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Dr. Paul Boehnert
U. S. Nuclear Regulatory Commission
Adivisory Committee on Reactor Safeguards
Washington, DC 20555

SUBJECT: Comments on the Utility Group Position; ATWS

Dear Dr. Boehnert;

In response to your letter dated June 30, 1982, subject as above, I have reviewed (selectively) the material provided with your letter and my comments are included herein. The documents reviewed were;

1) Letter, J. Christman to Secretary of the Commission, Utility Group on ATWS Comments, Apr. 27, 1982.
2) Report, Comments of the Utility Group on ATWS. Apr. 23, 1982.
3) Report, Technical Support for the Utility Group on ATWS; Task 1: Quantitative Evaluation of Industry Proposed Modifications Relative to Existing Plant ATWS Requirements (Appendix D), SAI Inc., Dec. 31, 1981.
4) Report, Technical Support for the Utility Group on ATWS; Task IV: Summary of Past ATWS Evaluations.

Before considering specific comments on the above documents, it is perhaps appropriate to very briefly discuss some aspects of the ATWS issue as it has developed over the years. This provides some perspective which may help explain the basis for the NRC and Utility positions as they exist today. The ATWS issue has been a particularly troublesome and intractable problem for many years.

Part of the reason that the ATWS issue has remained an unresolved problem is because of the very large difference which developed early between the NRC estimate of ATWS risk and that preferred by industry. NRC originally postulated some 10 transients (per WASH-1400) per year requiring scram, and argued for a scram failure as high as 10^{-4}/demand. This produced a conservative ARWS probability of 10^{-3}/reactor year. On the other hand, industry claimed the transient frequency was approximately 3-5/yr. and the scram failure probability was 10^{-6}/demand, producing an ATWS probability of $1\text{-}5X10^{-6}$/RY. Furthermore, the consequences of ATWS were in dispute. The NRC assessed consequences were generally significantly more severe than those calculated by industry.

An added complexity in the earlier years of the controversy was the NRC position that ATWS events should not contribute more than 10^{-7}/RY to the probability of core melt.

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Thus, there developed not only a large difference in the NRC vs. Industry ATWS risks, but also a significant disparity between the early NRC core melt goal and their ATWS core melt probability assessment.

It seems to me that these early disparities, which lingered for several years, created a highly polarized situation, with little prospects for compromise, in which the NRC position has remained that a substantial fix was required for ATWS/ This current NRC position may be the result of a carryover of this early large disparity coupled with skepticism over current PRA results even though the NRC and utility ATWS risk estimated today have come remarkably similar.

At present, NRC and industry agree that the frequency of transient events is on the order of 2 to 6, and both use $3X10^{-5}$/demand for scram failure. More sophisticated approaches to assessing the prospects of either accomodating scram failure or providing alternate means to terminate core power have reduced the ATWS risks further. Some disagreement apears to remain, however, over the consequences calculated to occur.

The utility position appears to be based on a generally sound analysis of the ATWS risk contribution, and I tend to favor their approach to resolving the issue. However, I have four major complaints with the utility position as provided in documents 1) and 2) listed previously. These are:

1. Excessive Minimizing of ATWS Risk Significance- I find that the Industry position tends to minimize ATWS risk significance beyond that which can be justified with available technical information. The Industry position appears to erroniously generalize PRA results in support of their low risk contention, and they incorrectly use risk in a manner that tends to obscure the actual ATWS risks. I have further concerns that this contention may promote complacency on the part of utilities which may reduce their zeal to effectively deal with the problem in operator training and procedures development.

2. Emphasis on Non-technical Aspects of the Issue- The utility position tends to emphasize the non-technical aspects of the ATWS issue by picking at the NRC for inconsistent policies, conflicting requirements and questionable legal positions. The issue is not (or at least should not)be whether the NRC has adequately fulfilled their mandate: rather the issue should be: What is the ATWS risk and is it acceptable? I have always been a strong proponent of self-regulation, and my impression is that the utility position does not adequately reflect a movement in that direction. In my opinion, reactor safety can be assured only if the owner-operators take a lead role in the understanding of and responsibility for safe plant operation.

3. Need for Analysis- I do not agree with the utility position that increased emphasis to develop more accurate ATWS analysis techniques is not justified. In fact, some parts of the utility position seem to argue that more accurate analysis would be beneficial.

4. Questionable use of Averaging Results- The Utility position uses only the average core melt probability as determined by SAI (Appendix D) to formulate their position. According to the SAI results, the first year ATWS core damage probability is considerably higher than subsequent years (higher than the proposed NRC safety goal after the utility proposed modifications). Based on this result, if it is verified by subsequent review, I would favor a further examination of ATWS fixes to apply to the first year of operation.

Specific comments related to these areas are provided in the following section of this letter.

COMMENTS-

A) Letter, Christman to Secretary of the Commission. (4/27/82)

1. Pg. 2- It is stated here that the present risk of ATWS is acceptable, and that the "Utility rule was proposed only as a concession to those NRC staff members who seemed determined to impose an ATWS rule no matter what the need for, or cost of, such a rule." The SAI and other PRA studies do not seem to support this conclusion, at least for BWRs. The BWR ATWS core melt probability (before utility rule modifications) is above the NRC safety goal, and for BWRs is a substantial fraction of it. It is not clear on what basis the conclusion is derived.

B) Comments of the Utility Group on ATWS. (4/23/82)

1. Pg. 41 thru 43- The argument is made here that existing PRAs show a low contribution to core melt from ATWS, and therefore there is no apparent reason why ATWS should be given special treatment. There are at least two flaws to this argument. First, for BWRs the ATWS core melt probability has not always been found to be a small contributor. For example, in the recently completed Browns Ferry IREP study, an ATWS sequence was found to be the second most dominant contributor of all core melt sequences considered. This sequence contributed 25% to the total core melt probability (at a probability of about $5X10^{-5}$). Second, and more important, ATWS core melt sequences have inherent features which tend to increase their consequences over other core melt sequences. These features include faster melt times (due to sustained high power levels) and, frequently, containment failure precedes core melt (for BWRS, at least) which increases radionuclide release fractions. The arguments offered by the Utility Group report do not include the risk significance of ATWS, but instead concentrate on the core melt probability contribution (per Table 2, Pg. 43). For example, while the core melt probability contribution from ATWS for Grand Gulf is about 14%,as stated in Table 2, the accident occurs in a Category 2 release. Category 2 releases dominate the risk for Grand Gulf, and the ATWS sequence is a dominate contributor to Category 2. For Limerick, ATWS is only about 8% of the total core melt probability, but ATWS core melt sequences occur in the most risk significant classes (III and IV). It can thus be very misleading to emphasize ATWS core melt probability at the exclusion of a consideration of their risk significance.

2. Pg. 43, footnote 38- It is stated here that the difference between the Grand Gulf core melt probability (with current equipment) and Limerick (with Altermate 3A assumed) is "small". Table 2 reveals that a factor of 3.6 exists between the two assessments. However, the Utility Group report strongly implies that the proposed Utility rule provides a significant reduction in the ATWS core melt probability, yet the reduction factor (per Table 1, Pg. 33) is 4 or less for all plants but CE. (the Amended rule does increase the GE reduction to a factor of 9). Furthermore, the Christman letter characterizes these reductions as substantial.

3. Pg. 45- It is stated here that "...the variations among plants are too great to permit much generic treatment at the low levels of risk that we are now addressing." This statement seems to diminish the applicability of the SAI generic study, and appears to be somewhat inconsistent with SAI's assess-

ment on page I-4 (Appendix D), "...it is judged that the uncertainties in the assumptions required of such an (generic) analysis are much larger than the varieation due to the plant-specific variation." (It should be noted that footnote 46 on pg. 51 of the Utility report appears more in line with the SAT conclusion). The issue of applicability of the SAI generic results to all plants is a perplexing one, and is discussed further in comments on the SAI study following.

4. Pg. 96- It is stated here that "... the resulting power (following ATWS with RPT) is generally within the bypass capacity of the plant." This is not true at least for Limerick based on the recent Limerick PRA (core power 30%, bypass capacity 25%).

5. Pg. 107- It is stated here that "...further analysis (of ATWS) cannot be justified." I do not agree with this apparent negative attitude towards enhanced development of ATWS analytical tools. Disagreement and uncertainty continues to exist regarding the plant consequences from ATWS events. Further, it seems to me that better analytical tools are needed to evalueate ATWS mitigating procedures, upgrade simulator ATWS capability, evaluate ATWS fixes, and gain precision on ATWS consequences.

6. Pg. 109- The utility position here calls for flexibility in the rule to permit alternate design changes. It would seem that judgements regarding the effectiveness, implementation and acceptability of such alternates depends on the availability of reliable and comprehensive analysis tools, the development of which seems to be discouraged by the utility position (see preceding comment).

7. Pg. 114, item 7- It appears that "necessary" here should definitely be "unnecessary." I agree with the utility position that augmented containment isolation may be counterproductive. In fact, it has been my feeling that current BWR logic for containment isolation (particularly MSIV closure) is too restrictive (calls for isolation too frequently). Isolation removes an important core heat removal option (the PCS).

8. Pg. 118- It is stated here that "...risk analysis show ATWS to be a minor contributor to risk." I don't believe this statement is valid for BWRs (see comment #1 preceding and #'s 9 and 10 succeding).

9. Appendix B, Pg. 3- It is stated here that "Recent plant specific risk assessment studies show that both BWRs and PWRs meet this (core melt probability less than 10^{-4}/year), even without the benefit of the Groups proposed rule. This statement is not true for all recent PRAs. At least three (Browns Ferry, Indian Pt. II, and Big Rock Point) show total core melt probabilities greater than 10^{-4}.

10. Appendix B, Pg. 4, Ist full Para.- This paragraph again minimizes ATWS risk based on PRA studies. However, only core melt probabilities are quoted, not risk from ATWS (although "ATWS risk" is erroneously used). See also comment 1 preceding.

C)Appendix D- Technical Support for the Utility Group on ATWS (SAI report)-

1. General- While I did not review this document in depth, it seems to be a comprehensive and reasonably accurate assessment. Particular positive features, not generally included in other PRAs, include the detailed segregation of transients and the separation of ATWS probability during the first year of operation. In some previous PRAs, I felt that transients were too

grossly lumped into a single event tree. There can be very subtle but important dependencies between transient initiators and mitigating systems typically used on event trees. (The recent ORNL accident precursor report, NUREG/CR-2497, tends to illustrate this point).

2. Pg. 3-5, Table 3.4- It is not clear what logic was used to distinguish turbine trip transients from the six other categories used since most of the other category transients would appear also to cause turbine trip.

3. General- There can be significant differences in safety system design among the five BWR models currently in the US BWR population. Furthermore, design differences among plants of the same model exist which can influence core melt probability (cf. NEDO-24708). Thus, it is not clear to what extent the SAI generic results apply to all BWRs as used in the Utility position.

4. Pg. 3-31 and 3-52- The averaging process used here is questionable and may lead to some complex policy questions related to the safety goal. While the SAI study appears to appropriately separate out the first year of BWR operation from following years, the averaging process subsequently used tends to obscure the high ATWS core melt probability computed for the first year. The Utility position is formulated around only the averaged result ($4.1X10^{-5}$ per reactor year after the utility recommended ATWS rule has been implemented). However, the first year probability (again after implementation of the rule) of core damage from ATWS is over four times as great ($1.8X10^{-4}$0, and above the NRC proposed safety goal! I see this averaging technizue as a dangerous precedent in that it can be used to demonstrate acceptable accident probabilities over the lifetime of the plant, when an individual year may have unacceptable core damage probability. It seems to me the NRC (or ACRS) should consider some additional requirements during the first year of BWR operation to improve this situation if the SAI results are found to be valid.

D) Report; TASK IV, Summary of Past ATWS Evaluations

(no comments- did not review in depth)

I hope these comments are of use to you and the ACRS. I look foreward to further participation with the ACRS on this important issue.

Sincerely,

P. R. Davis

cc: D. Okrent
J. M. Greismeyer