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

March 15, 1994

The Honorable Ivan Selin
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Selin:

SUBJECT: DRAFT COMMISSION PAPER ON SOURCE TERM RELATED TECHNICAL AND LICENSING ISSUES PERTAINING TO EVOLUTIONARY AND PASSIVE LIGHT WATER REACTOR DESIGNS

During the 406th and 407th meetings of the Advisory Committee on Reactor Safeguards, February 10-11 and March 10-12, 1994, respectively, we discussed the draft Commission paper on source term related technical and licensing issues pertaining to evolutionary and passive light water reactor (LWR) designs. During these meetings, we had the benefit of discussions with representatives of the NRC staff and industry. We also had the benefit of the documents referenced.

Separate source terms are provided for BWRs and PWRs. The source terms consist of the fraction of the equilibrium core inventory of fission products released into containment, the timing of this release, and the chemical form of the fission product iodine. In the past, such source terms have been specified in Regulatory Guides 1.3 and 1.4 to provide guidance on appropriate values to use in the site suitability analyses that are required by 10 CFR Part 100, and in conjunction with the other design basis accidents (DBAs) in Chapter 15 of the Standard Review Plan. The DBA source terms should not be confused with the plant and sequence specific source terms that are mechanistically derived and used in PRAs and other severe accident analyses. The specifications that are presently in Regulatory Guides 1.3 and 1.4 consist of 100 percent of the noble gases and 25 percent of the iodine (91 percent as elemental iodine, 5 percent as particulate iodine, and 4 percent as organic iodine). For site suitability analyses, these specifications have been used along with a thermal hydraulic specification. These analyses require that a peak containment pressure be calculated for a double-ended break of the largest primary system piping and be applied for 24 hours after which it is to be reduced to half that value.

The 10 CFR Part 100 specifications of the source term have always been viewed as being somewhat arbitrary, but conservative. The proposed revised source terms are intended to remove some of the arbitrariness of the present values and to make them more realistic. As part of the overall process of decoupling site suitability decisions from reactor design, the revised source term and the dose criteria provisions are to be removed from 10 CFR Part 100 and put into 10 CFR Part 50 where they would apply only to design features. The revised source terms are based on values developed in NUREG-1150 for the "in-vessel" release phase associated with severe accidents.

In the draft Commission paper, the staff describes the proposed revised source terms and proposed uses for reviews and assessments of evolutionary and passive LWR designs. The paper discusses positions taken by the staff on source term issues for evolutionary and passive LWR designs (identified in SECY-90-016 and SECY-93-087). The staff believes these positions will provide a basis for closing these issues with respect to design certification reviews and the EPRI Utility Requirements Documents.

We generally agree with the positions taken by the staff on the issues and agree with the principle that the source terms for DBAs should be made more realistic. Realistic source terms should result in more appropriate designs (e.g., engineered safety features, source term mitigation features, sampling and measurement devices, and containment integrity). We believe the changes can lead to increased coherence in the associated regulations and their application. As in all responses to the accumulation of new knowledge, such proposed changes in the regulations, whether toward enhancement or relaxation, or whether applied to existing plants or to future plants, should be assessed for their overall effect on risk. We also have the following concern about the revised source term specifications.

We think the realistic specification of the thermal hydraulics and production of nonradioactive aerosols associated with the DBAs is as important as the specification of the source term itself. These conditions can strongly influence the behavior of radioactive aerosols in containment. Additional consideration should be given to developing Commission guidance on the thermal hydraulic conditions and nonradioactive aerosol generation to be coupled with the source terms for the various DBAs.

We continue to recommend that the General Design Criteria for containment volume and strength for future ALWRs incorporate the spectrum of severe accident challenges described in our report of

May 17, 1991. The containment should represent a defense-in-depth feature that is not limited to design basis accidents.

Sincerely,

J. Ernest Wilkins, Jr.
Chairman

References:

1. Memorandum dated January 6, 1994, from Dennis M. Crutchfield, NRC Office of Nuclear Reactor Regulation, for John T. Larkins, Executive Director, ACRS, Subject: ACRS Review of Commission Paper on Source Term-Related Technical and Licensing Issues Pertaining to Evolutionary and Passive Light-Water-Reactor Designs
2. Memorandum dated February 10, 1994, from James M. Taylor, NRC Executive Director for Operations, for the Commissioners, Subject: Draft Commission Paper, "Source Term Related Technical and Licensing Issues Pertaining to Evolutionary and Passive Light-Water-Reactor Designs"
3. SECY-93-087, Memorandum dated April 2, 1993, from James M. Taylor, Executive Director for Operations, for the Commissioners, Subject: Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs
4. SECY-90-016, Memorandum dated January 12, 1990, from James M. Taylor, Executive Director for Operations, for the Commissioners, Subject: Evolutionary Light Water Reactor (LWR) Certification Issues and Their Relationship to Current Regulatory Requirements
5. NUREG-1150, Volumes 1 and 2, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power plants," December 1990
6. Report dated May 17, 1991, from David A. Ward, ACRS Chairman, to Kenneth M. Carr, NRC Chairman, Subject: Proposed Criteria to Accommodate Severe Accidents in Containment Design