

TO: Richard Savio

FROM: Ivan Latton

SUBJECT: Class 9 Accident Subcommittee Meeting  
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The first day of the two day meeting was devoted to NUREG-950 as it will be issued for public comment within a few days. NUREG-950 is supposed to be a prescription for "Best Estimate" source term calculations. It is touted to be "source term science". There is too much evidence of physical processes not included for the results to be accepted as "Best Estimates" and the contents of the report certainly are not science. There is a process of moving forward without doing something about bad analysis that is apparent. BMI-2104 is the basis for NUREG-0956. NUREG-0956, SNL work on containment performance and their interpretation of the containment loading are the basis for NUREG-1150 which is supposed to play a key role in severe accident policy. Rather than comment on the presentations made, I will discuss why I think their basis is weak. The primary reason is that BMI-2104 or the BCL suite of codes is based on little more than was used in WASH-1400. A notable exception is the aerosol work. The MARCH code still uses an input value for the molten core temperature in spite of it being the single most important variable. Simple engineering estimates of heat transfer coefficients just do not seem to have been made. MERGE supposedly couples MARCH to primary system T/H behavior yet is not rich enough to allow the type of behavior expected. Further, according to Denning, no changes will be made before issuance of NUREG-1150. This is in spite of published work showing important physical processes that not only are missing but are important to the accident progression. The physical process I am referring to is in-vessel buoyancy driven flows that transport both radionuclides and energy throughout the primary system. The first work in this area was speculative, see my letter on this subject written during the summer of 1981. Each refinement has shown the process not only to be real but more important to the accident evolution. This is particularly true for TLMB, the dominant risk contributor for many PWRs. A paper dealing with the process based on EPRI work will be presented at the 1985 NHTC (August) that clearly shows by both analysis and data that buoyancy driven flows result in recirculation within the vessel. EPRI has reported preliminary calculations of the resulting primary system temperatures. They are high and each successive refinement leads to more convincing arguments that they will cause failures in the surge line, small diameter piping or steam generator tubes. This work will be reported at the next ENS/ANS meeting (D. Okrent is the meeting chairman).

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It is my opinion that NUREG 0956 should not be issued without incorporating the EPRI results. Arguments about time schedules make no sense when a major contributor to source term transport is ignored. Further, hints that the phenomena may be accommodated probabilistically by assigning it to containment failure mechanisms is nonsense. Part of the containment loading comes from molten core-concrete interactions. The contribution is calculated with a code called CORCON. It is not clear what version was used for what calculations and how it compares with the most recent version. A number of changes have been made as a result of the KKK Beta tests. The initial heat transfer coefficient is much higher leading to lower molten core debris temperatures. Some believe this is the reason no aerosols (or very little after the first few minutes) are observed. Hydrogen production on the other hand is as high as available metals will allow. The low temperatures lead to crusting behavior that is melt thermal diffusivity dependent. At low temperatures, the gases from the concrete blurps through the melt like steam and gases through the mud pools at Yellowstone. Codes like VANESA are not appropriate for such phenomena. When the melt is finally solidified it appears to be porous enough to allow all the gases to pass through the solid matrix. The problem thus becomes one of transpiration through a solid matrix. Processes such as these can be modeled but not with the present tools. I suspect that the impact on containment loading is much less than has been estimated in the past. Kerr asked the staff on a number of occasions how they planned to use the method outlined in NUREG-0956. Silberberg listed several applications, e.g. auditing the IDCOR analysis, assuring and revising WASH 1400 results for emergency planning and possibly TID 14844 revision. I maintain that there is so much uncertainty in the results that they will serve little purpose. Mitchell noted several times that the bottom line is very close to WASH 1400 estimates. Further, I would maintain that the uncertainties contained in the NUREG-0956 methodology are probably similar as well.

Ernst described the severe accident risk rebaselining program. Looking at the initiators with PRA is certainly a worthwhile effort. For it to be meaningful, however, the plant operations staff impact must be factored in. Outliers will originate with poor design and maintenance, be propagated into a serious incident by poor operator actions. Poor design and maintenance can be overcome, as was shown at Davis-Besse, by the operators. Before one can attach any weight to the results, one must answer several questions:

1. How does one attempt global risk reduction on an even handed basis? Here I am referring to cost/benefit decisions and factors of greater than ten in risk resulting from who did the PRA.

2. How does one attempt to quantify risk reduction without including all known accident progression paths? It is bad enough when there are probably many we don't know about.
3. How does one attempt to quantify risk reduction without including external events? Generic or plant specific PRAs will make a big difference in cost and time.

I am not convinced that plant specific calculations are meaningful when the uncertainties are considered. Certainly, a study of initiators is of value, but not necessarily the final consequence estimates. Along this line, results of the Containment Loads Working Group (CLWG) are important. The pressures and temperatures a containment must deal with were estimated by a group of experts who in the mean found them to be much less severe than those predicted by the BCL suite of codes. I hope this is properly factored into the final assessment of the codes. Containment loading is the parameter that will determine the final consequences of a severe accident for a given containment building. At present some unknown process, as I see it, is being used to develop it. Loading resulting from the BCL suite of codes, the CLWG values without direct heating and with direct heating are weighted to yield high, low and expected values. How this weighting is done will be very important. It was felt at the CLWG meetings by most that direct heating was a low probability phenomena. Further, the direct heating pressure calculations were based on an inordinately large fraction of the core being instantaneously introduced into the containment building. The EPRI in-vessel accident progression work points to its low probability as do many other physical considerations. This aspect of the study will feed directly to the results of NUREG 1150 and should be reviewed in some detail. It is my view that the present loadings are skewed to the high side. In my opinion the most sensible approach to risk reduction suggested by NRR is to establish containment performance criteria. This may help take the edge of outliers resulting from management related events such as poor maintenance practice or inadequately trained operators. The requirement that each plant do a simplistic PRA of some type is very good. This will bring the plant personnel to a level of awareness that will probably be the largest contributor to risk reduction. The IDCOR methodology will probably be adopted by NRR. Resolution of the nineteen issues will bring the phenomenology into a reasonable form. The methodology and phenomenological models are well documented and very scrutable if somewhat prescriptive. I think NRR is making the correct choice.