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WCAP-16793-NP (Non-Proprietary)
Project Number 694

To: U.S. Nuclear Regulatory Commission
Document Control Desk
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Rockville, MD 20852

Subject: PWR Owners Group
Comments on the Draft Safety Evaluation for WCAP-16793-NP, Revision 2, "Evaluation of Fibrous and Chemical Debris in the Recirculating Fluid"

Reference: 1. Letter from S. D. Stuchell (NRC) to W. Anthony Nowinowski (PWROG), "Draft Safety Evaluation for Pressurized Water Reactor Owners Group Topical Report WCAP-16793-NP, Revision 2, "Evaluation of Fibrous and Chemical Debris in the Recirculating Fluid' (TAC No. ME1234)," January 29, 2013. (ADAMS ML12115A304)

The PWR Owners Group has reviewed the Draft Safety Evaluation (DSE) issued by the NRC in Referenced 1. The PWR Owners Group comments associated with this review are contained in Enclosure 1 to this letter. As requested in Reference 1, Enclosure 2 to this letter consists of a marked-up copy of the DSE which reflects the PWROG Owners Group recommended changes.

If you have any questions, please do not hisitate to contact Mr. Jeff Brown at 623-393-6891 or Mr. John Maruschak at 412-374-3512.

Sincerely

Norman J. Stringfellow

Jack Stringfellow, Chairman
PWR Owners Group

NJS:JDB:rfn

Enclosure (2):
1. PWROG Comments on the Draft Safety Evaluation for WCAP-16793-NP Revision 2
2. Marked-up copy of the Draft Safety Evaluation that Reflects the PWROG Comments

D048
NRR

Designated Original
4/2/13 Jonathan Rowley

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Reference	Comment
Page 4, Lines 18-20	For clarity, the following text change is recommended: *Initially, the source for this water is from stored locations, e.g., the refueling-water storage tank (RWST) at ~~CE PWRs and~~ Westinghouse PWRs, the refueling water tank (RWT) at CE PWRs, or the borated water storage tank (BWST) at B&W PWRs.*
Page 7, Line 31	The clad temperature limit, as expressed in WCAP-16793-NP Revision 2, is 800 degrees F during the 30-day period following initial quench of the core (as first correctly stated on Page 6, lines 42-44 of the draft SE). For consistency, the text should be revised accordingly. Throughout the entirety of the draft SE, this change also applies to the following: Page 9, line 32 Page 10, line 7 Page 10, line 45 Page 11, line 11 Page 12, line 1 Page 48, line 46 Page 49, line 7 Page 50, line 7 Page 61, line 43 Page 65, line 42 Page 68, line 4 Page 72 (Limitation and Condition #7), lines 28 and 32
Page 8, Line 5	Suggested text change: *...through engineering evaluations of plant- or group-specific conditions and/or plant- or group-specific testing.*
Page 8, Lines 39-41	For clarity, the following text change is suggeseted: *~~It is expected that e~~Each plant will be able to use this tool to show that decay heat would be removed and acceptable fuel clad temperatures would be maintained.*
Page 9, Lines 6-9	Suggested text change: *Licensees will have to perform plant-specific LOCADM evaluations (Section 7 and Appendix E of Reference 18) and ~~prove~~ confirm the plant-specific conditions are bounded by the debris load acceptance criteria (Sections 3 and 10, and Appendix G of Reference 18).*
Page 9, Lines 21-27	To remove addressing boric acid precipitation from the consideration of higher fiber limits, the suggested text modification is as follows: *Further, NRC staff finds the position stated in the WCAP that post-LOCA boric acid precipitation analysis scenarios, assumptions and acceptance criteria and resultant methodologies that demonstrate adequate post-LOCA LTCC can be addressed in a separate PWROG program acceptable. ~~if debris limits approved by the staff in this SE are not exceeded. Larger debris loads require the potential for boric acid precipitation to be addressed in conjunction with the resolution of in-vessel downstream effects.~~*

Page 9, Lines 39-42	Suggested text change: *Also, the NRC staff finds that plants with debris loads above the debris load acceptance criteria may perform engineering evaluations and/or tests of plant- or group-specific conditions to demonstrate adequate LTCC capability.*
Page 9 - footnote	To remove addressing boric acid precipitation from the consideration of higher fiber limits, the suggested text modification is as follows: *In the context of GSI-191 in-vessel downstream effects evaluations, the WCAP references to LTCC generally refer to the capability to maintain adequate core flow in the presence of debris and the absence of deposits on fuel rods and in grid straps that would result in fuel clad temperatures exceeding 800 °F. The staff considers LTCC to include all phenomena needed to satisfy the requirements of 10 CFR 50.46(b)(4) and (b)(5). ~~One Phenomenon that must be considered for LTCC is boric acid precipitation. This TR does not evaluate the potential for boric acid precipitation.~~*
Page 10, Lines 5 and 16	Page 10 lines 5 and 16 make a reference to Paragraph 3.1.3. There is no paragraph denoted as 3.1.3 in the draft SE.
Page 10, Lines 24- 29	Suggested text change: *The NRC staff finds the description of actions that are required of utilities to demonstrate acceptable LTCC with debris and chemical products present in the circulating fluid acceptable because it calls for licensees to perform plant- or group-specific evaluations to demonstrate that they satisfy the debris limits, debris and oxide deposition limits and cladding temperature limits of the WCAP, as qualified by the Limits and Conditions stated in this SE.*
Page 13, Line 27	(Grammatical) The following text change is suggested: 2. *The ~~F~~flow rate associated with a hot-leg break represented the limiting head loss condition.*
Page 13, Lines 37-39	For completeness, the following text change is suggested: *The section concludes that plants that have in core debris loadings that are within the limits of the debris masses successfully tested are bounded by the test program and that plants with debris amounts greater than those successfully tested can take other actions to ensure LTCC, including, but not limited to, reducing problematic debris sources by removing or restraining the affected debris source, plant-specific FA testing, engineering evaluations of plant-specific conditions, removal or reduction of chemical precipitate formation, and evaluation of debris transport/bypass calculations.*
Pages 14 Line 14 through Page 18 line 10	In the NRC Staff Evaluation, the write-up is silent on the conservative success criteria for hot leg break testing, which was to maintain the same flow into the simulated fuel assembly as was observed prior to development of a debris bed. That is, the hot-leg break testing took no credit for excess flow provided to the core. This is potentially a significant margin.
Page 15 Line 10	(Typographical) The word "head" should be deleted.
Page 15, Line 13	(Typographical) The statement *Based on the very low fiber bypass limits stated in Section 10 of this SE,…* Should be changed to *Based on the very low fiber ~~bypass~~ limits stated in Section 10 of*

	WCAP-16793-NP, Revision 2,…"
Page 15, Lines 31 and 32	Suggested text change: *If debris limits for the hot-leg break are increased through plant- or group-specific testing, the cold-leg break may become limiting.*
Page 16, Line 16; Page 27, Line 14; Page 37, Line 9	(Typographical): Change "*p-grid*" to "*P-grid*"
Page 16, Lines 47-49	Suggested text change: *However, if debris limits for a hot-leg break scenario are increased through additional plant- or group-specific testing, the cold-leg break scenario debris loads should be re-evaluated.*
Page 17, Lines 22-24	Suggested text change: *The NRC staff finds that plants that have debris loadings within those defined by acceptable tests are bounded by the test program and that plants not bounded by the program can perform plant- or group-specific evaluations to demonstrate acceptable LTCC,*
Page 17, Lines 46-47	Suggested text change: *If credit for settling in the lower plenum is used in later plant- or group-specific evaluations, it should be ~~adequately~~ justified via analysis and/or testing.*
Page 18, Lines 1-4	Suggested text change: *The NRC staff reviewed the position stated in Section 3.1.4.3 of the WCAP and finds that alternate flow paths into the core have not been credited when determining debris loads limits and that some licensees could potentially credit these alternate flow paths via plant- or group-specific evaluations.*
Page 18, Lines 5-10	To remove addressing boric acid precipitation from the consideration of higher fiber limits, and to clarify alternate flow path expectations, the suggested text modification is as follows: *If a licensee elects to take credit for alternate flow paths, such as core baffle plate holes, the licensee would need to demonstrate that the flow paths would be effective; i.e., that the flow holes would not become blocked with debris during a LOCA, and that debris ~~would not deposit in other locations after passing through the alternate flow path~~ that does pass through the alternate flow path does not adversely affect core cooling. ~~and that any changes to the flow patterns do not adversely impact boron precipitation~~.*
page 23, lines 20-34	All of the gpm values presented are on a per fuel assembly basis. The following text changes are suggested: *Line 24: …44.5 gpm per fuel assembly and 3.0 gpm per fuel assembly…* *Line 26: …11.0 gpm per fuel assembly for plants with AREVA fuel and 6.25 gpm per fuel assembly…* *Lines 28/29: …3.0 gpm per fuel assembly…* *Lines 33/34: …15.5 gpm per fuel assembly…*

Page 23, Line 36	Suggested text change: *For Westinghouse-designed fuel,...*
Page 29, Line 29	(Typographical): Change "AIs" to "RAIs"
Page 29, Lines 33-35	Suggested text change: *The NRC staff also concluded that debris loads above 15 grams may be acceptable, but should be evaluated on a plant- or group-specific basis.*
Page 31, Lines 26-30	To remove addressing boric acid precipitation from the consideration of higher fiber limits, the suggested text modification is as follows: *The NRC staff notes that the evaluations conducted in the topical report and the testing did not account for the potential for boric acid precipitation.* ~~*and that this issue could affect LTCC in some cases. The NRC staff concluded that for a hot-leg-break scenario at a fibrous debris limit of 15 grams per fuel assembly, LTCC would not be challenged because adequate coolant can flow through the core to maintain boric acid concentrations below the saturation limit. For the cold-leg-break or hot-leg-break scenarios where the licensee wishes to justify a higher fibrous debris limit such that flow through the core is decreased, the NRC staff concluded that boric acid concentration may affect LTCC. These effects should be addressed by industry as described in Section 8 of the WCAP.*~~
Page 32, Lines 47-49	Suggested text change: *However, if licensees perform plant- or group-specific evaluations to increase hot-leg debris limits they must evaluate the cold-leg case to ensure that it is not more limiting.*
Page 33, Line 9	Regarding the parenthetical phrase *(less than 7.5 grams per fuel assembly, as stated by the WCAP)* The 7.5 gram figure is not stated in WCAP-16793 Revision 2. It is thus recommended that the parenthetical phrase be deleted.
Page 33, Lines 10-12	Lines 10-12: The statement *During fuel-assembly testing at cold leg break flow rates, a significant debris bed was not detectable (via differential pressure) at fiber loads below 7.5 grams.* is not correct. All cold leg break tests were performed with the first fiber addition equal to 10 grams, not 7.5 grams (WCAP-17057-P, Revision 2). There are no references to 7.5 gram additions in WCAP-16793-NP, Revision 2. It is suggested that the statement be revised to say *During fuel-assembly testing at cold leg break flow rates, a significant debris bed was not detectable (via differential pressure) at fiber loads below 10 grams.*
Page 33, Lines 13-14	To remove addressing boric acid precipitation from the consideration of higher fiber limits, the suggested text modification is as follows: ~~*Licensees that credit debris limits greater than 15 grams per fuel assembly must evaluate the effects of additional debris on boric acid precipitation.*~~
Page 33, Lines 50-51	Suggested text change: *The NRC staff finds it acceptable that industry take additional actions, including testing, to justify higher debris limits as justified for plant- or group-specific cases.*

Page 34, Lines 16-19	Suggested text change: *Licensees that credit alternate flow paths should demonstrate that the flow paths are effective; i.e, that the flow holes will not become blocked with debris during a LOCA, and that debris will not deposit in other locations after passing through the alternate flow path such that LTCC would be jeopardized.*
Page 34, Lines 19-20	To remove addressing boric acid precipitation from the consideration of higher fiber limits, it is recommended that the following sentence be deleted: ~~*Also, if credit for alternate flow paths leads to a boil-off condition in the core, boron precipitation issues must be addressed.*~~
Page 34, Lines 26-28	Suggested text change: *The NRC staff finds that this is a potential flow path for coolant to enter the core, but notes that plant- or group-specific evaluations would have to assure that this is a viable flow path.*
Page 35, Lines 18-19	Suggested text change: *If the limits for the hot-leg case are increased by plant- or group-specific evaluation, the potential for the cold-leg case to become limiting should be addressed in the analysis.*
Page 36, Lines 10-14	Regarding the statement *"The AREVA test report (Reference 17) also states that the Westinghouse test facility provides repeatable test results..."* There is no such statement in Ref. 17 (AREVA 51-9170258-000). It is not clear from whence this statement originated, nor what is intended in regard to that report. The closest statement within the AREVA 51-9170258-000 that can be could find is: *"The AREVA and Westinghouse Fuel Assemblies behaved virtually identically in the RTU/Westinghouse loop. This is based on Figure 2-1, by comparing the AREVA and Westinghouse test assembly results in the RTU loop".* This is not a remark on test repeatability, but a remark on the fact that the two assemblies, when put in the same loop, give the same results. It is therefore suggested that the sentence in the draft SE be deleted.
Page 37 Lines 4-6	Suggested text change: *However, the NRC staff concluded that the 15 gram per fuel assembly limit should be maintained for UPI plants until plant- or group-specific evaluations provide adequate justification for a higher limit.*
Page 37, Lines 25-26	Suggested text change: *Any debris amounts greater than those tested and accepted by the NRC staff should either be mitigated or be justified on a plant- or group-specific basis.*
Page 37, Lines 28-29	Suggested text change: *If plant- or group-specific evaluations increase debris limits in the future, cold-leg conditions may become important.*
Page 40, Lines 15-16	Suggested text change: *Licensees may perform plant- or group-specific evaluations to increase this limit.*

Page 41, Lines 13-14	(Typographical) - Suggested text change: *~~Because t~~The results of some of the AREVA hot-leg case testing were significantly different from the results of the Westinghouse test under similar flow conditions.*
Page 43, Lines 21-30	This paragraph discusses flow past the Trapper Fine Mesh® filter. While AREVA no longer manufactures this filter, the PWROG believes that the statement made by the NRC is not correct: *"As discussed above, based on the results of more recent testing, the NRC staff does not agree that the gaps between fuel assemblies have been shown to allow adequate flow to maintain LTCC."* While it is understood that this statement applies to gaps around the spacer grids, the gaps around the Trapper Fine Mesh® filter are different. The Trapper is a 3-D body that collects debris. As explained in Ref. 8 (AREVA 51-9102685-000), debris will collect to a certain dP, at which point all flow and debris goes through the gap around the Trapper fine mesh filter. The testing has demonstrated this. It is therefore suggested that the above sentence be deleted.
Page 50, Lines 21-23	The first sentence can be interpreted to say that the PWROG did testing to determine adherence of fiber to fuel cladding. For clarity, it is recommended that the following change be made to the text: *The PWROG cited report ~~investigated the potential for fibrous material to collect on the fuel cladding by performing testing. The results of the tests are discussed and evaluated in~~ NEA/CNSI/R (95)11 (Reference 31) in its investigation of testing performed to evaluate the potential for fibrous material to collect on the fuel cladding.*
Page 57, Lines 17-31	For consistency with PWROG comments on Limitation and Condition #8 (herein), the following test changes are suggested: *...Actual corrosion of aluminum coupons during ~~the~~ ICET 1, which used sodium hydroxide (NaOH),~~test~~ appeared to occur in two stages; active corrosion for the first half of the test followed by passivation of the aluminum during the second half of the test. (NaOH is known to actively react with aluminum. The ICET tests that used tri-sodium phosphate (TSP) or sodium tetraborate did not have such an active early corrosion of aluminum.) Therefore, while the 30-day fit to the ICET data is reasonable, the WCAP-16530-NP-A model under-predicts aluminum release by about a factor of two during the active corrosion phase of ICET 1. This is important since the in-core LOCADM chemical deposition rates can be much greater during the initial period following a LOCA, if local conditions predict boiling. As stated in WCAP-16530-NP-A, to account for potentially greater amounts of aluminum during the initial days following a LOCA, a licensee's LOCADM input should apply a factor of 2 increase to the WCAP-16530-NP-A spreadsheet predicted aluminum release, not to exceed the total amount of aluminum predicted by the WCAP-16530-NP-A spreadsheet for 30 days. In other words, the total amount of aluminum released equals that predicted by the WCAP-16530-NP-A spreadsheet, but the timing of the release is accelerated. This applies to plants that use NaOH as a buffer. Alternately, licensees may choose to use a different method for determining aluminum release, including the use of ICET tests run with TSP or sodium tetraborate buffers.~~but~~ I Licensees that use NAOH as a buffer should not use an aluminum release rate equation that under-predicts the aluminum concentrations measured during the initial 15 days of ICET 1*
Page 57, Lines 34-37	Suggested text change: *If a licensee uses plant- or group-specific refinements to reduce the chemical source term calculated by the WCAP-16530-NP-A base model, the licensees should provide technical justification demonstrating that the refined chemical source term*

	adequately bounds the postulated plant chemical product generation.
Page 59, lines 15-17	The sentence *Since the assumed deposit thermal conductivity has a significant effect on the heat transfer analysis, the use of a 0.11 BTU/(h-ft-°F) value for sodium aluminum silicate scale needs to be justified.* is inconsistent with lines 18-20 of this same paragraph; *If plant-specific calculations use a less conservative thermal conductivity value for scale (i.e., greater than 0.11 BTU/(h-ft-°F)), the NRC staff expects the licensee to provide a technical justification for the plant-specific thermal conductivity to the NRC staff.* and with Limitation and Condition #10 (page 73, lines 12-17); *. . . The WCAP recommends that a thermal conductivity of 0.11 BTU/(h-ft-°F) be used for the sodium aluminum silicate scale and for bounding calculations when there is uncertainty in the type of scale that may form. If plant-specific calculations use a less conservative thermal conductivity value for scale (i.e., greater than 0.11 BTU/(h-ft-°F)), the licensee should provide a technical justification for the plant-specific thermal conductivity. . ."* Therefore, it is suggested that lines 15-17 of page 59 be amended to read as follows: *Since the assumed deposit thermal conductivity has a significant effect on the heat transfer analysis, the use of a <u>value less conservative (greater) than</u> 0.11 BTU/(h-ft-°F) ~~value~~ for sodium aluminum silicate scale needs to be justified. "*
Page 61, Lines 47-48	Regarding the statement *"The WCAP states that the effect of debris that passes through the ECCS sump strainer during a LOCA is not addressed in the WCAP."* WCAP-16793-NP, Revision 2 was written to address the effect of debris that passes through the ECCS sump strainer post-LOCA. This introduction should say *"The WCAP does not address boric acid mixing and transport in the RCS and potential precipitation mechanisms that may occur during the sump recirculation phase of a LOCA".*
Page 62, Lines 3-11	Section 8 of WCAP-16793-NP Rev 2 only acknowledges that "additional insights and new methodologies are needed to answer fundamental questions about boric acid mixing and transport in the RCS and potential precipitation mechanisms that may occur both during the ECCS injection phase and the sump recirculation phase after a LOCA", and makes no statement on LTCC as presented in the draft SE. It is suggested that the text be modified as follows: *Section 8 of Reference 18 states that the effects of boron precipitation are not addressed in TR WCAP-16793-NP, Revision 2. ~~This statement is in acknowledgement that effective LTCC involves (1) provision of sufficient coolant flow to the core to remove decay heat without unacceptable fuel clad heat-up, and (2) prevention of boric acid precipitation sufficient to inhibit adequate core cooling. In response to NRC findings made during a technical audit of Westinghouse Topical Report CENPD-254-P (Reference 41), the PWROG initiated a separate program to address staff questions related to boric acid precipitation, including the effect of debris accumulating in the core. NRC staff finds this approach acceptable if a plant limits the amount of fiber bypassing the strainer to the amount approved by this SE.~~*
Page 62, Lines 22-24	Regarding the statement, *Fuel assembly testing for cold leg conditions at low fiber amounts of approximately 7*

	grams (e.g., after the first batches of fiber addition) do not exhibit noticeable head loss. There are no references to fiber amounts of 7 grams in WCAP-16793-NP, Revision 2. All cold leg break tests were performed with the first fiber addition equal to 10 grams (WCAP-17057-P, Revision 2) and should be stated as such in the text above. The suggested text revision is: *Fuel assembly testing for cold leg conditions at low fiber amounts ~~of approximately 7 grams (e.g., after the first batches of fiber addition)~~ does not exhibit noticeable head loss.*
Page 62, Lines 28-36	To remove addressing boric acid precipitation from the consideration of higher fiber limits, it is recommended that this paragraph be deleted in its entirety.
Page 65, Lines 26-28	Suggested text change: *If UPI plant- or group-specific evaluations are conducted to increase the accepted debris limits, the ability to ensure any required cold-leg flushing should be demonstrated.*
Page 67, Lines 30-32	Suggested text change: 1. *Perform plant-specific LOCADM evaluations (WCAP, Section 7 and Appendix E) and ~~prove~~ confirm that their plant-specific evaluations are bounded by the 800 degrees Fahrenheit acceptance criterion.*
Page 69, Lines 10-12	Suggested text change: *3. Utilities may conduct plant- or group-specific tests to increase the fiber limit. However, the NRC staff expects plant- or group-specific tests to ensure margins adequate to address concerns with the test program discussed throughout this SE*
Page 70, Lines 3-4	To remove addressing boric acid precipitation from the consideration of higher fiber limits, it is recommended that the following sentence be deleted: ~~*The potential for debris to affect boric acid precipitation analyses should be included in any evaluation that increases debris loading.*~~
Page 70, Lines 6-7	The following change is suggested: *The NRC staff concluded that plants need to demonstrate that the quantity of fibrous debris that ~~bypasses the strainer and~~ transports to the ~~core~~fuel inlet is less than or equal to 15 grams per fuel assembly or as otherwise justified on a plant- or group-specific basis.*
Page 71 Limitation and Condition 1, Lines 25-26	The following change is suggested: *Licensees should limit the amount of fibrous debris reaching the fuel inlet ~~passing through the ECCS sump strainer~~ to that stated in section 10 of the WCAP (15 grams per fuel assembly).*
Page 71 Limitation and Condition 1, Lines 28-29	Suggested text change: *Alternately, licensees may perform plant- or group- specific testing and/or evaluations to increase the fibrous debris limits…*

Page 71, Limitation and Condition 1 Lines 29-32	The phrase, "*and also consider loop seal clearing*" represents an increase in the scope of GSI-191 that runs counter to the direction of the Commission. Loop seal clearing concerns require very specific conditions that are not consistent with GSI-191 conditions for limiting debris bed formation and resulting head loss. Furthermore, the topic of loop seal clearing is the subject of another PWR Owners Group program. Therefore, it is recommended that this phrase be stricken from Limitation and Condition #1.
Page 71, Limitation and Condition 1 Lines 33-35	To remove addressing boric acid precipitation from the consideration of higher fiber limits, the suggested text modification is as follows: *These tests shall evaluate the effects of increased fiber on flow to the core~~, and precipitation of boron during a postulated cold-leg break,~~ and the effect of p/f ratios below 1:1*
Page 71 Limitation and Condition 1, Lines 35-37	Suggested text change: *The NRC staff will review <u>plant- or group- specific</u> evaluations, including hot- and cold-leg break scenarios, to ensure that acceptable justification for higher <u>fibrous</u> debris limits is provided.*
Page 71, Lines 48-51 and Page 72, Lines 1-3 Limitation and Condition 3	To remove addressing boric acid precipitation from the consideration of higher fiber limits, the suggested text modification is as follows: *If a licensee chooses to take credit for alternate flow paths, such as core baffle plate holes, to justify greater than 15 grams of bypassed fiber per fuel assembly, the licensee should demonstrate, by testing or analysis, that the flow paths would be effective, that the flow holes will not become blocked with debris during a LOCA, ~~that boron precipitation is considered,~~ and that debris will not deposit in other locations after passing through the alternate flow path such that LTCC would be jeopardized.*
Page 72 Limitations and Conditions #4	Limitation and Condition #4 is silent on the calculations with an increased head loss coefficient uniformly applied to the bottom of the core (i.e., no unblocked or "open" fuel area) that are documented in Appendix B of the WCAP and are also discussed in Section 3.3.3. Furthermore, this Limitation and Condition incorrectly implies that the increase in loss coefficients included specific head loss information regarding debris bed formation but did not include chemical effects. From Appendix B of WCAP 16793-NP Revision 2, it is clear that the loss coefficients were increased as a parametric study; the increase was not ascribed to either the development of a fiber bed with debris and or post-accident chemical products. Therefore, it is respectfully concluded that the underlined statement in the Limit and Condition incorrectly characterizes the analysis approach. The amended Limit and Condition #4 given below is respectfully suggested as an accurate and technically correct replacement for the Limit and Condition 4 in the draft SE. *Sections 3.2 and 3.3 and Appendix B of the WCAP provide evaluations to show that even with large blockages at the core inlet or with a large loss coefficient applied uniformly at the core inlet, adequate flow will enter the core to maintain LTCC. In all cases, the blockage assumptions are implemented by increasing the loss coefficient at the entrance to the fuel region. This increase in loss coefficient is not ascribed to or associated with the formation of debris beds or deposition of post-accident chemical products on and or within debris beds. The use of these analyses to demonstrate adequate LTCC requires the licensee to equate loss coefficients used in the calculation with a loss coefficient obtained from fuel assembly testing.*
Page 72 Limitations and Conditions #5, Lines 16-18	The following change is recommended: *Any debris amounts greater than those justified by generic testing in this WCAP must be justified on a <u>plant- or group-specific</u> basis.*
Page 72 Limitations and Conditions # 6	The following change is recommended: *The <u>fibrous</u> debris acceptance criteria contained in the WCAP may be applied to fuel*

Lines 20-21	*designs evaluated in the WCAP."*
Page 72 Limitation and Condition 8	Limitation and Condition #8 requires licensees to use the aluminum release rate observed in ICET 1. It is noted that ICET 1 utilized sodium hydroxide (NaOH) as a buffer. Aluminum is known to be very reactive In a NaOH solution. The requirement that all plants use aluminum release associated with ICET 1, rather than the aluminum release rate associated with their specific buffer places an unnecessary and an inappropriate burden on plants not using NaOH as a buffer agent. It is thus suggested that the text in Limitation and Condition #8 be revised as follows: 1. *As described in the Limitations and Conditions for WCAP-16530-NP (ADAMS Accession No. ML073520891) (Reference 21)[5], the aluminum release rate equation used in TR WCAP-16530-NP provides a reasonable fit to the total aluminum release for the 30-day ICET tests but under-predicts the aluminum concentrations during the initial active corrosion portion of ~~the~~ test ICET 1. ICET 1 used sodium hydroxide (NaOH) as a buffer agent, which is known to actively react with aluminum. To provide more appropriate levels of aluminum for the LOCADM analysis for in-vessel effects in the initial days following a LOCA, licensees using NaOH as a buffer should apply a factor of two to the aluminum release rate as determined by the TR WCAP-16530-NP-A spreadsheet. The total aluminum considered does not need to exceed the total predicted by the WCAP-16530-NP-A spreadsheet for 30 days. Alternately, if a licensee chooses to use a different method for determining the aluminum release, it should demonstrate that the method does not under-predict the aluminum concentrations measured during the initial 15 days of the ICET ~~1~~ test run with the same buffer agent as is used in the plant. (Section 3.7 of this SE)*
Page 73 Limitation and Conditions #10 Line 78	Suggested text change: *...technical justification for the plant-specific thermal conductivity value.*
Page 73 Limitations and Conditions # 11 Lines 22-28	Condition 11 should be revised to say *Licensees should demonstrate that the quantity of ~~strainer bypassed~~ fibrous debris transported to the ~~core~~ fuel inlet is less than or equal to the fibrous debris limit specified in the proprietary fuel assembly test reports and approved by this SE. Fiber quantities in excess of 15 grams per fuel assembly must be justified by the licensee.*
Page 73 Limitation and Condition 11 Lines 32-35	It is not clear whether the expected fiber loading in the core for the cold-leg and hot-leg break scenarios is required to be provided for all plants, or for only those plants that do not meet the 15g/FA limit. Please clarify.
Page 73 Limitation and Condition 12 (Lines 37-40)	Suggested text change: *Plants or groups of plants that can qualify a higher fiber load based on the absence of chemical deposits should ensure that tests for their plant- or group-specific conditions ~~search for~~ determine limiting head losses using particulate and fiber loads that maximize the head loss with no chemical precipitates included in the tests.*
Page 73 Limitation and Condition 13	Consistent with discussions at the May, 2012 ACRS meeting, it is recommended that Limitation and Condition 13 be revised as follows: *"Licensees should verify that the size distribution of fibrous debris used in the fuel assembly testing referenced by their plant trends with the size distribution of fibrous debris expected downstream of the plant's ECCS strainer(s). (Section 3.4.2.1 of this SE)"*

Page 74 Conclusions Lines 10-12	Suggested text change: *... in Section 4.0 of this SE, <u>provides acceptable, plant- or group-specific</u> evaluation methods for demonstrating that adequate coolant flow reaches the core to maintain fuel clad temperature within acceptable limits.*