ACRSR-1960

September 17 , 2001

Dr. William D. Travers
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Dr. Travers:

SUBJECT: APPLICATION OF GE NUCLEAR ENERGY TRACG CODE TO ANTICIPATED OPERATIONAL OCCURRENCES

During our 485th meeting on September 5-7, 2001, the Advisory Committee on Reactor Safeguards met with representatives of the NRC staff and GE Nuclear Energy (GE) to review the application of the GE TRACG realistic or "best-estimate" code to Anticipated Operational Occurrence (AOO) transient events. Our subcommittee on Thermal-Hydraulic Phenomena also reviewed this matter during meetings held on November 13-14, 2000, and August 22-23, 2001. During our review, we had the benefit of the documents referenced.

**CONCLUSION**

On the basis of our review, we support the staff's finding that Version 02A of the TRACG code is acceptable for application to AOO transients.

**DISCUSSION**

All thermal-hydraulic codes are approximations to reality; they are assembled with careful attention to the regulatory needs that they will be required to meet. This requires adequate modeling of the important physical phenomena that are usually identified by the Phenomena Identification and Ranking Table (PIRT) process. As such, these models must be reasonable and founded on sound technical principles and experimental evidence, but they are never perfect. Therefore, using such models to support regulatory decisions usually requires an assessment of the uncertainties in the predictions generated by the code.

A key condition for the acceptability of a realistic code is that there be adequate quantitative measures of this uncertainty in the predictions of regulatory parameters and success criteria used for probabilistic risk assessment. An acceptable method for assessing these uncertainties is described in NUREG/CR-5249, Quantifying Reactor Safety Margins -- Application of the

Code Scaling, Applicability and Uncertainty (CSAU) Evaluation Methodology to a Large-Break, Loss-of-Coolant Accident (LOCA), dated December 1989.

GE has done an exemplary job of applying the CSAU methodology to Version 02A of the TRACG code, as it applies to AOO transients. These transients have potential importance for providing limits to power uprate and reducing requirements for emergency diesel generator start times, for example.

In the case of the TRACG code, GE assessed the code uncertainties on the basis of full-scale separate-effects tests, component performance data and full-scale plant data for boiling-water reactors (BWRs), as well as scaled integral tests. Confidence in the use of the code is also considerably enhanced by its ability to properly predict the AOO transients that have actually occurred in a number of plants of the various BWR types.

During the course of their reviews, our Thermal-Hydraulic Phenomena Subcommittee and the staff raised several questions about some models in the code. GE satisfactorily answered all of these questions. Even in cases where the Subcommittee found good reason to question some feature of a model, it was satisfied that use of the CSAU methodology enabled assessment of the significance of assumptions or approximations within the context of their use in evaluating AOO transients. While a better model might lead to less uncertainty, perhaps allowing a reduction in the level of conservatism implied in margins to be reduced, rational decisions can be made in the presence of uncertainty, as long as one knows the extent of that uncertainty. Thus, responding to the staff's comments on our letter of January 11, 2001, regarding the use of industry-developed thermal-hydraulic codes, we stated in our letter dated June 19, 2001, that the agency needs to decide how these quantitative measures of uncertainty can be used in a more formal way to support the rationale for regulatory decisions.

Our confidence in the acceptability of Version 02A of the TRACG code is supported by GE's professionalism, its willingness to respond openly to questions raised by the Committee and the staff, and its willingness to supply the source code to the staff.[1] In addition, the staff inspired confidence through its independent use of the code to assess its neutronic aspects. The staff's judgment was that the thermal-hydraulic features of the code had already been well assessed in previous reviews and did not need to be further evaluated by independent computer runs. Nonetheless, it will be advisable for the staff to perform its own computer runs to evaluate some thermal-hydraulic features of the code as part of future assessments of other transients, such as anticipated transients without scram and LOCA.

Another independent assessment that we consider to have significant positive influence on public confidence is the staff's assessment of the neutronic features of the code. In that assessment, the staff made comparisons with the predictions of the NRC's TRAC-B/NESTLE code. We look forward to similar comparisons with the thermal-hydraulic predictions of the TRAC-M code, which is nearing completion by the NRC's Office of Nuclear Regulatory Research, when the staff considers further applications of TRACG.

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[1]We note that Section II.1.b. of Appendix K to Title 10, Part 50, of the *Code of Federal Regulations* (10 CFR Part 50) requires that "A complete listing of each computer program, in the same form as used in the evaluation model, must be furnished to the Nuclear Regulatory Commission upon request."

ACRS members Mario Bonaca and F. Peter Ford did not participate in the Committee's review of this matter.

Sincerely,

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George E. Apostolakis
Chairman

REFERENCES

1. U. S. Nuclear Regulatory Commission, Draft Safety Evaluation Report, NEDE-32906P, "TRACG Application for Anticipated Operational Occurrences (AOO) Transient Analysis," undated (Proprietary).
2. General Electric Nuclear Energy Licensing Topical Report, NEDE-32176P, "TRACG Model Description," Revision 2, December 1999 (Proprietary).
3. General Electric Nuclear Energy Licensing Topical Report, NEDE-32906P, "TRACG Application for Anticipated Operational Occurrences (AOO) Transient Analyses," January 2000 (Proprietary).
4. General Electric Nuclear Energy Licensing Topical Report, NEDE-32177P, "TRACG Qualification," Revision 2, January 2000 (Proprietary).
5. General Electric Nuclear Energy Licensing Topical Report, NEDE-32900P, "TRACG Licensing Application Framework for AOO Transient Analysis," June 1999 (Proprietary).
6. General Electric Nuclear Energy Licensing Topical Report, NEDC-32956P, "TRACG02A User's Manua,l," February 2000 (Proprietary).
7. Letter dated January 11, 2001, from Dana A. Powers, Chairman, Advisory Committee on Reactor Safeguards, to Richard A. Meserve, Chairman, NRC, Subject: Issues Associated with Industry-Developed Thermal-Hydraulic Codes.
8. Letter dated June 19, 2001, from George E. Apostolakis, Chairman, Advisory Committee on Reactor Safeguards, to William D. Travers, Executive Director for Operations, NRC, Subject: Response to Your April 12, 2001 Letter on Issues Raised by ACRS Pertaining to Industry Use of Thermal-Hydraulic Codes.