D870513

The Honorable Lando W. Zech, Jr.
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Zech:

SUBJECT: ACRS REPORT ON PROPOSED RESEARCH TO REDUCE SOURCE TERM UNCERTAINTY

During the 325th meeting of the Advisory Committee on Reactor Safeguards, May 7-9, 1987, we discussed a proposed research program for resolution of source term uncertainty areas as described in SECY 86-369, "Plan To Address Source Term Technical Uncertainty Areas." We also considered BNL report NUREG/CR-4883, an evaluation of this program by panels of experts sponsored by NRC. The ACRS Subcommittee on Severe Accidents considered this matter during a meeting on April 22, 1987. In our review, we had the benefit of discussions with the NRC Staff and the documents referenced.

We commend the expert panels for their expedited review and for their comments concerning some very complex phenomena. We agree generally with their findings and recommend that the Staff give careful consideration to their suggestions in planning the proposed research program.

We make the following additional observations:

(1) In our report dated June 10, 1986 in which we commented on NUREG-0956, "Reassessment of the Technical Bases for Estimating Source Terms," we recommended that the Staff attempt to quantify the uncertainties that were identified. The expert panels also noted that there are no quantitative estimates of the magnitude of the identified uncertainties. We agree with the panels that those planning the research programs need guidance as to which contributors to uncertainty are most important. To provide this guidance, the Staff should attempt not only to specify uncertainties in the descriptions of particular phenomena, but should also estimate their contribution to risk. There is also a need for an estimate of the level of uncertainty that is acceptable in making regulatory decisions. Although SECY 86-369 identifies areas of uncertainty, it does not indicate what level of uncertainty would be acceptable, nor does it indicate how likely it is that the proposed research will reduce the uncertainty to an acceptable level.

(2) In the areas of steam explosions and hydrogen combustion, one of the panels recommended a reduction in research activities. For steam explosions within the vessel that lead to early containment failure, the consensus is that the conditional probability for such an event is very small (0.01), and thus need not be considered fur-

ther. This panel further concluded that hydrogen combustion is reasonably well understood and that uncertainty in its understanding contributes relatively little uncertainty to estimates of source terms and risk. However, significant uncertainties do remain in regard to the generation of hydrogen during an accident. With the evidence now available to us, we agree with the panel's recommendation.

(3) A panel concluded that information needed to reduce the uncertainty in risk estimates for direct containment heating (DCH) will not be available within the next four or five years, even if a crash program is implemented. In light of this estimate, the panel recommended the exploration of plant changes (hardware or procedures) which would eliminate the sequence. The panel also recommended that the DCH experimental program be reorganized to show the effects of water and structural failure on DCH. We concur in both recommendations. In general, we conclude that the existing program is too narrowly focused. The program should be redirected to encompass a broader range of possible scenarios, including estimates of realistic mass flows from the vessel and possible vessel failure modes. The question of what is credible in the various situations must not be submerged in some large computer code, but should initially be sorted out by more straightforward and transparent physical arguments concerning the range of possibilities.

(4) There has been considerable discussion of the uncertainty associated with the chemical form of iodine, either volatile (elemental) or non-volatile (chemically bound as in CsI). After the TMI-2 accident, the absence of elemental iodine led some to conclude that the estimated risk should be reduced by a factor of as much as 100 from risks reported in WASH-1400, where it was assumed that all of the iodine was in elemental form. It is now reported that in studies conducted in the preparation of NUREG-0956, the difference in risk for volatile vs. non-volatile iodine is only about a factor of 3. A lesser priority should be assigned to research in this area.

(5) We observe that estimates of accident progression at key points in the core melt sequence depend on the prediction, using inadequately based computer codes, of such parameters as melt temperature and time required for vessel melt-through. There appear to be significant uncertainties in the predictions of a number of these key parameters that tend to be masked by the codes. Since vessel penetration, core-concrete interactions, and the concurrent release of fission products, for example, are all very sensitive to melt temperature, we urge that efforts, including both experiments and independent calculations, be made to provide some independent and more transparent assessment of the behavior of key parameters. Comparison with another code embodying the same underlying assumptions is not sufficient.

(6) In light of the importance of containment behavior in determining the magnitude of the source term, we recommend that more attention be given to the identification and evaluation of other scenarios having the potential for leading to a large release of radioactive material.

Additional comments by ACRS Member Glenn A. Reed are presented below.

Sincerely,

William Kerr
Chairman

Additional Comments by ACRS Member Glenn A. Reed

While I agree with the ACRS letter to reduce the research in described areas, I wish to focus on the panels' observation made as a "first suggestion" in the general conclusions that a prevention technique of "depressurization" (procedures and design) was important "to make the problem go away."

I recommend that research be increased and accelerated on the depressurization idea and that the research include application of depressurization as an alternative technique for core decay heat removal.

References:

1. U.S. Nuclear Regulatory Commission Staff Document, "Plan to Address Source Term Technical Uncertainty Areas," SECY-86-369, dated December 11, 1986
2. Brookhaven National Laboratory Report, "Review of Research on Uncertainties in Estimates of Source Terms From Severe Accidents in Nuclear Power Plants," NUREG/CR-4883, dated April 1987
3. U.S. Nuclear Regulatory Commission Report, "Reassessment of the Technical Bases for Estimating Source Terms," NUREG-0956, Draft Report for Comment, dated July 1985
4. U.S. Nuclear Regulatory Commission Report, "Reactor Safety Study -- An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants," WASH-1400 (NUREG-75/014), dated October 1975
5. National Research Council Report, "Technical Aspects of Hydrogen Control and Combustion in Severe Light-Water Reactor Accidents," dated 1987
6. U.S. Nuclear Regulatory Commission Report, "A Review of the Current Understanding of the Potential for Containment Failure from In-Vessel Steam Explosions," NUREG-1116, dated June 1985.

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