March 10, 2005

Mr. George B. Stramback
Regulatory Services Project Manager
GE Nuclear Energy
175 Curtner Avenue
San Jose, CA 95125

SUBJECT: DRAFT SAFETY EVALUATION FOR NEDE-32906P SUPPLEMENT 2, "TRACG APPLICATION FOR ANTICIPATED TRANSIENTS WITHOUT SCRAM TRANSIENT ANALYSES" (TAC NO. MC5039)

Dear Mr. Stramback:

By letter dated November 3, 2004, General Electric Nuclear Energy (GENE) submitted NEDE-32906P Supplement 2, "TRACG Application for Anticipated Transients Without Scram Transient Analyses." In this supplement, GENE proposed a change to the process used by TRACG for the calculation of critical power ratio during transients. This letter transmits the staff's draft safety evaluation (SE) for GENE's review and comment.

Pursuant to 10 CFR 2.390, we have determined that the enclosed draft SE does not contain proprietary information. However, we will delay placing the draft SE in the public document room for a period of ten working days from the date of this letter to provide you with the opportunity to comment on the proprietary aspects. If you believe that any information in the enclosure is proprietary, please identify such information line-by-line and define the basis pursuant to the criteria of 10 CFR 2.390. After ten working days, the draft SE will be made publicly available, and an additional ten working days are provided to you to comment on any factual errors or clarity concerns contained in the SE. The final SE will be issued after making any necessary changes and will be made publicly available. The staff's disposition of your comments on the draft SE will be discussed in the final SE.

To facilitate the staff's review of your comments, please provide a marked-up copy of the draft SE showing proposed changes and provide a summary table of the proposed changes.

If you have any questions, please contact Mel Fields at (301) 415-3062.

Sincerely,

/RA/

Robert A. Gramm, Chief, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Project No. 710

Enclosure: Draft Safety Evaluation

cc w/encl: See next page

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DRAFT SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

NEDE-32906P SUPPLEMENT 2, "TRACG APPLICATION FOR

ANTICIPATED TRANSIENT WITHOUT SCRAM TRANSIENT ANALYSES"

GENERAL ELECTRIC NUCLEAR ENERGY

PROJECT NO. 710

1.0 INTRODUCTION

By letter dated November 3, 2004, General Electric Nuclear Energy (GENE) submitted NEDE-32906P Supplement 2, "TRACG Application for Anticipated Transients Without Scram Transient Analyses." In this Licensing Topical Report (LTR) supplement, GENE proposed a change to the process used by TRACG for the calculation of critical power ratio (CPR) during transients.

The staff has reviewed the GENE reactor accident and transient analysis computer code TRACG02A for application to the analysis of anticipated operational occurrences in the operating fleet of BWR/2-6 with a modified process for calculating the CPR. GENE previously submitted both code model documents that describe the TRACG code and the code itself to assist the staff review of the TRACG application to anticipated operational occurrences (Reference 1). The staff review and approval of that application of the TRACG code is documented in Reference 2.

The TRACG code is a thermal/hydraulic analysis code intended to be used in a realistic analysis mode. The approach taken by GENE in qualification of the code for the proposed application is under the Code Scaling, Applicability, and Uncertainty evaluation methodology described in Reference 3.

The TRAC family of computer codes began as a pressurized water reactor analysis tool developed for the NRC at the Los Alamos National Laboratory. A boiling water reactor version of the code was developed jointly by the NRC and GE at the Idaho National Engineering Laboratory as TRAC-BD-1/MOD1. GE, and later GENE, developed a proprietary version of the code designated as TRACG. The objective of the proprietary code development was to have the code capable of realistic analysis of transient, stability, and ATWS events. The code was modified to include a three-dimensional kinetics capability in addition to the multi-dimensional, two-fluid thermal/hydraulics modeling.

The plant types for which the TRACG code is to be applied includes the operating BWR/2s, BWR/3s, BWR/4s, BWR/5s, and BWR/6s. This safety evaluation report is applicable only to the operating BWRs 2-6.

2.0 REGULATORY BASIS

The draft Regulatory Guide and draft Standard Review Plan (References 4 and 5) outline the approach and guidance the staff is using in the review of thermal-hydraulic analysis codes. In addition, the staff has stated its guidance for code uncertainty analysis in Reference 3. These documents provide the regulatory basis by which the staff reviewed the November 3, 2004, proposed change to the process used by TRACG for the calculation of CPR during transients.

3.0 TECHNICAL EVALUATION

Sensitivity studies performed by Global Nuclear Fuels (GNF), a subsidiary of GENE, subsequent to the staff's review and approval of TRACG for Anticipated Operational Occurrences (AOOs) (Reference 2) have found that the change in critical power ratio (ΔCPR) divided by the initial CPR (ICPR) can vary when the ICPR is increased above the operating limit. As a result, GNF developed a different approach to the process for use in TRACG by which the CPR is calculated during AOOs. The new process yields a more consistent results ratio (ΔCPR/ICPR) as a function of ICPR. GNF has stated that there is minimal impact of the new method in those cases where the minimum CPR (MCPR) approaches the safety limit (SL).

Currently, the critical power is calculated from the GEXL correlation (Reference 1), which calculates the critical quality as a function of pressure, mass flux, boiling and annular lengths, R-factor and thermal diameter. Critical power is then defined as the condition where the equilibrium quality equals the critical quality. To determine the critical power, the power is increased to the fluid while holding all other parameters constant. However, as the heat flow to the fluid increases, the equilibrium quality decreases, resulting in the boiling boundary, the point at which the equilibrium quality becomes zero, moving down the fuel rod to a lower elevation. At the same time, the transition to annular flow also moves down the fuel bundle. At a given elevation, the boiling and annular lengths are increasing and the critical quality is also increasing. As the power is increased, the point in the fuel bundle at which the equilibrium and critical quality are equal yields the critical power. GNF then defines a thermal margin (TM) as a function of the critical quality to the equilibrium quality for the power and flow conditions present.

Sensitivity studies have found that under certain conditions, the TM to CPR relationship can result in errors in the ratio ΔCPR/ICPR. The process for calculation of the transient CPR has been modified to reduce the error. The new process uses actual calculated parameters rather than a pre-defined relationship to get the instantaneous conditions. In so doing the calculation of the transient CPR yields less error in the ΔCPR/ICPR ratio.

The proposed process has been evaluated and assessed versus ATLAS fuel bundle transient tests typical of a pressurization event, as well as the Peach Bottom turbine trip 1, which was conducted at 47% power and 100% flow. The Peach Bottom turbine trip used for the assessment is the test with the lowest power to flow ratio, that is, the highest ICPR for the fuel bundles. The assessment cases presented indicate a significant improvement in the ΔCPR/ICPR. Finally, the case presented in the Reference 1 submittal, the Hatch 1 Cycle 14 turbine trip event, was run using the new methodology. The change in the ΔCPR/ICPR ratio is small but does improve.

The staff has reviewed the proposed change in the process used in the TRACG code to calculate CPR using the regulatory basis described in Section 2.0 above and finds it acceptable. Use of the proposed methodology will result in less errors in the calculation of the CPR during AOOs.

4.0 CONCLUSIONS

GNF developed an improved approach to the process for use in TRACG by which the CPR is calculated during AOOs. The new process yields a more consistent results ratio (ΔCPR/ICPR) as a function of ICPR. GNF has stated that there is minimal impact of the new method in those cases where the minimum CPR (MCPR) approaches the safety limit (SL). The staff has reviewed the submittal using the regulatory basis described in Section 2.0 above and finds the proposed methodology acceptable.

The staff finds NEDE-32906P Supplement 2, " TRACG Application for Anticipated Transients Without Scram Transient Analyses." to be acceptable for referencing in license applications. The staff does not intend to repeat our review of the matters described in NEDE-32906P Supplement 2 when the report appears as a reference in licensing applications, except to ensure that the material presented is applicable to the specific plant involved. Our acceptance applies only to the matters described in NEDE-32906P Supplement 2.

5.0 REFERENCES

1. NEDE-32906P, Rev. 0, *TRACG Application for Anticipated Operational Occurrences (AOO) Transient Analyses*, January 2000.

2. *Safety Evaluation Report by the Office of Nuclear Reactor Regulation for NEDE-32906P "TRACG Application for Anticipated Operational Occurrences (AOO) Transient Analyses"*, June 2002.

3. NUREG/CR-5249, *Quantifying Reactor Safety Margins: Application of Code Scaling Applicability, and Uncertainty Evaluation Methodology to a Large-Break, Loss-of-Coolant Accident*, December 1989.

4. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, Draft Regulatory Guide, DG-1096, "Transient and Accident Analysis Methods," December 2000.

5. Nuclear Regulatory Commission, Draft Standard Review Plan, Section 15.0.2, "Review of Analytical Computer Codes," December 2000.

Principal Contributor: R. Landry

Date: March 10, 2005