ACRSR-2004

July 18, 2002

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

Dear Dr. Travers:

SUBJECT: RISK METRICS AND CRITERIA FOR REEVALUATING THE TECHNICAL BASIS OF THE PRESSURIZED THERMAL SHOCK RULE

During the 494th meeting of the Advisory Committee on Reactor Safeguards, July 10-12, 2002, we met with representatives of the NRC staff to discuss the status of the staff's work to identify risk metrics and criteria that can be used for reevaluating the technical basis of the pressurized thermal shock (PTS) rule. During our review, we had the benefit of the documents referenced.

We were previously briefed by the staff on the methodology and initial results of the PTS reevaluation project during our meeting on February 7-8, 2002, and we issued a letter dated February 14, 2002.

OBSERVATION

The proposed options for PTS acceptance criteria do not properly reflect the potential impact of air-oxidation source term on risk.

Discussion

The NRC staff has proposed the following three options for quantitative acceptance criteria for reactor vessel failure frequency.

> A reactor vessel failure frequency of 5×10^{-6}/year, which is the same as the current PTS acceptance criteria provided in Regulatory Guide (RG) 1.154.
>
> A reactor vessel failure frequency of 1×10^{-5}/year based on consideration of the core damage frequency (CDF) provided in RG 1.174 and the Option 3 framework for risk-informing 10 CFR Part 50.
>
> A reactor vessel failure frequency of 1×10^{-6}/year based on consideration of the RG 1.174 large early release frequency (LERF) that is a surrogate for the prompt fatality safety goal and on the Option 3 framework for risk-informing 10 CFR Part 50.

Because of the potentially severe challenge to containment integrity posed by reactor vessel failure resulting from PTS sequences, we believe that a risk-informed acceptance criterion for reactor vessel failure frequency should be based on considerations of LERF and not on CDF. However, the current LERF surrogate goal in RG 1.174 is not a proper starting point for developing an acceptance criterion because the source terms used to develop the current goal do not reflect the air-oxidation phenomena that would be a likely outcome of a PTS event.

There is currently no commonly accepted source term for air-oxidation events. However, we suggest that the "SST1" source term in NUREG/CR-2239 and the resulting calculated consequences at each site be extrapolated to assess the consequences of a postulated range of air-oxidation-induced source terms that would include significant releases of ruthenium, cerium, and actinides. Given such a source term, an acceptance criterion for the frequency of vessel failure from PTS events could be developed directly from the prompt fatality safety goal with due consideration of uncertainties and defense-in-depth.

If the consideration of an air-oxidation source term is too daunting and subject to unacceptable uncertainty, it may be necessary to fall back on a frequency-based approach to identify criteria that would provide assurance that reactor vessel failure from PTS events is very unlikely. The choice of such criteria is a value judgment that should reflect consideration of the Safety Goals and uncertainties.

We believe it is likely that qualitative consideration of the likelihood of containment failure along with the potential consequences of an air-oxidation source term will lead to an acceptance criterion for reactor vessel failure frequency that would be substantially smaller than any of those currently proposed by the staff.

Sincerely,

/RA/

George E. Apostolakis
Chairman

References:

1. SECY-02-0092, Memorandum dated May 30, 2002, for the Commissioners, from William D. Travers, Executive Director for Operations, NRC, Subject: Status Report: Risk Metrics and Criteria for Pressurized Thermal Shock
2. U.S. Nuclear Regulatory Commission, NUREG/CR-2239, "Technical Guidance for Siting Criteria Development," December 1982.
3. U. S. Nuclear Regulatory Commission, Regulatory Guide 1.154, "Format and Content of Plant-Specific Pressurized Thermal Shock Safety Analysis Reports for Pressurized Water Reactors," January 1987.
4. U. S. Nuclear Regulatory Commission, Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," July 1998.
5. Letter dated February 14, 2002, from George E. Apostolakis, Chairman, ACRS, to William D. Travers, Executive Director for Operations, NRC, Subject: Reevaluation of the Technical Basis for the Pressurized Thermal Shock Rule.