



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
Nuclear Safety Research Review Committee  
Washington, D.C. 20555

11 August 1992

Mr. Eric S. Beckjord  
Director  
Office of Nuclear Regulatory Research  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555

Dear Mr. Beckjord:

Enclosed please find a copy of a report of the review of the "Severe Accident Research Program Plan Update," Draft NUREG-1365, Revision 1, that was prepared by NSRRC's Severe Accident (SA) Subcommittee based upon its meeting on June 2-3, 1992. The SA Subcommittee's report was reviewed by the members of the NSRRC and was discussed by a quorum of the members in a telephone conference call on August 10, 1992. Members participating in the telephone conference call were David Morrison, Herbert Isbin, Thomas Boulette, Spencer Bush, Sol Burstein, Edwin Kintner, Fred Molz, and Richard Vogel. The Committee concurs with the findings and recommendations made by the SA Subcommittee and submits the Subcommittee's report verbatim to you as a report of the Committee.

If you have any questions on this NSRRC report, please contact Dr. Herbert Isbin or me.

Sincerely,

A handwritten signature in cursive script that reads "David L. Morrison".

David L. Morrison

Chairman

Nuclear Safety Research Review Committee

DLM/sje

Attachment

REVIEW OF THE "SEVERE ACCIDENT RESEARCH PROGRAM PLAN UPDATE"  
Draft NUREG-1365, Revision 1

The Severe Accident (SA) Subcommittee submits the following report for approval by the Nuclear Safety Research Review Committee (NSRRC).

The Severe Accident NSRRC Subcommittee met with NRC RES on June 2, 1982, to review NUREG-1365, Revision 1. Presentations were made covering the 11 major SA issues, and the discussions served to provide additional clarification and input, including assignment of priorities, the budgets for FY 1982 and the projected FY 1983, milestones, and user identification. Also included were new research results, and briefings on peer reviews. The current status of the NRC review of MAAP was given. The Committee has in prior meetings reviewed the process of identification of NRC needs and requirements for research, and in the course of the Subcommittee's discussions, recognition was made that as the various research programs progress that there may be other potential users of the research findings. The Subcommittee recommends that RES use the most effective means for including the additional information provided to the Subcommittee, along with other suggestions being made in this report, in updating the SARP report or in future Five-Year Plans which might well eliminate the need for the periodic revisions to NUREG-1365. The Subcommittee recognizes that RES's response to this report also represents an appropriate way to document additions, clarifications, and improvements in the Severe Accident Research Program.

The priorities assigned to the 11 major SA issues are noted as follows:

High Priority

- Closure of Mark I Liner Failure
- Closure of Direct Containment Heating (DCH)
- Advanced Light Water Reactors
- Severe Accident Codes

Medium Priority

- Fuel-Coolant Interactions and Debris Coolability
- Core Melt Progression and Hydrogen Generation
- Hydrogen Transport and Combustion

Issues Almost Complete and Continuing Studies Considered

- Affirmatory including International Work
- Scaling
- Source Term
- TMI-2 Vessel Investigation Project
- Core-Concrete Interaction (with refinements to the CORCON-MOD 3 code and continuation of validation)

The SA Subcommittee concurs with RES on the general ordering of priorities and on the programs underway. Results of these research programs are applicable to operating plants, updating the source term, generic rulemaking involving severe

accidents, probability risk assessments, and resolution of generic safety issues.

The SA Subcommittee also notes its concurrence with the goals of SARP:

"...complete all the major severe accident experimental programs within the next 2 to 3 years"

and

"...closure of all severe accident issues ... in 4 years"

For termination of a research activity, RES augmented the SARP report on criteria for closure with discussion of how judgments are to be used for regulatory closure of an issue, and what specifically is needed to close an issue. The Subcommittee recommends that the SARP report reflect additionally the comments made by the RES Deputy Office Director on closure. Committee meetings in the past have considered this matter, and the Committee would like to be involved for such specific actions in the future. Further, the Committee takes note of the recent memos involving the June 3, 1982, Commissioner F. Remick to E. Beckford, and the June 15, 1982, response "Closure of Research Projects and Maintenance of Capabilities".

RES's use of peer reviews to reach consensus and resolution of technical issues provides an open process for experts to interact with the ongoing research programs. The Subcommittee strongly endorses this activity. Additionally, the Subcommittee strongly endorses the various international and cooperative research programs underway. Not only do such international programs provide partners in sharing costs, but provide a broader technical base for ensuring more effective research and enhanced safety of nuclear plants worldwide. Severe accident codes are being used also on an international basis. For example, MELCOR involves users (both domestic and international) in a newly organized MELCOR Cooperative Assessment Program, MCAP. The Subcommittee recognizes the continuing need for research involving ongoing code improvements, and the need for the current and planned assessment tasks, using a disciplined approach. Users of codes as well as code developers have been aware of problems and limiting applications of the severe accident codes, and these problems have been restated and augmented through peer reviews. The Subcommittee was briefed on the progress of the RES response to peer review findings. The Subcommittee encourages RES in its continuing programs to resolve code deficiencies and to hold code developers to strict standards of scrutability. Further, the Subcommittee notes RES's programs for reducing the number of codes under development and for planning assessments for the remaining codes. These are areas that the full Committee will address in future meetings.

Further, the Subcommittee recognized that while computer codes play an important role in practically all aspects of modern science and engineering, the NRC research program dealing with severe accidents has developed knowledge and insights that go beyond what can be incorporated in a code. It is this knowledge and insight that is the primary product of research activities, and should guide the limitations and applications of code development as a means for summarizing and conveying information in a form that is manipulated easily. The experience of Subcommittee members is that the relative novelty of modern computers and graphics systems can sometimes induce individuals, including highly skilled peer reviewers, to over-emphasize the importance of computer codes at the expense of the broader knowledge base that is behind them.

The SA Subcommittee also agrees that research requires the coordination and

management of "...a continuing focussing and refocussing..." to "...provide the basis for improved judgments as to where to expend future efforts." The Subcommittee recognizes that RES has a six-point integrated plan for closure of severe accident issues, and, in future meetings with RES, will discuss progress by reviewing such elements as the assessment of individual plant examination and inclusion of external events, issues involved with containment performance improvements, fuel-coolant interactions and debris coolability, and how research findings affect accident management.

The Subcommittee concurs with RES that major accomplishments in the severe accident program include the process for reviewing and directing the programs which involves peer reviews; the progress made with the Mark I Liner Failure Issue including the Risk-Oriented Accident Analysis Methodology (ROAAM); and the setting and achieving of milestones for the 11 major severe accident issues. An important new development for resolving the DCH issue was presented to the Subcommittee. The proposed activity is a six-month cooperative program between Sandia and the University of California, Santa Barbara, and will use the integral test data and the methodology of ROAAM. Preliminary indications using the results of the integral facilities at Argonne and at Sandia are very promising for resolving the DCH issue for Zion-like containments. Test results to be obtained this year for the Surry-like containments will be used to confirm resolution of the DCH issue for these containments, too. Successful completion of this program will guide what additional considerations need to be given for containments not like Zion nor Surry.

The Subcommittee agrees that progress has been made in improving the data base and analytical studies for fission product release and transport, in code developments for VICTORIA, for in-vessel source terms, and for CONTAIN, for ex-vessel source terms; in core-concrete research and code developments; reaching closure on hydrogen transport and combustion with only a residual issue involving high-temperature mixtures to be studied and resolved; and with the TMI-2 vessel investigation project.

With respect to the Severe Accident Scaling Methodology (SASM), the Subcommittee recognizes the key to its application for a specific case, such as DCH, lies in the exploratory research that is required to identify key phenomena. This was accomplished in the integral tests that have been undertaken at Sandia and at Argonne. The Subcommittee concurs with RES that no further work needs to be done with SASM.

Programs being initiated for severe accidents involving advanced light water reactors will be followed through the cooperative efforts of the NSRRC Advanced Reactors Subcommittee and the Severe Accident Subcommittee.

Overall, the Subcommittee was impressed with RES management of the Severe Accident Research Program as reflected in the revisions to NUREG-1365, the use and response to peer reviews, the broadening of the technical support through user programs involving severe accident codes, and through the extensive international cooperative programs.