



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

January 26, 2012

The Honorable Gregory B. Jaczko
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: PROPOSED DRAFT RULE FOR 10 CFR 50.46C, "EMERGENCY CORE COOLING SYSTEM PERFORMANCE DURING LOSS-OF-COOLANT ACCIDENTS"

Dear Chairman Jaczko:

During the 590th meeting of the Advisory Committee on Reactor Safeguards (ACRS), January 19-20, 2012, we completed our review of the proposed draft rule for 10 CFR 50.46c, and the staff's safety assessment and audit of Boiling Water Reactor (BWR) and Pressurized Water Reactor (PWR) Owners' Group margin assessments. Our Materials, Metallurgy, and Reactor Fuels Subcommittee also reviewed these subjects during a meeting on December 15, 2011. We heard presentations by and held discussions with representatives of the Nuclear Regulatory Commission (NRC), PWR Owners' Group (PWROG), and BWR Owners' Group (BWROG). We also had the benefit of the documents referenced.

RECOMMENDATION

The staff should consider making the following change before issuing the draft rule for public comment:

The breakaway oxidation testing requirement for each reload batch and annual reporting requirement in the draft rule should be replaced by a requirement that licensees assure that the breakaway oxidation resistance requirements of the proposed rule are met for the fuel in their reactors and provide supporting documentation.

BACKGROUND

Staff Requirements Memorandum SECY-02-0057 directed the staff to develop a rule which replaces current prescriptive criteria with performance-based emergency core cooling system (ECCS) requirements, and expands applicability to all fuel designs and cladding materials. This proposed rule revises ECCS acceptance criteria to reflect research findings related to the various phenomena which affect fuel cladding ductility after a loss-of-coolant accident (LOCA).

We have issued three reports related to this rulemaking, addressing research findings and analyses by NRC and industry, and draft regulatory guides supporting the proposed rule.

DISCUSSION

The staff presented two major topics: an overview of the structure and content of the proposed rule and an ECCS safety performance assessment.

Proposed Rule

The proposed rule is clear and well organized, with the exceptions noted below.

Significant changes or errors are defined in the proposed rule as:

“Peak fuel cladding temperature different by more than 50°F from the temperature calculated for the limiting transient using the last NRC-approved model, or is a cumulation of changes and errors such that the sum of the absolute magnitudes of the respective temperature changes is greater than 50°F”.

or

“Integral time at temperature different by more than 0.4 percent [equivalent cladding reacted] ECR from the oxidation calculated for the limiting transient using the last NRC-approved model, or is a cumulation of changes and errors such that the sum of the absolute magnitudes of the respective oxidation changes is greater than 0.4 percent ECR.”

We agree that it is important for the staff to be informed of changes to the evaluation models. However, the 50°F peak cladding temperature (PCT) significance definition applies to all plants whether their baseline PCT is 1600°F or 2150°F. Similar concerns apply to the 0.4 % ECR significance definition. Greater thought should be given to this matter with the objective of adjusting the reporting requirements to levels that are commensurate with plant specific PCT and ECR margins, and the safety significance associated with changes or errors.

Breakaway Oxidation Measurement and Reporting

Paragraph 50.46c (m)(3) of the proposed rule requires that each holder of an operating license or combined license measure the breakaway oxidation properties of each batch of reload fuel and provide an annual evaluation report of these results to the NRC.

A more effective approach would be to require licensees to assure that the breakaway oxidation resistance requirements of the proposed rule are met for the fuel in their reactors and provide supporting documentation. Licensees would then add this new requirement to the many other fuel quality requirements that must be met in existing fuel supply requirements documents and contracts. Fuel suppliers would perform the required testing in compliance with methods defined in regulatory guides supporting the proposed rule and in a manner consistent with their normal manufacturing and quality control procedures, and provide appropriate documentation to licensees. Licensees would audit the fuel suppliers and be in a position to provide documentation to the NRC that the requirements of the proposed rule are being met.

ECCS Safety Performance Assessment

After the new research findings were obtained, the staff performed a preliminary safety assessment and concluded that there was not an immediate safety concern. Since implementation of new ECCS requirements would take several years, the staff decided that a more detailed safety assessment was necessary. The purpose of this ECCS performance safety assessment was to confirm, on a plant-specific basis, and consistent with the requirements of the proposed rule, the safe operation of the U.S. commercial nuclear fleet. The staff identified the approach and requirements of the assessment and industry offered to provide the needed information. Significant efforts by the BWROG and PWROG resulted in reports which started with ECCS analyses of record, identified initial margins, established credible conservatisms in the ECCS analyses of record, and evaluated margins to cladding embrittlement and breakaway oxidation acceptance criteria in the proposed rule. The staff audited the reports and concluded that all BWRs and PWRs could meet the breakaway oxidation criteria without the need to take credit for available conservatisms in their analyses of record. With respect to cladding embrittlement, the majority of the BWRs and PWRs met the criteria with no adjustments to their analyses of record. The remaining plants met the criteria by incorporating reasonable adjustments into their ECCS analyses. Overall, all operating U.S. plants had margin to the cladding embrittlement and breakaway oxidation acceptance criteria of the proposed rule.

The staff and industry contributors to the BWR and PWR compliance assessments and the ECCS safety performance assessment and audit are commended for their systematic and thorough work. The proposed rule should be issued for public comment after consideration of our recommended change.

Sincerely,

/RA/

J. Sam Armijo
Chairman

REFERENCES

1. NRC Memorandum, "ECCS Performance Safety Assessment and Audit Report," dated September 27, 2011 (Proprietary, ML11262A017)
2. Owner's Group Letter Report, OG-11-143, PWROG, 50.46(b) "Margin Assessment," dated April 29, 2011 (ML11139A309)
3. Owner's Group Letter Report, BWROG-TP-11-010 (Rev. 1), "Evaluation of BWR LOCA Analyses and Margins Against High Burnup Fuel Research Findings," dated June 30, 2011 (ML111950139)
4. ECCS Database (Proprietary, Excel Spreadsheet), dated September 2011

5. Office of Nuclear Regulatory Research Report, "Mechanical Behavior of Ballooned and Ruptured Cladding," dated May 26, 2011 (Proprietary, ML111370032)
6. NRC Memorandum, "Transmittal of Three Draft Regulatory Guides," dated March 30, 2011 (Package, ML110810076)
7. NRC Letter, "Draft Regulatory Guides DG-1261, DG-1262, AND DG-1263," dated June 22, 2011 (ML11164A048)
8. NRC Letter, "Proposed Technical Basis for the Revision to 10 CFR 50.46 LOCA Embrittlement Criteria for Fuel Cladding Materials," dated May 23, 2007 (ML071430639)
9. NRC Letter, "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 (ML083460310)
10. Preliminary Draft Federal Notice, "Performance-Based Emergency Core Cooling Systems (ECCS) Cladding Acceptance Criteria," dated January 10, 2012 (ML12005A004)

5. Office of Nuclear Regulatory Research Report, "Mechanical Behavior of Ballooned and Ruptured Cladding," dated May 26, 2011 (Proprietary, ML111370032)
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10. Preliminary Draft Federal Notice, "Performance-Based Emergency Core Cooling Systems (ECCS) Cladding Acceptance Criteria," dated January 10, 2012 (ML12005A004)

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Letter to The Honorable Gregory B. Jaczko, NRC Chairman, from J. Sam Armijo, ACRS Chairman, dated January 26, 2012

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