August 8, 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. 49 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. The RAI questions 4.4-10 through 4.4-14 are related to the TRACG application for stability evaluation of the ESBWR as discussed in Chapter 4.D of the ESBWR design control document. This set of RAI was sent to you via electronic mail on July 11, 2006. You did not request a telecon and agreed to respond to this set of RAI on August 31, 2006.

The RAI question 21.6-54, related to NEDC-33239P, "GE14 for ESBWR Nuclear Design Report," was sent to you via electronic email on July 11, 2006, and was discussed with your staff during a telecon on July 31, 2006. You agreed to respond to this RAI on August 18, 2006. The RAI question 21.6-76, related to the ESBWR separators was discussed with your staff during a telecon on July 31, 2006. You agreed to respond to this RAI on September 15, 2006.

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

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: See next page

August 8, 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. 49 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. The RAI questions 4.4-10 through 4.4-14 are related to the TRACG application for stability evaluation of the ESBWR as discussed in Chapter 4.D of the ESBWR design control document. This set of RAI was sent to you via electronic mail on July 11, 2006. You did not request a telecon and agreed to respond to this set of RAI on August 31, 2006.

The RAI question 21.6-54, related to NEDC-33239P, "GE14 for ESBWR Nuclear Design Report," was sent to you via electronic email on July 11, 2006, and was discussed with your staff during a telecon on July 31, 2006. You agreed to respond to this RAI on August 18, 2006. The RAI question 21.6-76, related to the ESBWR separators was discussed with your staff during a telecon on July 31, 2006. You agreed to respond to this RAI on September 15, 2006.

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

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: See next page

ACCESSION NO. ML062190254

OFFICE	NESB/PM	NESB/BC(A)
NAME	MBarillas	JColaccino
DATE	08/08/2006	08/08/2006

#### **OFFICIAL RECORD COPY**

Distribution for DCD RAI Letter No. 49 dated August 8, 2006 Hard Copy PUBLIC NESB R/F JColaccino MBarillas <u>E-Mail</u> JHan MGavrilas ACRS KWinsberg OGC ACubbage JGaslevic LRossbach LQuinones MBarillas TKevern VKlein

RLandry

### Request for Additional Information (RAI) ESBWR Design Control Document (DCD), Tier 2, Chapter 4D "Stability Evaluation"

RAI number	Reviewer	Summary	Full Text
4.4-10	Landry R Klein V	Update stability criteria in Chapter 4 of the DCD.	DCD Tier 2, Section 4D.1.1, "Stability Criteria," describes the criteria used to establish stable operation by using a map of core and channel decay ratios. DCD Tier 2, Section 4.3.3.6.2 states that "The ESBWR licensing basis for stability is satisfied by determining a stability criteria map of core decay ratio vs. channel decay ratio to establish margins to stability." During the review of NEDE-33083P, Supplement 1, "TRACG Application for ESBWR Stability Analysis," GE agreed (MFN 06-009) to modify the stability design criteria to include regional decay ratio calculations. Update the DCD accordingly to reflect this.
4.4-11	Landry R Klein V	Calculate density-wave stability with fine- nodalization in chimney.	Provide a core, channel, and regional stability calculation with fine nodalization in the chimney. Adjust the size of the chimney nodes to obtain a Courant number close to 1.0. The purpose of this calculation is to evaluate the effect of the chimney on the density-wave stability performance.
4.4-12	Landry R Klein V	Confirm buoyancy-driven oscillations do not develop.	Using the TRACG model developed in RAI 4.4-11, perturb the buoyancy term in the chimney to confirm that buoyancy-driven oscillations do not develop.
4.4-13	Landry R Klein V	Update DCD Chapter 4 to confirm unstable oscillation does not develop during startup.	Update the DCD Tier 2 documentation to include a TRACG calculation of the ESBWR startup transient including nuclear feedback to confirm that unstable oscillation do not develop during startup.
4.4-14	Landry R Klein V	Provide the value for each parameter in Table 4.4-14.	Provide the value for each parameter provided in Table 4.4-14 for the core design provided in the ESBWR DCD.

Parameter	Units	Value
Inlet K	"ODYSY"	
Inlet K (periphery)	"ODYSY"	
# fuel rods		
channel height	cm	
Heat transfer area per unit axial length	cm	
Channel flow area	Cm <sup>2</sup>	
Hydraulic diameter	cm	
Density of the fuel	g/cm <sup>3</sup>	
Fuel pellet diameter	cm	
Cladding heat capacity	cal/cm <sup>3</sup> °C	
Cladding thermal conductivity	cal/cm s °C	
Cladding thickness	cm	
Gap heat transfer coefficient	cal/cm <sup>2</sup> s °C	
Gap width	cm	
System Pressure	psi	
Core Inlet Coolant Temperature	С	
Total Core Thermal Power	MWth	
Total Flow rate (active + bypass)	Mlb/h	
Fraction of total flow rate through bypass at rated	%	
power		

## Request for Additional Information (RAI) "NEDC-33239P, GE14 for ESBWR Nuclear Design Report"

RAI Number	Reviewer	Question Summary	Full Text
21.6-76	Klein V (Barber D, ISL)	Provide design information about the ESBWR separators.	Provide additional design information on the ESBWR separators for the staff's independent TRACE calculations. Include details on the dimensions, losses, carry under and carry over fractions.

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