July 15, 2015

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

FROM: Jason J. Drake, Project Manager **/RA/**
Licensing Processes Branch
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Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF 1ST QUARTER 2015 PUBLIC TELECONFERENCE MEETING SERIES WITH THE BOILING WATER REACTOR OWNERS' GROUP

The U.S. Nuclear Regulatory Commission (NRC) staff engaged with representatives of the Boiling Water Reactor (BWR) Owner's Group (BWROG) in a series of public teleconferences. The teleconference series was intended as a follow-up to the December 4, 2014, public meeting, allowing NRC staff and BWROG representatives to expand discussions on key near-term BWR emergency core cooling system (ECCS) suction strainer (SS) issues. The teleconference series was comprised of three parts as identified in the body of the document. For reference, the December 4, 2014, public meeting summary can be found in the Agencywide Documents Access and Management System (ADAMS) at Accession No. ML14356A148.

Teleconference Series Details and Summary:

A. **January 8, 2015 - Chemical Effects: Review of BWROG-14003 (ML14027A137) "BWR Material Dissolution Test Plan," BWROG-ECCS-TP-4-1**

The notice of public teleconference between the NRC and the BWROG is found under ADAMS Accession No. ML14357A132.

The NRC staff presented the following comments on the BWR Material Dissolution Test Plan, and BWROG-14064, "Submittal of Requested Non-Proprietary BWROG Supplemental Reports on Post-LOCA [Loss-of-Coolant Accident] BWR Primary Containment Material Dissolution" (ADAMS Accession No. ML14328A636):

1) The NRC staff asked about BWROG plans for verifying the thoroughness and completeness of the plant material survey responses. The BWROG representatives indicated that data verification is underway. The NRC staff noted that it is important for plants to provide an accurate accounting of plant materials and post-LOCA

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environments so that future testing is designed to provide representative results for the range of plant conditions. For example, the plant material survey results show a minority of plants containing galvanized steel. It is not clear to the NRC staff if the remaining plants that did not report a value have little galvanized steel or were not able to estimate the quantity in time to respond to the survey.

BWROG Response: *The BWROG had no additional comments.*

2) The NRC staff stated that each plant should evaluate its specific conditions that may be the most challenging over the plant-specific range of materials and post-LOCA environment combinations. For example, plants with larger quantities of zinc or uncoated carbon steel will need to determine if post-LOCA accident conditions could result in a lower pH environment for an extended time. In contrast, plants with larger quantities of aluminum will need to determine if post-LOCA accident conditions could result in a higher pH environment for an extended time. Plants with a time delay before sodium pentaborate addition will need to determine if material dissolved prior to pentaborate addition will precipitate after pentaborate addition.

BWROG Response: *The BWROG had no additional comments.*

3) The NRC staff asked for clarification on the flow conditions for bench testing. Flow may be an important factor with respect to chemical effects for some materials. For example, the NWT Report, "Review of Boiling Water Reactor Material Dissolution in Post-LOCA Containment Solutions" (ADAMS Accession No. ML14328A369) states on page 9-3 that release rates for iron are expected to be a strong function of liquid velocity. The NRC staff questioned if the release rates calculated may be non-conservative in those cases where a significant amount of corrosion product was retained on the test coupon. The NRC staff questioned if corrosion products retained on a coupon during a test with little or no flow might be removed in a post-accident environment under greater flow or by cascading water from a higher elevation. Measurements of metallic coupon mass loss did not follow ASTM G-1 standard procedures for removing corrosion product following the test.

BWROG Response: *The BWROG identified that it did not descale coupons following benchtop testing, and that the amount of corrosion products retained on the coupons were quantified to provide the amount of material on the coupon that could potentially be released in a post-accident environment. Testing has been proposed to determine the corrosion and release rates from galvanized carbon steel and aluminum 1100 in demineralized water and in a sodium pentaborate solution at ~200°F and velocities of 0.1, 0.5, 1, and 5 fps over a 4 day period. Data is currently available in stagnant water and in solutions exposed to low and unquantified velocities induced by magnetic stirrers, intermittent air bubbling, and test vessel "rocking." Solutions will be circulated through a 1 to 2 liter polycarbonate feed container with visual inspections for precipitate formation and oxide scale release. Sampling and analysis will be performed intermittently during the test period. Coupons will be exposed in polycarbonate pipe.*

4) The NRC staff discussed results from international experience that corrosion of galvanized steel, in a falling water condition caused head loss issues with the sump filter bed. The BWROG representatives and NRC staff discussed the differences in water chemistry between the international tests and the BWR environment. The NRC staff stated that they would review the available information from the test series to determine if any tests were performed without boric acid addition.

   BWROG Response: The BWROG had no additional comments.

5) The NRC staff asked if future testing will include calcium silicate and micro-porous type insulation materials. The BWROG representatives indicated they will be evaluating the upcoming test materials based on the updated plant material survey and that the NRC staff will be given an opportunity to comment on the test plan. The NRC staff appreciates the opportunity to review plans and discuss questions prior to testing as the NRC staff thinks this is mutually beneficial.

   BWROG Response: The BWROG had no additional comments.

6) The BWROG representatives indicated that the results from earlier bench tests performed with Pyrex containers would not be used due to concerns with leaching from the container.

   BWROG Response: The BWROG clarified that Pyrex was only used in the initial Alion tests and its use was quickly eliminated from consideration. Results from tests with Pyrex containers were not considered in developing a test plan. All current and future benchtop tests shall be performed with non-reactive containers according to the BWROG.

7) The BWROG representatives indicated that they would review previous test information and get back to the NRC staff concerning a few items:

   a) Any differences in test conditions between LCS-B160 and LCS-B160A. The NRC staff noted a significant difference in the test results for these two tests.

   b) Details concerning Table 6.3 in Alion Report, “BWR Material Dissolution and Corrosion Evaluation Report.” In particular, how the “maximum dissolved aluminum” and “filtered sample dissolved aluminum” values were obtained for tests AL-SLCS-160 and AL-SLCS-160-200.

   c) The filter pore size for the filtering discussed on page 38 of the Alion Report. The NRC staff noted that the discussion for Test AL-SLCS-160C stated that precipitates may have either re-dissolved or passed through the filter paper.

   BWROG Response: The BWROG had no additional comments.

B. **January 22, 2015 - Fuels Testing Program: Benchtop Testing (BT2)**

The notice of public teleconference between the NRC and the BWROG is found under ADAMS Accession No. ML15012A410.

The BWROG representatives noted in the beginning of the teleconference that the test in question, BT2, was aimed at evaluating whether or not surface roughness is important in debris bed formation and resilience. The BWROG representatives continued by identifying that potential interactions between surface roughness and other parameters are therefore not considered at the present time. The NRC staff emphasized the need to stay in a prototypical range for the fixed parameters. The applicable parameters discussed were: fiber size distribution, particulate size distribution, debris concentration, and water chemistry.

The NRC staff presented the following comments during the teleconference:

1) If the test is successful, which of the request for additional information (RAI) questions submitted against NEDC-3308P, Revision 2 (ADAMS Accession No. ML11194A107) would be considered closed? From previous communication, the NRC staff understood the intended resolution list for BT2 includes RAI questions: 4b, 6a, 6c, 23a, and 27b. Is this still an accurate listing?

   BWROG Response: The BWROG indicated that the RAI questions referenced by the NRC staff are anticipated to be closed out by successful BT2 testing results.

2) Please explain the operation of the BT2 test loop and provide feedback on how shakedown tests have validated the loop operation and assumptions regarding loop operation.

   BWROG Response: The BWROG indicated that the test loop diagram was discussed in more detail than in the previous face-to-face meeting to better describe the test sequence. Replacement of the check valve with a slide gate valve has eliminated the need for a separate fill pump.

3) How is debris suspension assured? Is it a visual check? How does the manual stirring work to suspend debris? Was this validated during shakedown testing?

   BWROG Response: The BWROG representatives clarified that the mixing methods have not been validated in shakedown testing. The test plan establishes criteria that must be evaluated either during each test or in the facility inspection. Objective evidence that the requirements outlined in the test plan have been met must be collected. The BWROG representatives stated that Alden will document adequate mixing in the debris preparation and the region above the slide gate. This evaluation will be a visual evaluation. Alden is confident adequate mixing can be maintained, leveraging the experience of ongoing larger scale tank tests.

4) Is the debris arrival timing typical of the plant. Could this affect the sensitivity of debris adhesion to various surfaces?

   BWROG Response: The BWROG representatives noted that the debris arrival is not typical of the plant since the test is specifically aimed at establishing a debris bed and checking whether the debris bed forms differently depending on fuel rod surface roughness. However, the BWROG representatives identified that the initial concentration for testing is based on bounding estimates of debris concentration within the suppression pool (referred to as the torus during the call). No accident time-based conclusions will be drawn from the testing. Eventually it will be required, during Test 3 in the full-height fuel bundle test program, to demonstrate that the lower tie plate does not become blocked until a certain amount of time has elapsed (mentioned 5 minutes on the call). The BWROG representatives clarified that this is not the case for BT2.

5) What are the particulate debris characteristics? Pressurized water reactor (PWR) testing found that having some larger diameter particulate resulted in higher head losses. Could this influence the results of BT2?

   BWROG Response: The BWROG representatives emphasized that the test is not aimed at determining the debris characteristics for full height bundle testing but rather to be sufficiently close to those debris characteristics to allow the conclusion to be made that fuel rod surface roughness does or does not matter. Little information is known about realistic coating size distribution, but the utility resolution guidance (URG) document provides sludge size distribution values based on suppression pool clean-up sampling. The sludge is typically the dominant contributor to the particulate source term and therefore any uncertainties in regard to size distribution in the coatings contribution has less effect. Since the tests are aimed at determining if surface roughness is important, the specific size distribution for coatings particulate is not as important in these tests. The NRC staff expressed concern that the behavior with different size particulate could be different and urged the BWROG to consider sensitivity to particulate size distribution.

6) Is the debris concentration typical or conservative with respect to the limiting plant condition (high concentration)? Could having a non-conservative concentration of debris in the column affect the sensitivity of the test?

   BWROG Response: The BWROG representatives identified that the debris concentration was developed based on a conservative estimate for the suppression pool when all debris has transported to the suppression pool. The NRC staff expressed concern that this concentration may be very far away from concentrations expected within the fuel assembly due to boil-off and therefore not sufficiently prototypical. The BWROG representatives raised the point that the intention is to build a debris bed and if this is not possible at the concentration established for the test as a starting point, the concentration would be increased. The test plan provides for a method to raise debris concentration so that more debris can be added to the test since the test plan specifically limits the maximum debris slurry volume to 20 gallons. The NRC staff remains concerned that the concentration after longer

boil-off times could lead to different behavior at the spacer grid, relative to the effects of surface roughness.

7) Please explain how the rod stubs are manufactured and what the physical characteristics of the rods are when assembled. Is either end open? How are the rod segments joined?

   BWROG Response: The BWROG representatives explained that the reference fuel rod stubs will be made in a single piece without a seam in the middle. Surface modified rods will be manufactured in two parts to prevent the surface from being altered significantly due to insertion. The two sections will likely be connected using a rubber plug. The test plan contains a requirement that there be no flow through the fuel rods. The fuel rod tips will be manufactured using rapid prototyping.

8) Is the water quality important to the determinations made by this test? The NRC staff concluded that water quality should be maintained consistent throughout the test program unless otherwise justified.

   BWROG Response: The BWROG representatives noted that the current plan is to use tap water. The NRC staff expressed concern that tap water may not be prototypical and emphasized the need to maintain all test parameters in the prototypical range unless information is available to support that the parameter is not important. The BWROG representatives noted that Alden currently does not have water chemistry input data to compare tap water to expected suppression pool water chemistry. However, the chemical effects test program required input on water chemistry of the suppression pools and could be leveraged to better understand prototypical water conditions. The BWROG representatives emphasized that the objective of BT2, which is to verify that surface roughness is not important in debris bed formation or resilience to air removal, is unlikely to be a function of the water quality. However, the NRC staff felt strongly that test conditions must be maintained in a prototypical range. The BWROG agreed to consider testing in prototypical water.

9) Does the debris preparation method create fibrous debris that is consistent in size to that determined during bypass testing?

   BWROG Response: The BWROG representatives indicated that the fibrous debris size distribution obtained by the method outlined in the test plan will be compared to that from the bypass testing as well as other available data to make sure it is sufficiently similar. However, an exact match will not be pursued. The NRC staff was interested in seeing the final comparison between the bypass size distribution and that obtained via the method provided in the test plan.

10) What is meant by the term “bulking” of the water?

    BWROG Response: The BWROG defined the term “bulking” as what is expected to occur within the test chamber when counter-current air flow is initiated. The apparent mean density of the fluid above the spacer grid will go up causing the fluid level in the inlet chamber to increase.

11) Discussion on key considerations for the test assembly height and whether it is high/long enough to capture the scale of the two-phase behavior. If the fiber/particulate suspension is significantly more viscous than demineralized water, we might expect the formation of larger slugs of air.

BWROG Response: *The BWROG representatives answered that this amount of debris bed disruption is beyond the scope of the test and understands that under those conditions, the interaction between the air/debris and the spacer grid is no longer well represented by the benchtop test. The BWROG representatives explained that resilience to air removal will be measured by slowly applying air flow in order to determine the amount of air flow required to disrupt the debris bed sufficiently so that when the air is turned off, the head-loss is less than half of the original value. The objective of the test is therefore not to achieve full suspension of the debris bed but only achieve sufficient disruption to cause a substantial drop in head-loss. The BWROG representatives also clarified that no testing is planned where the debris bed is formed while counter-current steam flow simulation occurs. It may be very difficult to form a debris bed under these conditions and therefore difficult to evaluate the effects of fuel rod surface roughness. Test 4 in the full height fuel bundle test series will address the possibility of debris bed formation in the presence of counter-current steam flow simulation.*

C. **February 5, 2015 - Head Loss Thin Bed Testing: Debris Characteristics and Size Distribution**

The notice of public teleconference between the NRC and the BWROG is found under ADAMS Accession No. ML15015A719.

At the conclusion of the teleconference, the issue of debris sequencing (homogenous debris addition versus fines first, followed by larger and larger debris) had been largely resolved with the NRC staff accepting that the conditions between a BWR and PWR were different and homogenous debris additional was acceptable. On the second issue of debris size distribution, the NRC staff agreed on the basis for the size distribution presented but wanted to understand if there was further breakdown of fibrous debris in the suppression pool turbulence and suggested that there may be some Alden Research Labs (ARL) chugging data available that could support a basis for this phenomenon. The BWROG representatives agreed to look into this matter further. Lastly, both parties agreed on the origin of the test basis and that this single test may not fully address the issue generically for the fleet. The BWROG representatives communicated that they were looking to perform this test plan in the April/May timeframe.

The NRC staff presented the following comments during the teleconference:

1) The test plan goes into some detail in describing how the NRC staff previously agreed with the BWROG position that the thin-bed effect would not occur on complex strainers. The plan states that the BWROG conclusion that thin beds will not form on complex strainers is based on testing, not the results of correlation calculations. The plan further states that details on the BWR testing can be found in NUREG/CR-6808 (ADAMS Accession No. ML030920542). The NRC staff concern is that the BWROG test methods may not have been designed to allow a thin bed to form. The NRC staff reviewed NUREG/CR-6808 and did not find information that addresses the NRC staff concerns. Test conditions that could affect bed formation are debris addition sequence and amounts, homogeneous vs. heterogeneous debris additions, debris characteristics, debris preparation and addition methods, flow rates/velocities, etc. For example, if the particulate is added prior to the fiber a stratified debris bed may occur so that the addition of fiber beyond a specific amount may not result in significantly increased head loss. The concern originated because test methods have been improved since BWROG testing was completed.

   <u>BWROG Response:</u> The BWROG representatives agreed with all of the NRC staff's points regarding what can affect the experimental head loss results. The BWROG representatives asked that the NRC staff keep in mind that the debris arrival sequence and pool conditions in a PWR are quite different than a BWR suppression pool. There was general agreement by the NRC staff that the debris arrival in a BWR is different than a PWR and consistent with that described in the BWROG response. It was agreed that a turbulent homogenous debris mixture experiment would be representative for a BWR over one that added fines first, then small, then large pieces thereby creating a stratified bed.

Post-Teleconference BWROG Input: The BWROG representatives noted that the debris is quickly ejected from the drywell break location to the suppression pool through the vent system during blowdown and thoroughly mixed during pool swell, condensation oscillation, and chugging while the ECCS is drawing suction through the strainers. This is quite different from the PWRs where the containment recirculation pool is filling and relatively quiet while suction is being drawn from the RWST and not the ECCS strainers. Only after switchover (approximately 20 minutes or more) does the ECCS become active and start drawing water and debris toward the strainer in the PWRs. The PWR scenario has the potential to move finer debris first toward the strainer while larger debris re-suspends or tumbles later.

The BWROG representatives identified that the fully turbulent tank testing performed by the Electric Power Research Institute (EPRI) during the BWROG URG development appears to more closely resemble what would be occurring in the suppression pool in the early phases of the accident. In the development of this test plan, the BWROG has considered the lessons learned from the PWR such as debris preparation methods, design of the thin-bed and thick bed debris additions, and termination criteria. The BWROG found it important to note that the purpose of this experiment is to justify the original assumptions agreed upon by the NRC staff and the BWROG in light of any concerns over the test execution.

2) The test plan states that only fiber and sludge were used for testing and that the conclusions regarding thin-bed formation does not extend to problematic debris like microporous insulations. The test plan does not address how other types of particulate like coatings or latent debris that were not included in the original testing could affect thin-bed formation.

BWROG Response: The BWROG representatives clarified their rationale for baselining the test against the original URG testing with changes in debris characterization and preparation to meet currently accepted test methods. The BWROG representatives also informed the NRC staff that they agree that a single test may not sufficiently address the issue generically and that additional testing may be necessary to address coatings/latent debris or velocity contributions.

Post-Teleconference BWROG Input: The BWROG representatives stated that the current version of the proposed test plan does not address the impact of problematic insulation debris sources (calcium silicate, Min-K, Microtherm, etc.) on thin-bed formation. The BWROG's current position is that sludge is the dominating particulate source term and adequately represents a range of particulate sizes in evaluating thin-bed effects. Sludge contains a range of particles from 0 to 75 microns. The BWROG's opinion is that in a recirculation head loss loop as is currently proposed, the 0 to 75 micron size distribution would be adequate for establishing thin-bed susceptibility. The BWROG representatives noted that coatings and other latent debris were added as a part of the "Recipe" used in the original URG testing performed by CDI (See CDI Report 95-09 in URG Volume I, Tab 2) for certain tests. The objective of the proposed testing is to validate the original URG conclusions and at the same time address the identified concerns associated with debris preparation, events sequencing, and near-field effects. The upcoming test program will start with a particulate-to-fiber mass ratio of 30.

3) Figure 1-2 in the test plan graphs the results of head loss tests that appear to have head losses generally higher than those that would be acceptable for ECCS strainers. Why is the figure relevant to plant conditions?

   BWROG Response: The BWROG representatives explained that the figure is relevant to the behavior of the strainer component in response to debris loading and is intended to illustrate the different head loss characteristics of the specialty strainer to that of a flat plate or truncated cone shown in Figure 1-1. The BWROG representatives further noted that the figure, in itself, is not intended to represent a specific plant condition. More information on this specific curve can be obtained from NUREG/CR-6808, Section 8.2.1.

4) One purpose of the test, and the test objective, is stated to be to determine if thin beds cause higher head loss than thicker beds. Should the purpose be to determine if a thin bed can cause high enough head loss to be of concern for plant net positive suction head (NPSH) margin? A demonstration that full loads are bounding over thin-bed loads may be adequate if all plants determined their design basis head loss based on their maximum debris load, and plants did not assume that debris beds with fiber loading less than a specified value bed would not contribute to strainer head loss.

   BWROG Response: The BWROG representatives identified that while many plants have calculated thin-bed head losses, some have not under the original basis that these could be screened out if using an advanced strainer design (stacked disk type) as described in Appendix E of the safety evaluation (SE) on the URG. Since there is now concern by the NRC staff that this original guidance may have been potentially non-conservative due to debris preparation methods, the BWROG is attempting to validate this original guidance that thin-beds are not controlling over thicker beds for these strainer designs. The SE made this conclusion based on the existing test data, primarily Test P4 that had a mass of particulate to mass of fiber (p/f) ratio of approximately 30.

   The BWROG representatives emphasized the importance of gaining additional data at this time regarding the formation of thin-beds on advanced strainer designs with particulate to fiber ratio of 30 to validate the original guidance. The BWROG is currently verifying plant specific data for debris source terms to determine if additional plant specific thin-bed testing will be required.

   The BWROG is unaware of any plants that did not calculate a head loss because the design basis fiber loading was less than a specified value. However, it was generally accepted that fiber loads less than 1/8" would not form a fiber bed and exhibit head loss.

5) Should the test strainer flow rate be based on the average for the pellet clad interaction (PCI) strainer plants instead of all plants? This may not be a large difference.

   BWROG Response: The BWROG representatives stated that they were not sure that it made much of a difference. The target flow rate of 4,500 gpm is intended to represent a fleet average approach velocity of 0.06 fps. The test provides for flow

sweeps up to 14,000 gpm or 0.18 fps. The BWROG is currently discussing the maximum flow available with the test vendors.

6) What is the basis for the size distribution for Nukon debris listed in Section 5.2.1? Reference NUREG/CR-6224 (ADAMS Accession No. ML083290498), pages B-15, B-25, and E-27 for a discussion of expected fiber size distribution and the mechanisms resulting in fiber fragmentation. The fiber used in testing should be similar in characteristics to that expected to arrive at the strainer.

<u>BWROG Response:</u> The BWROG representatives discussed the above derivation of the size distribution for fiber. The NRC staff requested more information on the breakdown of debris in the suppression pool beyond the blowdown and wash-down phases (e.g., condensation oscillation and chugging). The BWROG representatives agreed to look into this further.

<u>Post-Teleconference BWROG Input:</u> The BWROG used AJIT data to derive the relative fractions of the insulation destroyed into one of three size categories: fines, small, and large pieces. The URG fractions are listed in Table 4-16 of NUREG/CR-6808. For example, 77 percent of the damaged NUKON within the zone of influence (ZOI) was considered blanket material and the remaining 23 percent were fines. In this description, fines are classified as small-fines that pass through grating with high transport efficiency. The proportion of fines and small is 25 percent fines and 75 percent small pieces. Using the URG methodology for Mark I plants:

Above Grating:

23% (25% fines) + 6.25% erosion (77% blanket) = 11% fines
23% (75% smalls) = 17% smalls

11% + 17% = 28% combined debris transport fraction specified in URG and confirmed in NUREG/CR-6369 Drywell Debris Transport Study (DDTS), (ADAMS Accession No. ML003728226).

Using this ratio, a split of 40% fines / 60% smalls.

Below Grating:

23% (25% fines)	*= 5% fines*
23% (75% smalls)	*= 17% smalls*
70% (77% blanket)	*= 54% large pieces*
6.25% (30% blanket not transported)	*= 2% fines*

This yields an overall transport fraction of 78% below the grating and a size distribution of 9% fines / 22% smalls / 69% large => 31% small-fines and 69% large pieces.

This is the derivation of the combined DG/DT transport fractions of 28 percent above grating and 78 percent below the grating which were confirmed acceptable in the NRC study NUREG/CR-6369, DDTS.

7) How was it determined that using only sludge as particulate debris would be conservative compared to the plant condition? Should coatings and latent debris surrogates be included? Was it determined that sludge is the dominant particulate debris based on mass or volume?

   BWROG Response: Depending on the results, the BWROG can perform an additional sensitivity test to understand the impact of coatings and latent debris surrogates on thin-bed formation. The NRC staff commented that other Industry tests have included particulates up to 100 micron.

   Post-Teleconference BWROG Input: The BWROG's current position is that sludge is the dominating particulate source term and adequately represents a range of particulate sizes in evaluating thin-bed effects. Sludge contains a range of particles from 0 to 75 microns. The BWROG's opinion is that in a recirculation head loss loop as is currently proposed, the 0 to 75 micron size distribution would be adequate for establishing thin-bed susceptibility.

   The BWROG representatives indicated that the sludge debris is based on mass. The BWROG would prefer to run a test that benchmarks back to the original URG test regarding the thin-bed effects assumption.

8) The test matrix and evaluation of results should consider the potential that particulate debris may concentrate in a relatively small layer (stratified) within a debris bed. This may occur for both homogeneous tests and tests where the particulate is added first followed by fiber.

   BWROG Response: The BWROG representatives agreed and indicated this will be represented in the thin-bed test.

9) The NRC staff expects fine fiber to be mostly class 2 fiber with a small amount class 1 and 3 fiber produced as a matter of preparation methodology.

   BWROG Response: Comment noted.

10) The test procedure should reflect the NRC staff guidance for performing head loss tests (March 2008). For example, the guidance states that finer fiber should be added before coarser fiber because finer fiber is expected to transport more easily.

    BWROG Response: The BWROG representatives pointed to the response to NRC staff Comment 1 regarding the difference in pool conditions and ECCS actuation for a BWR versus a PWR and that it would not be appropriate to artificially create a stratified bed for a BWR experiment.

    Post-Teleconference BWROG Input: The BWROG identified that the March 2008 guidance was followed where applicable. The BWROG representatives noted that the staged debris addition is not appropriate for the BWR suppression pool as the ECCS pumps start immediately which was one of the reasons for testing strainers in a fully agitated turbulent tank.

11) For the homogeneous debris bed test, should the initial batches be smaller, similar to the test that adds the entire particulate amount first?

    BWROG Response: The BWROG's opinion is that homogenous 1/4" bed thicknesses are acceptable batch additions for a thick bed.

12) Has the BWROG considered what outcomes would support the supposition that thin beds will not occur on complex geometry strainers? What outcomes would result in additional tests being performed?

    BWROG Response: The BWROG representatives identified that results similar or consistent to those presented in Table E-2 in Appendix E of the SE would be a positive outcome with respect to the original guidance. The BWROG representatives also noted that another positive outcome would be to establish a fiber load that creates an efficient filter, whether this is at 1/8" or 1/4" in terms of equivalent bed thickness.

13) What is the basis for assigning the particulate amount used in the test based on the average sludge amount for the BWR fleet? Are tests with varying particulate amounts required to demonstrate that thin-bed head loss is not a concern? For example, the p/f ratio of 30 at a 3/16" theoretical bed thickness may not be an adequate demonstration. The NRC Staff has noted that beds below a threshold thickness may not result in thin-bed effect head losses due to inadequate structural strength. The conclusion regarding the p/f ratio of 30 was based on testing that may not have been adequate as discussed above.

    BWROG Response: The BWROG representatives pointed to the response to NRC staff Comment number 4. The BWROG representatives did not disagree with the NRC staff comment and offered that they are not yet at a point where they would suggest that a single test will completely address the issue generically.

The NRC staff facilitated a wrap up discussion following each teleconference regarding the significant points made during the respective meeting. No public comments are registered.

Project No. 691

Enclosure:
List of Attendees

14) For the homogeneous debris bed test, should the initial batches be smaller, similar to the test that adds the entire particulate amount first?

BWROG Response: The BWROG's opinion is that homogenous 1/4" bed thicknesses are acceptable batch additions for a thick bed.

15) Has the BWROG considered what outcomes would support the supposition that thin beds will not occur on complex geometry strainers? What outcomes would result in additional tests being performed?

BWROG Response: The BWROG representatives identified that results similar or consistent to those presented in Table E-2 in Appendix E of the SE would be a positive outcome with respect to the original guidance. The BWROG representatives also noted that another positive outcome would be to establish a fiber load that creates an efficient filter, whether this is at 1/8" or 1/4" in terms of equivalent bed thickness.

16) What is the basis for assigning the particulate amount used in the test based on the average sludge amount for the BWR fleet? Are tests with varying particulate amounts required to demonstrate that thin-bed head loss is not a concern? For example, the p/f ratio of 30 at a 3/16" theoretical bed thickness may not be an adequate demonstration. The NRC Staff has noted that beds below a threshold thickness may not result in thin-bed effect head losses due to inadequate structural strength. The conclusion regarding the p/f ratio of 30 was based on testing that may not have been adequate as discussed above.

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MYoder	RidsNrrDprPlpb	RidsAcrsAcnwMailCenter
ARussell	RidsNrrOd	RidsResOd
AGuzzetta	RidsNrrDss	RidsNroOd
BParks	RidsNrrLADHarrison	PLPB R/F
JDrake	RidsEdoMailCenter	

Michael.iannantuono@ge.com

List of Attendees

1ST Quarter 2015 Public Teleconference Meeting Series with the Boiling Water Reactor Owners' Group (BWROG) and the U.S. Nuclear Regulatory Commission (NRC) Staff

JANUARY 8, 2015 - CHEMICAL EFFECTS	
NAME	**Organization**
Lesa Hill	BWROG (Chair)/SNC
Ken Knaide	BWROG/PSEG
Paul Duke	BWROG/PSEG
Joe Frisco	BWROG/Duke Energy
Phil Grissom	BWROG/SNC
Greg Broadbent	BWROG/Entergy
Steve Scammon	BWROG/Energy Northwest
Steve Sawochka	BWROG/NWT
Rob Choromokos	BWROG/SIA
Garth Dolderer	BWROG/NextEra
Gordon Clefton	Nuclear Energy Institute
Michael Iannantuono	BWROG (PM)/GE Hitachi
Jason Drake	NRC
Matt Yoder	NRC
Marioly Diaz-Colón	NRC
Paul Klein	NRC
Steve Smith	NRC
Gary Morgan	Public

ENCLOSURE

List of Attendees

1ST Quarter 2015 Public Teleconference Meeting Series with the Boiling Water Reactor Owners' Group (BWROG) and the U.S. Nuclear Regulatory Commission (NRC) Staff

JANUARY 22, 2015 - FUELS TESTING PROGRAM	
NAME	**Organization**
Ken Knaide	BWROG/PSEG
Phil Grissom	BWROG/SNC
Greg Broadbent	BWROG/Entergy
Steve Scammon	BWROG/Energy Northwest
Tony Borger	BWROG/PPL SUSQ
Bradley Tyers	BWROG/Exelon
Rob Choromokos	BWROG/SIA
Matt Leonard	BWROG/NWT
Steve Sawochka	BWROG/NWT
Michael Iannantuono	BWROG (PM)/GE Hitachi
Jason Drake	NRC
John Lehning	NRC
Marioly Diaz-Colón	NRC
Paul Klein	NRC
Steve Smith	NRC
Victor Cusumano	NRC
Jeremy Dean	NRC
Ben Parks	NRC
Andrea Russell	NRC
Ashley Guzzetta	NRC

List of Attendees

1ST Quarter 2015 Public Teleconference Meeting Series with the Boiling Water Reactor Owners' Group (BWROG) and the U.S. Nuclear Regulatory Commission (NRC) Staff

FEBRUARY 5, 2015 - HEAD LOSS THIN BED TESTING	
NAME	**Organization**
Lesa Hill	BWROG (Chair)/SNC
Eli Jackeman	BWROG/Energy Northwest
Phil Grissom	BWROG/SNC
Rob Choromokos	BWROG/SIA
Brad Tyers	BWROG/Exelon
Dan Fouts	BWROG/Entergy
Steve Scammon	BWROG/Energy Northwest
Tony Borger	BWROG/PPL SUSQ
Michael Iannantuono	BWROG (PM)/GE Hitachi
Ludwig Haber	Alden Labs
Jason Drake	NRC
Matt Yoder	NRC
Steve Smith	NRC
Victor Cusumano	NRC
Andrea Russell	NRC
Chris Rukanich	Public/Fermi 2
Steve Unikewicz	Public