June 1, 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. 33 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 "Engineered Safety Features," Chapter 6 of Tier 2 of the ESBWR design control document. This RAI was sent to you via electronic mail on March 22, 2006, and resent on May 19, 2006. The RAIs were discussed with you during a telecon on May 2, 2006. You agreed to respond to this RAI on the following schedule:

June 23, 2006:	RAI 6.2-48 through 6.2-51, 6.2-53 through 6.2-57, 6.2-62, and 6.2-64 through 6.2-74
July 28, 2006:	RAI 6.2-52, 6.2-58 through 6.2-60, and RAI 6.2-63

If you have any questions or comments concerning this matter, you may contact me at (301) 415-207 or lnq@nrc.gov, Amy Cubbage at (301) 415-42875 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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Enclosure: As stated

cc: See next page
ACCESSION NO. ML 061520025

OFFICE	NRBA/PM	NRBA/BC
NAME	LQuinones	ACubbage
DATE	06/01/2006	06/01/2006

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Distribution for DCD RAI Letter No. 33 dated June 1, 2006

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REQUESTS FOR ADDITIONAL INFORMATION (RAIs)
ESBWR DESIGN CONTROL DOCUMENT (DCD) SECTIONS: 6.2.0, 6.2.4, 6.2.5, AND 6.2.6

RAI Number	Reviewer	Question Summary	Full Text
6.2-48	Throm E	Clarification/Editorial: References	DCD Tier 2, Rev. 1, page 6.2-12 refers to References 6.2-3 and 6.2-4. These references are not included in DCD Rev 1, Section 6.2.9. Include these references in the DCD.
6.2-49	Throm E	Clarification/Editorial: Bases	DCD Tier 2, Rev. 1, page 6.2-23, under "Break Size and Location," the second item refers to "a., above." It is not clear what "a." refers to. Explicitly identify the item by DCD Section and bullet number if applicable. Include this information in the DCD Tier 2.
6.2-50	Throm E	Clarification/Editorial: Licensing Analyses	DCD Tier 2, Rev. 1, page 6.2-23 it is stated that "[i]n general, calculations of the mass and energy release rates for a [loss of coolant accident] LOCA are performed in a manner that conservatively establishes the containment internal design pressure..." Clarify this statement (i.e., what is meant by "in general"). Include this information in the DCD Tier 2.
6.2-51	Throm E	Clarification/Editorial: Condensate Flow Path	Regarding the passive containment cooling system (PCCS) description in DCD Tier 2, Rev. 1, on page 6.2-19, "the return condensate goes to the [reactor pressure vessel] RPV via an intermediate holding tank," this should be corrected; as the condensate goes to the gravity driven cooling system (GDCS) pools. Include this information in the DCD Tier 2.

RAI Number	Reviewer	Question Summary	Full Text
6.2-52	Throm E	The DCD TRACG model is not the same as previously reviewed and accepted during the preapplication review: “Tee” Component	The TRACG model used for DCD analyses does not include the “tee” model used to control the release of non-condensable gases from the lower drywell. The approved approach addressed uncertainties in TRACG’s ability to account for mixing and stratification in the drywell. A. In the evaluation of the main steam line break (MSLB), was the preapplication model used or was the newer DCD version of the TRACG model used? Include this information in the DCD Tier 2. B. If the new model was used, provide justification for its use in licensing analyses for MSLBs, specifically address non-condensable gas holdup, mixing and stratification. Include this information as an update to NEDC-33083P-A, "TRACG Application for ESBWR." C. If the new model is used for the MSLB, provide a discussion of the containment response to the MSLB using this model, particularly with respect to the movement of non-condensable gases, mixing and stratification, throughout the containment, and relate the response to the preapplication model. Include this information as an update to NEDC-33083P-A, "TRACG Application for ESBWR."
6.2-53	Throm E	The DCD TRACG model is not the same as previously reviewed and accepted during the preapplication review: Feedwater Line Break and non-condensable gases	Provide a discussion of the containment response to the feedwater line break (FWLB) using the DCD version of the TRACG model, particularly with respect to the movement of non-condensable gases, mixing and stratification, throughout the containment. Include this information as an update to NEDC-33083P-A, "TRACG Application for ESBWR."

RAI Number	Reviewer	Question Summary	Full Text
6.2-54	Throm E	The DCD TRACG model is not the same as previously reviewed and accepted during the preapplication review: Wetwell	An additional axial node was added to the upper wetwell in the DCD version of the TRACG model compared to the preapplication model. In the preapplication TRACG model, the treatment of the upper wetwell limited mixing to conservatively assess the wetwell gas space temperature. Include this information as an update to NEDC-33083P-A, "TRACG Application for ESBWR." A. Is the same conservative approach applied to the DCD TRACG model? B. Is the gas space temperature still treated in a conservative manner? C. What was rationale for adding the additional axial node?
6.2-55	Throm E	The DCD TRACG model is not the same as previously reviewed and accepted during the preapplication review: Suppression pool	In the pre-application TRACG model, the suppression pool heatup was conservatively addressed for the containment design basis accident (DBA). Is the same conservative approach used in the DCD version of the TRACG model? The model description should include text explaining the features used to ensure a conservative containment response evaluation. Include this information as an update to NEDC-33083P-A, "TRACG Application for ESBWR."
6.2-56	Throm E	The DCD TRACG model is not the same as previously reviewed and accepted during the preapplication review: Drywell	The DCD version of the TRACG model adds an additional node to the upper drywell. Provide a discussion of the containment response using the DCD TRACG model, particularly with respect to the movement of non-condensable gases, mixing and stratification, throughout the containment, as compared to the approved pre-application model. Include this information as an update to NEDC-33083P-A, "TRACG Application for ESBWR."

RAI Number	Reviewer	Question Summary	Full Text
6.2-57	Throm E	The *Accident Response Analysis* section (6.2.1.1.3) does not describe the scenarios evaluated: non-safety systems.	For each break type (FWLB, MSLB, GDCS line, and bottom drain line) provide a discussion of the treatment of non-safety systems as they affect the mass and energy releases into the containment, and describe how they are treated in the response calculations. Include this information in the DCD Tier 2.
6.2-58	Throm E	The *Accident Response Analysis* section (6.2.1.1.3) does not describe the scenarios evaluated: single failures.	For each break type (FWLB, MSLB, GDCS line, and bottom drain line) provide a discussion of the single failures considered and provide the resulting peak pressure and temperature for each case evaluated, in a tabular form, using appropriate licensing analysis assumptions to conservatively maximize the containment pressure or temperature response for each case. Include this information in the DCD Tier 2.

RAI Number	Reviewer	Question Summary	Full Text
6.2-59	Throm E	The *Accident Response Analysis* section (6.2.1.1.3) does not describe the scenarios evaluated: double ended guillotine breaks.	Provide (in graphical form) the results for the GDCS double ended guillotine (DEG) break, the vessel bottom drain line DEG break and the MSLB DEG using licensing analysis assumptions to conservatively maximize the containment pressure or temperature response for each case, in similar form to Figures 6.2-10, 11 and 12. All graphical results are to be provided in three formats, for each case evaluated. Include this information in the DCD Tier 2. A. From time zero to 72 hours. B. From time zero to 100 seconds, or slightly beyond the time of the peak pressure or peak temperature, which ever is more limiting. C. From time zero to 2,000 seconds. D. For each case provide a tabular summary, similar to Table 6.2-7. Also add isolation condenser system (ICS) functionality sequence and main vent clearing times for top, middle and bottom vents. E. Include the short term graphs for the feedwater line breaks presented in the DCD Tier 2.

RAI Number	Reviewer	Question Summary	Full Text
6.2-60	Throm E	The *Accident Response Analysis* section (6.2.1.1.3) does not describe the scenarios evaluated: intermediate size breaks.	The text indicates that only double ended guillotine (DEG) breaks were assessed. However, in DCD Tier 2, Section 6.2.1.3, it is stated that a spectrum of sizes and locations were performed. Include this information in the DCD Tier 2. A. Does this statement mean that only the four DEG breaks (different locations and different sizes) were evaluated? B. Provide the results of sensitivity analyses to smaller breaks sizes (for example, areas of 1.0, 0.8 and 0.6 of the equivalent DEG break area, and as appropriate for a small break) for the feedwater line and the steam line breaks to ensure that the DEG break is limiting, using licensing analysis assumptions to conservatively maximize the containment pressure or temperature response for each case. C. Provide the results of sensitivity studies for MSLB breaks high and low in containment, using licensing assumptions, to justify the limiting MSLB case. Provide results in same form as in RAI 6.2-59 (A), (B), and (C) above.

RAI Number	Reviewer	Question Summary	Full Text
6.2-61	Throm E	Information necessary for staff audit or confirmatory analysis of the ESBWR containment response to DBAs; per standard review plan (SRP) Section 6.2.1.1.C, and RG 1.70, Section 6.2.	Part 1: Provide the mass and energy release data for the limiting FWLB and limiting MSLB in the format given in Table 6-10 of Regulatory Guide (RG) 1.70. Include totals, from the reactor pressure vessel (RPV) side and from the balance of plant (BOP) side, and separated into steam and liquid sources. These are the mass and energy released from the reactor coolant system to the containment. Provide these data in graphical form. All graphical results are to be provided in three formats, for each case evaluated. A. From time zero to 72 hours. B. From time zero to 100 seconds, or slightly beyond the time of the peak pressure or peak temperature, which ever is more limiting. C. From time zero to 2,000 seconds. The tabular and graphical information should be provided in time steps that capture the changes in the parameters of interest.

RAI Number	Reviewer	Question Summary	Full Text
6.2-61 continued	Throm E	Information necessary for staff audit or confirmatory analysis of the ESBWR containment response to DBAs; per standard review plan (SRP) Section 6.2.1.1.C, and RG 1.70, Section 6.2.	Part 2: For the limiting breaks, in Part 1 of this RAI, provide in graphical form (short term and intermediate term): A. Mass and energy flows from the safety relief valves (SRVs) and depressurization valves (DPVs). B. Mass flows thru the various systems/pathways: GDCS, PCCS, ICS, standby liquid control system (SLCS), hydraulic control units (HCUs), drywell (DW) main vents, wetwell (WW) to DW vacuum breakers, and DW leakage. C. RPV water level-- collapsed and two phase, DW pool level, suppression pool level, GDCS water level, PCCS/ICS upper pool level, non-condensable partial pressure in the DW and WW. D. Local (selected nodes) gas and pool temperatures of the DW, WW and RPV to reveal regional stratification E. Suspended liquid water masses for the RPV steam dome, DW and WW volumes.
6.2-62	Throm E	Information necessary for staff audit or confirmatory analysis of the ESBWR containment response to DBAs; per standard review plan (SRP) Section 6.2.1.1.C, and RG 1.70, Section 6.2.	Provide the passive heat sink information identified in RG 1.70 Table 6-11, per SRP 6.2.1.1.C, to assist the staff in performing audit or confirmatory analyses to support design review. Include this information in the DCD Tier 2.

RAI Number	Reviewer	Question Summary	Full Text
6.2-63	Throm E	Information necessary for staff audit or confirmatory analysis of the ESBWR containment response to DBAs; per standard review plan (SRP) Section 6.2.1.1.C, and RG 1.70, Section 6.2.	Provide the energy source information identified in RG 1.70, Table 6-9, for the limiting FWLB and limiting MSLB cases. In addition, for the ESBWR design, include the energy removed by the PCCS. Provide these data in graphical form. All graphical results are to be provided in three formats, for each case evaluated. Include this information in the DCD Tier 2. A. From time zero to 72 hours. B. From time zero to 100 seconds, or slightly beyond the time of the peak pressure or peak temperature, which ever is the greater. C. From time zero to 2,000 seconds. The tabular and graphical information should be provided in time steps that capture the changes in the parameters of interest.
6.2-64	Throm E	Information necessary to evaluate ESBWR containment response to DBAs; per SRP 6.2.1.1.C: drywell temperature	The nominal drywell temperature is listed as 135 EF (Table 6.2-2). The reported DBA analyses were done at 115 EF (Table 6.2-6). Provide an explanation of the temperature used to ensure a conservative evaluation. Include this information in the DCD Tier 2.
6.2-65	Throm E	Information necessary to evaluate ESBWR containment response to DBAs; per SRP 6.2.1.1.C: drywell humidity	The nominal drywell humidity is listed as 100 percent (Table 6.2-2). The reported DBA analyses were done at 20 percent (Table 6.2-6). Provide an explanation of the humidity used to ensure a conservative evaluation. Include this information in the DCD Tier 2.

RAI Number	Reviewer	Question Summary	Full Text
6.2-66	Throm E	Information necessary to evaluate ESBWR containment response to DBAs; per SRP 6.2.1.1.C: PCCS initial conditions	The PCCS temperature and level (initial volume) are not listed in DCD Tier 2, Table 6.2-2. The reported DBA analyses were done at 110 EF (Table 6.2-6), with no reference to level (volume). Provide an explanation of the temperature (under certain conditions the temperature could be 115 EF) and level used to ensure a conservative evaluation. Provide a system diagram for the PCCS which discusses the temperature control system and provide a discussion on the allowable temperature range and level for continued operation. (DCD Tier 2, Rev. 1 did not contain Technical Specifications (TS), DCD Tier 2 Rev. 0 TS 3.6.2.3 and 3.6.2.3 do address these items.) Include this information in the DCD Tier 2.
6.2-67	Throm E	Information necessary to evaluate ESBWR containment response to DBAs; per SRP 6.2.1.1.C: suppression pool initial conditions	The suppression temperature in hot standby is listed as 130 EF in DCD Tier 2, Table 6.2-2. The reported DBA analyses were done at 110 EF (Table 6.2-6), with 110 EF the maximum under normal operation. Include this information in the DCD Tier 2. A. Provide an explanation of the temperature used to ensure a conservative evaluation. B. Provide a discussion of the impact of operation at less than 100% power (plus calorimetric uncertainty) with respect to the stored energy and mass in the primary system which would be released to containment during a DBA, and include the containment conditions for these situations. Is there a mode of operation which would result in a higher calculated DBA containment pressure or temperature?
6.2-68	Throm E	Information necessary to evaluate ESBWR containment response to DBAs; per SRP 6.2.1.1.C: GDCS initial conditions	Include in DCD Tier 2, Table 6.2-2, the GDCS pool data (both water and gas space temperatures) for normal operation and used for the accident analyses to ensure a conservative evaluation. Provide an explanation of the temperature used to ensure a conservative evaluation. Include this information in the DCD Tier 2.

RAI Number	Reviewer	Question Summary	Full Text
6.2-69	Throm E	Information necessary to evaluate ESBWR containment response to DBAs; per SRP 6.2.1.1.C: containment volumes and evaluation techniques	Provide a discussion of how the various containment volumes (gas space in drywell, wetwell and GDCS pool, water volume in the suppression and GDCS pools) were evaluated to ensure a conservative evaluation of the containment response to DBAs. Include this information in the DCD Tier 2.
6.2-70	Throm E	Information necessary for staff audit or confirmatory analysis of the ESBWR containment response to DBAs; per standard review plan (SRP) Section 6.2.1.1.C.	A. Provide a discussion of how the various primary system volumes and heat structures (piping, reactor pressure vessel, etc.) were evaluated to ensure a conservative evaluation of the containment response to DBAs. How does this treatment relate to the emergency core cooling system (ECCS) analysis in DCD Tier 2, Section 6.3? Include this information in the DCD Tier 2. B. The reactor power and reactor pressure are provided for the bounding case. What is the reactor temperature during normal operation and what is the temperature used to ensure a conservative containment calculation? Include this information in DCD Tier 2, Table 6.2-6. Include this information in the DCD Tier 2.
6.2-71	Throm E	Information necessary to evaluate ESBWR containment response to DBAs; per SRP 6.2.1.1.C: evaluation techniques for free volumes and pools	Since the DCD version of the TRACG model is nodalized for the free volumes and pool regions, how are the temperatures combined to determine the values shown in the figures provided. Include this information as an update to NEDC-33083P-A, "TRACG Application for ESBWR."

RAI Number	Reviewer	Question Summary	Full Text
6.2-72	Throm E	Information necessary for staff audit or confirmatory analysis of the ESBWR containment response to DBAs; per standard review plan (SRP) Section 6.2.1.1.C.	Systems are identified as part of the DCD version of the TRACG model, but are not shown in the nodal scheme, therefore a more complete nodalization should be provided, including, for example, the ICS, SLCS and the feedwater system. Include this information in the DCD Tier 2.
6.2-73	Throm E	Information necessary to evaluate ESBWR containment response to DBAs; per SRP 6.2.1.1.C: critical flow	A. Does the critical flow factor (set to 1.19 in the bounding feedwater line break to account for the upper uncertainty range for choked flow, and set to 1.0 for the nominal case) applied to all lines, such as the SRVs, DPVs, both sides of the break, etc? Is the same factor used for other breaks (MSLB, GDCS and bottom drain line) and in the same manner? Include this information in the DCD Tier 2. B. Indicate the critical flow models (e.g., Moody, homogeneous equilibrium, etc.) used for choked paths such as the SRVs, DPVs, FWLB (RPV side), FWLB (BOP side), and DW main vents. Include this information in the DCD Tier 2.
6.2-74	Throm E	Information to assist the staff in performing audit or confirmatory analyses to support design review.	Provide a description, and drawings, of the PCCS and ICS upper pool volumes per unit (m^3) with the location (elevation in meters) and areas (m^2) of connective pathways, and other connected pool volumes (storage, etc.) with connective pathways.

cc:

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