March 5, 2012

Mr. Frederick Schiffley
BWROG Chairman
Exelon Generation Co., LLC
Cornerstone II at Cantera
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION RE: BOILING WATER REACTOR OWNERS' GROUP LICENSING TOPICAL REPORT BWROG-TP-11-022, REVISION 1, PRESSURE-TEMPERATURE LIMITS REPORT METHODOLOGY FOR BOILING WATER REACTORS (TAC NO. ME7649)

Dear Mr. Schiffley:

By letter dated November 17, 2011, the Boiling Water Reactor Owner's Group (BWROG) submitted for U.S. Nuclear Regulatory Commission (NRC) staff review, licensing topical report (LTR) BWROG-TP-11-022, Revision 1, "Pressure-Temperature Limits Report Methodology for Boiling Water Reactors." Upon review of the information provided, the NRC staff has determined that additional information is needed to complete the review. On January 23, 2012, Lucas Martins, Project Manager for the BWROG, and I agreed that the NRC staff will receive your response to the enclosed Request for Additional Information (RAI) questions by June 13, 2012. If you have any questions regarding the enclosed RAI questions, please contact me at 301-415-1002.

Sincerely,

/RA/

Joseph A. Golla, Project Manager
Licensing Processes Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Project No. 691

Enclosure:
RAI questions

cc w/encl: See next page

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REQUEST FOR ADDITIONAL INFORMATION

BY THE OFFICE OF NUCLEAR REACTOR REGULATION

LICENSING TOPICAL REPORT BWROG-TP-11-022, REVISION 1

PRESSURE-TEMPERATURE LIMITS REPORT METHODOLOGY FOR

BOILING WATER REACTORS

BOILING WATER REACTOR'S OWNERS' GROUP

PROJECT NO. 691

RAI-1

Section 2.5.3 of Licensing Topical Report (LTR) BWROG-TP-11-022 (SIR-05-044), Revision 1, "Pressure-Temperature Limits Report Methodology for Boiling Water Reactors [(BWRs)]," provides a new equation (Equation (2.5.3-3a)), along with the existing equation (Equation (2.5.3-3b)), to calculate the thermal stress intensity factor (K_{It}) at the one-quarter thickness (1/4T) location of a postulated axial flaw in a nozzle corner. The LTR states that, "either Equation 2.5.3-3a or 2.5.3-3b may be used for any nozzle configuration in a BWR." The LTR's stated reason for allowing applicants to choose either of the equations arbitrarily is that, "the two formulations differ very little and in fact provide K_I values which differ only by approximately 5%."

As indicated in the ORNL/TM-2010/246 report, "Stress and Fracture Mechanics Analyses of Boiling Water Reactor and Pressurized Water Reactor Pressure Vessel Nozzles," Equation (2.5.3-3a) is for a nozzle with a sharp corner and Equation (2.5.3-3b) is for a nozzle with a rounded corner. Suggesting that applicants use either of the two equations arbitrarily and regardless of the nozzle's geometry is not appropriate because the nozzles with a variety of geometries should not get the 5 percent advantage uniformly simply because it is valid for a nozzle of a specific geometry. Please provide adequate justification for this, or consider the following alternatives: (1) establish a guideline regarding use of these two equations for different nozzle types similar to the ORNL/TM-2010/246 report approach, or (2) use only one equation that always generates conservative results for all nozzles. Quantitative information should be used to support your choice. In addition, based on your choice, Equation (2.5.3-5a) and Equation (2.5.3-5b) need also to be revised accordingly.

RAI-2

Regarding the nozzle corner flaw stress intensity factor due to pressure (K_{Ip}), Section 2.5.3 of the LTR provides a new equation (Equation (2.5.3-5c)) based on Appendix 5 of Welding Research Council (WRC) Bulletin No. 175, "PVRC Recommendations on Toughness Requirements for Ferritic Materials," as an alternative to calculate this value. Although the proposed alternative is based on a three dimensional finite element method (FEM) modeling of

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a nozzle, considerable progress has been made in fracture mechanics and FEM techniques since the publication of WRC-175 and could potentially make the WRC-175 approach on nozzles unacceptable in the future. Please clarify whether you elect to maintain your position in LTR SIR-05-044-A, or provide a comparison of results from all approaches, demonstrating that the WRC-175 nozzle approach can still provide conservative K_{Ip} results. If the BWROG decides to drop the new equation, a paragraph may be added to state that Appendix G of American Society of Mechanical Engineers *Boiler and Pressure Vessel Code*, Section XI currently permits use of the WRC-175 approach for nozzles.

RAI-3

Section 2.5.3 of the LTR addresses nozzles in the beltline region. One of the general guidelines regards disposition of the nozzle section with thickness equal to or less than 2.5 inches:

> For those nozzle inserts which are ferritic the exemption given in ASME XI, Appendix G, paragraph G-2223(c) is generally applicable in which "fracture toughness analysis to demonstrate protection against nonductile failure is not required for portions of nozzles and appurtenances having a thickness of 2.5 inches or less, provided the lowest service temperature is not lower than RT_{NDT} plus 60 °F."

Based on the NRC staff's experience of reviewing license renewal applications, the NRC staff found that some applicants missed the second half of paragraph G-2223(c) regarding the lowest service temperature. Therefore, the NRC staff suggests the BWROG add some verbiage that would highlight the condition on the lowest service temperature. Please provide this in response to this RAI.

cc:

BWROG Chairman
Frederick P. Schiffely
Exelon Generation Co., LLC
Cornerstone II at Cantera
4300 Winfield Road
Warrenville, IL 60555
frederick.schiffley@exeloncorp.com

BWROG Vice Chairman
Michael H. Crowthers
PPL Susquehanna, LLC
2 North Ninth Street
Allentown, PA 18101-1179
mhcrowthers@pplweb.com

BWROG Project Manager
Lucas Martins
GE-Hitachi Nuclear Energy
PO Box 780 M/C F-12
3901 Castle Hayne Road
Wilmington, NC 28402
Lucas.martins@ge.com

BWROG Program Manager
Craig J. Nichols
GE-Hitachi Nuclear Energy
PO Box 780 M/C F-12
3901 Castle Hayne Road
Wilmington, NC 28402
craig.nichols@ge.com

GEH Senior Vice President
Jerald G. Head
Senior Vice President, Regulatory Affairs
GE-Hitachi Nuclear Energy
PO Box 780 M/C A-18
Wilmington, NC 28401
jerald.head@ge.com