



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

September 2, 2008

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

**SUBJECT: SUMMARY REPORT – 554<sup>th</sup> MEETING OF THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS, JULY 9-11, 2008, AND OTHER RELATED ACTIVITIES OF THE COMMITTEE**

Dear Chairman Klein:

During its 554<sup>th</sup> meeting, July 9-11, 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:

- Security and Aircraft Impact Rulemaking for Nuclear Power Plants, dated July 18, 2008
- Stretch Power Uprate Application for the Millstone Power Station, Unit 3, dated July 23, 2008

**LETTER**

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

- Interim Letter 4: Chapter 3 of the NRC Staff's Safety Evaluation Report with Open Items Related to the Certification of the ESBWR Design, dated July 21, 2008

**MEMORANDUM**

Memorandum to R. W. Borchardt, Executive Director for Operations, NRC, from Frank P. Gillespie, former Executive Director, ACRS:

- Draft Regulatory Guides 1149 and 1189, dated July 15, 2008

## HIGHLIGHTS OF KEY ISSUES

### 1. Stretch Power Uprate Application for Millstone Power Station, Unit 3

The Committee met with representatives of the NRC staff, Dominion Nuclear Connecticut, Inc, and members of the public to discuss Dominion's license amendment request to increase the power level of Millstone Unit 3 by 7%. Topics of discussion included fuel system and nuclear design as well as containment and design basis accident analyses. Also discussed were proposed modifications to the plant to support the increased power level such as changes to the core design and disabling automatic control rod withdrawal. The plant safety analyses have been performed in many cases, with more modern methods than when the plant was initially licensed. These analyses show substantial margins to licensing limits for containment design pressure, peak cladding temperature, and departure from nucleate boiling.

Mr. Gunderson of the Citizens Against Millstone described a concern that the containment design pressure could be exceeded.

### Committee Action

The Committee issued a report to the NRC Chairman on this matter dated July 23, 2008, recommending that the application for power uprate at Millstone Unit 3 be approved.

### 2. Selected Chapters 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 to discuss Chapter 3, "Design of Structures, Components, Equipment, and Systems," of the NRC Staff's SER with Open Items related to the ESBWR Design Certification Application. The discussion focused on classification of Structures, Systems, and Components (SSCs) and the seismic analysis.

The SSCs are classified as Safety Class 1, 2, 3, or N depending on whether the SSC is needed to preserve the integrity of the reactor coolant pressure boundary, to shut down the reactor and maintain it in a safe shutdown condition, or to prevent or mitigate potential offsite exposures. Thus, the reactor coolant pressure boundary components and supports are classified as Safety Class 1 whereas nonsafety-related SSCs are classified as Class N. Safety Classes 1 through 3 are very closely related to Quality Groups A through C. The quality groups are defined in terms of their pressure retaining functions. Pressure retaining components of the reactor coolant pressure boundary are Quality Group A. Finally, there is a seismic classification; all safety-related SSCs are placed in Seismic Category I, which means they must remain functional in the event of a design basis earthquake. Nonsafety-related SSCs may be placed in Seismic Category II, which means that they need not remain functional, but must not fail in such a way as to interfere with safety-related SSCs. The remaining nonsafety-related SSCs may be assigned to Seismic Category NS, which means that they must conform to the International Building Code but have no further seismic design requirements.

Regarding the seismic design, the Combined Seismic Design Response Spectra (CSDRS) are based on Regulatory Guide 1.60 spectra with the addition of the North Anna site-specific spectra at high frequencies, i.e., the CSDRS is the envelope of the generic and North Anna spectra.

North Anna is representative of most severe rock sites in the eastern US, and thus the CSDRS envelopes most candidate sites with considerable conservatism.

The fluids in the reactor building pools are modeled as a mass-spring (sloshing) component and an impulsive (rigid) component. However, for conservatism, the entire water mass of each pool is considered as an impulsive mass in the seismic stick model for predicting overall building response. The sloshing component generally responds at very low frequencies (below 0.5 Hz), where no structural modes of vibration exist. The seismic loads used in the stress analysis of pool structures include both the global loads calculated from the seismic response analysis and local hydrodynamic pressure loading on the pool boundaries.

### Committee Actions

The Committee issued a letter to the EDO on this matter, dated July 21, 2008, stating that the evolving nature of the ESBWR design makes it difficult to perform an effective review, and that additional information is needed to demonstrate that dynamic forces from seismic events are treated properly in the analyses of heat exchangers immersed in elevated water pools.

#### 3. Safeguards and Security Matters

The Committee met with representatives of the NRC staff and a member of the public to discuss the draft final rules on security and aircraft impact assessment. Consistent with the Commission direction in the October 31, 2003, Staff Requirements Memorandum, the Committee did not review the elements of the security rule that dealt with physical security. The ACRS review was limited to three parts of the rule: (i) 10 CFR 50.54(hh), "Mitigative Strategies and Response Procedures for Potential or Actual Aircraft Attack;" (ii) 10 CFR 73.54 "Protection of Digital Computer and Communication Systems and Networks;" and (iii) 10 CFR 73.58, "Safety/Security Interface Requirements for Nuclear Power Reactors." The Committee also reviewed the draft final rule, "Consideration of Aircraft Impacts for New Nuclear Power Reactor Designs." The staff discussed the essential elements of each rule, how comments from the public were addressed, and the status of the associated regulatory guidance.

Mr. James Riccio of Greenpeace stated that the aircraft impact rule, in his opinion, lacks substantive acceptance criteria, and the requirements that the containment remains intact may not be sufficient.

### Committee Action

The Committee issued a report to the NRC Chairman on this matter, dated July 18, 2008, recommending that the draft final rules be approved. The committee agreed with the staff that it is appropriate to treat aircraft attacks as beyond-design-basis events.

#### 4. Status of NRC Staff Activities Associated with Seismic Design Issues at Nuclear Power Plants

The Committee met with representatives of the NRC staff to discuss the evaluation of earthquakes and how that information will be used to evaluate the safety of nuclear power reactors. The staff's presentation focused on four topics: (1) NRC Seismic Research Program Plan; (2) Generic Safety Issue-199, "Implications of Updated Probabilistic Seismic Hazard

Estimates in Central and Eastern U.S. on Existing Nuclear Power Plants;” (3) Interim Staff Guidance on Seismic Issues Associated with High Frequency (HF) Ground Motion; and (4) the July 2007 Earthquake at the Kashiwazaki-Kariwa (KK) Nuclear Power Plant Site.

The NRC staff issued a Seismic Research Program Plan in January 2008 that identifies approximately 40 research projects in the areas of (1) Earth Science and Natural Hazards Research; (2) Earthquake Engineering Analysis and Earthquake Resistant Design; (3) Cooperation in Ongoing International Research Activities; and (4) Updates to NRC Regulatory Guides. This plan will be implemented over the next three years.

In a 2004 analysis prepared for the NRC, the U.S. Geological Survey reported that the Peak Ground Acceleration (PGA) reference probability for the 29 Central Eastern United States (CEUS) nuclear power reactor sites had increased. As a result, the probability of exceeding the Safe Shutdown Earthquake at some nuclear power plants east of the Mississippi River is now believed to be higher than previously understood. The NRC staff is reviewing documentation to better understand what seismic margin currently exists for the current fleet of nuclear power plants and will then evaluate the new PGA estimates against those margins.

The NRC staff recently learned that for some current and future nuclear power plant sites, the site specific ground motion may exceed the ground motion derived from a Lawrence Livermore National Laboratory- or Electric Power Research Institutes-based Probabilistic Seismic Hazard Analysis.

On July 16, 2007, a magnitude 6.8 earthquake occurred about 9 kilometers offshore of the KK nuclear power plant site. PGAs as high as 0.69g were recorded at the bases of some of the reactor buildings, and PGAs at the tops of some building roofs were reported to be twice as high. In the U.S. the largest PGA assumed in reactor designs is 0.3g. The PGA associated with this earthquake was 2 to 2.5 times greater than the acceptable earthquake design for the KK site. Although SSCs important to safety appeared to have performed well, there were several incidents involving noncritical SSCs at the KK site. Inspections for all seven reactor units were completed and no abnormalities were found that could impact the functional or structural integrity of the reactor units. All seven reactor units at the KK site remain off-line while additional site inspections and assessments take place.

#### Committee Action

This was an information briefing. Future subcommittee meetings will get into more details related to seismic issues.

#### 5. Containment Overpressure Credit

The Committee met with representatives of the NRC staff and the Tennessee Valley Authority (TVA) to discuss technical issues related to crediting of containment overpressure during design basis accidents and special events in support of the extended power uprate for Browns Ferry Units 1, 2, and 3.

Representatives of TVA described how credit for containment overpressure is part of the current licensing basis for Appendix R and Loss-of-Coolant-Accident requirements. Of the two, the Appendix R is the more limiting. During a postulated fire event in two specific locations, if all of

the equipment in these locations is rendered inoperable by the fire, there will not be sufficient net positive suction head for the residual heat removal pumps if the containment overpressure resulting from primary system blowdown is not credited. However, TVA claims that this assumption, when taken together with other licensing basis assumptions, is overly conservative. Moreover, based on discussions with the pump vendor, TVA claimed that there is a high likelihood that the pumps would survive the period of low suction head. Several members expressed an interest in the pump data and how they were obtained, since the pump tests were performed when the pumps were new in the 1970s and the pump rotors were replaced in the 1990s. In addition, the fire hazard analysis is a deterministic analysis; the licensee does not have a fire Probabilistic Risk Assessment. Several Members discussed the lack of any means for quantifying the degree of conservatism claimed by TVA.

#### Committee Action

This was an information briefing. No Committee action was necessary.

#### RECONCILIATION OF ACRS COMMENTS AND RECOMMENDATIONS/EDO COMMITMENTS

- The Committee considered the EDO's response of June 20, 2008, to conclusions and recommendations included in the April 30, 2008, ACRS report on the Draft NUREG-1902, "Next generation Nuclear Plant Licensing Strategy Report." The Committee decided that it was satisfied with the EDO's response.

#### OTHER RELATED ACTIVITIES OF THE COMMITTEE

During the period from June 9, 2008, through July 8, 2008, the following Subcommittee meetings were held:

- ESBWR – June 18-19, 2008

The Subcommittee discussed selected Chapters of the SER with Open Items associated with the ESBWR design certification application.

- Thermal-Hydraulic Phenomena – July 7, 2008

The Subcommittee discussed the findings of the Peer-Review Panel for the TRACE computer code and the staff's plans to address the Panel's findings.

- Power Upgrades – July 8, 2008

The Subcommittee discussed the staff's safety evaluation associated with the stretch power upgrade application for Millstone Power Station, Unit 3.

- Planning and Procedures – July 8, 2008

The Subcommittee discussed proposed ACRS activities, practices, and procedures for conducting Committee business and organizational and personnel matters relating to ACRS and its staff.

LIST OF MATTERS FOR THE ATTENTION OF THE EDO

- The Committee plans to continue its review of the matters related to the certification of the ESBWR design during its future meetings.
- The Committee plans to review the regulatory guidance documents associated with draft final rules 10 CFR 50.54(hh), 10 CFR 73.54, 10 CFR 73.58, and 10 CFR 50.150.
- The Committee plans to undertake more detailed reviews of the seismic issues during its future meetings.
- The Committee plans to review the extended power uprate application for Browns Ferry Units 1, 2, and 3 during a future meeting.

PROPOSED SCHEDULE FOR THE 555<sup>th</sup> ACRS MEETING

The Committee agreed to consider the following topics during the 555<sup>th</sup> ACRS meeting, to be held on September 4-6, 2008:

- License Renewal Application for the Wolf Creek Generating Station, Unit 1
- Anticipated Advanced Reactor Research Needs
- Draft Final Revision 1 Regulatory Guide 1.131, "Qualification of Safety-Related Cables and Field Splices for Nuclear Power Plants"
- TRACE Computer Code Peer Review
- Quality Assessment of Selected Research Projects

Sincerely,

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Chairman

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- TRACE Computer Code Peer Review
- Quality Assessment of Selected Research Projects

Sincerely,  
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William J. Shack  
Chairman

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