February 21, 2008

Mr. Randy C. Bunt, Chair
BWR Owners' Group
Southern Nuclear Operating Company
40 Inverness Center Parkway/Bin B057
Birmingham, AL 35242

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION RE: BOILING WATER REACTOR OWNERS' GROUP (BWROG) TOPICAL REPORT (TR) NEDE-33213P, "ODYSY APPLICATION FOR STABILITY LICENSING CALCULATIONS INCLUDING OPTION I-D AND II LONG TERM SOLUTIONS" (TAC NO. MD5743)

Dear Mr. Bunt:

By letter dated June 5, 2007 (Agencywide Documents Access and Management System Accession No. ML071590196), the BWROG submitted for U.S. Nuclear Regulatory Commission (NRC) staff review TR NEDE-33213P, "ODYSY Application for Stability Licensing Calculations Including Option I-D and II Long Term Solutions." Upon review of the information provided, the NRC staff has determined that additional information is needed to complete the review. In e-mail dated January 4, 2008, BWROG Project Manager, Michael Iannantuono stated that the NRC staff will receive a response to the enclosed Request for Additional Information (RAI) questions by March 31, 2008. If you have any questions regarding the enclosed RAI questions, please contact me at 301-415-1774.

Sincerely,

/RA/

Michelle C. Honcharik, Senior Project Manager
Special Projects 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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ADAMS Accession No: ML080380056 NRR-106 *No substantive changes since e-mail

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REQUEST FOR ADDITIONAL INFORMATION

BY THE OFFICE OF NUCLEAR REACTOR REGULATION

TOPICAL REPORT NEDE-33213P

"ODYSY APPLICATION FOR STABILITY LICENSING CALCULATIONS

INCLUDING OPTION I-D AND II LONG TERM SOLUTIONS"

BOILING WATER REACTOR OWNERS' GROUP

PROJECT NO. 691

All section, appendix, and figure numbers in the request for additional information (RAI) questions below refer to Topical Report (TR) NEDE-33213P, unless stated otherwise.

1) The purpose of this RAI is to address modeling uncertainties along the new exclusion region (ER) boundary to support removing the 0.15 decay ratio adder.

   Please provide an analysis of the core outlet average void fraction and hot channel void fraction for the ER boundary points on the natural circulation line (NCL) and high flow control line (HFCL) using PANACEA (which employs an identical void quality correlation to ODYN) for a representative Option I-D plant with a maximum extended load line limit analysis (MELLLA) operating domain. Compare this void fraction to the qualification range for the Findlay-Dix correlation.

2) Please provide verification that ODYSY05 has attained a Level 2 engineering computer program (ECP) status. Specify the code change acceptance criterion for ODYSY05 and provide a list of the functions and restrictions listed in the user manual.

3) Explain the relevant physical processes that result in a relative ER boundary insensitivity to a feedwater temperature reduction (FWTR) along the NCL in Section 7 above a FWTR of 50 °F.

4) Please calculate the core average void reactivity coefficient at the end of cycle (EOC) using a PANACEA inlet enthalpy perturbation for the Haling and actual exposure histories in Appendix A and compare them.

5) Please provide additional descriptive details regarding the demonstration analyses in Section 5.5.

a) For the Nine Mile Point Unit 2 (NMP2) event, the decay ratio exceeds unity at the point of the SCRAM, the growth rate was measured to be on the order of 1.1 to 1.2. Please comment of the efficacy of ODYSY (a frequency domain code) to predict decay ratios that are greater than unity.

ENCLOSURE

b) Please comment on the capability of ODYSY to account for feedback resulting from feedwater temperature (FWT) decrease with decreased steam flow. In other words describe those features of ODYSY that account for feedback mechanisms for the feedwater heaters and balance of plant.

c) In the analyses in Figures 5-1 and 5-2 of Section 5.5, were the approximate event traces based on plant data, PANACEA calculations, or calculated using another method?

d) For the NMP2 and Perry events, please provide the decay ratio or growth rate prior to suppression and the oscillation frequency. Please update Figures 5-1 and 5-2 with an indication along the traces that indicates the transition to an unstable condition (i.e., where on the map the decay ratio is calculated to be unity).

e) TRACG04 has been used to model the NMP2 event (see NEDE-32177P, Revision 3), the results indicate that the growth rate is sensitive to the FWT showing a difference on the order of 0.15 in growth rate for approximately a 40 K difference in FWT. Please evaluate the sensitivity of ODYSY. Comment on any features of the analysis methodology that ensure results are adequately conservative.

f) The qualification in Section 6 provides descriptions of the ODYSY inputs that most accurately represent the NMP2 event prior to the onset of the instability. Using these same evaluation inputs (as case 3c) evaluate the sensitivity of the decay ratio to a FWTR consistent with FWT measurement uncertainty or typical operating variations based on a state point along the ER in Figure 5-1. Using the case 3c inputs, evaluate the sensitivity of the decay ratio to a variation in core flow consistent with measurement uncertainties.

g) Please clarify the differences between the case 3c evaluation conditions and the proposed evaluation conditions for a standard production analysis.

6) Deleted.

7) Typically FWT varies during normal operation over a range. Update the TR to provide a greater degree of detail regarding the analysis conditions when performing the ODYSY analysis of the ER boundary. Specifically update the TR to specify an analysis FWT that is reduced relative to the average FWT by one standard deviation based on plant-specific measurements or determine a means for accounting for the uncertainty.

8) Provide additional details regarding Figure 2-1, specifically the rated core thermal power, radial peaking factor, maximum nodal peaking factor, core inlet subcooling for the points on the NCL and HFCL, and rated core flow rate.

9) Please provide some more detail regarding the radial channel grouping approach for ODYSY. In particular, please confirm whether the channel grouping is such that:

- No single channel group accounts for more than 20 percent of the total core thermal power generation.

- There are at least three channel groups for each bundle type that contributes significantly to the core power.

- There is a hot-channel to model the highest power bundle for each significant bundle type in the core.

If an alternative approach is used, please describe those aspects of the radial channel grouping process that assures core and channel behavior are adequately modeled.

10) Please explain the unexpected trend in channel decay ratio with FWTR for Plant C along the NCL; particularly explain why ODYSY predicts such a high channel decay ratio for the 100 °F FWTR. The NRC staff expects that increasing the FWTR would increase the inlet subcooling and would result in increased channel thermal hydraulic instability margin. This trend is not demonstrated for Plant C along the NCL while it is consistently demonstrated for all other plants along both lines. Please explain the unexpected results for Plant C.

11) Please clarify how the ODYSY calculations are performed for FWTR specific ER boundaries. The TR does not describe how the core power distribution is determined for a specific FWTR. Is the power shape the same as the nominal FWT Haling EOC shape or is it recalculated using PANACEA based on the new inlet enthalpy? If PANACEA is used how is exposure determined?

The NRC staff has reviewed the demonstration analyses for FWTR specific ER but needs additional clarification, specifically there are certain conditions where FWTR may be stabilizing if the FWTR results in an increase in the single phase to two phase pressure drop ratio and serves to reduce the core average void reactivity coefficient. Explain how analysis input is specified to ensure that the FWTR specific ER boundaries are determined conservatively.