increased. Discuss measures to prevent inadvertent operation of SLCS, and discuss any potential safety consequences with inadvertent SLCS operation.
6.3-10	Thomas G	ECCS initiation	DCD Tier 2, Section 6.3.2.1 (a) It is stated that "[t]he starting signal for the ECCS comes from independent and redundant sensors of low reactor water level." Please address the drywell high pressure sensors and a delay timer, in this section of the DCD. (b) Can the GDCS timer be over-ridden? (c) It is recommended that the following statement be revised from "[b]ecause ECCS flow is gravity driven, NPSH is not a concern" to "[b]ecause <u>GDCS</u> flow is gravity driven, NPSH is not a concern." The SLCS is not gravity driven, therefore the entire ECCS is not gravity driven.
6.3-11	Thomas G	GDCS	DCD Tier 2, Section 6.3.2.7, GDCS State the bounds within which principal GDCS parameters must be maintained in the interest of constant standby readiness, e.g. minimum coolant reserve in the GDCS pool, maximum number of inoperable valves in injection lines, equalizing and deluge lines, maximum allowable time period for which a component can be out of service.

RAI Number	Reviewer	Question Summary	Full Text
6.3-12	Thomas G	Mechanical Separation Criteria	DCD Tier 2, Section 6.3.2.7.2, Detailed System Description On Page 6.3-8 it is stated that "[e]lectrical and mechanical separation between the divisions is complete." Since there are only three GDCS pools for four GDCS systems, mechanical separation between the divisions is not "complete". Revise and state the exception
6.3-13	Thomas G	Inspections, tests, analyses and acceptance criteria (ITAAC)	DCD Tier 2, Section 6.3.2.7.2, Detailed System Description On page 6.3-8, it is stated that "[t]he nozzle throat length is long enough to ensure that the homogenous flow model can be used in the LOCA analyses." Since the throat length is an important assumption in the LOCA analyses, throat length should be included in the ITAAC.
6.3-14	Thomas G	ECCS timers	The operation of several timers is crucial to the actuation of various parts of the ECCS in the ESBWR. The ADS and the GDCS, including injection from the GDCS pool and the suppression pool, depend on elapsed time signals to accomplish their functions. Confirm that common mode failure in the hardware or software can not disable all the timers.
6.3-15	Thomas G	Pre-op testing	DCD 6.3.4.1 Squib valves and biased open check valves should also be included with the safety relief valves (SRVs) and the DPVs which will be tested during plant initial power ascension.

RAI Number	Reviewer	Question Summary	Full Text
6.3-16	Thomas G	ECCS initiation signal	DCD 6.3.5 Instrumentation Requirements, Page 6.3-24 It is recommended that “[t]he GDCS is automatically initiated on low reactor water level” be changed to “[t]he GDCS is automatically initiated on low reactor water level plus high drywell pressure.”
6.3-17	Thomas G	GDCS pool volume	Table 6.3-2 Specify the total GDCS pool volume, in addition to the minimum inventory indicated.
6.3-18	Thomas G	ITAAC	The following important parameters given in DCD Tier 2, Table 6.3-2 should be incorporated into the ITAAC in DCD Tier 1, Table 2.4.2-1: (a) Minimum total drainable inventory (for 3 GDCS pools): 1760 cubic meters (b) Minimum long term core cooling flow delivered by the GDCS equalizing lines for a delta P of 1.32 psid across the equalizing lines: 100 gpm (c) Minimum flow through the deluge lines required to flood the lower drywell region: 70 kg/sec (d) Minimum available suppression pool water inventory: 1 meter above top of active fuel (TAF), 334 cubic meters (e) Minimum GDCS equalizing line driving head: 3.3 feet

RAI Number	Reviewer	Question Summary	Full Text
6.3-19	Thomas G	ITAAC	DCD Tier 1, Table 2.4.2-1, ITAAC Item # 2 The calculated flow resistance between each GDCS pool line and the reactor vessel need to be specified in the acceptance criteria for item # 2. (8 injection lines, 4 equalizing lines and 12 deluge lines between each GDCS pool and the reactor vessel, the suppression pool and the drywell floor). Include the tests for the deluge line flow to the drywell floor.
6.3-20	Thomas G	ITAAC	DCD Tier 1, Table 2.4.2-1, ITAAC item # 2 describes the open reactor vessel flow test, but the flow rate required for the test in not specified in the acceptance criteria. Please specify the required flow rate.
6.3-21	Thomas G	ITAAC	DCD Tier 1, Table 2.4.2-1, ITAAC item # 3, 4 and 5 specify the parameters such as flow coefficient and minimum flow to be tested, but there is no value specified in the acceptance criteria. Please specify values for the acceptance criteria.
6.3-22	Thomas G	ITAAC	DCD Tier 1, Table 2.4.2-1, ITAAC item # 6, add reactor pressure vessel (RPV) Level 0.5 and the lower drywell high temperature 1000 degrees F in the acceptance criteria.
6.3-23	Thomas G	ITAAC	Add the following items to DCD Tier 1, ITAAC Table 2.4-2: Inspection of the elevation of all the GDCS pools and suppression pool will be conducted. The elevation of the bottom inside pool surface is higher than the direct vessel injection nozzle centerline by the specified value.

RAI Number	Reviewer	Question Summary	Full Text
6.3-24	Thomas G	ITAAC/GDCS	DCD Tier 1, Section 2.4.2 ECCS - GDCS, Design Description (a) Specify the location of the system (b) Add equipment to be qualified for harsh environment
6.3-25	Thomas G	ITAAC/GDCS	Add the following to DCD Tier 1, ITAAC Table 2.4.2-1: (a) Divisional power supplies (b) Physical Separation

RAI Number	Reviewer	Question Summary	Full Text
6.3-26	Thomas G	ITAAC for ECCS Timers	DCD Tier 1, ITAAC Table 2.1.2-2, Nuclear Boiler System Item # 12 ADS Logic should be similar to the ABWR ITAAC. Add the acceptance criteria similar to item # 12 of the ABWR Nuclear Boiler System ITAAC for each timer in the ECCS. Add the following ECCS Timer values given DCD Tier 2, Table 6.3-1, "Significant Input Variables to the ECCS-LOCA Performance Analysis": (a) Time delay to confirm ECCS-LOCA signal: 10 secs (b) Time after LOCA confirmed initiating before signaling Group 2 ADS to open: 10 seconds c) ADS time delay before Group 1 DPVs open: 50 seconds (d) ADS time delay before Group 2 DPVs open: 50 seconds (e) ADS time delay before Group 3 DPVs open: 50 seconds (f) ADS time delay after Group 3 initiation, before Group 4 DPVs open: 50 seconds (g) Injection squib valve time delay: 150 seconds (h) Equalization squib valve time delay: 30 minutes (I) Manual equalization squib valve initiation logic time delay: 30 minutes (j) ECCS initiation time delay for Level 1.5 initiation: 15 minutes

RAI Number	Reviewer	Question Summary	Full Text
6.3-27	Thomas G Hammer G	SRV opening time	DCD Tier 1, ITAAC Table 2.1.2-2, Nuclear Boiler System Item # 10: The opening times for the SRV are 1.7 seconds and 0.3 seconds for ESBWR and ABWR respectively. Confirm that this value is correct. If so, explain why the SRV opening time for the ESBWR is higher?
6.3-28	Thomas G	ITAAC for nuclear boiler system	DCD Tier 1, ITAAC Table 2.1.2-2, Nuclear Boiler System Item # 12: Change "The SRV flow capacities are given in Table 2.1.2-1" to "The SRV and DPV flow capacities are given in Table 2.1.2-1". Table 2.1.2-1 provides both SRV and DPV flow capacities.
6.3-29	Thomas G	Remote SRV control	DCD Ter 1, ITAAC Table 2.1.2-2, Nuclear Boiler System Include the SRV Control from Remote Shutdown Panel.
6.3-30	Thomas G	TMI-2 Action Item III.D.1.1	DCD Tier 2, Table 1A-1, addresses TMI-2 action item III.D.1.1 with respect to provisions for leakage control and detection in the design of systems outside containment that contain (or might contain) accident source term radioactive materials following an accident. The table lists seven systems that could contain radioactive material outside the primary containment. Please explain why SLCS was not included in this list.

RAI Number	Reviewer	Question Summary	Full Text
6.3-31	Thomas G	Post-LOCA ECCS operation	The SRP Section 6.3, Revision 2, April 1984, states that "The ECCS design is reviewed to confirm that there are provisions for maintenance of the long-term coolant recirculation and decay heat removal systems, e.g; pump or valve overhaul, in the post LOCA environment (including consideration of radioactivity)." Confirm that the above item is not applicable for the ESBWR design.
6.3-32	Thomas G	ECCS outage times	What limitations, if any, will be placed on the ECCS cumulative outage times, i.e., unavailability due to frequent outages, but within the allowable outage times in the technical specifications.
6.3-33	Thomas G Drozd A	GDCS and passive containment cooling (PCC) pools interaction	Add a paragraph describing the interaction between GDCS and passive containment cooling system (PCCS), and address the following: (a) What are the normal water levels in the pools? What will the GDCS pool level be after the LOCA? Is there a limit to the GDCS pool drainage during a LOCA? (b) When an equilibrium is reached between the reactor decay heat and the condensate flow rate from the PCC, what will the level be in the GDCS pools?
6.3-34	Thomas G	Common mode failure of squib valves	If the same batch pyrotechnic booster charge is used for all the squib valves in the GDCS injection and equalizing lines, there is a potential for common mode failure. We understand that a different batch is used for squib valves in the deluge lines. For diversity and defense in depth, different batches of booster charges may be needed. This may be COL action item.

RAI Number	Reviewer	Question Summary	Full Text
6.3-35	Thomas G	Inconsistency between drawing 105E4038, Note 6, and the DCD.	On drawing 105E4038 (GDCS P&ID), Note 6, use of the term “GDCS Gravity line” is not consistent with Chapter 6 of the design control document (DCD) that refers to “GDCS injection line.” Which terminology is correct?
6.3-36	Thomas G	Correct inconsistency between DCD Figures 2.4.2-1 (Tier 1) and 6.3-1 (Tier 2) and the P&ID.	DCD Tier 1, Figure 2.4.2-1 and DCD Tier 2, Figure 6.3-1 are not in agreement with the GDCS P&ID. The DCD figures state that Division A, shown, is typical of Divisions B, C, and D. This is not precise since one of the GDCS pools shares two injection lines. Please clarify the DCD figures. The staff proposes to add the following note to these DCD figures: “Two of the three pools (A and D) contain one RPV injection line. The third GDCS pool (B/C) contains two independent RPV injection connections.”
6.3-37	Thomas G	Clarification of Note 12 of Drawing 105E4038.	Regarding Note 12 of Drawing 105E4038 (GDCS P&ID) what is the purpose of the additional interconnecting lines between the GDCS pools?

RAI Number	Reviewer	Question Summary	Full Text
9.3-3	Thomas G	Provide a process diagram showing the SLCS operating parameters	Provide a process diagram showing the SLCS operating parameters: pressure, temperature and flow rates.
9.3-4	Thomas G	SLCS safety related classification	DCD Tier 2, Rev.1, Section 7.4.1 states: "The Standby Liquid Control (SLC) system does not ensure any safety-related function, nor does it perform a safety-related function associated with any design basis event, as defined by 10 CFR 50.49(b)(1)(ii). However, for conservatism, the SLC system is classified as safety related." Since SLCS is part of the emergency core cooling system (ECCS) in the ESBWR design, the above statement is not correct. Recommend changing the above statement in the DCD to "The SLCS performs safety-related functions, it is classified as safety-related and is designed as a Seismic Category I system."
9.3-5	Thomas G	Include GDC applicable to ECCS systems in DCD	Since SLCS is part of the ECCS, General Design Criteria (GDC): 2 (Seismic design), 5 (Sharing among units), 17 (Electric power), 27 (Capability to cool the core), 35 (Emergency core cooling), 36 (Inspection of ECCS) and 37 (Testing of ECCS) apply. Include application of these GDC in the DCD. Also, add 10 CFR 50.46, in regard to the ECCS being designed so that its cooling performance is in accordance with an acceptable evaluation model. We understand that the above GDC are included in DCD Section 6.3 for ECCS, but for clarity, refer to them in the corresponding sections of the DCD describing the individual ECCS systems. Explain in detail how the SLCS meets GDC 4, as related to dynamic effects associated with flow instabilities and loads.

9.3-6	Thomas G	Provide a diagram showing spargers in the core bypass region	The boron injection path to the core is not described in the DCD. Discuss flow pattern (injection geometry) and movement of injected boron solution through the bypass region. Provide a diagram showing spargers in the core bypass region and show the header, feeder pipes, nozzles, discharge ports and the jets. Describe, in detail, positions of the injection points relative to the active length of the core.
9.3-7	Thomas G	ATWS Rule applicability	Anticipated transient without scram (ATWS) Rule 10 CFR 50.62 c) (4) is applicable to SLCS. Add a reference to the rule in the DCD.
9.3-8	Thomas G	Confirm that the divisional separation criteria is still met for the system.	The following sentences were included in DCD Section 9.3.5.2, Revision 0, but were deleted from Revision 1: "The bulk of the safety-related SLCS equipment is located within two divisionally separated compartments of the Reactor Building except for a portion of the injection lines that leads to the [reactor pressure vessel] RPV and therefore passes through containment." Confirm that the divisional separation criteria is still met for the system.
9.3-9	Thomas G	What is the rated pressure for the piping in the SLCS.	What is the rated pressure for the piping in the SLCS.
9.3-10	Thomas G	Clarification of each SLCS train capacity	DCD Tier 2, Section 9.3.5.2 states: "Each train provides 50% injection capacity." Clarify in the DCD that the capacity is in relation to the reactor shutdown function and not the ECCS function.
9.3-11	Thomas G	Specify the time is takes to reach hot shutdown in the most limiting ATWS scenario	DCD Tier 2, Section 9.3.5.3 (Page 9.3-11) states: "The extremely rapid initial rate of isotopically enriched born injection ensures that hot shutdown boron concentration are achieved within several minutes of SLCS initiation based on initial reactor water inventory." Specify the time is takes to reach hot shutdown in the most limiting ATWS scenario

9.3-12	Thomas G	Accumulator capability for reactor pressure above nominal operating pressure	DCD Tier 2, Section 9.3.5.3 (Page 9.3-12) states: "The initial accumulator tank inventory of compressed nitrogen is adequate to ensure full injection of the solution inventory at a reactor pressure of 1000 psia." The calculated reactor pressure during ATWS is 1426.1 psig as shown in DCD Tier 2, Table 15.5-4b, and in DCD Tier 1, Table 2.2.4-1 reactor pressure is shown as 1250 psia. Does the reactor pressure refer to the steam dome pressure? Which reactor pressure is correct? Describe the capability of the accumulators to provide sufficient driving head to ensure boron injection for a reactor pressure greater than 1000 psia and explain how the capability is provided.
9.3-13	Thomas G	Clarification of the SLCS ECCS function	In DCD Tier 2, Section 9.3.5.3, SLCS is evaluated against Regulatory Guide (RG) 1.26. Since SLCS is part of ECCS, the following statement is not correct "Because the SLCS is a defense-in-depth beyond design basis shutdown system, -----" Revise the RG 1.26 discussion in the DCD to state that SLCS is also an ECCS system.
9.3-14	Thomas G	Clarification of KCM673	DCD Tier 2, Table 9.3-3 states: " A poison solution line for initial charging and any necessary periodic makeup for each accumulator (KCM673)." What is "KCM673" ?
9.3-15	Thomas G	ITAAC Table 2.2.4-1 is not complete	The format of Table 2.2.4-1 is not consistent with the format required for ITAAC table with Design commitment, inspections, tests, analyses and acceptance criteria. The information in ITAAC Table 2.2.4-1 is duplicated in Table 2.2.4-2 except for the jet velocities. If the velocities can be added to Table 2.2.4-2, Table 2.2.4-1 can be deleted.

9.3-16	Thomas G	Missing items in the ITAAC regarding SLCS	Why are the following items are not included in the ITAAC: (a) The SLCS can be manually initiated from the main control room. (b) Both trains of the SLC system are automatically initiated during an ATWS (c) Injection valve shutoff after injection (d) Accumulator relief valve set point (e) Add the following if applicable: " In the SLC system, independence is provided between Class 1E divisions, and also between Class 1 E divisions and non-Class 1E equipment. (f) Add the following: motor operated valves (MOVs) and squib actuated valves designated as having an active safety-related function open, close, or both open and close under system pressure, fluid flow, and temperature conditions. (g) Physical Separation between trains (h) PRA insights (I) Seismic qualification
9.3-17	Thomas G	Include system values assumed in the ITAAC	DCD Tier 1, ITAAC Table 2.2.4-2, item # 2c, RPV inventory and reactor water cleanup (RWCU)/shutdown cooling (SDC) system values assumed in the calculations should be included in the ITAAC as in ABWR.

9.3-18	Thomas G	Add a description of the accumulator and the squib actuated valves in the ITAAC	DCD Tier 1, ITAAC Description Add a description of the Accumulator and the squib actuated valves
9.3-19	Thomas G	Provide additional information regarding the accumulator to the ITAAC	DCD Tier 1, ITAAC Figure 2.2.4-1 Add accumulator relief valve FO30 in addition to the vent shown for the Accumulator. Also, add the set pressure of the relief valve to the ITAAC. Add accumulator pressure indicator in addition to the level indicator, as pressure is a critical parameter. 2500 psia is indicated in the figure. Clarify whether the 2500 psia is the normal pressure in the accumulator, the design pressure of the accumulator, or the accumulator pressure assumed in the safety analyses. Also, clarify whether the 24.5 cubic meters indicated is the design capacity of the accumulator, or the accumulator capacity assumed in the safety analyses. If these parameters are to be verified by the ITAAC, these values should be included in the ITACC Table 2.2.4-2. Note: The ITAAC values to be verified should be the values assumed in the safety analyses
9.3-20	Thomas G	What is the basis for the three minute timer setting for SLCS automatic initiation	DCD Tier 2, Section 9.3.5.2 states "The SLCS automatically initiates by the APRM not downscale (6%) and one of the following conditions persisting for at least 3 minutes." What is the basis for the three minutes?

9.3-21	Thomas G	How are the environmental conditions maintained without the operation of the Reactor Building HVAC	DCD Section 9.3.5.2 states: "Environmental conditions to prevent precipitation of solute do not require operation of the Reactor Building HVAC systems during the time that SLCS operation is required." How are the environmental conditions maintained without the operation of the Reactor Building HVAC?
9.3-22	Thomas G	Discuss Diversity and Defense in Depth as it relates to SLCS squib valves	What would be the benefit in terms of reliability if several different batches of pyrotechnic booster chargers were used in the different squib valves for the SLCS injection lines? Briefly describe the testing program for the valves. How long are the valves in service before being replaced?
9.3-23	Thomas G	Is the power supply for the normally open MOV F002 AC or DC	From Drawing 105E3976, Sheet No. 2, it is not clear if MOV F002 is AC or DC powered. Is the power supply for the normally open MOV F002 AC or DC? DCD Tier 1, ITAAC Figure 2.2.4-1 shows only one air-operated valve for the Accumulator vent line, but the P&ID shows two valves, which is correct?
9.3-24	Parks B Thomas G	Discuss the impact of level increase following SLCS actuation	The control system that engages the SLCS differs from conventional designs of boiling water reactors. A depressurization valve (DPV) opening signal is also used to initiate the SLCS. This logic is in place to increase core coverage in the event of a loss of coolant accident (LOCA). If both SLCS trains are activated, a total of approximately 5000 gallons of borated water would be injected into the core. Discuss the resulting increase in level that this volume of water would provide in the vessel annulus and above the core.

9.3-25	Parks B Thomas G	Describe the flow path for the borated solution that develops during the ATWS/MSIV closure scenario	The staff identified several phenomena that could challenge the capability of the core's natural circulation patterns to disperse boron uniformly. First, the SLCS injects into the core bypass region within the core shroud. It is expected that the presence of fuel channels and, in the instance of the middle of cycle, some control rods, will inhibit planar flow. Second, this core has an unconventionally large diameter, which not only poses another challenge to passive means of boron mixing, but means that the core is less neutronically coupled than conventional BWRs. Third, restrictions imposed by two-phase flow will inhibit core upflow, and thus further limit boron transport in the core. Additional challenges to axial mixing include the presence of chimneys on top of the core, which would prevent the boron from traveling upward through the bypass and downward into the core via density-driven flow mechanisms, and flow reversal in the event of a main steamline isolation valve (MSIV) closure. Provide additional information about local boron concentration at various regions within the core and bypass during the evolution of the ATWS/MSIV closure scenario. Discuss the technical bases underlying the 25% (non-uniformity) and 15% (RWCU/SDC) numerical conservatisms used to calculate the boron concentration requirements. Describe the flow path for the borated solution that develops during the ATWS/MSIV closure scenario and its impact on the distribution of boron in the core, additionally describe how the resulting distribution affects shutdown time.
9.3-26	Parks B Thomas G	Provide the reactivity worth of the radial reflector	Provide the reactivity worth of the radial reflector (that is the bypass region surrounding the core, shroud, and annulus).

cc:

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