



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001**

MEMORANDUM TO:           ACRS Members

FROM:                    Christopher L. Brown, Senior Staff Engineer */RA/*  
                              Reactor Safety Branch A, ACRS

                              Kathy D. Weaver, Senior Staff Engineer */RA/*  
                              Reactor Safety Branch A, ACRS

SUBJECT:                CERTIFICATION OF THE MINUTES OF THE ACRS ESBWR  
                              SUBCOMMITTEE MEETING OPEN PORTION, JUNE 17, 2009,  
                              ROCKVILLE, MARYLAND

The minutes of the subject meeting were certified on August 26, 2009, as the official record of the proceedings of that meeting. A copy of the certified minutes is attached.

Attachment: As stated

cc w/o Attachment:   E. Hackett  
                              C. Santos



Certified by: M. Corradini  
On: August 26, 2009

Issued on: September 3, 2009

**ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
MINUTES OF ACRS ESBWR SUBCOMMITTEE MEETING  
JUNE 17, 2009  
ROCKVILLE, MARYLAND**

The ACRS Economic Simplified Boiling Water Reactor (ESBWR) Subcommittee held a meeting on June 17, 2009, in Room T-2B1, 11545 Rockville Pike, Rockville, MD. The afternoon portion of this meeting was open to the public. The purpose of this meeting was to review and discuss the resolution of containment issues associated with Chapter 6 of the ESBWR SER with open items. The RAIs reviewed and discussed were 6.2-139, 6.2-140, 6.2-145, 6.2-148, and 6.2-173. No new SER was submitted by the staff.

Christopher Brown was the designated Federal Official for this meeting. The Subcommittee received no written statements or requests for time to make oral statements from the public. The Subcommittee Chairman convened the open portion of this meeting on June 17, 2009 at 3:16 p.m. and adjourned the open 5:53 p.m.

**ATTENDEES:**

ACRS Members

M. Corradini, Chairman  
D. Bley  
S. Abdel-Khalik  
T. Kress, Consultant  
G. Wallis, Consultant

S. Armijo  
M. Bonaca  
M. Ryan

ACRS Staff

C. L. Brown, Designated Federal Official  
K. D. Weaver, ACRS staff

NRC Staff

A. Cabbage, NRO  
Royce Beacon, NRO  
Kimberly Corp, NRO  
Jeffrey Cruz, NRO  
Ian Jung, NRO  
H. Li, NRO  
Dennis Galvin, NRO  
Joe Ashcroft, NRO

LeRoy Hardin, NRO  
Kenneth Mott, NRO  
James Gilmer, NRO  
San Rhow, NRO  
Ian Jung, NRO  
Peter Yarsky, NRR  
E. Eagle, NRO  
L. Dudes, NRO

General Electric-Hitachi (GEH) Staff

Skip Butler, GEH  
Patricia Campbell, GEH  
R. Eff GEH  
P. Galub, GEH  
R. Wachowiak, GEH

Steve Kimura, GEH  
Rick Kingston, GEH  
R. Miller, GEH  
Ira Poppel, GEH  
David Wakayama, GEH

This portion of the meeting was open to members of the public. A complete list of attendees is in the ACRS Office File and is available upon request. The presentation slides and handouts used during this portion of the meeting are attached to the office copy of these minutes.

### **Opening Remarks and Objectives:**

Dr. Michael L. Corradini, Chairman of the ACRS ESBWR Subcommittee, convened the open portion of the meeting at 3:16 p.m. The purpose of the meeting was to review and discuss the resolution of containment issues associated with Chapter 6 of the ESBWR SER with open items. The RAIs reviewed and discussed were 6.2-139, 6.2-140, 6.2-145, 6.2-148, and 6.2-173. The presenters included representatives from the NRC's Office of New Reactors (NRO) and GE Hitachi (GEH).

### **GEH Presentation of Vacuum Breaker and Vacuum Breaker Isolation Design:**

Mr. Diaz-Quiroz from GEH, presented information on the ESBWR design Vacuum Breaker and Vacuum Breaker Isolation. Mr. Diaz-Quiroz described the Technical specification requirements associated with Vacuum Breaker and Vacuum Breaker Isolation valve leakage including the maximum leakage from the isolation valve pathway. He also described the overall suppression pool bypass leakage and the design basis analytical limit of 2 cm squared. Mr. Diaz-Quiroz further described the vacuum breaker and isolation valve design details including the isolation signaling for closure.

Although, the modified design of the vacuum breaker with the associated isolation valve was an improvement from what was initially proposed, the committee wanted to obtain additional information to guarantee that the temperature sensors and the proximity switches in the design were capable of detecting excessive leakage through the vacuum breaker and yet not too sensitive to cause spurious actuation of the isolation valves.

### **NRC Staff Presentation to the ACRS ESBWR Subcommittee: ESBWR Design Certification Review SER Section 6.2 Containment Systems:**

Dr. Henry Wagage of the Office of New Reactors, presented the NRC staffs presentation of the ESBWR containment systems. Dr. Wagage began his presentation by describing the requirements of GDC 50 - Containment Design Bases, GDC 38 - Containment Heat Removal. Dr. Wagage further described the staff's evaluations and RAIs regarding the ECCS debris strainer and the suppression pool bypass leakage. Dr. Wagage described the MELCOR confirmatory analysis and the differences with the TRACG model. Dr. Wagage described the SER Open Item issue for the TRACG and MELCOR differences. Dr. Wagage also discussed the evaluation of the ESBWR design bypass leakage capacity performed by the staff, as well as the ESBWR features including the vacuum breaker and vacuum breaker isolation.

### **Member Comments:**

Member Armijo stated that there is still a lot of work to do to close on the issues between the audit calculations and the GEH calculations. He also felt that there are some big engineering problems with the vacuum breakers and he desired to hear more about their design.

Member Bonaca stated the he was impressed with the quality of the responses and some of the closures begin proposed. However, he thought the vacuum breaker issue was a very significant

issue. He also stated that the argument was made of not taking credit for active systems and that some appeared to be credible.

Member Abel-Khalik stated that he there were many issues identified below that he was concerned about:

- 1) The differences in the long-term pressure histories predicted by GEH versus the staff. The rapid drop in pressure between 27 and 76 hours versus what the staff predicted. The continuing increase in temperature and pressure after 30 days versus what GEH predicted
- 2) The TRAGG model nodalization and whether that truly represents the actual physical geometry.
- 3) The leak detection and vacuum breakers. He stated that you must be able to detect the leak even if it is a slowly increasing leak, and you must show that this leak detection system is capable of preventing spurious isolation. He stated that what was presented did not convince him that these two conditions were actually met.
- 4) The hydrogen mixing. Member Abel-Khalik was not sure if the model was cable of predicting local variability of hydrogen concentration and showing that it is below the flammability limit.
- 5) The time constant of the reactor building being 12 hours, which long after more than six time constants, there is still a presumably large temperature difference between the suppression pool and the reactor building wall, therefore, you still have significant heat transfer to the reactor building.
- 6) He would like to know more about the fan characteristics and how it affects the calculations.

Member Abdel-Khalik also stated that there was a difference in the trends. GEH calculation shows that containment pressure is decreasingly stable while the staff's calculation show it to be increasing even after 30 days.

Member Ryan stated that it is not clear how to effectively communicate how safety is inherent in a design that is passive and you have to do nothing for three days. He encouraged the staff that this should be made a topic of education for everybody that has to interact with this design.

Consultant Kress stated that Mr Jack Tills' presentation was very useful and it was good of the staff to have such confirmatory analyses. However, he was concerned about the accident containment pressure and responded that a way to reduce this pressure needs to be figured out done sooner or later.

Chairman Corradini stated that there are two big issues in containment, the GDACS performance particularly, so that the committee would understand better the gas binding, and also the controlling habitability relative to DBs calculations had heating versus cooling extremes.

### **SUBCOMMITTEE DECISIONS AND ACTIONS:**

Following the GEH and staff presentations and discussions, Chairman Corradini asked if anyone had any further questions, thanked everyone for their presentations, and then adjourned the open portion of the meeting at 5:53 pm.

**BACKGROUND MATERIALS PROVIDED TO THE SUBCOMMITTEE PRIOR TO THIS MEETING:**

1. Letter from James C. Kinsey, Project Manager, ESBWR Licensing, GEH, to NRC, dated February 22, 2007, transmitting ESBWR Design Control Document, Revision 3 (ML070660561).
2. "TRACG Application for ESBWR Anticipated Transient Without Scram Analyses," M. D. Alamgir, Wayne Marquino, Antonio J. Barrett, Shivakumar Sitaraman, Bharat S. Shiralkar, NEDE-33083P, Supplement 2, Revision 1, February 2008 (ML080520104).
3. Memorandum from D. B. Matthews, Director, Division of New Reactor Licensing/Office of New Reactors (DNRL/NRO), to F. P. Gillespie, Executive Director, Advisory Committee on Reactor Safeguards, dated December 20, 2007 "Safety Evaluation Report (SER) with Open Items (OIs) for Chapter 6, "Engineered Safety Features" regarding the ESBWR Design Certification Review (ML073100702).
4. Letter from James C. Kinsey, Vice President, ESBWR Licensing, GEH, to NRC, dated June 1, 2008, transmitting ESBWR, Revision 5 to Design Control Document – Tier 1 and Tier 2 (ML081820343)
5. Letter from James C. Kinsey, Vice President, ESBWR Licensing, GEH, to NRC, dated June 7, 2007, Response to Portion of NRC RAI Letter No. 85 – Containment Systems and Emergency Core Cooling Systems – RAI Numbers 6.2-144, 6.2-145, 6.2-146, 6.2-147, and 6.3-66 (ML071770542)
6. Letter from James C. Kinsey, Vice President, ESBWR Licensing, GEH, to NRC, dated November 13, 2007, Response to Portion of NRC RAI Letter No. 101 - Containment Systems - RAI Number 6.2-173 (ML073200166)
7. Letter from James C. Kinsey, Vice President, ESBWR Licensing, GEH, to NRC, dated April 4, 2008, Response to Portion of NRC RAI Letter No. 110 - Containment Systems - RAI Number 6.2-140 S01 (ML081000256)
8. Letter from James C. Kinsey, Vice President, ESBWR Licensing, GEH, to NRC, dated April 18, 2008, Response to Portion of NRC RAI Letter No. 85 - Containment Systems - RAI Number 6.2-148 (ML081130426)
9. Letter from James C. Kinsey, Vice President, ESBWR Licensing, GEH, to NRC, dated April 19, 2008, Response to Portion of NRC RAI Letter Nos. 80 and 126 - Containment Systems - RAI Numbers 6.2-139, 14.3-235, and 14.3-236 (ML081130504)
10. Letter from James C. Kinsey, Vice President, ESBWR Licensing, GEH, to NRC, dated August 18, 2008, Response to Portion of NRC RAI Letter No. 192 - Containment Systems - RAI Numbers 6.2-140 S02 (ML082340695)
11. Letter from James C. Kinsey, Vice President, ESBWR Licensing, GEH, to NRC, dated February 10, 2009, Additional Information Related to ESBWR Suppression Pool Bypass Leakage Test Acceptance Criteria (ML090410512)
12. Letter from James C. Kinsey, Vice President, ESBWR Licensing, GEH, to NRC, dated

April 27, 2009, Response to Portion of NRC RAI Letter No. 321 - Containment Systems -  
RAI Numbers 6.2-145 S03 (ML091170436)

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Note: Additional details of this meeting can be obtained from a transcript of this meeting available for downloading or viewing on the Internet at <http://www.nrc.gov/reading-rm/doc-collections/acrs/tr/subcommittee/2007/> or purchase from Neal R. Gross and Co., Inc., (Court Reporters and Transcribers) 1323 Rhode Island Avenue, NW, Washington, DC 20005 (202) 234-4433.