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Dear Paul:

Below are my comments on the joint meeting of the Thermal Hydraulics and the Core Performance subcommittees of the ACRS held on May 12, 1993 in Bethesda:

After a period of considerable study the BWROG has concluded that given an ATWS and a simultaneous pump trip, core power oscillations are very likely to occur. They have further concluded that the preferred strategy for mitigation is a lowering of the vessel water level to a point that the reactor becomes subcritical. Their faith that this procedure will prevent serious core damage is based on computer calculations using the TRACG code, a version of the TRAC code that has been modified by GE to make it more nearly applicable to the BWR.

Whether the code will represent adequately the oscillations that may be generated is an open question in my mind. The code will calculate oscillations, but when questioned as to whether one could be certain that the oscillations that might be triggered can be bounded by code calculations, the BWROG representatives gave a negative answer.

Further it is questionable that there has been modelling of the actual conditions that may exist in the core during the course of the system behavior associated with power oscillations. Prof. Lee asked if the void coefficients that were used in the modelling were calculated for the case in which voids exist not only in the channel boxes, but in the space in between boxes. The void coefficient for this case is almost certainly different than for the case of liquid in between boxes. The answer that he got seemed to indicated that the representative thought Lee expected that the coefficient might be positive. He missed the point. For oscillations to occur, the phase relationship between the power oscillations and the reactivity oscillations must be such that a coefficient that is negative in steady state has an effect which reinforces the power level that occurs during oscillations. Thus what would be calculated as a negative coefficient for steady state behaves, in a sense, as if it were positive. An increase in the negative coefficient (calculated for steady state) could thus make the oscillation larger. If one is to take the results of these calculations seriously the modelling must be examined in more detail than has been the case to this point.

I am also skeptical that operators will be able to cope with the emergency procedures that are being formulated. These have to be scenario based, and I have no evidence that we yet understand these oscillations well enough that we can write procedures that will deal with what might well occur. Incidentally when I asked Taggert Rogers about airline pilots and how they handled the DC-10 loss of control, he claimed that they used procedures. What he said, however, in demonstrating that he thought they did, clearly indicated that the pilots had thought about and devised a strategy, but that they worked out the tactics (aka procedures) on the spot!

What then should be done? We have little choice but to depend on the shutdown systems. Considering that the failure likelihood of the BWR shutdown system, with the modifications that have been made to satisfy the ATWS rule, must be very low, the residual risk, even if we don't know how to deal with the power oscillations associated with a full blown ATWS, must be extremely low. Let's concentrate on maintenance of the shutdown systems to ensure that we continue to have a highly reliable system when it is needed. Those emergency procedures represent a "bruised reed", in my view.

Sincerely,

Bill Kerr

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