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TO: Johnson, NRO

AUTHOR: William Shack

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AFFILIATION: ACRS

ADDRESSEE: Dale Klein

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SUBJECT: Summary Report-558th meeting of the ACRS, December 4-6, 2008, and other related activities of the Committee

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

December 29, 2008

The Honorable Dale E. Klein
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: SUMMARY REPORT – 558th MEETING OF THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS, DECEMBER 4-6, 2008, AND OTHER RELATED ACTIVITIES OF THE COMMITTEE

Dear Chairman Klein:

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

HIGHLIGHTS OF KEY ISSUES

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

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 in significantly 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.

Committee Action

The Committee issued a letter to the Executive Director for Operations on this matter, dated December 22, 2008, concluding 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.

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

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.

Committee Action

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.

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

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 mentioned 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.

Committee Action

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.

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

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 50.63), station blackout (10 CFR 50.62), 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.

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

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.

Committee Action

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.

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

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.

Committee Action

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.

7. Election of ACRS Officers for CY 2009

The Committee elected Mario V. Bonaca as ACRS Chairman, Said Abdel-Khalik as ACRS Vice Chairman, and J. Sam Armijo as Member-at-Large for the Planning and Procedures Subcommittee for CY 2009.

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.

PROPOSED SCHEDULE FOR THE 559th ACRS MEETING

The Committee agreed to consider the following topics during the 559th ACRS meeting, to be held on February 5-7, 2009:

- Draft Regulatory Guide DG-5021, "Managing the Safety/Security Interface"
- Oconee RPS/ESF Digital I&C Upgrade
- Advanced Reactor Research Plan
- Draft NUREG-1855, Guidance on the Treatment of Uncertainty in Risk-Informed Decisionmaking
- NRC Staff White Paper on Containment Overpressure

Sincerely,

/RA/

William J. Shack
Chairman