



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

February 12, 2009

MEMORANDUM TO: Sherry Meador, Technical Secretary
Advisory Committee on Reactor Safeguards

FROM: Cayetano Santos, Chief */RA/*
Reactor Safety Branch
Advisory Committee on Reactor Safeguards

SUBJECT: MINUTES OF THE 558th MEETING OF THE ADVISORY
COMMITTEE ON REACTOR SAFEGUARDS (ACRS),
DECEMBER 4-6, 2008

I certify that based on my review of the minutes from the 558th ACRS Full Committee meeting, and to the best of my knowledge and belief, I have observed no substantive errors or omissions in the record of this proceeding subject to the comments noted below.

OFFICE	ACRS	ACRS:RSB
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DATE	2/ 12 /09	2/ 12 /09

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Date Certified: February 12, 2009

TABLE OF CONTENTS
MINUTES OF THE 558th ACRS MEETING

December 4-6, 2008

- I. Opening Remarks by the ACRS Chairman (Open)
- II. Chapters 7 and 14 of the SER Associated with the Economic Simplified Boiling Water Reactor (ESBWR) Design Certification Application (Open)
- III. Early Site Permit Application and the Final SER for the Vogtle Nuclear Plant (Open)
- IV. Status of Staff Activities Associated with Potential Revision to 10 CFR 50.46 (Open)
- V. NRC Staff's Initial White Paper on Containment Overpressure Credit Issue (Open)
- VI. Overview of the Human Reliability Analysis (HRA) Research Activities (Open)
- VII. Draft Policy on Defense-in-Depth for Future Nuclear Reactors (Open)
- V. Executive Session (Open)
 - A. Reconciliation of ACRS Comments and Recommendations
 - B. Report on the Meeting of the Planning and Procedures Subcommittee Held on December 3, 2008
 - C. Future Meeting Agenda

During its 558th meeting, December 4-6, 2008, the Advisory Committee on Reactor Safeguards (ACRS) discussed several matters and completed the following reports, letter, and memorandum:

REPORTS

Reports to Dale E. Klein, Chairman, NRC, from William J. Shack, Chairman, ACRS:

- Final Review of the Vogtle Electric Generating Plant Early Site Permit Application and Limited Work Authorization Request and the Associated Safety Evaluation Report, dated December 22, 2008
- Technical Basis and Rulemaking Strategy for the Revision of 10 CFR 50.46(b) Loss of Coolant Accident Embrittlement Criteria for Fuel Cladding Materials, dated December 18, 2008

LETTER

Letter to R. W. Borchardt, Executive Director for Operations, NRC, from William J. Shack, Chairman, ACRS:

- Interim Letter 6: Chapters 7 and 14 of the NRC Staff's Safety Evaluation Report with Open Items Related to the Certification of the ESBWR Design, dated December 22, 2008

MEMORANDUM

Memorandum to R. W. Borchardt, Executive Director for Operations, NRC, from Edwin M. Hackett, Executive Director, ACRS:

- Proposed Rule Regarding Enhancements to Emergency Preparedness Regulations, dated December 10, 2008

MINUTES OF THE 558th MEETING OF THE
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
DECEMBER 4-6, 2008
ROCKVILLE, MARYLAND

The 558th meeting of the Advisory Committee on Reactor Safeguards (ACRS) was held in Conference Room 2B3, Two White Flint North Building, Rockville, Maryland, on December 4-6, 2008. Notice of this meeting was published in the *Federal Register* on November 19, 2008 (72 FR 69681-69682). The purpose of this meeting was to discuss and take appropriate action on the items listed in the meeting agenda. The meeting was open to public attendance.

A transcript of selected portions of the meeting is available in the NRC's Public Document Room at One White Flint North, Room 1F-19, 11555 Rockville Pike, Rockville, Maryland. Copies of the transcript are available for purchase from Neal R. Gross and Co., Inc., 1323 Rhode Island Avenue, NW, Washington, DC 20005. Transcripts are also available at no cost to download from, or review on, the Internet at <http://www.nrc.gov/ACRS/ACNW>.

ATTENDEES

ACRS Members: Dr. William J. Shack (Chairman), Dr. Mario V. Bonaca (Vice-Chairman), Dr. Said Abdel-Khalik (Member-at-Large), Dr. George E. Apostolakis, Dr. Sam Armijo, Dr. Sanjoy Banerjee, Dr. Dennis Bley, Mr. Charles Brown, Dr. Michael Corradini, Mr. Otto L. Maynard, Dr. Dana A. Powers, Mr. Harold Ray, Dr. Michael Ryan, Mr. John Sieber, and Mr. John Stetkar.

I. Chairman's Report (Open)

[Note: Mr. Sam Duraiswamy was the Designated Federal Official for this portion of the meeting.]

Dr. William J. Shack, Committee Chairman, convened the meeting at 8:30 a.m. In his opening remarks he announced that the meeting was being conducted in accordance with the provisions of the Federal Advisory Committee Act. He reviewed the agenda items for discussion and noted that no written comments or requests for time to make oral statements from members of the public had been received. Dr. Shack also noted that a transcript of the open portions of the meeting was being kept and speakers were requested to identify themselves and speak with clarity and volume. <X:\558\1204 558 Transcript.pdf>

II. Chapters 7 and 14 of the Safety Evaluation Report (SER) Associated with the Economic Simplified Boiling Water Reactor (ESBWR) Design Certification Application

[Note: Mr. Harold Vandermolen was the Designated Federal Official for this portion of the meeting.]

The Committee met with representatives of the NRC staff and General Electric - Hitachi Nuclear Energy (GEH) to discuss Chapters 7 and 14 of the NRC Staff's SER with Open Items associated with the ESBWR Design Certification Application.

GEH staff presented an overview of Chapter 7, which covers the Distributed Control and Information System (DCIS). The DCIS is divided into the Q-DCIS, which controls reactor trip, Emergency Core Cooling Systems (ECCS), and other safety systems, and the N-DCIS, which performs all other functions. The Q-DCIS has four divisions which are independent and are physically, electrically, and data isolated from each other as well as from the N-DCIS. The N-DCIS can receive data from the Q-DCIS but cannot influence the Q-DCIS. The system is designed such that if one division is taken out of service for maintenance and a random single failure occurs in another division, the remainder of the DCIS will actuate all of the ECCS. GEH staff also discussed the ESBWR main control room and the remote shutdown system.

The NRC staff described the staff's review of Chapters 7 and 14 of the ESBWR Design control Document (DCD). The staff followed Chapters 7 and 14 of the Standard Review Plan and discussed IEEE-603 compliance, the life cycle design process, the setpoint methodology, diversity and defense-in-depth, and data communication. The staff stated that most of the remaining open items are related to clarification and consistency and that no significant technical issues remain.

Several Committee members commented that the applicant's presentation described a design significantly in more detail than what was presented in the DCD, giving an impression that the design process had progressed considerably beyond the DCD description. The NRC staff indicated that it is necessary to distinguish between what is conceptual and what was submitted for approval. The NRC staff will discuss this distinction further in a future meeting. The Committee issued a letter to the Executive Director for Operations on this matter, dated December 22, 2008, which concluded that the applicant has an acceptable process for developing the Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) for the Initial Plant Test Program and that the Design Acceptance Criteria (DAC) for the DCIS are incomplete. The Committee recommended that the Tier 2 DCD include additional detailed information on the architecture of the instrumentation control system and that appropriate ITAAC and DAC be added to the Tier 1 DCD.

III. Early Site Permit Application and the Final SER for the Vogtle Nuclear Plant

[Note: Mr. Derek Widmayer was the Designated Federal Official for this portion of the meeting.]

The Committee met with representatives of the NRC staff and Southern Nuclear Operating Company (SNC) to discuss the application submitted by SNC for the Vogtle Early Site Permit (ESP), SNC's request for a Limited Work Authorization (LWA), and the associated NRC staff SER. The Vogtle ESP application is different from other ESP applications in two significant ways. The Vogtle ESP application references parameters of a specific reactor design, the Westinghouse AP1000, rather than relying on a plant parameter envelope. The Vogtle ESP application also proposes a complete and integrated emergency plan, including emergency planning ITAAC, rather than providing only major features of an emergency plan. The SNC LWA requests permission to begin limited work on construction activities at the site, including placement of backfill, construction of retaining walls, and installation of foundation mudmats.

SNC staff provided an introduction to the Vogtle ESP application and the request for an LWA. This included brief descriptions of the contents of the application and LWA, the remaining schedule for NRC staff review of documents, the site location and the nature of open items in the draft SER. SNC described the pre-construction activities requested in the LWA, including placement of engineered backfill, a concrete mudmat and water proofing, and mechanically stabilized concrete retaining walls.

NRC staff provided brief summaries of the closure of open items in the draft SER in the technical areas of hydrology, meteorology, seismology and geotechnical engineering and emergency planning. SNC provided a great deal of additional information on geotechnical engineering properties of the soils at the Vogtle site and their response to a seismic event to close several open items in the draft SER.

Several Committee members noted that seismicity is the most important site safety issue. Seismicity at the proposed Vogtle site is dominated by the Charleston seismic zone. The predicted ground motion response spectrum at the proposed Vogtle site is not bounded by the seismic design response spectrum certified for the AP1000 reactor. Therefore, this difference should be addressed in the future combined license application for new reactors at the proposed Vogtle site. The Committee issued a report to the NRC Chairman on this matter, dated December 22, 2008 recommending that the Vogtle ESP and LWA be granted.

IV. Status of Staff Activities Associated with Potential Revision to 10 CFR 50.46 (b)

[Note: Mr. Christopher Brown was the Designated Federal Official for this portion of the meeting.]

The Committee met with representatives of the NRC staff and Electric Power Research Institute (EPRI), concerning activities related to 10 CFR 50.46(b) rulemaking.

The staff's presentation described the strategy for revising 10 CFR 50.46(b) fuel performance criteria. The current rule uses prescriptive criteria to ensure post quench ductility (PQD) in the cladding during loss-of-coolant accidents (LOCAs). The proposed rule would use performance-based requirements to ensure PQD in the cladding. In addition, the rule would permit the use of Zirconium alloys that meet the performance acceptance requirements. These new requirements would be based on a sound understanding of the phenomena controlling cladding embrittlement and would be applicable to low and high burnup fuel for both large-break and small-break LOCAs. The rule would permit the use of current and future zirconium alloys that meet the performance acceptance requirements without the need for exemptions. The staff also stated that an Advance Notice of Proposed Rulemaking (ANPR) may be issued in parallel with the completion of remaining confirmatory research. The staff believes that the ANPR process will enhance public participation and facilitate formal stakeholder interaction on the rulemaking while confirmatory data is gathered.

EPRI representatives stated that industry is supportive of the NRC's overall objective to revise 10 CFR 50.46(b) to a performance-based rule; however, they expressed concerns about the implementation cost, requirements to use two-sided oxidation, and periodic testing on breakaway oxidation. They also indicated that since studies completed-to-date indicate no

significant safety concerns with respect to the current design basis, there is no need to rush to rulemaking. The Committee issued a report to the NRC Chairman on this matter, dated December 18, 2008, concluding that there are sufficient data and understanding of the cladding embrittlement phenomena to justify and proceed with rulemaking. The Committee recommended that the rule include the optional testing program to allow licensees to demonstrate compliance with PQD criteria on an alloy-specific and temperature-specific basis.

V. NRC Staff's Initial White Paper on Containment Overpressure Credit Issue

[Note: Ms. Zena Abdullahi was the Designated Federal Official for this portion of the meeting.]

The Committee met with representatives of the NRC staff regarding the White Paper on the use of containment accident pressure in determining the available net positive suction head (NPSH) for safety system pumps which provide: (1) core cooling and coverage, (2) suppression pool cooling, and (3) containment cooling. At issue is the reliance of safety systems on containment accident pressure to perform their design functions and successfully mitigate LOCA (10 CFR 50.46 and Appendix K), anticipated transients without scram (10 CFR 50.62), station blackout (10 CFR 50.63), and Appendix R fire events.

The NRC staff discussed the technical basis supporting its position that crediting containment accident pressure when determining the available NPSH is acceptable provided the licensees demonstrate the use of conservative assumptions for the LOCA event, including minimizing the containment pressure and maximizing the suppression pool temperature. The staff stated that its assessment indicates that neither the magnitude of containment accident pressure nor the duration of the credit needed was important. The staff also supported its conclusions by citing its evaluation of the: (1) robustness of the pumps to withstand cavitations; (2) potential loss or decrease of the containment accident pressure assumed in the calculation of the available NPSH; and (3) integrity of the seals and penetrations.

The ACRS members noted that crediting of containment overpressure was first allowed in response to the emerging issue of BWR suction strainer clogging during a loss-of-coolant accident. In fact, this is an excellent example of the role maintaining NPSH margins play in ensuring safety in both addressing newly discovered issues and in mitigating additional unknowns or nonconservatisms. The ACRS members described their concerns of the staff's positions on: (1) allowing reduced or negative NPSH margins; (2) placing no limits on the amount or duration that containment accident pressure is credited; (3) justifying pump cavitations, and (4) accepting reliance on operator intervention to manage cavitations under some circumstances. The members also discussed the fact that the risk analysis does not include the risk associated with the reduction in NPSH margin and the impact of the duration the credit is needed. Also missing was a sensitivity analysis for quantifying the impact of the cited conservatisms in the overall LOCA containment evaluation.

In its concluding remarks, the NRC staff acknowledged that the technical differences appear to remain and that they intend to pursue writing a commission paper.

Committee Action

The Committee plans to write a report to the NRC Chairman on this matter during its February 2009 meeting.

VI. Overview of the Human Reliability Analysis (HRA) Research Activities

[Dr. Hossein Nourbakhsh was the Designated Federal Official for this portion of the meeting.]

The Committee met with representatives of the NRC staff regarding HRA research activities and the joint NRC/EPRI plan for evaluating different human reliability analysis models. The NRC staff indicated that its current focus of HRA research includes benchmarking HRA methods to understand strengths and weaknesses of existing methods and determine ways to improve them.

In a November 8, 2006 Staff Requirements Memorandum (SRM), resulting from the October 20, 2006 meeting with ACRS, the Commission directed the Committee to “work with the staff and external stakeholders to evaluate the different Human Reliability models in an effort to propose either a single model for the agency to use or guidance on which model(s) should to be used in specific circumstances.” The staff briefed the Committee on its plan and status of current activities to address the November 8, 2006 SRM. The staff indicated that Phase 1 of the joint NRC/EPRI plan (to be completed by April 2009) includes reviewing the use of HRA in decision making and establishing a common terminology and HRA process. During Phase 2 of this effort (to be completed by May 2009), insights from Phase 1 and the International HRA Empirical Study will be utilized to recommend a consolidated HRA approach. In Phase 3 (to be completed by September 2010), a single HRA method or a small set of methods will be developed for use by NRC and Industry. In the final Phase 4 (to be completed by September 2010), the methods will be tested and guidance and training materials will be developed. This was an information briefing no Committee action was necessary. The Committee plans to continue its discussions on Human Reliability Analysis Research Activities in future meetings.

VII. Draft Policy Statement on Defense-in-Depth for Future Nuclear Reactors

[Note: Ms. Maitri Banerjee was the Designated Federal Official for this portion of the meeting.]

The Committee met with representatives of the NRC staff regarding the development of a draft policy statement on defense-in-depth for future plants. In order to avoid any impact on the established existing regulatory processes for the light water reactors (LWRs), the staff would apply the policy statement to only non-LWR advanced reactors. The current staff effort was initiated as a part of its development of the risk-informed (RI), performance-based (PB), and technology neutral alternative regulatory framework. The staff obtained Commission direction and sought public comments through an advance notice of proposed rulemaking on the RI and PB alternative to 10 CFR Part 50. This rulemaking is currently on hold. Previous work by international groups, the industry, and the ACRS was mentioned. The Commission has directed the staff to engage members of the public, ACRS, the industry, and other stakeholders as they develop this policy statement. The Commission also directed that the insights gained from the development of the Next Generation Nuclear Plant licensing strategy and completion of the Pebble Bed Modular Reactor pre-application review be used in developing this policy statement. The issues that received considerable Committee attention include: definition of defense-in-depth, its objective and principles, the use of PRA to distinguish between a desirable design/program requirement vs. defense-in-depth measures, and implementation issues. The Committee members noted that licensing information available on Fort St. Vrain or the Clinch River Breeder Reactor could be used to test the draft policy. This was an information briefing and no Committee action was necessary. The Committee plans to review the development of the defense-in-depth policy statement.

VIII. Executive Session

[Note: Mr. Edwin Hackett was the Designated Federal Official for this portion of the meeting.]

A. Reconciliation of ACRS Comments and Recommendations/EDO Commitments

- The Committee considered the EDO's response of November 26, 2008, to conclusions included in the October 22, 2008, ACRS report on the status of resolution of Generic Safety Issue-191, "Assessment of Debris Accumulation on PWR Sump Performance." The Committee decided that it was satisfied with the EDO's response.

B. Report of the Planning and Procedures Subcommittee Meeting

Review of the Member Assignments for the November ACRS Meeting

Member assignments for the February ACRS meeting were discussed. Reports and letters that would benefit from additional consideration at the future ACRS meeting were also discussed.

Anticipated Workload for ACRS Members

The anticipated workload for ACRS members through April 2009 was discussed. The objectives were:

- Review the reasons for the scheduling of each activity and the expected work product and to make changes, as appropriate
- Manage the members' workload for these meetings
- Plan and schedule items for ACRS discussion of topical and emerging issues

Staff Requirements Memorandum (SRM)

In the January 8, 2009 SRM resulting from the November 7, 2008 ACRS meeting with the Commissioners, the Commission states the following:

- + The staff should consider what has been learned from the analyses of PWR sump performance and determine if issues have arisen that call for revising BWRs.
- + With regard to power uprates for BWRs consistent with previous Commission direction, the staff should continue working to resolve the differences of opinion between the Committee and the staff concerning containment overpressure credit, and as necessary and appropriate, provide policy decision papers to the Commission if a resolution cannot be reached.

Browns Ferry Units 1, 2, and 3 Extended Power Uprate Applications

The staff plans to provide a draft Safety Evaluation (SE) report for Browns Ferry Units 1 and 2 in early April in support of a Subcommittee meeting in May and full Committee meeting in June. [There is a possibility a complete SE may not be available for Units 1 and 2 in April.]

For Unit 3, the steam dryer information may not be available until late (October/November) 2009. There were some discussions among the staff about providing a partial SE to the ACRS in April for discussion at the May Subcommittee and June full Committee meetings. After the steam dryer information is made available to the Committee, it needs to review only that information and provide a final report to the Commission. The staff would like to know whether the Subcommittee/full Committee will be willing to review partial SE for Unit 3 and possibly for Units 1 and 2 in May and June respectively.

It should be noted that during its October 20, 2006 meeting with the Commission, the Committee stated the following:

ACRS will review the extended power uprate application for Browns Ferry Units 1, 2, and 3 after receiving the complete Safety Evaluation report.

Biennial ACRS Report on the NRC Safety Research Program

The biennial ACRS report on the NRC Safety Research Program is due to the Commission on March 15, 2010. Drs. Shack and Powers will have the lead in coordinating the preparation of the report. Assignments for the members as well as format, content, and schedule for providing input to the report will be provided to the members during the March ACRS meeting.

Quality Assessment of Selected NRC Research Projects

During its November 2008 meeting, the Committee selected the following research projects and Panels for quality assessment in FY2009:

- + NUREG/CR-6964, "Crack Growth Rates and Metallographic Examinations for Alloy 600 and Alloy 82/182 from Field and Laboratory Materials Testing in PWR Environments"
Panel: Armijo (Chair), Abdel-Khalik and Ray
- + NUREG/CR-XXXX, "Diversity and Defense-in Depth for Digital Instrumentation and Control Systems"
Panel: Brown (Chair), Apostolakis and Sieber

The Committee report is provided to the RES Director in October of each year. Since the Committee needs to prepare its biennial report on the NRC Safety Research Program this year, Dr. Powers proposed that the Committee complete its Quality Assessment report in July 2009.

Tour of the Mitsubishi and Westinghouse Simulators in Pittsburgh

Several ACRS members and ACRS staff are scheduled to tour the Westinghouse simulator on February 18 and the Mitsubishi simulator on February 20, 2009. On February 19, 2009, a Subcommittee meeting is scheduled to discuss selected Topical reports associated with US-APWR. Proposed schedule for the Subcommittee meeting and an itinerary for touring the simulators are attached.

Reappointment of an ACRS Member

The Commission has reappointed Dr. Shack for a fifth term. He joins the elite group of members [Drs. Siess (24 yrs.), Okrent (24 yrs.), and Kerr (20 yrs.)] who served 20 or more years on the Committee.

ACRS Meeting With the Commission

The ACRS is scheduled to meet with the Commission between 1:30 and 3:30 p.m., on Thursday, June 4, 2009 to discuss items of mutual interest. A list of proposed topics will be provided to the Planning & Procedures Subcommittee and the full Committee during their March meetings.

TRACE Thermal-Hydraulic System Analysis Code (EMH/DB)

During the ACRS meeting with the Commission on November 7, 2008, Dr. Abdel-Khalik made several comments regarding the capability of the TRACE code in evaluating the passive system safety performance. Dr. Sheron, the RES Director, sent a memorandum to the Commissioners responding to the comments made by Dr. Abdel-Khalik at the Commission meeting.

Revision to the ACRS Charter

In approving the renewal of the ACRS Charter, the Commission added a new paragraph stating that the ACRS shall report to and advise the Commission on issues associated with nuclear materials and waste management. This action stems from the merger of the ACNW&M with the ACRS.

Draft Regulatory Guides

The staff plans to issue the following Draft Regulatory Guides (DG) for public comment and would like to know whether the Committee wants to review these Guides prior to being issued for public comment.

Proposed Revision 2 to Regulatory Guide 1.189 (DG-1214), "Fire Protection for Nuclear Power Plants"

Regulatory Guide 1.189 lacked clear guidance with respect to the treatment of fire-induced circuit failures. In SECY-08-0093 "Resolution of Issues Related to Fire-Induced Circuit Failures," the staff proposed a clarification to the NRC's guidance with regard to fire-induced circuit failures. The proposed Revision 2 (DG-1214) is to include the fire-induced circuit-failure clarifications described in SECY-08-0093.

Proposed Revision 4 to Regulatory Guide 1.28 (DG-1215), "Quality Assurance Program Requirements (Design and Construction)"

Regulatory Guide 1.28, Revision 3, endorsed the American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME) NQA-1-1983 standard, "Quality Assurance Program Requirements for Nuclear Power Plants." The proposed Revision 4 endorses the ANSI/ASME NQA-1-2008 standard, "Quality Assurance Program Requirements for Nuclear Facilities Applications," including ANSI/ASME NQA-1a-2008 (which is Addendum A to the NQA-1 standard).

Draft Regulatory Guide (DG) - 5028, "Guidance on Making Changes to Emergency Response Plans for Nuclear Power Reactors"

The NRC staff's objectives for 10 CFR 50.54(q) are to ensure that licensees (1) follow and maintain the effectiveness of their approved emergency plans, (2) evaluate proposed changes to these plans for their impact on the effectiveness of the plans, and (3) obtain prior NRC approval for changes that would reduce the effectiveness of the plans. These actions are essential if these plans are to continue to provide reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency. The purpose of DG-5028 is to provide guidance on the implementation of 10 CFR 50.54(q) with respect to making changes to emergency response plans.