

February 25, 2013

MEMORANDUM TO: Anthony J. Mendiola, Chief  
Licensing Processes Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

FROM: Jonathan G. Rowley, Project Manager /RA/  
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Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF AUGUST 22, 2012, MEETING WITH THE  
PRESSURIZED WATER REACTOR OWNERS GROUP  
REGARDING ONGOING GENERIC SAFETY ISSUE 191 ISSUES

On August 22, 2012, a category 2 meeting was held between the U.S. Nuclear Regulatory Commission (NRC) staff and representatives of the Pressurized Water Reactor (PWR) Owners Group (PWROG). The purpose of this meeting was to discuss the PWROG and industry resolution path for resolving Generic Safety Issue 191, "Assessment of Debris Accumulation on PWR Sump Performance" (GSI-191) and the potential for boric acid precipitation with potential for debris to reduce mixing in the core.

The PWROG led a discussion on the conceptual approach to addressing issues that could arise with long term core cooling (LTCC) due to debris entrained in the emergency core cooling system reaching the reactor fuel. The program is intended to assess appropriate debris limits based on individual plant design and operating conditions as opposed to a determining a single, value that bounds all U.S. plant designs. The program intends to consider input received from the Advisory Committee on Reactor Safeguards (ACRS) Thermal Hydraulic Subcommittee meeting from May 2012. The PWROG and NRC staff agreed that assurance of LTCC (as opposed to simply limiting head loss to a specific value) is an acceptable method to resolve the issue. The PWROG also presented information on the proposed thermal hydraulic analyses that can be used to establish the conditions necessary to ensure LTCC.

The NRC staff encouraged the industry to communicate with the NRC staff during the development and performance of the in-vessel debris program. In particular, the NRC staff highlighted the need to communicate during the thermal hydraulic model development. Additional discussions will be held to confirm a communications plan. However, the PWROG identified that it intends to hold discussions with the NRC staff based on technical milestones rather than strictly on regular calendar dates.

The PWROG also stated that it would be conducting an independent third party review (I3PR) and noted that there are two phases to the review. The first is a retrospective look at the initial test program objectives, test plan, and results. Alden Labs was identified as the vendor selected to perform the I3PR. Secondly, the PWROG plans to convene a challenge board to review the final test plan prior to initiating any tests.

A discussion was held regarding a related PWROG program intended to address the potential for debris in the reactor vessel to impact boric acid precipitation. The NRC staff emphasized that the issues are coupled and that a coordinated evaluation of the core blockage and boric acid precipitation was required.

The PWROG indicated that no additional testing will be performed to support Revision 2 of WCAP-16793, "Evaluation of Long-Term Cooling Considering Particulate, Fibrous and Chemical Debris in the Recirculating Fluid," and acknowledged that additional limitations or conditions may be imposed if ACRS concerns cannot be addressed. The PWROG will attempt to find available relevant data that can be used to provide additional data for discussions of WCAP-16793, Revision 2, with the ACRS. The NRC staff will assist with identification of data needed.

The PWROG discussed the purpose of the supplemental information submitted for WCAP-16793, Revision 2. The intent of the submittal was to provide information for utilities that close out Generic Letter 2004-02, and subsequently need to address emergency core cooling system operability issues that occur due to the discovery of unanalyzed debris sources in containment. The supplement is not intended to modify the current licensing bases or new design limits. The PWROG presented the bases for the conservatism document. The NRC Technical Specifications Branch concluded that inclusion of the supplemental information for the purposes of future operability assessments was not an appropriate process. Industry leadership responded that a process must be determined to provide plants with assurance of continued operability when confronted with identification of additional sources of debris. The NRC staff acknowledged that it would be beneficial to establish a consistent protocol for instances when these situations arise. However, the NRC staff stated that the supplemental information would not have a significant impact on the safety evaluation review. The NRC staff did offer some input regarding the development of risk-informed technical specifications that provided a possible avenue for utilities to continue to operate until outage conditions provided an opportunity to remove the debris. Additional discussion will follow as to determine the correct process.

Enclosure 1 is a list of attendees. The slide presentations presented by the PWROG representatives can be found in the ADAMS at Accession Number ML122430287. Enclosure 2 lists the questions asked by the PWROG representatives and participants via the telephone conference line and webinar.

Project No. 694

Enclosures:

1. List of Attendees
2. Questions and Answers

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**ADAMS Accession Nos.: (Package) ML13017A261; (Notice) ML12221A137; (Presentation) ML122430287      NRR-106**

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DATE	2/1/2013	1/31/2013	2/4/2013	2/25/2013	2/25/2013

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List of Attendees

**Public Meeting with the Pressurized Water Reactor Owners Group representatives and  
the U.S. Nuclear Regulatory Commission (NRC) staff to Discuss Ongoing Generic Safety  
Issue-191 Issues**

August 22, 2012

<b>Name</b>	<b>Organization</b>
Fariba Gartland	AREVA NP Inc.
Jeffrey Brown	Arizona Public Service Company
Wei-wu Chao	Atomic Energy Council
Paul Leonard	Consultant
Craig Sellers	Enercon Services, Inc.
Greg Halnon	First Energy Corporation
Mike Testa	First Energy Corporation
Wes McGoun	Legacy Progress Energy
Mark Biery	Mitsubishi Nuclear Energy Systems
Kurt Walter	Mitsubishi Nuclear Energy Systems
Yuta Maruyama	Mitsubishi Nuclear Energy Systems
Josh Wargo	MPR Associates
William A. Cross	NextEra Energy Inc.
Jonathan Rowley	(U.S. Nuclear Regulatory Commission) NRC
Jack Davis	NRC
Anthony Mendiola	NRC
Stewart Bailey	NRC
Steve Smith	NRC
Carl Schulten	NRC
Clint Ashley	NRC
Ervin Geiger	NRC
John Stang	NRC
Chris Van Wert	NRC
Bruce Heida	NRC
Greg Makar	NRC
Mike Cheok	NRC
John Burke	NRC
Paul Klein	NRC
John Butler	Nuclear Energy Institute
Mark Richter	Nuclear Energy Institute
PJ Reyes	Performance Contracting Group
Pete Wilkens	Southern California Edison Company
Jacques Vandenbroek	Southern California Edison Company
Phillip Grissom	Southern Nuclear Operating Company
Jack Stringfellow	Southern Nuclear Operating Company
Tim Croyle	Westinghouse Electric Company
John Maruschak	Westinghouse Electric Company
James Spring	Westinghouse Electric Company
Ron Holloway	Wolf Creek Nuclear Operating Company

ENCLOSURE 1

<b>Name</b>	<b>Organization</b>
Ludwig Haber*	Alden Research Laboratory, Inc.
Megan Stachowiak*	Alion Science and Technology Corp.
Tim Sande*	Alion Science and Technology Corp.
Jay Slaggert*	American Electric Power
Stephen Kinsey*	American Society of Mechanical Engineers
Luke Bockewitz*	Anatech Corporation
Robert Choromokos*	Anatech Corporation
Eugene Moore*	AREVA NP Inc.
Carl Stafford*	Arizona Public Service Company
Nancy Chapman*	Bechtel Power Corporation
Andre Drake*	Constellation Energy
Andrew Kaufman*	Continuum Dynamics, Inc
Lori A. Christensen*	Dominion Energy Kewaunee
Dana Knee*	Dominion Generation
Kurt Flaig*	Dominion Generation
Ari Tuckman*	Duke Energy Carolinas
Eric Cragtree*	Enercon Services, Inc.
Haifeng Li*	Enercon Services, Inc.
Kip Walker*	Enercon Services, Inc.
Kristin Alfieri*	Entergy Nuclear Operations, Inc.
Mark Harris*	Entergy Nuclear Operations, Inc.
Roger Waters*	Entergy Nuclear Operations, Inc.
Valerie Myers*	Entergy Nuclear Operations, Inc.
Wendi Croft*	Exelon Corporation
Roy Linthicum*	Exelon Corporation
Richard Faix*	Florida Power and Light
Stan Wisla*	Florida Power and Light
Charles Feist*	Luminant Energy
Joseph Gasper*	Omaha Public Power District
Shinji Otani*	Mitsubishi Nuclear Energy Systems
Greg Quitorian*	Pacific Gas and Electric Company
Christopher Kudla*	Performance Contracting Group
Craig Miller*	Progress Energy
Don Phillips*	Progress Energy
Emily Maguire*	Public Service Electric and Gas Co.
Helmut Kopke*	Sargent and Lundy
Kenneth Leonelli*	South Carolina Electric and Gas Co.
Ernie Kee*	South Texas Project Electric Generating Station
Jonathan Nevins*	Southern Nuclear Operating Company
Ken Petersen*	STARS Alliance
Nathan Miller*	Transco Products Inc.
Kenneth Nemit*	Westinghouse Electric Company

\* Participated via webinar or telephone conferencing

<b>Name</b>	<b>Organization</b>
Anthony Nowinowski*	Westinghouse Electric Company
Paul Young*	Wolf Creek Nuclear Operating Company
Jason Loeffler*	Xcel Energy Operating Company
Dale Vincent*	Xcel Energy Operating Company

\*Participated via webinar or telephone conferencing

**Pressurized Water Reactor Owners Group and Other Participant Questions**  
**with the U.S. Nuclear Regulatory Commission (NRC) Staff Answers**

**Question 1:** SECY-12-0093 identifies three options for closure of Generic Safety Issue (GSI)-191. Option 1 is called "Demonstrate Compliance with 10CFR50.46 [Title 10 of the *Code of Federal Regulations* Part 50.46] Based on Approved Models," which implies that this is the only option that ensures compliance with 10 CFR 50.46 and does not require an exemption. However, the first sentence on page 8 under POLICY DISCUSSION indicates that only the risk-informed path in Option 2 would need an exemption from certain requirements of 10 CFR 50.46. Does the NRC staff agree that Option 2 Deterministic (Plant-Specific Testing and Analyses) would also meet the requirements of 10 CFR 50.46?

**Answer:** The title of Option 1 is not meant to imply that Option 1 is the only way of demonstrating compliance with 10 CFR 50.46. The Options were developed based on two primary considerations: (1) the level of maturity of the technical models – established vs. requiring further development and (2) the final licensing basis for the plant – compliance vs. exemption. The only title that is explicit in this respect is the Option 1 title. Option 2 deterministic methods are expected to meet the requirements of 10 CFR 50.46 and not require an exemption.

**Question 2:** A plant that does not meet 15 grams of fiber per fuel assembly (g/FA) limit (proposed limit) may identify refinements to the approved methods in WCAP-16793, Revision 2, that would still be conservative and deterministic in justifying a higher fiber limit than 15 grams or in demonstrating that chemical effects does not occur before initiation of hot leg recirculation. How is that plant expected to classify itself in its December 2012 letter to the NRC? Is that plant in a "modified version" of Option 1 (i.e., can't meet 15 grams but other deterministic approach will be employed) or in Option 2 Deterministic?

**Answer:** In the NRC staff's view, the method for demonstrating a fiber limit higher than 15 grams per assembly needs further development. Credit for delay of chemical effects may be relatively straight forward, but questions about boric acid precipitation are being addressed generically on the timeframe discussed in the meeting. Therefore, the NRC staff would expect a plant that is justifying a higher fiber limit to be classified as Option 2.

**Question 3:** If a plant meets 15 g/FA (proposed limit) or if a plant chooses Option 1 in December 2012, with the possibility that bypass testing does not meet the current acceptance value and has determined that the limit is too restrictive to use for its long-term licensing basis, it may choose to defer GSI-191 closure until the PWROG comprehensive program provides more relaxed acceptance criteria for implementation. Would the qualifying plant have to implement "additional defense-in-depth measures to mitigate risk," as required by Option 2 Deterministic even though it can meet all the Option 1 requirements?

**Answer:** If a plant can meet all of the Option 1 requirements, the plant can remain in Option 1. Additional refinements (e.g., future testing that increases margin) can be adopted later under the provisions of 10 CFR 50.59. If a plant is classified as Option 1 and future bypass testing does not meet the assumptions for that classification, the NRC staff would expect the plant to follow the guidelines under Option 2, which include mitigative measures.

**Question 4:** Pages 8 and 9 of Enclosure 2 introduce the concept of event timing and operator actions and implies that any such technical approach is risk-informed. This type of discussion is not found in Option 1 or Option 2 Deterministic, although the concept of modeling improvements and refinements are applied without definition. However, the explicit language under Option 3 indicates that the NRC staff considers these types of technical arguments to fall under a "risk-informed" treatment for in-vessel effects. This is in contrast to experiences where the NRC staff has accepted deterministic solutions for strainer performance using both event timing (e.g., no appreciable chemical precipitants before X hours when net positive suction head margin is large) and operator actions (e.g., reduce containment spray trains within Y hours to reduce flow through the strainer). The NRC staff is requested to clarify how event timing and proceduralized operator actions are considered. The PWROG believes that these elements can be part of a deterministic solution that falls under Option 1 or Option 2 Deterministic.

**Answer:** The NRC staff concurs that event timing and operator actions that effect event timing, can be credited in a deterministic evaluation. The NRC staff has accepted these arguments for a number of licensees. The intent of the discussion in SECY-12-0093 was to emphasize that an exemption may not be needed for Option 3.

**Question 5:** Background page 5: Can the NRC provide specific references to the basis for statements made under "Refinements to Methodologies." These refinements are not generally known and it may be useful for the PWROG/Nuclear Energy Institute (NEI) to provide details to members and consider in future test plans.

**Answer:** The NRC staff does not have a comprehensive list of refinements that have been used by licensees in their GL 2004-02 submittals. The referenced section discusses the most prominent refinements that have been used by licensees to date. It is recommended that if a comprehensive list of refinements is useful that NEI or the PWROG poll licensees to determine what refinements have been used and the extent to which they have supported their GL 2004-02 evaluations. The NRC staff believes that most of the refinements used are relatively widely understood by licensees and others performing strainer and in-vessel evaluations so that such an undertaking may not be worthwhile. The purpose of the section on "Refinements to Methodologies" is to illustrate that the staff has accepted refinements that have been justified, and to communicate that the staff will consider additional refinements proposed by industry.

**Question 6:** Cover letter and Enclosure 2, page 1: What conditions and limitations might be placed on the topical report, WCAP-16793, Revision 2?

**Answer:** The PWROG has reviewed the SE, including the conditions and limitations, for proprietary concerns. Licensees may contact the PWROG if they desire to know the specific conditions and limitations. The NRC staff anticipates that the SE will be issued in the very near term if it has not been issued prior to this meeting summary.

**Question 7:** In the Background Discussion and Technical Issues the NRC staff points out that the transition break size (TBS) has not been fully utilized because of conservative modeling assumptions have not been fully relaxed by the NRC staff. The NRC staff's statement of their perception (Enclosure 1, page 10, bottom paragraph) that refinements would not help plants meet the very low in-vessel fiber limits prohibits the application of refinements that could have



assisted some plants in developing a resolution path based on alternative methods. Why was this alternative been eliminated from the resolution options?

**Answer:** The TBS approach is still available for licensees to use in resolving GSI-191. Guidance is available in Section 6 of NEI 04-07 and the NRC staff's Safety Evaluation (SE) on NEI 04-07. At the moment, the NRC staff anticipates that this approach will result in an exemption because proposed rule 10 CFR 50.46(a) (since withdrawn) will not be adopted in the near term. The statement that refinements would not help plants meet the very low in-vessel limits is in response to industry statements that latent debris alone is sufficient to reach the in-vessel limits for some plants; therefore, refinements such as a reduced zone of influence would not be sufficient to address in-vessel concerns.

**Question 8:** If the PWROG decides to pursue the holistic approach and not currently address the ACRS open items related to WCAP-16793, what are the implications for the SE on WCAP-16793 that would allow low fiber plants to close out GSI-191?

**Answer:** The SE will be issued with a 15 gram limit. This limit may be used by plants wishing to close out the generic letter.

**Question 9:** If the PWROG does not dedicate resources to addressing ACRS questions related to WCAP-16793, Revision 2 (i.e., focus on new projects), what are the implications for the issuance of the SE on WCAP-16793 that would allow plants meeting the "clean-plant" criteria to close GSI-191?

**Answer:** Plants may use 15 g/FA as a limit for closure of the GL.

**Question 10:** The NRC staff approved "clean-plant" criteria to resolve in-vessel issues in a letter to the NRC dated May 2, 2012. The in-vessel guidance used the 15 g/FA limit from WCAP-16793, Revision 2 and generic bypass and transport percentages. The NRC staff stated that plants may use the 45 percent bypass assumption if it can be shown to be valid for their plant conditions. What kind of validation was the NRC looking for in justifying this generic bypass assumption?

**Answer:** The NRC staff expects that 45 percent bypass is conservative for all strainers installed in existing US PWRs. The value was obtained using a small amount of fiber that was prepared as 100 percent fines using a conservative size distribution for acceptance. The small fiber amount is conservative because it would not allow a filtering bed to increase the amount of fiber trapped on the strainer, and the small size distribution allows a greater percentage of fiber to bypass the strainer. The testing was conducted on strainer modules constructed of perforated plates at flow velocities representative of those typical for installed strainers. Several licensees have performed, or are planning to perform bypass testing to gain additional margin. Licensees should consider the results of this testing when evaluating the applicability of the 45 percent bypass value to their strainer.

**Question 11:** Referring to the question regarding the 45 percent generic bypass percentage, would that mean that the NRC is expecting some sort of bypass testing will be performed to show that the 45 percent is met or could more of a qualitative approach based on strainer parameters be taken to justify it?

**Answer:** The NRC staff is aware that some bypass testing has already been performed, additional testing is ongoing, and more testing is planned by several licensees. These licensees plan to recoup margin in the NRC approved value of 45 percent. A qualitative approach may be used to justify the 45 percent value in lieu of plant specific testing. For a qualitative evaluation, licensees should compare strainer parameters important to bypass with those of licensees who have performed testing. If a licensee desires to reduce the bypass percentage used in their downstream evaluations to below the 45 percent approved value, the staff would expect a more detailed comparison showing that the other testing is conservative with respect to the plant being evaluated.