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TAP A-9

MEMORANDUM FOR: S. H. Hanauer, Director
Unresolved Safety Issues Program

FROM: A. Thadani, Task Manager, A-9

SUBJECT: NRC-GE - BWR OWNERS ATWS MEETING SUMMARY

A meeting was held in Bethesda on August 10, 1979 between representatives of the NRC staff, the General Electric Company, and several BWR owners. The purpose of the meeting was to discuss plans for resolution of the Anticipated Transients Without Scram (ATWS) issue, and applications of GE's topical report on ATWS.(1)

The introductory remarks centered on schedular information. The NRC staff pointed out that a) the recent report on the BWR/3(2) did not cover failure of the ARI system (and therefore was not acceptable), b) no BWR/3 owners were present at the meeting, and thus the staff will have no choice but to press on with unilaterial actions on the BWR/3s if no more information is forthcoming. GE replied that it was their understanding that the BWR/3 owners intended to request a meeting during the week of 8/13/79. However, GE could not act as the representative of BWR/3 owners.

GE then stated their proposed schedule as follows:

Bin 1 documents have been submitted(1)
Bin 2 (balance of analyses) - December, 1979
Bin 3 - early in 1980

They will request a meeting to discuss Alternate 4 in September, 1979. Alternate 4 analyses (see Question #22) will be included in the December submittal.

The NRC staff requested GE to include the BWR/4 Mark II containment analysis in the December submittal, and to expedite the radiological portion of the Alternate 4 analyses.

After the introductory discussions, the NRC staff noted the inadequacy of the GE submittal(1) and the staff questions on Reference 1 were discussed. The list of

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questions is enclosed as Attachment 1. Because of the time constraints on availability of some staff members, the questions were not discussed in numerical order. Highlights of the discussions are as follows:

Question 10 - GE was requested to power the Rod Position Indication System (RPIS) from uninterruptable DC power source otherwise justify availability of the RPIS during a loss of offsite power ATWS event.

Questions 3 and 25 - No manual reset function will be provided for the SLCS timer. The "Rods Not In" signal is still under development. A signal based on 5-rod clusters, derived by a microprocessor, is under consideration. GE was requested to provide more detail.

-The "Neutron Flux" signal will be common to the APRM trip channels in the sense that the same analog signals will be used, but separate and diverse bistables will be used. Because of this and because the APRM channels are only one of many inputs to the Reactor Protection System, GE considers the "Neutron Flux" signal to be diverse.

-There are no interlocks which prevent changing the RHR system from LPCI mode to suppression pool cooling mode as long as the water level in the reactor is not low. GE was requested to provide a study of the sensitivity of the ATWS analyses to the time of RHR changeover.

Question 31 - GE has not identified any problem with borated water attacking the pressure boundary, but has no formal program on this subject. GE was asked to provide more detailed information.

Question 51a - The manual scram input to both ARI and SLCS initiation is necessary to mitigate the Inadvertant Opening of a Relief Valve (IORV) transient without scram. The design for this circuitry is still under development, but will contain some sort of "one-way" provision to preserve independence of the RPS and ATWS mitigation systems. GE was requested to provide the design requirements to be used.

Question 51b - GE will use Paragraphs A - H, Appendix C of NUREG-0460 v. 3,(2) as design criteria.

Question 53 - In Table 7.3.1, p. A7.3-8 of Reference 1, the inputs listed in the first two columns are not diverse to ARI, but the inputs listed in Columns 3-7 are diverse to ARI.

- GE was asked to reconsider the use of the same type (and manufacturer) of relays in both the RPS and ARI system. The staff is not convinced that energized vs. de-energized logic, plus AC power vs. DC power, provides sufficient diversity.

Question 68 - GE intends to use a 90% confidence level (i.e. 50-90 instead of their original 50-50 level). After examination of the data base, GE decided that the stricter level could be accommodated.

- GE was requested to provide a detailed study to fully answer Question 68.

Questions 69 and 70 - GE was requested to address these questions on an expedited basis, preferably by means of a separate meeting on or about 8/15/79.

Question 71 - The NRC staff does not believe that nationwide annual averages for service water temperature and initial suppression pool temperature are valid, since individual plants at individual times vary greatly from the average. GE replied that the sensitivity studies should cover these variances.

- GE was requested to provide the data base as an answer to Question 71.

Question 72 - GE was requested to approach the Mark II containment owners' group to resolve Question 72.

Questions 4 and 29 - The NRC staff desires calculations of the turbine trip without bypass transients without scram, but needs these calculations (plus the other transients) to be done with the ODYN code, rather than the less sophisticated REDY code, for at least the first minute of the transient. GE replied that difficulties have been experienced in simulating these transients for a full minute. ODYN had to be modified to accommodate dissolved boron and the special thermal-hydraulic conditions experienced in an ATWS.

- At this point, GE presented the results of an ODYN calculation of a turbine trip without bypass or scram for a BWR/6. The results are included on Attachment 2. GE was requested to provide similar calculations for the BWR/4 and BWR/5.

Questions 60, 61 and 62 - The NRC staff repeated its desire for one minute of ODYN simulation for these cases.

Questions 16 and 57 - GE was requested to:

- provide a sensitivity study on flow coastdown rate,
- provide quantitative figures of assumed flow vs. time and its impact on results

Questions 17 and 21 - GE was requested to provide a sensitivity study on time of initiation of pool cooling and time of manual scram attempt. The latter could be in the form of Figure 4.2.14 of Reference 1, for BWR/4.

Question 48 - A BWR owner pointed out that the JPI lines are equipped with excess flow check valves. These valves will pass pressure signals but may not allow the SLCS injection flow to pass. GE was requested to resolve this matter.

Questions 73 and 75 - GE was requested to provide the appropriate data, and confirm that pressure is within Service Level C in piping and equipment connected to the vessel, in the next formal submittal.

GE was also requested to demonstrate that the effect on reactivity of void collapse in the upper plenum due to HPCS is adequately addressed.

At this point, some of the major questions had been covered. The NRC staff made the following points:

1. Due to the impact of the TMI-2 event followup, it is the staff's intention to separate BWR from PWR ATWS work. The BWRs will be considered on higher priority.

2. The May report[1] does not completely fulfill the requirements of Bin 1.

3. The staff finds the December date for the next submittal to be acceptable. However, the staff must go to the Commission with whatever information it has in the spring of 1980. Therefore, there is no margin for delays.

4. Subsequent discussions revealed that GE had intended to provide the responses to the majority of questions in attachment one in the Bin 2 package in December. The staff wants GE to address the schedule for responses to these questions as well as the remaining questions in the February 15, 1979 letter from Mattson to Sherwood in their forthcoming August 25th letter on scope and schedule of work for the next submittals.

GE's presentation slides are given in Attachment 3, and list of attendees is given in Attachment 4.

A. Thadani

cc: ATWS Distribution

References:

1. "Assessment of BWR Mitigation of ATWS," GE generic ATWS analysis submittal dated May, 1979.

2. "Assessment of BWR/3 Mark I Mitigation of ATWS in Response to NUREG 0460," NEDE-24669, June 1979.

ATTACHMENT 1

A Thadani
Draft
8/6/79

QUESTIONS ON GE ATWS REPORT ON BWR 4/5/6

* Identify [illegible] of [illegible] questions answered and schedule for all other responses

1) Provide (preferably colored) schematics showing primary and secondary containment and the location of the equipment needed for safe shutdown.

2) Provide P&IDs for systems relied on for safe shutdown. For systems and components, provide its function(s) and

   (a) source and capacity of water or poison

   (b) Initiation Signal

   (c) Qualification - circuitry and hardware (valves, pumps, pipe) including NPSH (from CST and Suppression pool)

   (d) Diversity of circuitry from RPS

   (e) Power Source

   (f) Indications in Control Room and Operator Actions

   (g) Design parameters of System

   (h) Technical Specification for System (e.g. allowable outage period).

   Also describe differences between systems on different plants.

* 3) In light of TMI-2 why should credit be given for operator action even after ten minutes? Provide:

   (a) information displayed to the operator

   (b) time and bases for operator action assumed in the analyses. Describe the actions.

* 3A) Why is Alt #3 Analysis not provided for BWR 3 plants

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4) Provide analyses of Turbine Trip Without Bypass ATWS event applicable to each plant. Limited information (P3-2) is insufficient.

5) Describe how each item of alternate #3 as described on p18 of NUREG-0460, Vol. 3 is addressed in the GE report. Can these changes be made on all plants.

6) In estimating safety/relief valve discharges, what flow rate is assumed when the vessel pressure is higher than the valve opening set point.

7) Pages 1-1 and 1-2 state that the analyses provided do not bound all plants in each class. Generic early verification concept depends or correct bounding analyses for each class of plants or plant specific analyses will be required. Therefore, if GE supports early verification approach, GE with support from BWR owners must provide these analyses and justify their applicability to specific plants.

8) Page 2-2. Under what conditions and at what plants can MSIVs be opened by operator. Discuss this in regards with the ATWS event scenario and the calculated vessel level during the transient.

9) Page 3-4. Why are these initial conditions different than those in NEDO-20626.

10) Would loss of all normal AC power result in loss of Control Rod Position Indication on any plants? Explain how this would impact actuation of any ATWS mitigating equipment.

11) P 3-7. Do reactor water cleanup valves close automatically? If so, discuss signal and diversity.

12) P 3-8. Why are RCIC for vessel inventory and RHR for pool cooling not identified.

13) P3-9 Justify values in Tables 3.4.1, 3.4.2, and 3.4.3. Also explain parameters of interest for the two types of RPT mechanisms.

14) Explain all modifications in SLCS. Include limitations of current system.

15) P 3-2. Explain how instability is mitigated by boron injection.

* 16) P 4-1. Explain RPT flow coastdowns assumed and justify.

* 17) P 4-9 and 4-10. Describe how and when SLCS would be initiated automatically for IORV ATWS event. Describe each operator action and the time in transient when this action is performed.

* 18) P 4-10. Explain the statement, "Each Specific plant size has some features which may after the results of this event" in light of Early verification approach.

19) For specific plant designs justify and tie in the following:

a) Vessel Size

b) Containment Size

c) HPCI and RCIC Flow

d) SLCS capability

e) Boron mixing

f) Sensitivity to longer delays in SLCS and RHR pool cooling.

20) Explain Why

a) feedwater flow goes to zero in 20 seconds

b) differences in flux vs time in Figures 4.1.1, 4.3.2 and 4.4.1

c) Why does power settle to ~20% - inconsistent with earlier calculations.

21) P 4-25. Justify 2 min. boron injection assumption.

22) Why no calculations are provided for alternative #4. GE on 3/27 (Telecon) was asked to also provide sensitivity vessel inventory and pressure as well as radiological assessment. Effects of single failures are not provided.

23) P 4.35. What are the ranges of S/R valves within a unit? What ranges apply from unit to unit? Explain and justify the size of the valve assumed to be stuck open.

24) Explain the impact on consequences for plants which use either turbine driven or motor driven main feed pumps.

25) How would operator decide to cool pool when the vessel level is low?

26) All questions apply to all classes of plants.

27) P 4-80. Why model comparisons are provided for 238" vessel only?

28) P 5-4. Why was initial pool temp. of 75°F assumed? Use 90°F.

29) P5-13. Describe consequences from TTWOBP.

30) P 5-20. Describe how these assumptions are consistent with the staff guidelines in 2/15/79 Mattson letter and the 3/27 telecon.

31) What is the effect of Boron on RCPB.

32) P 5-31/5-32. Several FSARs indicate different qualification values.

33) P 6-4. Describe ino. displayed to operator and his actions to safely shutdown the plant.

34) P 6-7/6-8. What leakage assumptions used in radiological assessment.

35) P A.7.1-5 top paragraph. Higher vessel level followed by MSIV closure could be more severe. Explain why not.

36) A.7.1-5 and beyond. Explain these events if scram does not occur

37) Why are calculated dome pressures lower than previous GE calculations. What is the peak pressure for pressure regulator malfunction ATWS event.

38) Is loss of auxiliary power same as loss of all normal AC power? If not, analyze the latter.

39) Appendix 7.2

a) What happens to pumps in these systems if the pump suction is lost.

b) What is the dedicated supply of water for each system.

c) Describe what happens if CST level is low and the pool temperature is above the limit for which HPCI is qualified.

d) Which systems draw suction from CST? Describe the conditions under which they take suction from CST and the flow rate.

40) P A.7.2-19. Why is a pool temp. limit of 170°F used for LOCA?

41) Appendix 7.2. Several figures are referenced but not provided. Provide the necessary figures.

42) P A.7.2-34. What would be the consequences if the minimum rate flow were not used for S/R valves.

43) P A.7.2.36. What is the calculated Δ P (for each line used to inject poison) between pump discharge and the injection point in the vessel.

44) P A.7.2-42. Items a, b, and c. What would the operator do if one or more of these were to happen.

45) P A.7.6-1. What is the effect of boiling in the core on boron concentration in the core. What is the effect of varying boron concentration (across core) on consequences?

46) Provide sensitivity studies using lower boron mixing efficiency (range 50%-100%) statements like "obviously conservative" (p A.7.6-8) are inadequate.

47) Provide a description of the system (including schematics) of SLCS design for each class of reactors.

* 48) P A.7.7-11. Describe and justify the adequacy of the number of jet pump instrument lives used for SLCS injection and other purposes.

49) We require all the information in electrical areas identified in item IX.D of our February 15, 1979 letter to GE to facilitiate completion of our review of the proposed ATWS modifications.

50) As part of ATWS mitigation, it appears that GE relies on number of manual operation actions, some within 10 minutes, of the ATWS event. In the light of TMI-2 experience and the current licensing practice, we need to critically evaluate this and hence require a detailed discussion from GE on all the manual operation actions needed in the mitigation of an ATWS event.

* 51) Reference to Figure 3.4.3.1, 3.4.3.2.

a) A manual reactor scram signal is shown to have input to ARI and SLCS initiation circuits. Would not this feature compromise the independence required between RPS and ATWS prevention and mitigation systems?

b) Two permissive signals, "Neutron Flux" and "Rods not in" are shown in the actuation circuitry for SLCS. GE to provide a discussion as to how these signals conform to the requirements of IEEE 279.

52) In section 4.0 for various ATWS event analyses, GE assumes proper functioning of relief valves. In the light of TMI-2 experience, GE to provide failure rate data for these valves and how these valves should be powered in specific plant designs.

53) From Sec. 6.1. discussion, it appears that the diversity between RPS and ARI/RPT is achieved in providing different types of power source (A.C. vs D.C.) with complementary functional requirements (de-energize vs energize). No diversity is provided either in the sensor input or logic relays. In this regard GE to discuss the following:

a) Operating experience has indicated that adhernece to A.C. and D.C. power sources alone did not assure diversity in the operation of identical scram breakers.

b) With identical components there exists a high potential for mis-calibration by a technician on these similar components i.e., pressure and level sensors. This could result in credible common cause failures. (Refer to G.E. Scram reliability analysis dated September 30, 1976 page II-135).

54) GE need to address to what extent the heat tracing and the high-low temperature alarms associated with SLCS meet the requirements of IEEE 279.

55) GE states on page 7.3-4 that "RPS is a fail safe system both for random mode and common cause failures".

GE to define what is "fail-safe" and discuss the consequences of failure in the CRD hydraulic system in accomplishing the scram functions.

56) On page A7.7.2 GE states, "all equipment with exception of the field breaker trip coil are environmentally and seismically qualified". In this regard we need the following:

a) GE to justify the above exception

b) GE to describe the qualification requirements imposed on recirc-pump motor breakers/recirc M.G. set field breakers to perform the RPT functions adequately.

✱ 57) RPT function is achieved by tripping either the recirc-pump motor breakers or recirc M.G. set field breakers. We require GE to discuss the significance of these two different approaches and the resultant effects, if any, in the ATWS analysis.

58. NEDO-24154 states that the version of the ODYN code presented should not be used for ATWS. Present information as to changes made to ATWS analysis of the ODYN code. Present the list of ODYN limitations for ATWS analysis.

59. Perform calculations for a turbine trip without bypass ATWS transient using the ODYN code until consequences are mitigated.

60. Present input parameters for the turbine trip without bypass ATWS analysis for both ODYN and REDY calculations.

61. Present input parameters for MSIV closure - ATWS analyses for both ODYN and REDY code. Present the analyses until consequences are mitigated.

62. In the analyses above (Questions 59, 60, and 61) present tables showing sequence of events.