PDR
CT-1498

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Sept. 5, 1982

Dr. David Okrent
United States Nuclear Regulatory Commission
Advisory Committee on Reactor Safeguards
Washington, D.C. 20555

Ref: Letter, J. M. Greismeyer to Peter R. Davis, May 18, 1982

Dear Dr. Okrent;

In response to the above referenced correspondence, I have reviewed the Limerick PRA study and my comments are attached. In accordance with the referenced letter, I have limited by review to a total of 3 man-days. This level of effort did not allow more than a quick reading of most of the Studv plus a more detailed review of a very few areas which I perceived as important to the results and conclusions. I was unable in many cases to determine the relative significance of my comments. Furthermore, it is possible that some of my comments could be resolved by information contained in the Study which I could not find.

Probably my major concern with the Study is the lack of completeness apparently given to the consideration of initiating events (see comments # 4, 5, 8, 14).

I hope these comments are of some use to the ACRS. If you have any questions, please call.

Sincerely,

P. R. Davis

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cc: J. M. Greismeyer, ACRS

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COMMENTS ON LIMERICK PROBABILISTIC RISK ASSESSMENT

1. Pg. i, Background- It is not clear what the third sentence means; "These (Limerick) risks were evaluated to determine if they represent a disproportionately high segment of the total societal risk from postulated nuclear accidents."

2. Pg. ii, Conclusions, last sentence- Similar to the preceding comment, this sentence is not clear.

3. Pg. 1-10- Genetic effects are not listed as an accident consequence. This issue has been raised frequently with respect to nuclear accident consequences and needs to be considered.

4. Executive Summary- The Executive Summary implies a best estimate, complete, risk assessment for Limerick, and draws conclusions about the relative significance of Limerick plant risks. However, the summary does not indicate that external events have been excluded from consideration. (Such an indication does not appear until well into Sect. 1, pg 1-14). In view of the dominant influence of such events as assessed in other PRA's, it would seem appropriate to emphasize this potentially important qualification in the executive summary when the merits of the results are being extolled.

5. Pg. 1-14, 3rd Para.- It is stated here that Sect. 3.2 addresses the problem of completeness in a systematic manner. Sect. 3.2 (2 pages) actually only provides a brief discussion of how initiating events were identified and the use of event trees. This Section could hardly be considered a systematic consideration of the completeness problem.

6. Pg. 1-14, 2nd Para.- Contrary to the statment here, WASH-1400 did consider earthquakes as accident initiating events.

7. Pg 1-14, last Para.- It is not clear why "...it is not possible to have a complete peer review during the report preparation."

8. Pg. 1-15, 2nd Para.- According to this paragraph, the characterization of uncertainties is contained in Sect. 3.8. In the corresponding listing of areas of uncertainty, one principal area is "Events possibly requiring further investigation." It is not clear what uncertainty contribution is meant by this item. Furthermore, no discussion of this contribution could be found in Sect. 3.8

9. Pg. 1-19, 2nd Para.- It is not clear why containment sprays were not included in the Limerick evaluation. Under some accident conditions, containment sprays can have a significant mitigating effect on the source term.

10. Pg. 1-20, item 6- Should this read "containment isolation failure or leakage..."?

11. Pg. 1-21, item 7- It is unclear from information presented here and elsewhere in the report why and to what extent the aerosol agglomeration and settling process are treated "conservatively" and the risk significance of such treatment.

12. Pg. 1-26, Table 1.2- Several comments were derived in reviewing this table:

A. The LOCA break size ranges for small, medium, and large breaks do not correspond to the pipe size vs. probability table (Table 3.2.2, Pg. 3-7). It is not clear, therefore, how LOCA probabilities were derived.

B. According to the table, ADS is required for steam break sizes up to .08 $ft.^2$ and is not required for any sizes greater than .08 $ft.^2$ The footnote to the table indicates that two safety/relief valves are required for adequate depressurization by the ADS. If Limerick is typical of other BWRs, the effective S/R valve throat area is about .11 $ft.^2$ There appears, therefore, to be an inconsistency in the table; the footnote implies that .22 $ft.^2$ is required for adequate depressurization, yet the table indicates that break sizes above .08 $ft.^2$ do not require depressurization (for operation of the low pressure injection systems).

C. It is not clear why condensate pumps are not included under the coolant injection success criteria for large and medium LOCA events. It would appear that for these breaks, condensate pump injection would be at least as effective for coolant injection as they are for small LOCAs where they are included.

D. The "1 condensate pump" which appears under the small LOCA coolant injection success criteria should probably be 1 condensate pump plus 1 condensate booster pump. In other BWRs, condensate pumps cannot operate without condensate boosters.

E. For containment heat removal success criteria during small and medium LOCAs, it is not clear how the PCS alone can be considered a long term heat removal system since the condensate water supply will be depleted by feedwater operation and not be adequately replenished due to fluid loss out the break. Futher, it would appear, based on MSIV closure logic at other BWRs, that MSIVs would likely close for most small and medium LOCAs. Such closure obviously renders the PCS inoperable.

13. Pg. 1-29, Table 1.3- The footnote regarding IORV is not clear. It implies that analysis determined this combination to be both acceptable and unacceptable.

14. Pg. 3-11- The initiating events listed here seem to exclude some contributors which could be important. These include: loss of DC power, control system malfunction, LOCAs outside containment, electromagnetic interference, and control rod withdrawal.

15. Pg. 3-17, Fig. 3.4.1- Failure of event Q (Cond./feedwater and PCS available) would appear to have a significant influence on the failure of W (RHR and RHRSW <u>or</u> PCS available) which occurs later. However, no such dependency appears to exist (compare W for sequences T_tPE(P) and T_tPQW(PQ)).

16. Pg 3-20, 1st full Para.- This discussion leaves out any requirement for condensate booster pumps, which for other BWRs must operate, along with condensate pumps, to allow successful feedwater operation.

17. Pg. 3-25, event V- It is not clear why no credit was taken for condensate injection as stated here, especially since condensate injection is considered in the success criteria in Table 1.2.

18. Pg. 3-33- Same comment as 15 preceding (sequence $T_fPE(P)$ vs $T_fPQW(PQ)$.

19. Pg. 3-43- The basis for the "probability of failure to repair diesel" is not given for this table. However, the values seem to be somewhat optimistic considering that the repairs must be made under total loss of AC power conditions. Under these conditions, lighting, communications, diagnostic instrumentation, intra-plant mobility, and availability of restart air may all be compromised.

20. Pg. 3-55, Event E- This event (failure of CS and LPCI) is shown to have a failure probability of $4x10^{-6}$ given a large LOCA initiator (Fig 3.4.6a). Page 3-52 indicates that off-site electric power loss following LOCAs has be eliminated from the event tree, but has been included in the fault tree evaluation of event E (and other) systems. However, this low failure probability does not appear to adequately account for AC power loss. For example, if a LOCA at Limerick (which drops a large power source off the grid) causes loss of off-site power with a probability of .01, then event E would fail with a probability of $1x10^{-5}$ (using diesel failure of $1x10^{-3}$ from Table 3.4.1) considering only this AC power loss contribution.

21. Pg. 3-42, Fig 3.4.4b- It is not clear why branch point probabilities have been left off of this Figure (as well as Fig. 3.4.4c, Pg. 3-47) while other event trees include these values.

22. Pg. 3-67, Fig. 3.4.8a- This figure shows RPT failure has a probability of 10^{-4}. For other BWRs, RPT must be accompanied by feedwater run back (requiring some manual operations) if feedwater is not otherwise interrupted (as is the case for ATWS events considered in this figure) in order for RPT to be as effective ATWS mitigation function. Unless Limerick is different in this regard, 10^{-4} seems an excessively small probability for this function.

23. Pg. 3-111, Table 3.5.7- For the Loss of Offsite Power portion of this table, it is stated in a footnote that main feedwater is available. This is incorrect since loss of offsite power disables condensate and condensate booster pumps in addition to condensor recirculation pumps.

24. Pg. 3-111, Table 3.5.7- A large difference exists between the loss of containment heat removal fuction (W) probability between Limerick ($3.5x10^{-8}$/demand) and WASH-1400 ($1x10^{-6}$/demand). The Limerick assessment includes (Pg. 3-59) recovery or continued operation of the PCS or availability of the RHR service water system and 1 RHR heat exchanger combined with an injection path to the core. The combined RHR-SWS failure is 10^{-5} (per Fig. 6, System Level Fault Tree volume). This means (apparently) that PCS unavailability is $3.5x10^{-3}$. This seems quite low; justification for the value could not be found.

25. Pg. 3-138, Table 3.6.4- These decontamination factors appear very low (conservative) compared with recent values being proposed by General Electric Co. based on experiments and analysis.

26. Pg. 3-147, Sect. 3.7.3- Insufficient information is provided in this Section to determine either the relative or absolute risk significance of specific accident sequences. Such information is invaluable in helping to determine critical safety systems, initiating events, and containment failure modes, the identification of which is helpful in assessing the validity of PRA results.

27. Pg. 3-164, Table 3.8.1:

A. It is not clear how the conclusion of a "minor effect on uncertainties" could be obtained for some assumptions. For example, common-mode (cause) failures could have a significant impact... the actual impact is very difficult to judge, but the fact that common cause failures have occurred with non-negligible frequency has lead some to believe that this area is a significant deficiency in some PRAs.

B. It is not clear (2nd subject, Pg. 3-165) why a better definition of the liklihood and permissive conditions for MSIV reopening can't be defined. The control logic and performance specifications for these valves should be available.