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August 8, 1983

Dr. Melvin Silberberg
Accident Source Term Program Office
Office of Nuclear Regulatory Commission
Washington, DC 20555

Dear Mel:

I have reviewed the handouts and have read the material given to us at the Peer Review on July 28 and 29th. Before commenting on the work of the Accident Source Term Program Office (ASTPO) and its contractors, I would like to make the following general comments.

I was, and still am, particularly dismayed at the attitude taken by the IDCOR program, as voiced by Ed Fuller. ASTPO has gone to great lengths in assuring a free and open dialogue during the course of its work. Progress, review, and criticism have been carried out in full public view. To announce that the IDCOR results will be completely different, without giving any details as to why, (except in some general vague manner), is inappropriate technically and does not serve in the public interest.

I expect that on some given day, IDCOR will deliver the results of two years work to NRC's doorstep and request instant evaluation and comparison with ASTPO conclusions. If indeed their results are radically different, ample time and effort must be made available for review of IDCOR results, and reconciliation of any major differences. The Commission should be made aware of this situation, and every effort be made to move the IDCOR program into the public domain for appropriate review.

With respect to ASTPO's work, I comment as follows:

1. A number of my remarks made during the peer review were aimed at insuring that source-terms generated by ASTPO were representative of a broad enough spectrum of accident sequences for each reactor type, so as to ensure some degree of "completeness". For example, there are no sequences for BWRs (both Mark I and Mark III containments) in which there is a B or B' (i.e. failure of electric power to engineered safety features or failure to recover either onsite or offsite electric power within 1-3 hours following a transient initiated by loss of offsite AC power). Similiarly there are no loss of coolant accident (LOCA) sequences included for Mark III BWRs, and no small break LOCA's considered for Mark I, BWRs.

I would like to explain why I am concerned about completeness, via two examples. First, the results to date are based only on "internal initiators", i.e. external events such as earthquakes and fires are not considered. In the Zion PRA, seismic initiators increase core melt frequency but even more importantly they increase risk. While the SE sequence frequency (the earthquake induced core-melt) by itselt, is small, it can be shown that by using mean values, the containment also fails structurally in about 3.5% of the cases, leading to an early release and hence the high risk. The remaining SE cases can fail containment by slow overpressurization. Without this external analysis, one might be led to only consider sequences leading to slow overpressurization, when in fact the early release is risk dominant.

Second the results to date are based on event trees which are "static", and as such, miss a number of important considerations; operator intervention, partial success or failure of engineered safety features, use of non-safety grade features (e.g. use of CRD pumps for supplying coolant in a BWR LOCA) etc. The accident at TMI started as a transient and ended as a small break LOCA due to operator intervention, and cannot be described by WASH-1400 type event trees.

In view of this, I recommend very strongly that Battelle reconsider its choice of sequences and include at least some LOCA's and B events for BWRs.

2. In making an effort to ensure some degree of "completeness", Battelle might attempt the following type exercise. For BWRs, there are two important combinations of core melt/containment failure: core melt before containment failure and core melt after containment failure. In addition, time sequencing is important, i.e. early core melts and late core melts.

In the Limerick PRA for example the accident sequences fall into four classes: three with early core melt (one with containment intact, but at low pressure; one with containment intact, but at high pressure, one with failed containment) and one with late core melt (containment failed prior to core melt).

Battelle might consider grouping the various sequences for Mark I and III containments (Limerick is a Mark II), and check to see if the various physically possible combinations of core melt/containmnent failure are included. A similar approach might be used for PWRs, although in this case the containment is usually intact except for bypass (failure to isolate) and the V sequence.

3. In my last letter, I recommended that some parametrics on containment failure location and pressure should be undertaken. I fully appreciate Battelle's response (the problem with available time, funds, etc.), but at a minimum I would repeat the calculations for Surry and Peachbottom using the new codes (MARCH 2.0, NAUA etc.), but keeping the WASH 1400 containment failure pressures and location. In this way the source-term would be decoupled from containment questions, and the role of physical chemistry would be better understood. Furthermore I would like to see how the source term evolves with time for the PWR long-time overpressurization sequences.

4. As I mentioned at the Peer Review, some consideration should be given to sequences in which the ice compartment could be bypassed in the PWR-Ice Condenser containments. There are return paths from the upper compartment to the lower compartment (the ventilation system represents one, although it has a baffle which is supposed to prevent this. However, these events are beyond the design basis so it would be an open question). Since the ice compartment is an effective scrubber, the presence of the ice is important in determining the source term. Bypass would be an important consideration. So would the time that the ice melts.

5. I have had the opportunity to quickly review Volume 1, "PWR-Large, Dry Containment Draft Report" given out at the meeting. It appears that the treatment of the containment failure modes for each sequence (for the AB there are four, for the TMLB' there are two) are certainly along the lines I have discussed above. I hope this serves as a model for the rest of the volumes.

It is easy to be critical when one does not have to meet milestones, stay within budget, and respond to the peer review so I want to congratulate you and Mike on the meeting, as well as Battelle on their efforts, given the constraints (time and money) under which you are all working. A number of comments focused on the thermal hydraulic modeling; in particular nodalization using MARCH. I agree strongly with these comments and hope Battelle is responsive to them.

I hope these comments prove useful and I look forward to the next peer review.

Sincerely,

W. E. Kastenberg

W.E. Kastenberg,
Professor of Engineering

WEK/shm

cc: M. Jankowski
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