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# The University of Michigan

DEPARTMENT OF NUCLEAR ENGINEERING

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October 26, 1982

Mr. Paul A. Boehnert  
Advisory Committee on Reactor Safeguards  
U. S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Dear Mr. Boehnert:

This is written to present my comments regarding the Anticipated Transients Without Scram (ATWS) Subcommittee meeting held on October 22, 1982. The following comments are primarily elaboration of the remarks I made toward the conclusion of the meeting; some comments are also added regarding the improved operator training program for the ATWS.

As indicated in my letter to you of August 20, 1982, I believe the probabilistic risk analysis (PRA) and value-impact analysis, reported by the Utility Group on ATWS, made a positive contribution toward resolution of the ATWS issue. For example, the risk reduction associated with hardware improvements could perhaps be meaningfully quantified along the line suggested by the Utility Group. The absolute values one obtains from such analyses are, however, subject to a great deal of uncertainties. Thus, in my opinion, the quantitative risk analysis for low-probability events, e.g., the ATWS, can best be used in combination with qualitative engineering analysis or judgement to determine sensitive parameters and uncover weak points in system interactions. In this regard, I believe it is neither proper nor prudent to ignore, in the ATWS analysis, certain transients with unacceptable consequences, merely because they are correctly considered in the formal PRA framework.

Two specific examples can perhaps be considered to clarify my point. One is the main steam isolation valve (MSIV) closure events for boiling water reactors (BWRs). The latest analysis reported at the meeting indicates that, with a 43-gpm capacity standby liquid control system (SLCS), the maximum suppression pool temperature could very likely exceed the present limit of 200°F in an MSIV closure event. I feel quite uncomfortable with the Utility Group position that one could exclude MSIV closure events from further ATWS

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considerations because treating these transients as unacceptable events in the PRA makes little difference to the overall risk estimate.

Another example of the need for engineering judgement perhaps is the NRC staff's suggestion regarding the moderator temperature coefficient (MTC) for pressurized water reactors (PWRs) manufactured by Combustion Engineering (CE) and Babcock and Wilcox (B&W). For these PWRs, with the MTC values applicable for 95 % of the fuel cycle, the primary system pressure in certain ATWS events could exceed the Level C Service Limit with potential for lifting of the pressure vessel head. I believe here again it is an unwise application of the PRA to suggest the use of MTC values applicable to 50 % of the fuel cycle, regardless of whether this lower percentage is correctly factored into the formal PRA structure or not. I feel that the proper approach in this case should rather be to reduce the apparent sensitivity of the ATWS consequences to the MTC values, especially early in the fuel cycle when transient events are more likely to occur.

In the case of the MSIV closure events for BWRs, I would suggest the first remedy to consider should be an 86-gpm SLCS or equivalent, as suggested by the NRC staff at the meeting. Regarding the CE and B&W reactors, I believe the best approach is to improve the MTC values through a modified burnable poison design. As suggested in my letter to you of August 20, 1982, this modification is expected to be relatively simple and will not involve any additional hardware modifications. In addition, this modification could allow more efficient use of fuel at the same time.

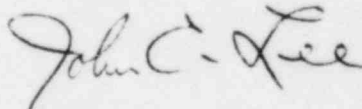
Another concern I have regarding the BWR ATWS analysis is the potential for limit cycle oscillations in natural circulation conditions. It was suggested at the meeting by a representative of General Electric Company that a new computer analysis indicates absence of such oscillations. The fact that the transient results could be sensitive to the calculational model perhaps reinforces, rather than diminishes, my feeling that we should learn more about this possible oscillatory behavior in BWRs.

The potential oscillations in BWRs could indeed become a serious concern, especially in regard to the Emergency Procedure Guidelines (EPGs) that the industry is working on. Although the principle behind the symptom-based procedure is recommendable, such a procedure may not be sufficient in the presence of oscillations. In this regard, it should be noted that the most likely oscillations in BWRs would be density wave oscillations (DWOs), and that the DWOs are characterized

by inlet flow out of phase with outlet flow. Such an oscillatory transient would be rather hard to follow and control, by relying solely on symptom-based approach. Thus, in addition to learning more about the potential oscillatory behavior in BWRs, I would suggest that the EPGs be supplemented by some diagnosis or recognition of the causes of the transient events.

I hope the above comments are of some use to the ACFS.

Yours sinerely,

A handwritten signature in cursive script that reads "John C. Lee". The signature is written in dark ink and is positioned above the typed name and title.

John C. Lee  
Professor

xc: W. Kerr