

Title: ATWS (A-9) (TAC #4019)

Lead Responsibility: DSS

Lead Assistant Director: D. F. Ross, Jr., A/D for Reactor Safety

Task Manager: A. C. Thadani

1. Problem Description

The Technical Report on Anticipated Transients Without Scram for Water-Cooled Power Reactors, WASH-1270, discussed the probability of an ATWS event and an appropriate safety objective for these events. After several years of discussions with the vendors and evaluation of vendor models and analyses, the staff published in late 1975 its status report on each vendor analysis including detailed guidelines on analysis models, and ATWS safety objectives. The available information on consequences consists of vendor calculations based on essentially realistic models, but with some conservatism in the input data. The calculated consequences using the staff status report indicate design changes ranging from minor to significant are needed to meet the safety objective. The industry has argued that the staff requirements in the status reports are excessive and that inadequate attention has been given to ATWS probabilities and consequences.

2. Plan for Resolution:

The staff is presently rereviewing the whole ATWS program to reassess the impact of the status report requirements. In this regard, a task force, chaired by Dr. Stephen Hanauer, has prepared a draft technical report which includes a review of recent vendor calculations, probability of an ATWS, discussion of various options, and a recommended course of action.

The following provides an estimate of the manpower effort needed to complete this generic review. This estimate on manpower and schedule would have to be revised if one or more of the potential problems discussed in Section 8 materialize.

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I. TECHNICAL REPORT.

The Hanauer task force has completed a draft technical report which includes the following considerations.

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1. Safety Goal

Rationale for safety goal using WASH-1270, WASH-1400, and conservative versus realistic risk calculations.

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2. Frequency of ATWS

Transients of concern and their recurrence frequency and the reliability of scram systems. The data and methods use the information presented in WASH-1270, WASH-1400, EPRI reports and other publications. The scram system unreliability estimates include the consideration of the rods and drives.

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3. Course of ATWS Events

The discussion covers evaluation of each vendor analysis: assumptions, evaluation models and transient analyses. This evaluation also includes a discussion of system availability.

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4. Conclusions

Using the ATWS safety goal, estimates frequency of events and the calculated consequences, and decides which design modifications are necessary.

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5. Criteria for Acceptable Fix

Having defined the kinds of design changes indicated to meet the ATWS goals, the staff criteria for acceptability of any required design modifications are provided.

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II. INTERNAL REVIEW OF THE DRAFT TECHNICAL REPORT

The staff has initiated an internal review of the draft technical report on ATWS. The necessary steps in the conduct of this review are outlined in the plan in Section 7. At the conclusion of this phase of review a revised draft ATWS report will be prepared, including the proposed requirements to mitigate, if necessary, the consequences of the postulated ATWS event. This report will form the basis for staff recommendations to the ACRS and the RRRC.

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III. BWR POOL TEMPERATURE LIMIT

Establishment of the suppression pool temperature limit is needed to completely identify the necessary design changes for Boiling Water Reactors. The pool temperature limit is part of a Category A item (this activity number not yet assigned) and an interim acceptance limit is expected to be available in November 1977 and the final acceptance limit to be available in June 1978.

IV. COMPLETION OF EVALUATION MODELS (See Item 3D)

V. STANDARD REVIEW PLAN

Following completion of the technical report and selection of an alternative for CPs and OLs, it would be necessary to develop a plan for review of individual license applications.

VI. OPERATING REACTORS

A) Short Term Fix

DOR has begun an effort to require implementation of a recirculation pump trip on all operating BWRs. This task involves development of criteria and implementation procedures.

B) Long Term ATWS Fix

Following selection of an option for satisfying ATWS requirements for CPs and OLs, develop requirements for the operating reactors.

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VII. REVIEW OF FINAL VENDOR ATWS GENERIC ANALYSES

In conformance with the selected option, the vendors will be required to provide ATWS analyses. The analyses will be reviewed to insure that the assumed modifications satisfy the ATWS limits.

3. NRR Technical Organizations Involved: (Manpower Estimates for FY 78 only)

A. DSS/Reactor Systems Branch

- (1) Coordination of ATWS Program
- (2) This effort would involve coordination of internal reviews, meetings with vendors and consultants.
- (3) Manpower Requirements: 4 Man Months

B. DSS/RSB/AB/CPB/CSB/ICSB, DOR, EDO, DSE, RES (RSB Estimates)

- (1) Draft Technical Report Review (Task II)
- (2) Technical Report Discussions with ACRS, other NRR Divisions, and Preparation of DSS Draft ATWS Report.
- (3) Manpower Requirements:

EDO:	1/2 Man Month	ICSB:	1 Man Month
RSB:	8 Man Months	DOR:	2 Man Months
AB:	1 Man Month	DSE:	1 Man Month
CPB:	2 Man Months	RES:	2 Man Months
CSB:	2 Man Months		

C. DSS/AB/ICSB for GE Model (Task IV)

- (1) Evaluation Models
- (2) Complete Review of B&W and GE Models
- (3) Manpower Requirements:

AB:	2 Man Months
ICSB:	1/2 Man Month

D. DSS/RSB/CPB/ICSB/CSB, DSE/AAB (Task V)

- (1) Develop Standard Review Plans including consideration of value impact and obtain RRRC approval.
- (2) RSB with support from other branches will develop review guidelines.
- (3) Manpower Requirements:

RSB:	3 Man Months
ICSB:	3 Man Months
Other Branches:	3 Man Months

E. DSS/RSB/I&CSB/CSB/MEB/AB/CPB (Task VII)

- (1) Generic vendor analyses for staff guidelines
- (2) The staff will review the vendor analyses to assure that the analyses are performed in accordance with the staff guidelines. Design changes necessary to meet the limits would also be identified.
- (3) Manpower Requirements:

<u>Branch</u>	<u>MMS Vendor</u>				<u>Total</u>
	GE	W	B&W	CE	
RSB	1	1	1	1	4 MM
MEB	1/2	1/4	3/4	1	2 1/2 MM
AB	1/4	1/4	1/4		3/4 MM
AAB	1/2	1/2	1/2	1/2	4 MM
CPB	1/4	1/4	1/4	1/4	1 MM
CSB	1/4	1/8	1/8	1/8	5/8 MM
I&CSB	1	1	1	1	4 MM

F. AAB/DSE

Review vendor analyses and calculate radiological consequences.

Four Man Months

G. DOR/PSB/RSB/ORB (Task VI A)

- (1) Short Term Fix on BWRs
- (2) This effort involves development of criteria for recirculation pump trip and development of implementation procedures.
- (3) Manpower Requirements:

Plant Systems Branch: 6 Man Months
 Reactor Safety Branch: 6 Man Months
 Operating Reactors Branch: 6 Man Months

H. DOR/PSB/RSB/ORB (Task VI B)

- (1) Long Term ATWS Program
- (2) Depending on DSS findings, develop criteria and implementation procedures for required fixes on operating reactors.
- (3) Based on presently available information, the projected required manpower is as follows:

- Plant Systems Branch: 6 Man Months
- Reactor Safety Branch: 12 Man Months
- Operating Reactors Branch: 6 Man Months

I. DOR/PSB/RSB/ORB

- (1) Contributions to other subtasks
- (2) Liason and review efforts that DOR will supply
- (3) Manpower Requirements:

- Plant Systems Branch: 6 Man Months
- Reactor Safety Branch: 6 Man Months
- Operating Reactors Branch: 3 Man Months

4. Technical Assistance Requirements:

A. BNL: Computer runs for B&W 177 FA plant to obtain sensitivity values for changes in initial conditions. This task has been completed.

B. Sandia: Perform Monte Carlo calculations using vendors' and BNL calculations.

Support ATWS probability studies

Management: EDO

EDO/RSB Effort - Two Man Weeks

Funding: FY 78 Scope not yet estimated

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C. Reactor Pressure Vessel Closure (TAC-3932)

Finite Element Analysis of B&W Vessel

Report Completed and Reviewed 11/15

Management: Mechanical Engineering Branch

MEB Effort - 2 Man Weeks

Funding: \$ 30K

D. Three-Dimensional Inelastic RPV Closure Analysis

The decision to contract this analysis will be made following review of the two-dimensional analysis.

Funding: \$ 100K

MEB Manpower - Five Man Weeks

5. Interactions with Outside Organizations

A. EPRI

The staff has been reviewing the EPRI probabilistic studies and intends to document its review in the technical report.

B. KWU

As noted in 8.E.

C. Standard Development

It is anticipated that an ATWS ANSI standard would be developed. NRC and vendor participation in this task is anticipated. The standard would be a useful tool in the implementation stages. Therefore, a decision to participate in the standard development effort must be made.

6. Assistance Requirements from other NRC Offices:

Nuclear Regulatory Research/Probabilistic Analysis Branch Support on ATWS statistical effort.

7. Schedule for Problem Resolution:

Technical Report (TR) Draft #1	10/19/77
Comments on TR Draft #1 Received	11/03/77
TR Draft #2 Complete	12/13/77
ACRS, RRRC Information Meetings	12/20/77
Technical Report transmitted to ACRS and RRRC; Commission Briefing	01/15/78
ACRS Subcommittee, RRRC Decision	02/15/78
ACRS Committee	03/15/78
Commission Consideration of Policy Paper	04/15/78
Vendor Analyses Submittal	06/15/78
Standard Review Plans	07/30/78
GE - SER	10/30/78
W - SER	12/30/78
CE - SER	01/39/79
B&W - SER	02/30/79

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8. Potential Problems

A. Rulemaking Hearings

If rulemaking is eventually chosen as the method of generic resolution of this problem, hearings would likely be requested. If so, it is difficult to assess the length of time and manpower the hearings would require.

B. Plant Hearings

Extensive effort is expected for hearings on some plants. For example, the Black Fox hearing (possibly this fall), would require significant effort because of the type and the details of contentions. Three or more man months from RSB and two man months effort from other branches may be needed.

C. Role of Hanauer Task Force

If the completion of the technical report is delayed or if the recommendation of the task force is to do additional studies, this action plan would have to be revised.

D. Reactor Safety Study

Possible differing conclusions between NRR and RES on ATWS contribution to the overall risk.

E. Pressurizer Safety Valve Integrity and Water Relief Rate

If the decision is made to obtain this information experimentally, the staff could continue ATWS generic review with an interim

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statement on safety valve integrity and water relief rate. However, significant effort from the Reactor Systems Branch to coordinate this experimental program would be required.

F. Long-Term Detailed Probabilistic Studies:

In the present simplified probabilistic study, a large number of assumptions, necessarily made to get some quick results, may cast a doubt on the study. These concerns relate to inadequate selection of parameters, their distributions, nonlinear effects of parameters, interdependencies between parameters, etc., and the staff may recommend in the technical report to perform a more detailed study.

Management: Reactor Systems Branch

RSB: Significant Efforts (Support from ASG) FY '78 and FY '79

Estimated Cost: \$ 2 1/2 M

G. Standard Development

If it is decided to participate in the ANSI ATWS standard development effort, approximately two man months of RSB effort would be anticipated and support from other branches may be necessary.

H. Recent tests related to the GE evaluation model have resulted in a possible need for a revision in the GE evaluation model. The schedule for a modified model submittal and the staff review effort is being developed. | 1

I. If substantive comments on the Technical Report (TR) draft #1 are received after 11/10/77, the schedule in item 7 would need a revision. | 1