

July 13, 2006

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

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 42 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 Fire Protection and includes the Auxiliary Systems, Chapter 9, Initial Test Program, Chapter 14, and Safety Analyses, Chapter 15, of Tier 2 of the ESBWR design control document. The RAIs were sent to you via electronic mail on May 12, and were discussed with you during a telecon on June 16, 2006. You agreed to respond to this RAI on the following schedule:

June 31, 2006:	RAI 9.5-5, 9.5-23, 14.2-4, 15.5-1, 15.5-4
August 31, 2006:	RAI 9.5-3 through 9.5-4, 9.5-6 through 9.5-22, 9.5-24, 15.5-2 through 15.5-3

If you have any questions or comments concerning this matter, you may contact me at (301) 415-207 or [lnq@nrc.gov](mailto:lnq@nrc.gov), Amy Cubbage at (301) 415-42875 or [aec@nrc.gov](mailto:aec@nrc.gov), Lawrence Rossbach at (301) 415-2863 or [lwr@nrc.gov](mailto:lwr@nrc.gov), or Martha Barillas at (301) 415-4115 or [mcb@nrc.gov](mailto:mcb@nrc.gov).

Sincerely,

**/RA/**

Lauren Quiñones, 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. ML061940124\*See previous concurrence

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Distribution for DCD RAI Letter No. 42 dated July 13, 2006

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**Requests for Additional Information (RAIs)**  
**ESBWR Design Control Document DCD, Fire Protection**

<b>RAI Number</b>	<b>Reviewer</b>	<b>Question Summary</b>	<b>Full Text</b>
9.5-3	Iqbal N	Discuss FPS deviations from NFPA codes and standards.	Deviations should not degrade the performance of fire protection systems or features. Does the ESBWR Standard Plant Design deviate from the applicable NFPA codes and standard? Discuss all deviations with technical justification or if this information is to be provided by COL applicant, then identify as such.
9.5-4	Radlinski R	Two 100% capacity fire water storage tanks should be provided. (DCD Tier 2, Section 9.5.1.4)	Although this section states that water for the fire protection system is supplied from a minimum of two reliable sources, only a single fire water storage tank is shown on DCD Tier 2, Figures 1.1-1 and 9A.2-22. Presumably these figures reflect a site where an existing fire water storage tank will provide the second fire water system (FWS) tank. A note should be added to the figures to address the requirement for two separate tanks.
9.5-5	Radlinski R	Amend third defense-in-depth principle to include radiological release. (DCD Tier 2, Section 9.5.1.1)	In accordance with Section 9.5.1 of the SRP, Revision 4, October 2003, Section I, add, "and will not significantly increase the risk of radioactive releases to the environment." to the end of the third defense-in-depth principle in DCD Tier 2, Section 9.5.1.1.
9.5-6	Radlinski R	Add a design basis element for radiological release. (DCD Tier 2, Section 9.5.1.1)	In accordance with Section 9.5.1 of the SRP, Revision 4, October 2003 and RG 1.189, April 2001, the fire protection program should demonstrate that the plant will maintain the ability to minimize the potential for radioactive releases to the environment in the event of a fire. (We note that Appendix 9A of the ESBWR identifies the potential for radiological release for each fire area). Add a design basis element for radiological release.

<b>RAI Number</b>	<b>Reviewer</b>	<b>Question Summary</b>	<b>Full Text</b>
9.5-7	Radlinski R	Verify design basis for fire detection coverage. (DCD Tier 2, Section 9.5.1.1)	DCD Tier 2, Section 9.5.1.1 states that automatic fire detection and annunciation will be provided for “selected” areas of the plant and Section 9.5.1.2 says that detection is provided in “various locations” throughout the plant, whereas Section 8.3.3.4 states that “all” areas of the plant are covered by a fire detection and alarm system. Section 9.5.1 of the SRP, Revision 4, October 2003, Branch Technical Position (BTP) SPLB 9.5-1, Section C6.1 states that detection should be provided in areas that contain equipment important to safety. Verify which of the two statements in the DCD is correct and revise the DCD accordingly.
9.5-8	Radlinski R	Provide acceptance criteria for deviations from regulatory requirements for circuit routing. (DCD Tier 2, Section 9.5.1.3)	The DCD Tier 2, Section 9.5.1.3 states that exceptions to the BTP SPLB 9.5-1 requirements for circuit routing and separation will be “analyzed and justified as acceptable on an individual basis.” Provide the acceptance criteria for such exceptions.
9.5-9	Radlinski R	Verify that both safety related and non safety-related cables will meet the flame test criteria of IEEE 383 or 1202. (DCD Tier 2, Section 9.5.1.3)	The DCD Tier 2, Section 9.5.1.3 states that safety-related cables conform to the Institute of Electrical and Electronics Engineers (IEEE) 383 flame test. In accordance with Section 9.5.1 of the SRP, Revision 4, October 2003, BTP SPLB 9.5-1 Section C7.1.4, all cable should meet the flame test criteria of IEEE 383 or IEEE 1202.
9.5-10	Radlinski R	Provide the ESBWR design criteria for protection against migration of smoke, hot gases, or fire suppressant. (DCD Tier 2, Section 9.5.1.11)	The enhanced fire protection criteria of Appendix B of Section 9.5.1 of the standard review plan (SRP), Revision 4, October 2003, requires that the design must ensure that smoke, hot gases, or fire suppressant will not migrate into other fire areas to the extent that they could adversely affect safe shutdown capabilities, including operator actions. Provide the ESBWR design criteria to address this hazard.

RAI Number	Reviewer	Question Summary	Full Text
9.5-11	Radlinski R	Address ESBWR design for smoke and heat control during a fire. (DCD Tier 2, Section 9.5.1.11)	The smoke control systems described in DCD Tier 2, Section 9.5.1.11 appear to be for use only after a fire has been extinguished. Section 6.4.4 of NFPA 804, 2001 Edition, requires that smoke control systems be provided to facilitate manual fire fighting in high-density cable-use areas, switchgear rooms, diesel fuel oil storage areas, turbine buildings and other areas where potential exists for heavy smoke and heat conditions as determined by the fire hazards analysis. These requirements are similar to those in Section 4.1.4.2 of Regulatory Guide (RG) 1.189, April 2001. What provisions does the ESBWR include for smoke and heat removal during a fire?
9.5-12	Radlinski R	The provision of fire detection within the electrical cabinets in the main control room complex should be based on the fire hazards analysis. (DCD Tier 2, Section 9.5.1.12.1.1)	As noted in the DCD Tier 2, Section 9.5.1.12.1.1, Section 6.1.2.2 of RG 1.189, April 2001 states that smoke detectors should be provided in control room consoles and cabinets. The justification provided in the DCD is based partly on ceiling mounted area detection and detection by operators. Detectors in individual electrical cabinets provide additional protection by providing early detection of invisible products of combustion and by providing operators with the specific location of the incipient fire. This will allow rapid extinguishment of the fire and minimize the potential for control room evacuation. If the final fire hazard analysis indicates that a fire in an Main Control Room (MCR) cabinet is a significant fire hazard, the in-cabinet detectors should be provided. The DCD should be revised accordingly.

RAI Number	Reviewer	Question Summary	Full Text
9.5-13	Radlinski R	The provision of auto fire suppression in the offices adjacent to the main control room should be based on the fire hazards analysis. (DCD Tier 2, Section 9.5.1.12.1.2)	As noted in the DCD Tier 2, Section 9.5.1.12.1.2, Section 6.1.2.c of RG 1.189, April 2001 states in part that peripheral rooms in the control room complex should have automatic water suppression..." The office areas may contain significant levels of combustible materials and there are no provisions for smoke removal during a fire. An automatic water suppression system can reduce the potential for a forced evacuation due to smoke migration to the main control room, as well as minimize the extent of the fire damage. If the final fire hazard analysis indicates that a fire in a room adjacent to the MCR is a significant fire hazard, auto suppression systems should be provided. The DCD should be revised accordingly.
9.5-14	Radlinski R	The provision of auto fire suppression below the raised floor in the main control room complex should be based on the fire hazards analysis. (DCD Tier 2, Section 9.5.1.12.1.3)	Section 6.1.2.1 of RG 1.189, April 2001 states that area automatic suppression should be provided for under-floor areas unless cable is run in #4-inch steel conduit. The description in DCD Tier 2, Section 9.5.1.12.1.3 of the circuits that will be routed below the raised floor in the control room complex indicates that there will be significant combustible loading in this area and does not state that it will be run in steel conduit #4-inch. Since access to this area is by lifting individual panels and detection of a fire is by general area detectors, it may be difficult to locate a fire quickly enough to manually suppress the fire before evacuation of the main control room is required. If the final fire hazard analysis indicates that a fire below the MCR is a significant fire hazard, an auto suppression system should be provided (consideration should be given to a water mist system per NFPA 750). The DCD should be revised accordingly.

RAI Number	Reviewer	Question Summary	Full Text
9.5-15	Radlinski R	Provide basis for fire pump flow rate. (DCD Tier 2, Table 9.5-2)	A fire pump flow rate of 2,000 gpm is indicated for all three fire pumps in DCD Tier 2, Table 9.5-2. The criteria for sizing the pumps (included in Section 7.2.1 of NFPA 804, 2001 Edition) is to provide sufficient flow for the single largest design demand of any sprinkler or fixed water spray system plus 500 gpm for manual hose streams. Identify the system with the single largest design demand and the required flow for that system.
9.5-16	Radlinski R	Address potential for hydrogen accumulation in safety-related battery rooms. (DCD Tier 2, Table 9A.5-1)	DCD Tier 2, Table 9A.5-1, Reactor Building, Area F1210, Division I Battery Room does not address the potential for accumulation of hydrogen and an explosion hazard (this RAI is typical for all plant safety-related battery rooms). If there is the potential for an explosive concentration of hydrogen in these rooms, describe the ventilation features provided to prevent an explosion. Section 8.3.2.1.1 describes a ventilation system but does not mention that loss of ventilation will be alarmed in the control room as required by Section 6.1.7 of RG 1.189, April 2001. Also verify that DC switchgear and inverters are not located in the battery rooms.
9.5-17	Radlinski R	Address potential for hydrogen explosion and consequences in hydrogen gas rooms. (DCD Tier 2, Table 9A.5-1)	Section 4.1.8 of RG 1.189, April 2001 requires that systems that involve hydrogen supplies should be designed to prevent explosive mixtures. DCD Tier 2, Table 9A.5-1. Reactor Building, Area F1450, Hydrogen Gas A contains 16m <sup>3</sup> of hydrogen. Address the potential for a hydrogen explosion and the consequences for this area and the redundant, Train B area.
9.5-18	Radlinski R	The MCR Complex is indicated as not having any safety-related divisional equipment or cables. This should be corrected. (DCD Tier 2, Table 9A.5-3)	The form in DCD Tier 2, Table 9A.5-1 for area F3270, Main Control Room (MCR) Complex, indicates "none" for safety-related divisional equipment or cables. This should be changed to indicate the presence of all four trains.



<b>RAI Number</b>	<b>Reviewer</b>	<b>Question Summary</b>	<b>Full Text</b>
9.5-19	Radlinski R	Identify the safety-related division equipment and cables that are located in the turbine building and explain affect of fire on them. (DCD Tier 2, Table 9A.5-4)	The form in DCD Tier 2, Table 9A.5-1 for area F4100, Turbine Building, indicates that Division I, II, III, and IV cables and equipment are located in this area. Identify and provide location by room of all safety-related equipment and cables in the turbine building, if other than the main steam isolation valves (MSIVs) and associated cables. The table also states that complete burnout of all equipment and cables within the fire area affects no safe-shutdown divisions. Explain this conclusion.
9.5-20	Radlinski R	Provide description of spill containment for oil-filled transformers and fuel oil storage tanks. (DCD Tier 2, Table 9A.5-7)	NFPA 804, 2001 Edition and RG 1.189, April 2001 require spill containment for oil-filled transformers and for fuel oil storage tanks. The fire hazards analysis does not indicate the provision of spill control. Describe where spill control is provided and the design criteria for the containment sizing - should include an appropriate volume for any fire suppression water.
9.5-21	Radlinski R	Clarify manual hose station coverage inside containment. (DCD Tier 2, Section 9.5.1.1)	The power generation design bases state that manual suppression capability is provided to all areas of the plant and that one effective hose stream can reach any location containing safe shutdown equipment. Please clarify whether this includes areas inside the containment (there is no mention in the DCD of water suppression systems inside the containment and no mention of a containment penetration for the fire protection system).
9.5-22	Iqbal N	Describe the use of any electrical raceway fire barrier systems (ERFBS) for raceway in ESBWR.	NRC Generic Letter (GL) 2006-03, "Potentially Nonconforming Hemyc and MT Fire Barrier Configurations," (ML 053620142) provides the most current guidance on the design and testing of ERFBS. If the ESBWR Standard Plant Design utilizes electrical raceway fire barrier systems (ERFBS), describe how they will be in accordance with this GL. Also describe the application and the design criteria and test acceptance criteria.

RAI Number	Reviewer	Question Summary	Full Text
9.5-23	Iqbal N	Provide clarification regarding exceptions to containment penetration requirements for the drywell inerting system.	<p>DCD Tier 2, Section 9A.3.4: "Exceptions to Penetration Requirements," notes that two Drywell Inerting System supply (two 350 mm (14 in.)) and exhaust (one 350 mm (14 in.) and one 400 mm (16 in.)) lines for the wetwell and drywell do not have fire dampers. There are two containment isolation valves for each supply and exhaust.</p> <p>Describe deviations from the Position C.8.1.1 of BTP SPLB 9.5-1 and verify that the ESBWR design meets the requirement of Position C.6.1.1.2 of RG 1.189, April 2001.</p>

RAI Number	Reviewer	Question Summary	Full Text
9.5-24	Iqbal N	Provide additional requirements for information to be included in the COL application.	<p>The following additional COL Items should be included in DCD Tier 2, Table 1.10-1:</p> <ul style="list-style-type: none"> <li>• Final quantity and capacity of fire water storage tanks</li> <li>• Final fire pump flow rate and head</li> <li>• Details of the QA program for the fire protection program</li> <li>• Applicability of RG 1.91, Revision 1, February 1978</li> <li>• Applicable editions of codes and standards (within 6 months of COL docket date)</li> <li>• Details of manual fire-fighting capability, including smoke control during a fire</li> <li>• Description of electric cable insulation and jacketing materials</li> <li>• Details of electric cable and raceway penetrations of fire barriers, including tests and acceptance criteria</li> <li>• Details of electrical raceway fire barrier systems, including tests and acceptance criteria</li> <li>• Details of steam tunnel water spray curtain system between turbine building and reactor building</li> <li>• Description of program that ensures that the inspections and tests performed on the fire protection system verify that the system parameters specified in the DCD are enveloped by the as-built parameters</li> <li>• Complete description of the licensee's fire protection program</li> <li>• Proposed fire protection license condition for making changes to the fire protection system without prior review and approval of the NRC</li> <li>• Fire protection system piping and instrumentation diagram showing complete site-specific system</li> </ul>

RAI Number	Reviewer	Question Summary	Full Text
14.2.-4	Radlinski R	Expand list of general test methods and acceptance criteria to include all tests and inspections required by the applicable NFPA standards and associated acceptance criteria. (DCD Tier 2, Section 14.2.8.1.38)	<p>Fire protection systems are to be in accordance with applicable NFPA standards which include requirements for tests and inspections of installed systems and equipment. DCD Tier 2, Section 14.2.8.1.38 should reflect that requirement. The section title includes acceptance criteria, yet there are no acceptance criteria included. The high level acceptance criteria appropriate to a DCD should be included. The preoperational tests and inspections should also include the following to verify the proper functioning of fire protection features:</p> <ul style="list-style-type: none"> <li>• Verification of integrity of fire barriers including penetration seals, fire doors, etc.</li> <li>• Verification of correct location of fire protection equipment including sprinkler heads, spray nozzles, detectors, hose stations, and portable extinguishers.</li> </ul>
15.5-1	Radlinski R	Verify that the consequences of the safe shutdown fire will not be greater if off-site power is not lost. (DCD Tier 2, Section 15.5.6)	BTP 9.5-1 Section 6.3 notes that in evaluating the capability to accomplish post-fire safe shutdown, offsite power may or may not be available and consideration should be given to both cases. Verify that in the event offsite power is not lost, the consequences of the safe-shutdown fire will not be greater.
15.5-2	Radlinski R	The acceptance criteria for the safe-shutdown fire do not include reactor pressure control. (DCD Tier 2, Section 15.5.6)	While the acceptance criteria in the safe-shutdown fire analysis (DCD Tier 2, Section 15.5.6) do not include reactor pressure control, the analysis assumptions identifies systems that will be available for “vessel inventory and pressure control”. Should pressure control be included in the acceptance criteria?

RAI Number	Reviewer	Question Summary	Full Text
15.5-3	Radlinski R	Provide basis for assumption that there will be no spurious actuation of SRVs or DPVs. Provide criteria for spurious actuations for post-fire safe-shutdown circuit analyses in general. (DCD Tier 2, Section 15.5.6)	<p>Provide the basis for the assumption that a fire in the main control room that requires operator evacuation cannot cause a spurious actuation of the safety relief valves (SRVs) or depressurization valves (DPVs). For post-fire, safe-shutdown circuit analyses, in general for the entire plant, the NRC has recently issued clarification of regulatory requirements regarding fire induced spurious actuations. That guidance is provided in Regulatory Issue Summary (RIS) 2005-30, "Clarification of Post-Fire Safe-Shutdown Circuit Regulatory Requirements," dated December 20, 2005 (ML053360069) and draft Generic Letter 2005-XX, "Post-Fire Safe-Shutdown Circuit Analysis Spurious Actuations." (ML061280517).</p> <p>Confirm that the ESBWR post-fire, safe shutdown circuit analyses are in compliance with the regulatory expectations described in these generic communications.</p>
15.5-4	Radlinski R	Provide design criteria and/or analysis acceptance criteria for post-fire, safe-shutdown operator manual actions. (DCD Tier 2, Section 15.5.6)	<p>Paragraph 5.5.2.1 of NFPA 804, 2001 Edition, states that "operator actions necessary to achieve FSSD [fire-safe shutdown] of the reactor shall be kept to a minimum." The NRC has issued specific regulatory expectations and guidelines for crediting operator actions in the event of a fire. That guidance is provided in RIS 2005-30 and draft Regulatory Issue Summary 2006-XX, "Regulatory Expectations for Appendix R Paragraph III.G.2 Operator Manual Actions" (ML061430404). Confirm that operator manual action credited by the ESBWR for post-fire, safe shutdown analyses are in compliance with the regulatory expectations described in these generic communications.</p>

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