

September 7, 2006

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

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 56 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. RAI questions 4.4-7 through 4.4-9 are related to the loose parts monitoring system (LPMS), as discussed in Chapter 4 of the ESBWR design control document (DCD), Tier 2, Revision 1. This set of RAI was sent to you via electronic mail on July 7, 2006, and was discussed with your staff during a telecon on August 18, 2006. You agreed to respond to this set of RAI on September 29, 2006.

RAI questions 17.1-1, 17.2-1, and 17.4-1 through 12, are related to Quality Assurance, as discussed in Chapter 17 of the ESBWR DCD, Tier 2, Revision 1. This set of RAI was sent to you via electronic mail on July 1, 2006. You did not request a telecon and agreed to respond to this RAI on September 29, 2006.

RAI question 21.6-77 is related to NEDE-33083P, Supplement 2, "TRACG Application for ESBWR Anticipated Transient Without Scram Analysis." This RAI was sent to you via electronic mail August 8, 2006, and was discussed with your staff during a telecon on August 30, 2006. You agreed to respond to this RAI on September 29, 2006.

RAI question 6.3-38 is related to single failure evaluation, as discussed in Chapter 6 of the ESBWR DCD, Tier 2, Revision 1. This RAI was sent to you via electronic mail July 7, 2006, and was discussed with your staff during a telecon on August 24, 2006. You agreed to respond to this RAI on September 29, 2006.

D. Hinds

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If you have any questions or comments concerning this matter, you may contact me at (301) 415-4115 or [mcb@nrc.gov](mailto:mcb@nrc.gov) or you may contact Amy Cabbage at (301) 415-2875 or [aec@nrc.gov](mailto:aec@nrc.gov).

Sincerely,

*/RA/*

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

Docket No. 52-010

Enclosure: As stated

cc w/encl: See next page

D. Hinds

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If you have any questions or comments concerning this matter, you may contact me at (301) 415-4115 or [mcb@nrc.gov](mailto:mcb@nrc.gov) or you may contact Amy Cubbage at (301) 415-2875 or [aec@nrc.gov](mailto:aec@nrc.gov).

Sincerely,

*/RA/*

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

Docket No. 52-010

Enclosure: As stated

cc w/encl: See next page

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NESB R/F

JColaccino

MBarillas

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JGaslevic

LRossbach

LQuinones

MBarillas

TKevern

GThomas

MRazzaque

KKavanaugh

RMcIntyre

GCranston

DThatcher

ACCESSION NO. ML062480378

OFFICE	NESB/PM	NESB/BC(A)
NAME	MBarillas	JColaccino
DATE	09/06/2006	09/07/2006

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**Request for Additional Information (RAI)**  
**ESBWR Design Control Document (DCD) Tier 2, Revision 1, Section 4.4**

<b>RAI Number</b>	<b>Reviewer</b>	<b>Summary</b>	<b>Full Text</b>
4.4-7	Razzaque M	Discuss LPMS design differences relative to operating experience.	Address how operating experience with loose parts monitoring systems (LPMS) was factored into the design of the ESBWR LPMS. Identify improvements and/or differences, if any, between the current LPMS design used in operating BWRs compared to design of the LPMS proposed for the ESBWR.
4.4-8	Razzaque M	Describe sensitivity of LPMS sensors.	In DCD Tier 2, Chapter 4, describe the sensitivity of the LPMS sensors in terms of its ability to detect the range of size, mass and kinetic energy of metallic parts, and the maximum distance from the sensor location up to which a part can be detected.
4.4-9	Razzaque M	Provide ESBWR LPMS ITAAC.	The staff requests that ITAAC be provided for LPMS in ESBWR consistent with the ABWR ITAAC in DCD Tier 2, Chapter 4.

Enclosure

**Request for Additional Information (RAI)**  
**ESBWR Design Control Document (DCD) Tier 2, Rev. 1, Chapter 17**

RAI Number	Reviewer	Request Summary	Full Text
17.1-1	McIntyre R Kavanagh K	Provide an introductory paragraph to DCD Tier 2, Section 17.1 specifically stating its applicability.	<p>DCD Tier 2, Rev. 1, Section 17.1 is titled “Quality Assurance During Design and Construction,” and Section 17.2 is titled “Quality Assurance During the Operations Phase.” Based on the staff’s review, Section 17.1 only applies to General Electric (GE) quality assurance during the design phase and not to construction. This is supported by the statement in Section 17.2 which states “QA responsibilities during the plant construction and operations phases are combined operating license (COL) holder scope.”</p> <p>Provide an introductory paragraph in DCD Tier 2, Section 17.1 which specifically states section applicability, and consider revising the title of DCD Tier 2, Section 17.1 to be more representative of the section.</p>
17.2-1	McIntyre R Kavanagh K	Provide an introductory paragraph in DCD Tier 2, Section 17.2 to address the COL applicant’s QA responsibilities in all phases (design, construction, and operation), and consider a more representative section title.	<p>DCD Tier 2, Rev. 1, Section 17.2 briefly states that the COL applicant is responsible for the QA activities during construction and operating phases. The COL applicant could be responsible for the design phase, along with procurement, fabrication, installation, construction and testing of structures, systems and components.</p> <p>Provide an introductory paragraph in Section 17.2 which accounts for the COL applicant’s QA responsibilities in all phases (design, construction, and operation), and consider a more representative section title.</p>

RAI Number	Reviewer	Request Summary	Full Text
17.4-1	Talbot F Kavanagh K	Add reference in DCD Tier 2, Section 17.4 to the list of risk significant SSCs identified in NEDC-33201P, Chapter 19, Tables 19-1 and 2, and references to identify risk significant SSCs within the scope of D-RAP identified from the PRA.	<p>The Advanced Boiling Water Reactor (ABWR) Standard Safety Analysis Report (SSAR) included Table 19K-1, "ABWR SSCs of Greatest Importance for CDF - Level 1 Analysis," which listed the risk significant SSCs along with probabilistic risk assessment (PRA) importance measure thresholds including risk rankings values for risk significant SSCs within the scope of RAP. This information is not provided in ESBWR DCD Tier 2, Sections 17.4. Some of this information is provided in NEDC-33201P, Table 19-1, "ESBWR SSCs of Greatest Importance for CDF and Level I Analysis," and Table 19-2, "ESBWR Initiating Event Contribution to CDF, Level 1 Analysis."</p> <p>A reference should be added to DCD Tier 2, Section 17.4, "Reliability Assurance Program During Design Phase," to the list of risk significant systems, structures, and components (SSCs) identified in the NEDC-33201P, Tables 19-1 and 19-2. The applicant should also add references to identify risk significant SSCs within the scope of D-RAP identified from PRA Level-I analysis for external events, PRA Level-II analysis, engineering judgment and operating experience supporting risk insights, and the expert panel process. The applicant should ensure that the list is all-inclusive of SSCs that have been identified to be within the scope of D-RAP.</p>

RAI Number	Reviewer	Request Summary	Full Text
17.4-2	Talbot F Kavanagh K	If the applicant used the D-RAP to improve the reliability of an ESBWR system, provide an example in DCD Tier 2, Section 17.4.11.	<p>DCD Tier 2, Rev. 1, Section 17.4.1, states, “Also included in this explanation of the D-RAP is a descriptive example of how the D-RAP applies to one potentially important system, the Isolation Condenser System (ICS). The ICS example shows how the principles of D-RAP will be applied to the other systems identified by the PRA as being significant with respect to risk.”</p> <p>The staff notes that references to design reliability improvements of the ICS were incorporated into the GE simplified boiling water reactor (SBWR) DCD Tier 2, Section 17.4. However, GE later withdrew the SBWR application in 1995. This information from the SBWR application was not included in the ESBWR DC application. If GE used the D-RAP to improve the reliability of an ESBWR system, provide an example in DCD Tier 2, Section 17.4.11, “D-RAP Implementation.”</p>
17.4-3	Talbot F Kavanagh K	Provide PRA importance measure threshold values in Section 17.4.6, “SSC Identification/ Prioritization.”	Provide additional information in DCD Tier 2, Section 17.4 concerning use of PRA importance measures (i.e., Fussel-Vesely Importance (FVI) greater than 1% and Risk Achievement Worth (RAW) greater than 5). PRA importance measure threshold values should be added to DCD Tier 2, Section 17.4.6, “SSC Identification/ Prioritization.”

RAI Number	Reviewer	Request Summary	Full Text
17.4-4	Talbot F Kavanagh K	Provide an overview of the process for implementing essential elements into the D-RAP.	<p>The essential elements for the D-RAP were not described in DCD Tier 2, Section 17.4. The essential elements, as described in SECY 95-132, Item E, have been interpreted by the NRC staff to mean the application of the following quality elements to the RAP:</p> <ol style="list-style-type: none"> <li>1. Organization</li> <li>2. Design Control</li> <li>3. Procedures and Instructions</li> <li>4. Corrective Action</li> <li>5. Records</li> <li>6. Audits</li> </ol> <p>Provide an overview of the process for implementing these essential elements into the D-RAP.</p>
17.4-5	Talbot F Kavanagh K	Discuss GE's implementation of the DCD D-RAP, and procedures for D-RAP implementation.	<p>The applicant should provide details on its D-RAP organizational structure. This should include a discussion of the interface controls between the PRA, D-RAP and design organizations. The applicant should also consider developing an expert panel within the GE organization whose charter would include determining the list of risk-significant SSCs within the scope of D-RAP. The expert panel should be composed of subject matter experts with experience in systems, operations, and maintenance. In DCD Tier 2, Section 17.4.5, "GENE Organization for D-RAP," the applicant should discuss the PRA organization within the design organization. The applicant should also develop an internal procedure on how the organization will implement the D-RAP.</p>



RAI Number	Reviewer	Request Summary	Full Text
17.4-6	Talbot F Kavanagh K	Describe the design and configuration control process used to maintain the list of risk-significant SSCs within the scope of the D-RAP.	In DCD Tier 2, Chapter 17, the applicant should discuss the measures that will be established for the identification and control of design interfaces and for coordination among participating design organizations. Since the ESBWR full scope PRA is not complete and subject to change, the applicant should describe the process used to control changes in the PRA which could affect the list of risk significant SSCs within the scope of D-RAP. In addition, the applicant should describe how the design control process provides a feedback mechanism for notifying the PRA organization of changes in the design of risk-significant SSCs within the scope of D-RAP that could affect the PRA. The applicant should also describe its configuration control process for maintaining the list of risk-significant SSCs within the scope of D-RAP similar to the control of a quality list (Q-list).
17.4-7	Talbot F Kavanagh K	Discuss development of an internal procedure for implementing the D-RAP.	In DCD Tier 2, Chapter 17, the applicant should develop an internal procedure for implementing the D-RAP. The procedure should also describe interface controls between all of the organizations involved in D-RAP. The procedure should describe the process for identifying and prioritizing the list of risk-significant SSCs within the scope of D-RAP.
17.4-8	Talbot F Kavanagh K	Describe the corrective action process applied to risk-significant SSCs within the scope of D-RAP.	In DCD Tier 2, Chapter 17, the applicant should describe, in detail, the corrective action process applied to risk-significant SSCs within the scope of D-RAP.
17.4-9	Talbot F Kavanagh K	Describe the controls for records of activities involving risk-significant SSCs within the scope of D-RAP.	In DCD Tier 2, Chapter 17, the applicant should describe, in detail, the controls for records of activities involving risk-significant SSCs within the scope of D-RAP.

RAI Number	Reviewer	Request Summary	Full Text
17.4-10	Talbot F Kavanagh K	Describe audit plans for conducting QA audits of D-RAP activities.	In DCD Tier 2, Chapter 17, the applicant should describe, in detail, the audit plans for conducting QA audits of D-RAP activities.
17.4-11	Talbot F Kavanagh K	Clarify the source of information used to define dominant failure modes as described in DCD Tier 2, Section 17.4.8.	<p>DCD Tier 2, Section 17.4.8, "Defining Failure Modes," states that "[m]any boiling water reactor (BWR) systems and components have compiled a significant historical record, so an evaluation of that record is performed."</p> <p>During the NRC staff's review of the GE QA program, it was determined that evaluation of the historical records for BWR systems and components had not been used by GE to develop D-RAP. Clarify the source of information used to define dominant failure modes as described in DCD Tier 2, Section 17.4.8.</p>
17.4-12	Talbot F Kavanagh K	Add a COL action item to DCD Tier 2, Section 17.4.13 regarding site-specific risk-significant SSCs.	<p>The following COL action item should be added to DCD Tier 2, Section 17.4.13:</p> <p>The COL applicant [or holder] will establish PRA importance measures, the expert panel process, and other deterministic methods to determine the site-specific list of risk-significant SSCs under the scope of D-RAP. The reliability of risk-significant SSC, which are identified by the PRA and other sources, will be evaluated at the COL applicant [or holder] detailed design phase by appropriate design reviews and reliability analysis.</p>

**Request for Additional Information (RAI)**  
**NEDE-33083P Supplement 2 “TRACG Application for ESBWR Anticipated Transient Without Scram Analysis”**

RAI Number	Reviewer	Question Summary	Full Text
21.6-77	Boyd C Parks B	Provide additional information to support the staff's CFD modeling of the boron flow paths during an ATWS event.	<p>Provide the following additional information to support the staff's computational fluid dynamics (CFD) modeling of the boron flow paths during an anticipated transient without scram (ATWS) event:</p> <p>A. Provide a TRACG nodalization diagram that identifies all volumes that act as sources of mass and energy into or out of the core bypass region along with those volumes or nodes that make up the bypass region. The dimensions (flow areas, volumes, length) and extent (elevation, radial and azimuthal locations) of these volumes is also requested.</p> <p>B. Provide the TRACG output data used to develop the boundary conditions for General Electric's confirmatory CFD analysis of boron mixing in the ESBWR core bypass region.</p>

**Request for Additional Information (RAI)**  
**ESBWR Design Control Document (DCD) Tier 2, Rev. 1, Chapter 6**

<b>RAI Number</b>	<b>Reviewer</b>	<b>Question Summary</b>	<b>Full Text</b>
6.3-38	Thomas G	Clarify Table 6.3-6 regarding the single failure evaluation.	DCD Tier 2, Table 6.3-6 "Single Failure Evaluation," indicates that two standby liquid control (SLC) <u>systems</u> are remaining for each scenario listed. This table implies that there are two 100 percent capacity SLC Systems. Since each SLC accumulator is 50 percent capacity, please clarify this table in the DCD.

ESBWR

cc:

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

Mr. George B. Stramback  
Manager, Regulatory Services  
GE Nuclear Energy  
1989 Little Orchard Street, M/C 747  
San Jose, CA 95125

Mr. David Lochbaum, Nuclear Safety  
Engineer  
Union of Concerned Scientists  
1707 H Street, NW., Suite 600  
Washington, DC 20006-3919

Mr. Paul Gunter  
Nuclear Information & Resource Service  
1424 16th Street, NW, Suite 404  
Washington, DC 20036

Mr. James Riccio  
Greenpeace  
702 H Street, Suite 300  
Washington, DC 20001

Mr. Adrian Heymer  
Nuclear Energy Institute  
Suite 400  
1776 I Street, NW  
Washington, DC 20006-3708

Mr. Paul Leventhal  
Nuclear Control Institute  
1000 Connecticut Avenue, NW  
Suite 410  
Washington, DC 20036

Mr. Ron Simard  
6170 Masters Club Drive  
Suwanne, GA 30024

Mr. Brendan Hoffman  
Research Associate on Nuclear Energy  
and Environmental Program  
215 Pennsylvania Avenue, SE  
Washington, DC 20003

Mr, Jay M. Gutierrez  
Morgan, Lewis & Bockius, LLP  
1111 Pennsylvania Avenue, NW  
Washington, DC 20004

Mr. Glenn H. Archinoff  
AECL Technologies  
481 North Frederick Avenue  
Suite 405  
Gaithersburg, MD. 20877

Mr. Gary Wright, Director  
Division of Nuclear Facility Safety  
Illinois Emergency Management Agency  
1035 Outer Park Drive  
Springfield, IL 62704

Mr. Charles Brinkman  
Westinghouse Electric Co.  
Washington Operations  
12300 Twinbrook Pkwy., Suite 330  
Rockville, MD 20852

Mr. Ronald P. Vijuk  
Manager of Passive Plant Engineering  
AP1000 Project  
Westinghouse Electric Company  
P. O. Box 355  
Pittsburgh, PA 15230-0355

Mr. Ed Wallace, General Manager  
Projects  
PBMR Pty LTD  
PO Box 9396  
Centurion 0046  
Republic of South Africa

Mr. Russell Bell  
Nuclear Energy Institute  
Suite 400  
1776 I Street, NW  
Washington, DC 20006-3708

Ms. Sandra Sloan  
Areva NP, Inc.  
3315 Old Forest Road  
P.O. Box 10935  
Lynchburg, VA 24506-0935

Mr. Robert E. Sweeney  
IBEX ESI  
4641 Montgomery Avenue  
Suite 350  
Bethesda, MD 20814

Mr. Eugene S. Grecheck  
Vice President, Nuclear Support Services  
Dominion Energy, Inc.  
5000 Dominion Blvd.  
Glen Allen, VA 23060

Mr. George A. Zinke  
Manager, Project Management  
Nuclear Business Development  
Entergy Nuclear, M-ECH-683  
1340 Echelon Parkway  
Jackson, MS 39213

E-Mail:

tom.miller@hq.doe.gov or  
tom.miller@nuclear.energy.gov  
sfrantz@morganlewis.com  
ksutton@morganlewis.com  
jgutierrez@morganlewis.com  
mwetterhahn@winston.com  
whorin@winston.com  
gcesare@enercon.com  
jerald.holm@framatome-anp.com  
erg-xl@cox.net  
joseph\_hegner@dom.com  
mark.beaumont@wsms.com  
steven.hucik@ge.com  
patriciaL.campbell@ge.com  
bob.brown@ge.com  
david.hinds@ge.com  
chris.maslak@ge.com  
james1beard@ge.com  
louis.quintana@gene.ge.com  
wayne.massie@ge.com  
kathy.sedney@ge.com  
mgiles@entergy.com  
tansel.selekler@nuclear.energy.gov or  
tansel.selekler@hq.doe.gov  
george.stramback@gene.ge.com