UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

November 19, 1998

The Honorable Shirley Ann Jackson
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Chairman Jackson:

SUBJECT: PROPOSED RULE ON USE OF ALTERNATIVE SOURCE TERM AT OPERATING REACTORS

During the 457th meeting of the Advisory Committee on Reactor Safeguards, November 4-7, 1998, we reviewed the proposed rule on use of the alternative source term at operating reactors and discussed the status of the associated pilot application under way at the Perry Nuclear Power Plant. During this meeting, we had the benefit of discussions with representatives of the NRC staff. We also had the benefit of the documents referenced.

The regulations (10 CFR Parts 50 and 100) and associated regulatory guides include a conservative source term (TID-14844) that the staff has considered acceptable for performing design-basis accident (DBA) analyses and for assessing the suitability of the containment design for an intended site. This source term is characterized by the composition and magnitude of the radioactive material, timing of release from the reactor core, and physical/chemical form of radionuclides assumed to enter into the containment under accident conditions. In practice, this source term has also been utilized in other regulatory activities, including assessment of the requirements for equipment qualification and for control room habitability.

New knowledge and experience gained through severe accident research revealed that the TID-14844 source term was unrealistic compared to what would be expected if a reactor actually experienced a core-damage accident of a magnitude commensurate with the DBAs. Consequently, the staff developed a revised source term (in NUREG-1465) with the intention that it be applied to the design and siting of future light-water reactors. The major changes in the revised source term were: an extended timing of introduction of the fission products; a change in the predominant chemical form of fission-product iodine from gaseous

to particulate; an increase in the quantities of iodine, cesium, and tellurium; and an increase in the number of fission-product groups.

The proposed rule would allow licensees to voluntarily apply the revised source term to operating plants. The staff has conducted a number of activities to obtain information for use in deciding whether this proposed rule is appropriate and acceptable, including the following:

- Identified likely plant modifications that would result from applications of the revised source term.

- Sponsored studies at the Grand Gulf, Surry, and Zion nuclear power plants using both the TID-14844 and the revised source term to gain insights on the impacts related to DBA doses.

- Undertook review of pilot plant studies submitted to address a range of revised source term applications to operating plants.

- Performed limited evaluations for the Grand Gulf and Surry plants to determine the risk implications [core damage frequency (CDF), large, early release frequency (LERF), and latent fatalities] of selected plant modifications.

The outcomes of the above activities include:

- The DBA doses are generally smaller with the revised source term (in some cases by a factor of six), implying the potential for relaxation of the fission product control requirements.

- The effects on the above risk metrics are insignificant.

- Considerable margin exists with respect to the magnitude of the revised source term, compared to the releases expected to accompany a DBA.

As a result of these findings for a very limited sample of plants, the staff has concluded that there is sufficient justification for the proposed rule that would allow plants to voluntarily adopt the revised source term and make appropriate plant modifications. Such modifications would have to be implemented by a license amendment under 10 CFR 50.90 (a new Section 50.67 would be added to provide the implementation requirements). The licensee would be required to repeat applicable portions of the DBA analyses included in its Final Safety Analysis Report to demonstrate compliance with regulatory requirements in the revised total effective dose equivalent (TEDE) form.

Because of the regulatory significance of source-term usage, we have had a long-standing interest in the subject. Previously, our endorsements of the staff's source-term related efforts have included: updating and defining a more realistic source term; using TEDE and the "worst" two hours for dose-acceptance criteria; developing guidance on acceptable methods for determining source-term mitigation in containment by natural and engineered

safety feature processes; allowing application of the revised source term to operating plants (including partial application – particularly the timing of the release of fission products); and developing a better understanding of the risk implications for implementing the revised source term in operating plants.

The primary reason for our past support to the development of a more realistic DBA source term was due to a concern that use of an unrealistic source term can result in placing regulatory and design emphasis in the wrong areas. There is also the possibility that risk-significant effects may have been missed or that safety enhancements may have been precluded. An unrealistic source term can result in unnecessarily burdensome regulatory requirements.

In formulating the proposed rule, the staff has developed risk information in two areas:

- The risk implications relative to CDF and LERF.
- The margins related to the DBA source term magnitude associated with best-estimate DBA releases.

The staff's efforts in addressing these two areas of concern have been commendable. The staff has done what could be expected within the constraints of the existing regulatory framework.

For the subject rulemaking, it is clear that, to some degree, the likely plant modifications will adversely affect the potential for some quantity of fission product release for plants opting to use the revised source term. For most plants, it is unlikely that the increases in fission product release will be of unacceptable amounts. To a large extent, this is confirmed by the risk-informed values calculated for CDF and LERF. This should be verified, however, for each application.

Recommendations

- In view of the low risk and the possible benefits, we support the proposed rule that would allow licensees to apply the revised source term to operating plants on a voluntary basis.
- Each application for use of the revised source term should be evaluated with respect to absolute values of CDF, LERF, and the effects of the proposed plant modifications on these risk metrics.

Sincerely,

R. L. Seale

R. L. Seale
Chairman

References:

1 Memorandum, dated October 16, 1998, from Jack W. Roe, Office of Nuclear Reactor Regulation, NRC, to John T. Larkins, ACRS, Subject: Transmittal of the Draft Proposed Rule Package - Proposed Amendments to 10 CFR Parts 21, 50, and 54; Regarding Use of an Alternative Source Term at Operating Reactors.

2 SECY-98-154, Memorandum dated June 30, 1998, from L. Joseph Callan, Executive Director for Operations, NRC, for the Commissioners, Subject: Results of the Revised (NUREG-1465) Source Term Rebaselining for Operating Reactors.

3. SECY-98-158, Memorandum dated June 30, 1998, from L. Joseph Callan, Executive Director for Operations, NRC, for the Commissioners, Subject: Rulemaking Plan for Implementation of Revised Source Term at Operating Reactors.

4. Memorandum dated September 4, 1998, from John C. Hoyle, Secretary of the Commission, to L. Joseph Callan, Executive Director for Operations, NRC, Subject: Staff Requirements - SECY-98-158 - Rulemaking Plan for Implementation of Revised Source Term at Operating Reactors.

5. Letter dated August 27, 1996 from D. Shelton, Centerior Energy, to NRC, Subject: License Amendment Request: Revision of Main Steam Line Leakage Requirements and Elimination of the Main Steam Isolation Valve Leakage Control System.

6. U. S. Nuclear Regulatory Commission, NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants," February 1995.

7. U.S. Nuclear Regulatory Commission, NUREG-1150, Vols. 1 & 2, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants," December 1990.