



UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
ADVANCED BOILING WATER REACTORS SUBCOMMITTEE
MEETING SUMMARY/MINUTES

By: C.M.-04/03/92

FEBRUARY 20-21, 1992
BETHESDA, MARYLAND

Purpose: The purpose of this subcommittee meeting was to hear presentations by the NRC staff and GE's representatives regarding SECY-91-320 and SECY-91-355 and other related issues regarding the GE/ABWR review process.

Attendees: Principal meeting attendees included:

ACRS

- C. Michelson, Chairman
- I. Catton, Member
- W. Kerr, Member
- D. Ward, Member
- C. Wylie, Member
- M. El-Zeftawy, Staff

NRC

- C. Abbate, NRR
- J. Wilson, NRR
- C. Poslusny, NRR
- R. Pierson, NRR
- J. Wermiel, NRR
- G. Georgiev, NRR
- J. Wilson, NRR
- M. Hum, NRR
- G. Bagchi, NRR
- R. Hermann, NRR
- D. Kotley, NRR
- J. Lyons, NRR
- G. Thomas, NRR
- W. Burton, NRR
- D. Thatcher, NRR
- C. McCracken, NRR
- R. Van Houten, SECY

Others

- G. Miller, GE
- U. Saxena, GE
- E. Maxwell, GE
- P. Harris, Bechtel
- J. Beard, NUS
- R. Taud, SNPS

Meeting Highlights, Agreements and Requests

1. Mr. Michelson, Subcommittee Chairman, stated that the Staff Requirements Memorandum (SRM) from the Commission specified what level of design detail the application for design certification should include. Specifically it should: (i) reflect a design which, for all structures, system or components that can affect safe operations of the plant, be complete, except to the extent that some further adjustment to the design within established design envelopes may be necessary -- during what the staff has referred to as the design reconciliation process -- to accommodate actual, as-procured hardware characteristics; (ii) encompass a depth of detail no less than that in an FSAR at the operating stage for a recently licensed plant, except for site-specific, as procured, and as-built information; (iii) be sufficient to

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allow the staff to evaluate the resolution of severe accident issues in the design, as well as to incorporate the experience from operating events in current designs which the Commission wants to prevent in the future; and (iv) provide a sufficient level of detail to ascertain how the risk insights from the design-specific PRA are addressed in the design.

The last two Draft Safety Evaluation Reports (DSERs) that were issued by the staff are addressed through SECY-91-320 and SECY-91-355. The staff's DSERs are based on the ABWR Standard Safety Analysis Report (SSAR) and the first 18 amendments thereto.

2. Mr. C. Poslusny, NRR, summarized the subject two SECY-papers to the subcommittee members.

SECY-91-320 addresses the DSER for Chapter 18 "Human Factors Engineering" of the GE/ABWR SSAR. The staff's review of Chapter 18 was focused on the evaluation of four aspects of human factors:

- i) the organizational structure of the human factors function,
- ii) design goals and assumptions,
- iii) design process, and
- iv) the human system interface design requirements.

The review assumes that Human-System Interfaces (HSIs), i.e., control room local control stations, and procedures are best designed in a top-down fashion in accordance with regulatory guidelines. The staff indicates that the SRP and NUREG-0700 recommend a human factors team to be established with appropriate qualifications and experience to assure the proper inclusion of human factors in the design process.

The staff concludes that the DSER for Chapter 18 does not contain new policy issues. However, the staff stated that GE has not provided sufficient information in its SSAR to allow the staff to reach a positive conclusion for many areas relative to the safety of the ABWR design. The staff also stated that most of the open items are due to the lack of design detail provided for the staff review.

SECY-91-355 transmits the DSER that addresses additions to the previously issued Chapters 1,2,3,5,6,9,10,13 and addresses Chapters 8,12,14 and 15 in their entirety. This DSER contains

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no new policy issues. The staff will document its resolution of the open items in the Final Safety Evaluation Report (FSER).

Mr. Poslusny stated that currently, there are approximately 300 open items for the ABWR review. However, there are high priority open issues identified in the DSERS or in resolution meetings between GE and NRR staff. These high priority issues are:

- Main Steamline Seismic Classification
- Design Basis Tornado
- Natural Phenomena Missiles
- Tornado Design Features
- Effects of Pipe Breaks Outside Containment
- Control Rod Acceptance Criteria
- SGTS Single Filter Train

- HVAC Design Detail
- MSIV Leakage Control System
- Condensate & Feedwater System Power Source to Cutoff Valve

- Level of Design Detail
- Diversity
- Common Mode Failure
- Design Process

- Human Factors/Control Room Design Process
- Conformance Review (Hold) Points
- Design Acceptance Criteria
- Inventory of Fixed Displays, Controls, Alarms, based on EPGs

- Impact of Failure of Support Systems on Plant Trips
- Justification of Train-Level vs. Component-Level Common Mode Failure
- Modification of CETs and Sensitivity/Uncertainty Effort
- Assessment of Procedure Vulnerabilities in All Modes
- PRA Insights in the Design Process/Internal Flooding PRA

- Suppression Pool Loads
- Suppression Pool Bypass Leakage
- Limiting Fault Classification of Trip of All RIPS
- Compliance with IEEE 384/1974
- DC to DC Converters as Isolation Devices
- Shielding Issues
- Airborne Concentrations and Monitoring Design
- Criticality Monitoring

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- Credit for Non-Safety Grade Equipment
- Chapter 15 Revisions
- ATWS Issues

In addition to the above 34 high priority open issues, the staff identified other issues that are not specifically identified as open items in the DSERs, but need to be resolved post the DSER issuance. These items are:

- Seismic Design Adequacy
- High Energy Line Break Analysis
- Leak-Before-Break
- Piping Design-Level of Detail
- Severe Accident Closure
- Shutdown Risk
- Reliability Assurance Program
- ITAAC
- Intersystem LOCA
- Technical Specifications
- Emergency Procedure Guidelines Evaluation

3. Summary of Subcommittee Members Concerns and Observations

- a. Mr. Michelson expressed concern regarding the quality and depth of the DSER review, and stated that there is a significant amount of information required by 10 CFR Part 52 which remains to be completed such as:
 - The proposed technical resolutions of Unresolved Safety Issues and medium- and high-priority Generic Safety Issues (USIs and GSIs).
 - The proposed inspection, tests, analyses and acceptance criteria (ITAAC).
 - Interface requirements for those portions of the plant for which the application does not seek certification, including sufficient detail to allow completion of the FSAR and design-specific probabilistic risk assessment.
- b. Mr. Michelson also indicated that the treatment of severe accident issues is unclear.
- c. Dr. Kerr expressed concern regarding the lack of guidance on the use of PRA in the review of GE/ABWR design. He commented that GE has submitted a PRA, a contractor has performed an extensive review, and the staff has prepared a DSER. However, the use of the PRA in the design certification process is still undefined.

- d. Mr. Michelson expressed concern regarding the inadequate documentation of the reactor water clean-up system (RWCU) in the SSAR. He commented that the RWCU is of special interest because that portion of the system outside of the primary containment, contains reactor water at pressure and elevated temperature and uses up to 8-inch nominal piping which is not seismically qualified or built to safety-grade quality assurance standards. A rupture of this high energy piping followed by a failure of the isolation valves to close could lead to a core melt if the uncontrolled blowdown jeopardizes the engineered safety features located in the building. Mr. Michelson added that the staff did not investigate and review this system either deterministically or through a PRA study.
 - e. Mr. Wylie stated that the GE/ABWR design life is not discussed in the SSAR, yet the staff identified it as 60 years. He indicated that a program plan specifying the design life for all components and equipment should be specified in the SSAR.
 - f. Mr. Michelson stated that the ABWR design provides motor overload protection at all times for all non-1F motors and during manual testing or maintenance only for all 1E motors. He commented that this design practice should be reevaluated for the ABWR to include consideration of any common mode potential for stalled motors to cause multiple fire ignitions, inadvertent actuations of fire protection features, or other disruptive effects in multiple areas of the plant which could lead to the loss of redundancy safe-shutdown equipment during serious transients or postulated accidents.
 - g. Mr. Michelson expressed concern regarding the heavy load handling during reactor pressure vessel (RPV) opening and closing operations. He stated that his concern is related to the hazards associated with possible accidents during RPV operations such as the failure of the wire rope sling which is temporarily attached to the reactor building crane hook and the pool seal gate sections. He commented that the consequences associated with dropping a massive gate section into the open reactor core (especially for Mark I and II containment design) is an important event and the SSAR should address it.
4. Mr. U. Saxena (GE), addressed the ABWR containment hydraulic loading, as per Dr. Catton's request. He stated that the ABWR containment design utilizes Mark III horizontal vent system feature, and uses same size of horizontal vents. In ABWR

design the horizontal (suppression pool) vents were extended into the suppression pool, in order to maintain consistency with the horizontal vent length in Mark III.

The short-term large LOCA blowdown analyses for ABWR were performed using same analytical models as used for Mark III analyses. These models adequately simulate the air clearing process during early part of the blowdown.

A test program was conducted to confirm the condensation oscillation (CO) and chugging (CH) pressure loading conditions which could occur in the event of a LOCA in an ABWR plant. This test program was conducted anticipating that CO and CH loads might differ from prior (Mark III) testing in horizontal-vent facilities for several reasons. These included (i) pressurization of the wetwell airspace, (ii) the presence of a lower drywell (L/D), (iii) the smaller number of horizontal vents (30 in ABWR vs. 120 in Mark III), (iv) extension of the vents into the suppression pool, (v) vent submergence (11 ft in ABWR vs. 7.5 ft in Mark III), and (vi) suppression pool width (24.6 ft in ABWR vs 20.5 in Mark III).

The test program consisted of a total of 24 simulated blowdowns in test facility representing a one-cell (36°) sector of the horizontal vent ~~360°~~ design, which included a single vertical/horizontal vent module. The tests were divided into two parts: (1) using sub-scale (SS) test facility, and (2) using partial full-scale (FS) test facility. The SS tests were performed primarily for the purpose of obtaining CO data, and the FS tests were performed primarily for the purpose of obtaining CH data.

Dr. Catton expressed concern regarding this issue and stated that the ABWR is different for two reasons: (1) the volume of the wetwell airspace in the ABWR is close to that of a Mark II, and (2) the impact of the air clearing loads will be alleviated somewhat because the expected blowdown flows are much smaller than those expected in a Mark I or Mark II. Nevertheless, the combination of a much smaller wetwell and the lower mass flow from the break have not received sufficient attention to be written off without further analysis or experimental investigation.

Dr. Catton also expressed concern regarding the containment response to stuck open wetwell-to-drywell vacuum breaker valves. He stated that if one vacuum breaker does not close, the suppression pool is bypassed and the wetwell-drywell pressures will rise and the SSAR should address this issue.

5. Future Action

Mr. Michelson, Subcommittee Chairman, will prepare a draft letter to the EDO at the full committee meeting in March 1992 addressing the concerns regarding the ABWR design and the review process. Mr. Michelson requested that the subcommittee members prepare appropriate paragraphs, as necessary, to address the issues and concerns.

Reviewing Documents Provided for the Subcommittee Meeting

1. SECY-91-320, dated October 15, 1991.
2. SECY-91-355, dated October 31, 1991.
3. Letter from Mr. Mitchell (JE) to Mr. Boehnert, dated February 5, 1992.

The above three items were submitted with the status report for the meeting.

4. NRC Staff viewgraphs - SSAR Section 6.2.1 - Containment Functional Design (attached)
5. NRC Staff - Significant open issues (ABWR) - Electrical Systems (attached)
6. NRC Staff - Chapter 9, open items (attached)
7. NRC Staff - Chapter 12, DSER open items (attached)
8. GE/U. Saxena - ABWR Containment Pool Boundary Hydrodynamic loads (attached)

NOTE: Additional meeting details can be obtained from a transcript of this meeting available in the NRC Public Document Room, 2120 L Street, NW, Washington, DC 20006, (202) 634-3273, or can be purchased from Ann Riley and Associates, Ltd., 1612 K Street, NW, Suite 300, Washington, DC 20006, (202) 293-3950.