July 25, 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. 44 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. Questions 4.6-23 through 4.6-37 relate to the functional design of reactivity control system as discussed in Section 4.6 of the ESBWR design control document, Tier 2, Chapter 4. These questions were sent to you via electronic mail on May 31, 2006, and were discussed with your staff during a telecon on June 29, 2006. You provided clarification on three of the staff's questions during the call, causing these RAI to be withdrawn. You agreed to respond to the RAI on the following schedule:

July 28, 2006: 4.6-24 through 4.6-26, 29-33, 35-37
August 31, 2006: 4.6-23, 27, 28, 34.

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

Sincerely,

/RA/

Martha C. 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: See next page

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

July 25, 2006

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 44 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. Questions 4.6-23 through 4.6-37 relate to the functional design of reactivity control system as discussed in Section 4.6 of the ESBWR design control document, Tier 2, Chapter 4. These questions were sent to you via electronic mail on May 31, 2006, and were discussed with your staff during a telecon on June 29, 2006. You provided clarification on three of the staff's questions during the call, causing these RAI to be withdrawn. You agreed to respond to the RAI on the following schedule:

July 28, 2006: 4.6-24 through 4.6-26, 29-33, 35-37
August 31, 2006: 4.6-23, 27, 28, 34.

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

Sincerely,

/RA/

Martha C. 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: See next page

ACCESSION NO. ML062060322

OFFICE	NESB/PM	NESB/BC
NAME	MBarillas	ACubbage
DATE	07/25/2006	07/25/2006

OFFICIAL RECORD COPY

Distribution for DCD RAI Letter No. 44 dated July 25, 2006

Hard Copy
PUBLIC
NESB R/F
ACubbage
MBarillas

E-Mail
ACubbage
MGavrilas
JDanna
ACRS
KWinsberg
OGC
LRossbach
LQuinones
MBarillas
JGaslevic
PClifford
RLandry
GCranston
GThomas
MCullingford
TKobetz
AKugler

Requests for Additional Information (RAIs)
ESBWR Design Control Document (DCD) Tier 1 Section 2.2.2 and Tier 2 Section 4.6, Control Rod Drive (CRD) System

RAI Number	Reviewer	Question Summary	Full Text
4.6-23	Clifford P	Describe CRD design changes relative to ABWR.	The Safety Evaluation for the ABWR Design Certification did not recognize the General Electric (GE) position that the control rod drop accident was beyond design basis. In response to RAI 4.6-3, differences between the ABWR fine motion control rod drive (FMCRD) and ESBWR FMCRD are discussed. (a) Describe any enhanced features or design requirements developed for the ESBWR to minimize the probability of an excess reactivity addition event. (b) Building upon the ABWR CRD Failure Modes and Effect Analysis (FMEA), discuss the probability and potential consequences for each scenario leading to an excess reactivity event.
4.6-24	Clifford P	Specify scram insertion time.	DCD Tier 1, Section 2.2.2 and ITAAC #4 of Table 2.2.2-1 provide time requirements for the "average" scram insertion for all FMCRDs. The hydraulic-powered rapid control rod insertion time requirements for each FMCRD needs to be specified as maximum allowable insertion time to a given insertion point (e.g. notch) similar to Standard Technical Specifications.
4.6-25	Clifford P	Discuss alternative system functions and impact on scram insertion.	DCD Tier 1, Section 2.2.2 states that each hydraulic control unit (HCU) "also provides the flow path for purge water to the associated drives during normal operation." Discuss this mode and any other CRD system line-up and their potential impact on scram insertion. Also, is it possible to unseat the hollow piston from the ball nut as a result of excess purge flow?

RAI Number	Reviewer	Question Summary	Full Text
4.6-26	Clifford P	Provide clarification on blowout support and core support.	With regard to blowout support, DCD Tier 2, Section 4.6.1.2.2 states, "...after the interconnected assembly of the housing, CRD and [control rod guide tube] CRGT moves down a short distance, the flange at the top of the CRGT contacts the core plate, stopping further movement of the assembly." Whereas, DCD Tier 2, Section 4.1.2.1.2 states, "Each guide tube, with its orificed fuel support, bears the weight of four assemblies and is supported on a CRD penetration nozzle in the bottom head of the reactor vessel." (a) Describe in further detail the support of the fuel assemblies and the core support plate. Include in your response, address thermal expansion and contraction of the reactor vessel and internals. (b) Describe the design margin between the CRGT flange elevation and core support plate elevation. In your response, address (1) thermal expansion and contraction of the reactor vessel and (2) differential growth between the reactor vessel and CRGT.
4.6-27	Clifford P	Describe the core and plant systems' response to a RWE event involving large groups of rods.	DCD Tier 2, Section 4.6.1.2 describes the CRD system functions including the "ability to position large groups of rods simultaneously." With the ability to move multiple control rods simultaneously comes the ability to inadvertently move multiple rods. This inadvertent withdrawal would introduce a more global, core-wide power transient than the traditional localized rod withdrawal error (RWE) event. Please describe the core and plant systems' response to a RWE event involving large groups of rods.
4.6-28	Clifford P	Describe the core and plant systems' response to the limiting inadvertent control rod run-in event.	DCD Tier 2, Section 4.6.1.2 describes the CRD system functions including "provides for selected control rod run-in." An inadvertent control rod run-in would result in a redistribution of core power and potentially an approach to a fuel design limit. Please describe the core and plant systems' response to the limiting inadvertent control rod run-in event.

RAI Number	Reviewer	Question Summary	Full Text
4.6-29	Clifford P	Verification test of spring-loaded latches.	DCD Tier 2, Section 4.6.1.2.1 describes the spring-loaded latches on the hollow piston that engage slots in the guide tube and support the control rod and hollow piston in the inserted position following a scram. (a) Failure of these latches to secure the control rod in the full in position would result in significant power peaking and loss of shutdown margin (until the motor driven ball-nut travels a distance and reinserts the control rod). Due to the importance of these spring-loaded latches, an new ITAAC should be added (or an existing one modified) to specifically test this device. (b) Describe the slot locations on the guide tube.
4.6-30	Clifford P	Provide accuracy of control rod position instruments.	DCD Tier 2, Section 4.6.1.2.2 states, “Each FMCRD provides two position detectors, one for each control system channel, in the form of signal detectors directly coupled to the motor shaft through gearing.” This section goes on to state, “This configuration provides continuous detection of rod position during normal operation.” Please provide detail on the accuracy of this position indication and all others and address the concern that the above position detection is on the motor and not on the hollow piston.
4.6-31	Clifford P	Discuss the effects of irradiation on spring relaxation.	DCD Tier 2, Section 4.6.1.2.2 describes the FMCRD components. Included in this section is a discussion of the spring-loaded control rod separation mechanism. Over time, irradiation-induced spring relaxation may impact the ability of this mechanism to perform its safety-related function. Please discuss the potential impact of neutron fluence on this component as well as other spring-loaded mechanisms.

RAI Number	Reviewer	Question Summary	Full Text
4.6-32	Clifford P	Provide details of FMCRD brake torque.	DCD Tier 2, Section 4.6.1.2.2 describes the FMCRD components. Included in this section is a discussion of the FMCDR electro-mechanical brake which states that a "braking torque of 49 N-m (minimum) and the magnetic coupling torque between the motor and the drive shaft are sufficient to prevent control rod ejection in the event of failure in the pressure retaining parts of the drive mechanism." Please provide details of this calculation including the assumed system pressure.
4.6-33	Clifford P	Justify scram time surveillance.	DCD Tier 2, Section 4.6.3.5 states, "A test of the scram times at each refueling outage is sufficient to identify any significant lengthening of the scram times." Current Technical Specification surveillance (STS SR 3.1.4.2) require routine (e.g. 120 days) sampling of scram times for a representable set of control rods. Based on recent experience with channel bow, the staff believes that routine scram tests are necessary to detect the onset of control blade interference due to channel bow and to ensure control rod operability and scram time requirements. Please provide further justification for removing this routine surveillance or justify a sampling frequency.
4.6-34	Clifford P	Is rod gang misalignment accounted for in any safety analysis or LCOs?	DCD Tier 2, Section 4.6.1.2.6 describes a rod withdrawal block signal generated due to rod gang misalignment. Please quantify the allowable gang misalignment (prior to rod block) and the accuracy of measuring the misalignment. Is this misalignment accounted for in any safety analysis or LCOs?
4.6-35	Clifford P	Provide frequency of surveillance on CRD makeup pumps.	DCD Tier 2, Section 4.6.3.5 describes the surveillance test for the high-pressure makeup mode. No frequency for this surveillance is stated. Please provide the frequency.

RAI Number	Reviewer	Question Summary	Full Text
4.6-36	Clifford P	Describe surveillance requirements following maintenance.	Standard Technical Specification require certain surveillance tests following maintenance and prior to declaring a system operable. No such requirements are included in DCD Tier 2, Section 4.6.3.5. Please discuss this omission.
4.6-37	Clifford P	Discuss any reactor operating experience with CRD system designs similar to the ESBWR.	The ESBWR CRD system design represents a departure from the current operating BWR fleet. Discuss any reactor operating experience with CRD system designs similar to the ESBWR. Discuss any manufacturing and qualifying experience with CRD systems similar to the ESBWR (e.g. ABWR).

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

Mr. Jerald S. Holm
Framatome ANP, 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
eddie.grant@exeloncorp.com
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.seleklier@hq.doe.gov
george.stramback@gene.ge.com