



UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001

February 12, 2004

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

Dear Dr. Travers:

SUBJECT: DRAFT SAFETY EVALUATION REPORT FOR THE ECONOMIC AND
SIMPLIFIED BOILING WATER REACTOR (ESBWR) PRE-APPLICATION
REVIEW

During the 509th meeting of the Advisory Committee on Reactor Safeguards February 5-6, 2004, we met with representatives of the NRC staff and General Electric Nuclear Energy (GENE) to discuss the draft Safety Evaluation Report for the ESBWR pre-application review (Ref. 1). Our Subcommittee on Thermal-Hydraulic Phenomena reviewed this matter during its meeting on January 14-15, 2004. We also had the benefit of the documents referenced.

CONCLUSION

We agree with the staff's decision to approve the TRACG code for use in analysis of the ESBWR in response to a LOCA scenario.

OBSERVATIONS

The SER is well-written and provides summaries of specific features of TRACG followed by conclusions regarding their acceptability.

Compared with previous SERs that we have reviewed, the staff has improved its explanation of why some features of the code are acceptable, and some are not. However, the amount of substantive technical information contained in the SER is limited. Presentations by GENE and the staff of additional quantitative evidence, and our own review of many supporting proprietary documents were necessary to provide the Committee with additional supporting evidence for the staff's conclusions.

Some of the supporting evidence is proprietary, and it is difficult to provide this evidence in the SER. This is unfortunate from the point of view of public confidence. Although we have determined that the staff's conclusions are appropriate, an outside observer would have insufficient evidence to appreciate why they were made. A clear exposition of the process, criteria, and evidence by which the staff reached its decisions would improve the transparency of the agency's decisionmaking process. We were pleased to see that both the staff and GENE were able to present some of this evidence in the open meeting of the ACRS on February 5, 2004. We hope that the staff can continue to work with the industry to identify similar ways to include more technical supporting information in SERs without compromising sensitive intellectual property.

The staff's conclusion of acceptability is a judgement. The quality of this judgement depends on the skill, experience, and diligence of the staff. It would help in future decisionmaking if clear criteria for acceptability were established and articulated. These might include, for example, a measure of when the experimental evidence is sufficient to establish uncertainties in the relevant parameters in the code and in the resulting measures of success, with a prescribed level of confidence. We note that this issue has been addressed partially by a regulatory guide issued in 1989 (Ref. 2) that contains criteria for assessing the performance of best-estimate LOCA computer codes. However, two additional general guidance documents that build on Ref. 2 have been available for over 3 years in draft form as a draft regulatory guide and an associated Standard Review Plan section. We are disappointed to learn that they still have not been completed. (Refs. 3 and 4).

The staff's ability to examine the source code, run TRACG on its own computers, challenge the assumptions, run sensitivity analyses, and compare its predictions with those of the NRC's TRACE code played a large role in convincing us that approval should be given for the use of TRACG to analyze the ESBWR. We believe that these practices should continue.

GENE's extensive and successful comparisons of TRACG predictions with data from a number of experiments at different scales were additional evidence that helped to give us confidence in the decision even though some simplifying assumptions in the code were not fully justified a priori.

FURTHER USE OF TRACG FOR ANALYZING THE ESBWR

The only decision that is being made at this time is to approve the future use of TRACG in the design certification process for the analysis of LOCA scenarios for the ESBWR. When TRACG is used for design certification purposes, attention should be given to the following:

1. The arguments for "conservative" assumptions in the condensation processes in the suppression pool and in the Passive Containment Cooling System and Isolation Condenser performance should be made more explicit and quantified, or demonstrated to be bounding.
2. The assumptions about various mixing processes and noncondensable hideout in the drywell should be made more specific and quantified in such a way that it is clear that the full range of possibilities is covered.
3. Assumptions about operator actions should be justified and shown to cover all relevant actions that can reasonably be expected.
4. The analysis of uncertainty by adding up the effects of two-sigma variations around the base values is not a satisfactory approach, although margins are so large that we are confident that regulatory requirements can be met. Some measure of confidence in the predicted uncertainties in key parameters, such as water level above the core, should be established. There is perhaps a potential for simplifying this process if a convincing bounding analysis can be developed for one or more of these parameters to demonstrate that large margins are available between the calculated values and the associated regulatory limits.

5. Scaling should be addressed comprehensively, including an evaluation of the sources of error. The staff described a scaling approach that appears to do this (Ref. 5). We look forward to seeing how the staff applies this approach when it considers other aspects of the ESBWR during the design certification review.
6. The effects of entrance length on the flow regimes in the "chimney" should be quantified.
7. The predicted leak rate of the vacuum breakers is much lower than experience with current vacuum breakers would suggest. The staff needs to obtain adequate assurance that the predictions of leakage for this new vacuum breaker design are realistic and are based on a sufficient range of test results simulating likely operational history and conditions.
8. The explanations of level tracking and its robustness should be made more complete, including confirmation calculations to show that the correct hydrostatic head is predicted under all important conditions and that spurious "levels" or other features do not emerge.
9. The TRACG containment calculations sometimes showed significant deviations from corresponding predictions using the NRC's CONTAIN code. It is not sufficient to argue that these deviations are "conservative." The differences are large enough to require explanation in terms of physical phenomena and the development of quantitative estimates of the magnitudes in order to verify that the hypothesized explanations are correct.

We appreciate the professional, forthright, and responsive interactions that we have had with both GENE and the staff during this evaluation.

Dr. Peter Ford did not participate in the formulation of this letter.

Sincerely,

/RA/

Mario V. Bonaca
Chairman

References:

1. Memorandum dated December 11, 2003, from James E. Lyons, NRR to John T. Larkins, ACRS, Subject: Draft Safety Evaluation for the ESBWR Pre-Application Review
2. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.157, "Best-Estimate Calculations of Emergency Core Cooling System Performance," May 1989
3. U.S. Nuclear Regulatory Commission, Draft Regulatory Guide DG-1120, "Transient and Accident Analysis Methods," December 2002
4. U.S. Nuclear Regulatory Commission, Standard Review Plan Section 15.0.2, NUREG-0800, "Review of Transient and Accident Analysis Methods," January 2003
5. M. DiMarzo, "A Simplified Model of the BWR Depressurization Transient," Nuclear Engineering and Design, 205 (2001), pgs. 107-114, July 28, 2000