April 1, 2010

MEMORANDUM TO: Stacey L. Rosenberg, Chief
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Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

FROM: Holly D. Cruz, Project Manager **/RA/**
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Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF THE DECEMBER 16, 2009, CATEGORY 2 PUBLIC MEETING (WITH PORTIONS CLOSED) BETWEEN THE U.S. NUCLEAR REGULATORY COMMISSION AND THE PRESSURIZED WATER REACTOR OWNERS GROUP REGARDING REDUCED ZONE-OF-INFLUENCE TESTING OF INSULATION MATERIALS FOR RESOLUTION OF GENERIC SAFETY ISSUE - 191

On December 16, 2009, a Category 2 public meeting (with portions closed) was held between the U.S. Nuclear Regulatory Commission (NRC) staff and representatives of the Pressurized Water Reactor Owners Group (PWROG) at One/Two White Flint North, Conference Rooms O-1-F/G16 and T-8-A1 11555/11545 Rockville Pike, Rockville, MD 20852, to discuss the PWROG's approach to resolving NRC staff questions on certain assumptions that some licensees have made regarding the generation of debris following a hypothetical loss-of-coolant accident. The assumptions, based on industry insulation testing documents, result in a significant reduction (as compared to guidance in the NRC's 2004 Safety Evaluation on Nuclear Energy Institute [NEI] document NEI 04-07, Agencywide Documents Access and Management System (ADAMS) Accession No. ML051460182) in the amount of debris assumed to be generated as a result of a coolant pipe break. The volume surrounding a hypothetical break within which insulation damage would be expected to occur is known as the zone of influence (ZOI). The relevance of the ZOI size to containment sump strainer performance is that a larger predicted ZOI results in a larger predicted fiber quantity which must be evaluated as potentially reaching and clogging the strainers. A list of meeting attendees is enclosed and the meeting agenda dated December 3, 2009, ADAMS Accession No. ML093340472.

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During NRC opening remarks, Mr. Michael Scott, Safety Issues Resolution Branch Chief, noted that the NRC staff had interacted substantially with the PWROG and Westinghouse in the months leading up to the public meeting regarding two of its insulation test reports that greatly reduce the ZOI for some insulations. Mr. Scott expressed disappointment that a large error in the 2007 ZOI testing was identified only a few days prior to the meeting as a direct result of NRC staff questions. The error was related to several locations of small diameter piping upstream of the test nozzle, which choked the jet flow during the test, and resulted in non-conservative test results. Mr. Scott stated that the error will likely result in revised submittals by every licensee that relies on the test reports. In addition, Mr. Scott stated that those revised submittals may or may not be able to reference the reports, and that the NRC would be communicating with all affected plants in the beginning of 2010.

Following the opening remarks, Mr. John Maruschak, of the Westinghouse Electric Company (Westinghouse), presented a briefing regarding the PWROG's plans to address NRC staff questions (ADAMS Accession No. ML100060467). The NRC staff's questions are grouped into seven main issues, some of which have a number of questions. Mr. Maruschak covered each issue, including PWROG responses to those questions that the NRC staff considers to have already been adequately answered. The NRC staff interacted with the PWROG throughout the presentation and provided staff views on each of the issues. The following is a brief summary of each issue's status.

ISSUE 1: The NRC staff concern was that the Westinghouse tests did not maximize shock waves and resulted in potentially non-conservative test results. Prior to the public meeting, the PWROG had hired scientific experts, performed technical analyses, and referenced experimental data to support its conclusions that significant shock waves will not occur during a cold-leg or a hot-leg break. After reviewing all available information, the NRC staff agreed with the PWROG conclusion. However, the NRC staff noted that the Westinghouse tests, which were performed using a sub-cooled jet, should not be applied to postulated breaks on steam-bearing piping (e.g., within the steam space of the pressurizer or secondary steam lines where applicable). For these postulated break locations, the recommended ZOIs in the 2004 safety evaluation should be assumed or separate insulation testing using a single-phase steam jet should be performed. The NRC staff has confidence this issue will be resolved when the PWROG makes its docketed submittal to respond to the NRC staff questions on the ZOI reductions.

ISSUE 2A, ISSUE 2D, ISSUE 2G: The PWROG proposed using finite element analysis (FEA) to model the forces of a full-scale jet on a full-scale target. The NRC staff did not have confidence in this approach because the FEA had not been developed at the time of the meeting, and use of FEA would likely require additional testing to benchmark the model. As an alternative approach, the NRC staff noted that the Safety Evaluation (SE) for topical report NEDO-32686, "Utility Resolution Guidance [URG] for ECCS Suction Strainer Blockage," ADAMS Accession No. ML092530482, provided a simple method for scaling test results to the plant condition. The PWROG reviewed this method and stated they will use the SE method to scale the test results. The NRC staff has confidence this issue will be resolved when the PWROG makes its docketed submittal.

ISSUE 2B: The PWROG position was that center-focused damage from the jet only occurs at distances less than 3D (3 pipe-diameters equivalent spherical jet volume). The NRC staff did not agree with the PWROG position and noted evidence of center-focused indentations on test

targets as far as 5D for jacketed NUKON tests. However, the NRC staff noted that the radial profile of the jet gets flatter the further away the target is from the jet. The NRC staff noted that the 8D test did not show any evidence of center-focused damage. In addition, the 8D test for jacketed NUKON was the closest test where the jacketing remained on the insulation for the duration of the test. The NRC staff position is that this issue is not a concern for jacketed NUKON at distances corresponding to 8D during the test. The NRC staff also noted that 8D is only used as a reference point for discussion of the Westinghouse tests. The actual spherical equivalent when all the NRC staff issues are addressed (e.g. scaling of test results and accounting for upstream choke locations) may be significantly larger. The NRC staff has confidence this issue will be resolved when the PWROG makes its docketed submittal or will be resolved through the proposed PWROG testing of unjacketed NUKON insulation.

ISSUE 2C, ISSUE 2F: The PWROG proposed new testing of unjacketed insulation on a reactor coolant pump bowl and representative panels of steam generator insulation for the worst possible impingement angle and an axial case to address 2F. The NRC staff still needs to understand details regarding how the insulation will be attached to the test stand and how the angle and distance of the targets will bound the plant condition. However, as these are only clarifications, the NRC staff has confidence this issue will be resolved through the proposed PWROG testing.

ISSUE 3: The NRC staff concern was that Westinghouse performed a test at 5D where the metal jacketing for NUKON insulation was blown off during the test, but the underlying insulation was relatively undamaged. The test report stated that unjacketed NUKON was undamaged at the tested distance. The NRC staff did not agree with this conclusion and stated that success criteria for jacketed insulation systems should be that the jacketing remains intact for the duration of the test. The reason for this conclusion is that the jacketing could have been ejected at any time during the test and it is impossible to determine how long the unjacketed insulation was subjected to the jet or that it would not be damaged in a subsequent test if the jacketing was ejected sooner. The closest test where the jacketing remained intact was the test ran at the calculated 8D distance. The NRC staff again noted that 8D is only used as a reference point for discussion of the Westinghouse tests. The actual spherical equivalent when all the NRC staff issues are addressed (e.g. scaling of test results and accounting for upstream choke locations) may be significantly larger. The PWROG stated they intend to perform new testing of unjacketed insulation at distances less than 8D to show that the smaller ZOIs are justifiable for jacketed NUKON. The NRC staff agrees that smaller ZOIs will be justified if testing shows unjacketed NUKON insulation survives the entire blowdown at distances less than 8D. The NRC staff has confidence this issue will be resolved when the PWROG makes its docketed submittal or will be resolved through the proposed PWROG testing of unjacketed NUKON insulation.

ISSUE 4A: The NRC staff understands how the PWROG used the American National Standards Institute (ANSI) model to relate test pressures at the test targets to equivalent spherical volumes in the plant. The NRC staff has confidence this issue will be resolved when the PWROG makes its docketed submittal.

ISSUE 4B: The PWROG also showed through a sensitivity calculation that the use of the test tank temperature in the ANSI model calculation resulted in only a small change to the calculated ZOIs (e.g. 8D ZOI changes to an 8.15D ZOI). The NRC staff stated that the actual test tank temperature should have been used in the PWROG ANSI model calculation, but the NRC staff

agrees that the impact was minor. The NRC staff has confidence this issue will be resolved when the PWROG makes its docketed submittal.

ISSUE 4C: The NRC staff noted concerns with the accuracy of the mass flow-rate used as an input to the ANSI model calculations for the test conditions. The NRC staff also stated they did not have confidence in using the ANSI free jet expansion model given the upstream choke locations that existed in the previous test apparatus. Specifically, the PWROG informed the NRC staff via teleconference on December 14, 2009 that an internal diameter of 2.625" existed in a reducer upstream of the 3.54" jet nozzle, which resulted in choking the jet flow and non-conservative test results. In addition, the PWROG submitted a partial hand-sketch of the test facility on December 14, 2009, that included the dimensions of the reducer as well as a 13-inch length of pipe between the rupture disks that had an internal diameter of 2.9". This was identified by the PWROG as a second potential choke location upstream of the jet nozzle. In light of the new information regarding upstream choke locations, the NRC staff stated during the public meeting that to have confidence in the previous test results, the PWROG must re-run the previous tested condition several times (at least 3) using pressure instruments at different axial locations with central and radial pressure measurements to fit the previous test jet to the ANSI model. The PWROG committed to performing the stated jet tests and measurements. The NRC staff has confidence this issue will be resolved through the proposed PWROG testing and subsequent recalculation of previous test ZOIs.

ISSUE 5: The PWROG was not able to provide the requested information at the time of the meeting but stated that they are attempting to get the detailed test apparatus information and will provide the information to the NRC staff as soon as possible. A representative of Westinghouse stated that the upstream choke issue has been entered into Westinghouse's Potential Issue (PI) system and will be evaluated for Part 21 applicability and potential extent-of-condition concerns as applicable. The NRC staff will need the requested information to determine that Issue 5 is resolved.

ISSUE 6: The NRC staff has confidence this issue will be resolved when the PWROG makes its docketed submittal or this issue will be resolved through the proposed PWROG testing of unjacketed NUKON piping insulation at distances less than previous tests of jacketed NUKON insulation where the jacketing survived (i.e. previously calculated 8D location).

ISSUE 7: The PWROG responded to this NRC staff concern by making a plant-specific argument that the insulation in question could not be impacted by the jet due to its location. As a result, the test did not need to be credited. The NRC staff noted that other plants should not credit this test result either. The NRC staff has confidence this issue will be resolved when the PWROG makes its docketed submittal.

Follow-up Actions

During the meeting, the NRC staff determined that the reduced ZOIs have not been acceptably justified by the testing that has been performed to date. In response, the PWROG intends to recalculate previous ZOIs based on upstream choke locations, the URG SE scaling method, and pressure measurements of the previous test jet. In addition, the PWROG stated that it will perform additional testing in January 2010 to acceptably justify reduced ZOIs for jacketed NUKON on piping and large components. The NRC staff stated that it recognizes that new testing, as discussed at this meeting, might address the NRC staff's remaining concerns.

However, the NRC staff stated that it considered it prudent to begin the process of taking additional regulatory action to deal with the possibility that the PWROG will not be able to complete its work as stated herein by the end of January 2010. The NRC staff stated that it is not willing for this issue to remain unresolved for an extended period. Therefore, the NRC staff stated that it intended to develop letters in accordance with 10 CFR 50.54(f) to all affected licensees that will ask them to respond in writing regarding how they intend to ensure compliance given the NRC staff's position on use of the subject ZOI documents. The NRC staff stated that it planned to issue the letters by the end of January 2010. Should the PWROG resolve remaining issues regarding the subject ZOI documents by the end of January 2010, the NRC staff may revisit the content, need for, and/or timing of the letters. Licensee responses to the letters may reflect any resolution that occurs after January 2010 as documented in official NRC correspondence on the subject.

In addition to the NRC staff decision to send letters to all affected licensees, a number of other follow-up actions were identified during the meeting. They are listed below:

1. Westinghouse will provide the NRC staff a basis for the proposed impingement angle for the new large component insulation testing prior to the testing being performed.

2. Westinghouse will provide the NRC staff a basis that shows surge line breaks will be bounded by the impingement angle assumptions of the new large component insulation testing prior to the testing being performed.

3. Westinghouse will provide details to the NRC staff of the previous test apparatus as soon as possible.

4. A Westinghouse representative will contact the NRC staff on December 18, 2009, to provide a schedule for PI (potential issue) resolution regarding the upstream choke location during the previous tests.

5. A phone call will be scheduled for the week of December 28, 2009, to discuss testing instrumentation and impingement angle.

6. Westinghouse stated it would provide NRC staff the results of the PI review when completed.

7. The NRC staff agreed to schedule a phone call the week of January 11, 2010, with the NEI to discuss the likely contents of the NRC letters that will be issued to licensees in the beginning of 2010.

8. The PWROG agreed to perform new testing beginning in mid-January and lasting approximately two weeks.

9. The PWROG agreed to have a phone call with NRC staff on or about January 28, 2010,to discuss preliminary test results.

10. The NRC staff agreed to include guidance in the licensee letters on how reduced ZOIs for jacketed NUKON on piping may be achieved using sure-hold bands in accordance with the NEI 2004-07 SE.

11. The NRC staff will schedule a public meeting with the PWROG on February 16, 2010, to discuss the final results of the new testing.

12. The PWROG will formally submit all previously discussed documents by March 1, 2010, to address the NRC staff's questions regarding the previous testing reports.

13. The PWROG will also formally submit the new test results by March 1, 2010.

The PWROG handout is available in ADAMS as Accession No. ML093570159.

Members of the public were in attendance and also participated via bridgeline. Public meeting feedback forms were provided, none were received.

Project No.: 694

Enclosure: List of Attendees

cc w/encl: See next page

11. The NRC staff will schedule a public meeting with the PWROG on February 16, 2010, to discuss the final results of the new testing.

12. The PWROG will formally submit all previously discussed documents by March 1, 2010, to address the NRC staff's questions regarding the previous testing reports.

13. The PWROG will also formally submit the new test results by March 1, 2010.

The PWROG handout is available in ADAMS as Accession No. ML093570159.

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ADAMS Accession No: ML100040263 (Package); ML093340472 (Notice); ML093570159 (Handouts); ML100040251 (Summary) NRC-001

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NAME	HCruz	CHawes for DBaxley	MScott	EBowman	HCruz
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Memo to Stacey L. Rosenberg from Holly D. Cruz dated February __, 2010

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ENCLOSURE

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