



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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AUG 8 1979

NOTE TO: M. B. Aycock, Deputy Director
Unresolved Safety Issues Program

FROM: A. Thadani, Unresolved Safety Issues Program

Enclosures 1 and 2 describe some of my concerns on the incompleteness of our audit calculations on BWRs and PWRs respectively. I see a need for a short term (1 ~ 2 months) as well as long term (3 ~ 4 months) effort to conduct some audit calculations to confirm our past judgments on ATWS. The manpower needs and the computer time estimates are preliminary and were provided by M. Levine of BNL.

BWRs

All ATWS calculations to date performed by GE have utilized "REDY" code. Some audit calculations were performed by BNL in 1973, 1974. Subsequent tests at the Peach Bottom reactor indicated some inadequacies of the REDY code. Currently GE uses a 1.D "ODYN" code for all overpressure transient events. The staff is adamant that Turbine Trip Without Bypass (TTWOBP) ATWS overpressure event be analyzed using "ODYN" code. As discussed in Enclosure 1, two types of audit calculations should be performed.

Type 1: Short Term Plant Response

Analyze two ATWS transients, TTWOBP and MSIV closure
Carry calculations up to 1 minute real time
Codes: TWIGL - RELAP-3B
Manpower: 2 men - 4 to 6 weeks
Computer Time: 5 hours

Type 2: Long Term Plant Response (~ 10 min.)

Analyze effects of Boron injection on plant response for
TTWOBP and MSIV closure ATWS events.
Codes: RELAP-3B
Manpower: 1 man - 2 months
Computer Time: 4 hours

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PWRs

As explained in Enclosure 2, the staff audit calculations addressed only over-pressure concern and not the potential for core uncovering for some ATWS events. Thus there is a need for the following audit calculations (20 ~ 30 minutes real time) for each vendor design.

Transients: Loss of feedwater with stuck open valve
Loss of offsite power with stuck open valve

- a. base case
95% MTC, HEM
- b. 99% MTC
- c. Time delay in aux feed and 1/2 aux feed
- d. 0.9 HEM
- e. HPSI Design effects

Codes: IRT - RELAP-3B
Manpower: 2 man - 4 months
Computer Time: 80 hours

Comment: If we expect to go to Commission by December 1979, then we need as a minimum short term BWR audit calculation as well as the PWR calculations. If the PWR calculations show serious core uncovering problem, then I think we should discuss that with the Commission before December 1979 because our perception of higher risk from BWRs may not be quite correct. Because BNL staff is committed on other tasks (some physics type manpower may be available), I spoke with Richard Denning and Bob Collier of BCL and they indicated their knowledge of RELAP and their willingness to provide personnel to go to BNL and use BNL facilities to perform these tasks. BNL is receptive to the idea of getting this help from BCL. Thus with coordinated effort between NRC/BNL/BCL we may be able to meet the following schedule if we begin work by 9/1/79.

BWRs

Type 1: Complete by 10/30/79
Type 2: Complete by 11/30/79

PWRs

Preliminary Assessment 11/30/79
Studies Complete 2/28/80

Total Manpower ~ 13 Man Months
Total Computer Time ~ 90 hours

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The need to perform BWR ATWS analysis:

Short Term:

Previous audit calculations were performed using point kinetics. The model did not include steam line dynamics. The previous GE code used for ATWS analysis is the REDY code. The REDY code did not predict Peach Bottom test results where steam line dynamics and space kinetics were important. The REDY code predicted neutron flux peak nonconservatively by a factor of 2 to 3. The need for fairly accurate heat flux cannot be overemphasized because of the resultant effects on containment and other structures. This is particularly important for plants with alternative #3 fix. On a best estimate basis the REDY code is not acceptable for sudden overpressurization transients. General Electric submitted the ODYN code for the analysis of these transient and they do not seek the approval of REDY for sudden overpressurization transients. Most ATWS events result in rapid overpressure condition. Hence, previous analyses performed by GE should be reperformed using the ODYN code at least to verify previous analyses. The staff should reperform the audit calculations using steam line dynamics and space kinetics models.

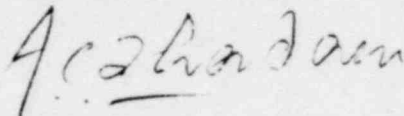
Long Term:

Audit calculations were not performed to verify GE calculations for long term behavior. The effectiveness of the fixes "Boron reactivity feedback" was never evaluated. Both short and long term energy releases are important to evaluate torus behavior. The frequency and duration of the opening of the valves are governed by the effectiveness of the fix and the dynamics of the steamline. Because of the criticality of alternative #3 fix (small margin to limit) and its impact on consequences, it is necessary to perform some audit calculations.

The need to perform PWR ATWS analyses:

TMI-2 event showed that some transients may lead to boiling in the primary system loop and eventually to core uncovering. The previous ATWS analyses were performed evaluating the overpressurization effects which occur for a short time in the beginning of the transient. The aspects of core uncovering and boiling in the primary system were overlooked. It is necessary to establish: 1) the validity of the vendor codes used in the ATWS analysis if there is some boiling and 2) if there is boiling, does the core uncover. We need audit calculations to answer these questions.

TMI-2 event also showed that ATWS audit calculations must cover some failures which impact consequences. These failures are 1) stuck open valve, 2) delay in auxiliary feedwater and 3) reduction in auxiliary feedwater. We need audit calculations to establish sensitivities of the ATWS events to these failures. Further an inadvertent opening of a safety or relief valve is an anticipated transient which may have significant consequences and audit calculations are necessary to confirm vendor analysis. (Note vendor analyses are probably inadequate). The potentially serious consequences for some design (different HPSI shut off head) should be carefully reviewed and audit calculations of such cases are warranted.



A. Thadani
Unresolved Safety Issues Program

cc: ATWS Distribution

Enclosure:
As stated

ENCLOSURE 1

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Ashok Thadani

JUL 11 1979

Generic Task Action A-9

POOR ORIGINAL

NOTE TO: S. H. Hanauer, Director
Unresolved Safety Issues Program

FROM: Ashok Thadani

SUBJECT: BWR CODE EVALUATION

Most of the ATWS analyses were performed by GE using their code called "REDY" as described in NEDO-10802. Our audit calculations using RELAP only cover several seconds (25 seconds) of an ATWS transient and the calculated peak pressures agreed well with the GE calculational result. However, GE is now using "ODYN" code for all overpressure events. This new code was developed by GE because the Peach Bottom turbine trip test results did not agree well with the results predicted by "REDY". The application of ODYN code to ATWS events has not yet been reviewed by the staff. I see a need for the following effort in code evaluation.

1. Review "ODYN" for ATWS application.
2. Perform Audit Calculations
 - a) First several seconds of ATWS event - determine flux, pressure, S/R discharge (the model includes RPT).
 - b) Several minutes of ATWS Event - Use different SLOCS injection rates, injection time and Sodium Pentaborate Solution concentration. Look at power, pressure, discharge through S/R valves and estimate pool temperatures.

Currently BNL is planning (under Tech Assistance contract) to use RAMONA (a 3D code) for transient analyses. It would appear, on the basis of my discussions with Fuat Odar, that any ATWS audit calculations using RAMONA cannot be completed until some time next year (March).

Since we hope to propose to the Commission a recommended course of action on BWRs in the next few (3-4?) months, I see a need for the following:

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- Complete Item 1 above in two months.] Acceptable Model
By 8/31/79
- Complete Item 2a above in two months (this could be justification of why earlier RELAP studies provide sufficient basis for now but to be further confirmed later using RAMONA or other suitable code).
- Complete item 2b early next year but prior to ATWS rule being effective (guess - March '80). Completion of this task would require that a fairly simple containment model be incorporated in the code.

also, b-)
8/31/79
} would it
} should
} discuss

While I see a need for supporting ATWS audit calculations, I do not believe that a 3-D core model is needed to get more accurate reactivity feedback effects. Before we sign a Tech Assistance contract using RAMONA, I recommend that you, Mike, Fuat, Dan (Fiene), and I meet to discuss our needs and help Fuat prepare Tech Assistance request consistent with our ATWS plans for BWRs.



Ashok Thadani

- cc: M. Aycock
F. Cherny
D. Fiene
RSB Files
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