

**NEI 09-10: NRC Comment Disposition**

Sec	Comment	Cat	Proposed Disposition	Agreed Disposition
5	<b>Gas Intrusion and Accumulation Prevention</b> -... repeated accumulation that potentially jeopardizes operability must be corrected at the first reasonable opportunity and enhanced monitoring must be employed when needed to reasonably ensure continued operability / functionality as required by the regulations.	C.1	<p><b>THIS COMMENT INCLUDED IN CONCLUSION ITEM 1.</b> SE pg 13 NRC comments on the last sentence in NEI section 5.3. This section is gives guidance on actions to take for locations where gas has been found and dealt with repeatedly (each individual occurrence would be covered by section 13 and would require timely correction in order to continue operability). Further this sentence would apply after any and all other remedies for repeat locations are exhausted. The purpose to shorten to the frequency would be to ensure continued operability between inspections. Section 12.2 would be used to determine the new frequency.</p> <p>Clarification could be made in NEI section 5.3 to refer to these other sections if it is determined to be required.</p>	<p>NEI 09-10, sec 5.3</p> <p>after 1<sup>st</sup> sentence in para 5.3: Each instance will be evaluated in accordance with section 13.</p> <p>After word "considered" in sec 5.3:... considered in accordance with section 12.2.</p> <p>Last sentence in para 5.3: Once identified as a repeat location that potentially jeopardizes operability, the chosen remedy must be implemented at the first reasonable opportunity.</p>
7	<b>Plant System Selection</b> - It is not acceptable for systems to be considered out of scope if an evaluation supports a determination that gas intrusion into a "system would not adversely affect the ability of the system to perform its function" if mechanisms exist that could cause the allowable gas void to be exceeded. This statement is acceptable if it is limited to systems or portions of systems that remain operable if totally void of water.	C.2	<p><b>ALL THREE OF THESE COMMENTS INCLUDED IN CONCLUSION ITEM 2.</b> SE in conclusion item 2 pg 36 and section 3.6 on page 15 are commenting on the last 2 sentences of last paragraph on NEI page 8 section 7. NEI gives guidance that if a gas intrusion mechanism has been identified that has no impact on the ability of a system to perform its function then the system or sub-system does not have to be in scope of the program. ALL 3 comments by NRC are aimed at this allowance. This conclusion would be the same as accepting a void volume as a design limit. As such the first comment is then inconsistent with the thought</p>	<p>Add sentence to end of section 7: "In such cases, a design change should be completed and evaluated in accordance with section 9."</p>
7	<b>Plant System Selection</b> - Gas volumes that are predicted to not affect functionality and that are excluded from further consideration must be documented in the FSAR and in applicable procedures.			
7	<b>Plant System Selection</b> - The only presently approved methodologies and criteria to assess functionality are the methods			

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	<p>approved in the attachments to this safety evaluation, the pump suction void criteria provided in NEI 09-10's Tables 1 and 2 or in other documents that provide identical information, the use of Froude number (<math>N_{FR}</math>) as discussed in NEI 09-10 Section 8.4.2 and NEI 09-10 Attachment 4 subject to the review comments, and the 0.5 second NRC process to assess suction voids. .</p> <p>Vortexing and computer codes that address gas issues have not been approved for prediction of gas-associated phenomena at this time. <b>These topics must be addressed on a plant-specific basis until NRC provides an evaluation that supports an acceptable generic approach.</b></p>		<p>that sometime in the future methods that allow for design limit determination may exist and be applied to in scope systems. The second comment is incorrect in that if such determination is made then the proper document to hold this information would be the system design document not the FSAR. Finally the third comment points to the attachment 4 which is clearly ONLY applicable to determination of operability limits.</p> <p><b>NEI section 7 could be clarified</b> in the paragraph to indicate that the evaluation discussed there to exclude a system/sub-system on this basis would be required to meet section 9 for design limit determination.</p>	
8	<p><b>System Gas Accumulation Locations</b> - All locations are considered accessible unless actual environmental conditions constitute a hazard to personnel or are such that conducting the surveillance in the specific locations will result in an unacceptable dose.</p> <p>Regardless of accessibility considerations, surveillance is required for all locations of concern unless it is acceptably determined that the surveillance is not necessary to reasonably ensure operability. However, we will allow more flexibility in determination of operability for non-accessible locations...</p>	C.3	<p><b>THIS COMMENT INCLUDED IN CONCLUSION ITEM 3.</b> SE pg 16 sec 3.7 and pg 37 conclusion item 3 are commenting on NEI section 8.4.2 last paragraph on page 11 the first sentence. NRC correctly points out that NEI does not define "accessible". This was on purpose. There are too many site specific inputs into such a determination to provide generic guidance on what accessible means. This document has left that determination to each site and the subsequent NRC inspection process both TI and ongoing. What the remainder of the paragraph does do is to clearly state that the site must determine some other way to monitor such locations and cannot just not monitor at all once they determine it to be "inaccessible".</p> <p><b>A NOTE could be added to NEI section 8.4.2</b></p>	<p><b>Add a note to the beginning of section 8.4.2: "A determination that a location is inaccessible may result in additional regulatory scrutiny."</b></p>

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			before the paragraph stating that determination of "inaccessible" will result in additional regulatory scrutiny.	
9	<b>Design Limit</b> - Any methods used to predict acceptable void volumes must be approved by NRC	ST	<p style="background-color: #90EE90;">This comment not included in the conclusions.</p> <p>SE pg 17 section 3.8 NRC makes this statement about NEI section 9 in general. We agree that any method used to determine a design limit would involve NRC review of some kind. Pre-approval may not always be required as determination and documentation would be performed as clearly indicated using the site design change process. This would require 50.59 review to be completed which would determine the timing of NRC review of the method used.</p> <p style="background-color: #FF00FF;">It does not appear that any changes to NEI are required for this comment.</p>	No change to NEI 09-10 is necessary.
10 (p 19)	<b>"Fill and Vent Processes</b> - In performing reviews or inspections, we will address corrective action from the viewpoint that if the CAP is entered because of failure to meet an acceptance criterion, corrective actions are immediately initiated, an immediate review will be conducted to identify other locations that are potentially affected by the observed gas intrusion mechanism, and the licensee will perform follow-up inspections at the locations identified by the review. Further, the licensee will be expected to evaluate locations where gas continues to accumulate for possible remedies which could prevent or minimize future gas intrusion. If changes cannot be made immediately to remedy these locations, then enhanced monitoring will be expected to be implemented	ST	<p style="background-color: #90EE90;">This comment not included in the conclusions.</p> <p>SE pg 19 section 3.9.5 NRC makes this statement about NEI section 10.6 in general. Section 10 includes guidance on review of the procedures. Section 10.6 specifically provides that sites include provision in the procedure to enter the CAP when gas is found. Section 13 provides guidance on corrective actions for specific instances of voids.</p> <p style="background-color: #FF00FF;">It does not appear that any changes to NEI are required for this comment.</p>	No change to NEI 09-10 is necessary.
12.1 (p 20)	<b>List of Gas Intrusion Precursors</b> - We note that some system configurations may result in a temperature that is greater than the saturation temperature at the interface with system components that are expected to be at a lower temperature and this should be	ST	<p style="background-color: #90EE90;">This comment not included in the conclusions.</p> <p>SE pg 20 section 3.11.1 NRC makes this statement about NEI section 12.1 in general. It is agreed that temperature in excess of the</p>	No change to NEI 09-10 is necessary.

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	considered in the list of precursors. With the addition of the saturation temperature item, we find this list to be an acceptable starting point for determining plant-specific precursors.		saturation temperature could result in gas and should be identified as a gas intrusion mechanism. As such it is listed as the 5 <sup>th</sup> bullet in section 4. The associated precursor would be an unexpected increase of temperature in a system. As such section 12.1 bullet item 5 appears to cover it adequately.  It does not appear that any changes to NEI are required for this comment.	
12.2 (p 20)	<b>Periodic Monitoring</b> – with respect to the list of considerations for establishing monitoring frequency:  We do not expect probability analyses. Rather, judgment may be used to assess likelihood.  There are two aspects that NEI did not address in the above list: accessibility and unique conditions that prevent gas accumulation.	EN	<b>This comment not included in the conclusions.</b> SE pg 21 section 3.11.2 NRC makes this statement about NEI section 12.2 in general. It was NEI intent to provide full PRA for such determination. The Nuclear industry has attached certain specific meaning to words and as such we agree that a word change would be in order for the first bullet. As discussed earlier and in section 8.4.2 accessibility would not eliminate the need to determine a monitoring frequency therefore, no discussion is required here. Additionally only point that have been determined in section 8 to require monitoring would get to this point to determine a frequency as such those unique conditions would have been evaluated in section 8 as not requiring a frequency and no additional direction appears to be required.  A change to NEI section 12.2 could be made to replace the word "probability" to "Likelihood".	Section 12.2 will be revised to change the word "probability" to "likelihood".
Att 3	<b>Monitoring and Trending</b> " - This flow chart does not accurately describe the process that should be followed: <ul style="list-style-type: none"> <li>The block near the lower left, "Consider reducing the monitoring frequency," is misleading. We suggest that</li> </ul>	C.4	<b>THIS COMMENT INCLUDED IN CONCLUSION ITEM 4.</b> SE pg 24 section 3.14 NRC comments on NEI Attachment 3 flow diagram. The word choices proposed do clarify the meaning for	The flow chart will be changed to accept the words suggested in the draft SE.

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	<p>"Consider monitoring more frequently" is clearer. Similarly, "Consider extending the monitoring frequency" would be clearer if stated "Consider monitoring less frequency."</p> <ul style="list-style-type: none"> <li>• The lower left block "Consider extending the monitoring frequency" implies no further action as opposed to correctly transferring to "Continue trending and tracking all identified locations."</li> <li>• Similarly, the lower right block "Exit the additional monitoring process" should correctly transfer to "Continue trending and tracking all identified locations."</li> <li>• The block near the lower right, "Has the gas volume been reduced to or below the Design Limit," has two weaknesses. First, the wording should be continued to include "that is predicted to exist at the next monitoring." Secondly, this test only addresses the Design Limit, not the need to reduce gas volume to as-low-as-practical</li> </ul>		<p>bullets 1,2 and 3. Bullet 4 while it is desired to remove as much as possible once a no zero design limit is established when gas is removed below that level full qualification is restored.</p> <p>A change to NEI attachment 3 should be made to provide these clarifications.</p>	
Att 4	<p><b>Reasonable Expectation of Operability</b> - NEI 09-10 Attachment 4 states that a discharge "pressure increase of sufficient duration may challenge a system relief valve, and the licensee should consider the potential impact due to an unexpected lift." NEI 09-10 states that "The pressure surge must be limited to a value that does not ... result in lifting of relief valves where system pressure exceeds reseal pressure." The NEI 09-10 Section 10 statement is the correct statement. (See pg 26 of SE)</p>	C.5	<p><b>THIS COMMENT INCLUDED IN CONCLUSION ITEM 5.</b> SE pg 37 conclusion item 5 and pg 26 section 3.15.1 NRC comments on NEI attachment 4 page 27 5<sup>th</sup> sentence in the discussion paragraph. <b>THE SE APPEARS TO HAVE AN ERROR.</b> The text NRC lifted was from section 9 both they refer it to section 10. The text is different on purpose. In section 9 the document is describing that the acceptance limit should be set such that a relief valve does not lift. In attachment 4 here the acceptance criteria has been potentially surpassed and this section is directing what attributes need to be evaluated to determine what harm may or may not have been done as result of the event..</p> <p>It does not appear that any changes to NEI are required for this comment.</p>	No change to NEI 09-10 is necessary.

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Att 4	<p><b>Gas Transport</b> – (SE p 28): There are several methods that can be used to address void movement. For example, NEI 09-10 states "that gas voids less than 20% will not be transported in piping with Froude numbers (<math>N_{FR}</math>) less than 0.31," consistent with the NRC staff's assessment to which the industry agreed as documented in References 8, 9, and 10. This agreement also included that at <math>N_{FR} \leq 0.65</math>, some gas may be transported and if <math>N_{FR} \geq 2.0</math>, all gas will be carried out of a pipe with the flowing water. Time to clear gas from a pipe for <math>0.8 &lt; N_{FR} &lt; 2.0</math> is a function of flow rate. Dynamic venting may not be assumed effective for <math>N_{FR} &lt; 0.8</math>. Time to clear gas as a function of time has not been well documented at this time. Information discussed at the end of Section A-6, below, has substantiated a modification to the above criteria. Flow in a horizontal pipe that has no local high points may be assumed to move any gas toward the downstream end of the pipe when the Froude number is greater than 0.54.</p>	EN	<p><b>This comment not included in the conclusions.</b> SE pg 28 (middle paragraph) section 3.15.3 NRC makes this statement about NEI attachment 4 first sentence of the first paragraph on page 28. The highlighted text to the left essentially is discusses the effectiveness of dynamic venting to remove gas as well as the evaluation of gas transport. Since no specific time at the given flow can be provided it was decided not to include this guidance as it really does not provide the user a complete answer that can be used. Industry efforts are ongoing to determine the timing for <math>1.0 &lt; N_{FR} &lt; 2.0</math>.</p> <p>An enhancement will be made to NEI attachment 4 and 10.3 to add these thoughts with or without time guidance.</p>	<p>An enhancement will be made to NEI section 10.3 to add these thoughts for <math>N_{FR}</math> numbers and the possibility of guidance in the future. Also add a reference to section 10.3 to attachment 4.</p>
Att 4	<p><b>Gas Voids at the Pumps</b> - With respect to Tables 1 and 2, we impose a restriction that the instantaneous void fraction must be less than 1.7 times the tabulated values.</p>	C.6	<p><b>THIS COMMENT INCLUDED IN CONCLUSION ITEM 6.</b></p> <p>Based on the earlier presentation, industry believes that the 1.7 number is included in the test that supports the values in the table and that additional criteria is not required.</p>	
Att 4	<p><b>Gas Voids at the Pumps</b> - NEI states that "further review by the respective Owners Groups may determine that criteria for pump operation below 70% BEP (best efficiency point) may 38 not be required, as the conditions are bounded by the set of criteria for the 70%-120% BEP range." This is incorrect unless operation below 70% BEP will not occur.</p>		<p><b>THIS COMMENT INCLUDED IN CONCLUSION ITEM 6.</b> SE pg 37 conclusion item 6 and pg 27 section 3.15.2 the cut to 5% for BEP less than 70% was rather arbitrary as a result of a lack of data or robust analysis that would support the use of the full values at the lower flows. The inclusion of this sentence simply allows that new information may come about in the future that could change these values. Obviously if it does revision to the document</p>	<p>We will strike the paragraph that begins "Further review by the Owners Groups..." in attachment 4, pg 31, second paragraph below table 1.</p>

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			<p>and additional regulatory review would be required before any future new criteria could be adopted. As such the paragraph really adds no value to the technical content of the document and could be removed.</p> <p>A change to NEI attachment 4 could be made to simply remove this paragraph</p>	
Att 4	<p><b>Gas Transport in Pump Suction Piping</b> - It is not always correct to assume voids in BWR piping are dominated by elevation drops. We will expect that BWRs where such configurations exist must be shown to be consistent with the stated assumption.</p>	C.7	<p>THIS COMMENT INCLUDED IN CONCLUSION ITEM 7.</p> <p>A change to NEI 09-10 will be made to address this comment.</p>	<p>NEI 09-10 will indicate that it is up to the licensee to ensure that the proper mechanisms are considered in their piping evaluations.</p>
Att 4	<p><b>Net Positive Suction Head Required (NPSHr) for Pumps</b> – “It is also expected that any gas voids present would be transported through the pump at a time when margin in NPSH available is quite large.”</p> <p>This is not always correct. For example, switching from the refueling water storage tank to the containment sump can occur when pressure is low and temperature is close to saturation where meeting NPSHr can be a challenge.</p>	C.8	<p>THIS COMMENT INCLUDED IN CONCLUSION ITEM 8. SE pg 38 conclusion item 8 and pg 29 section 3.15.4 NRC comments NEI attachment 4 page 34 first paragraph and 3<sup>rd</sup> sentence of the second paragraph. Both locations use the word “expected” to describe that gas ingestion would occur at the beginning of an event. Taken as a whole the argument for NPSHr is based upon the long term nature of the damage due to lack of NPSH over a long time period. The argument about timing of gas transport simply adds to the unlikely combination of the gas transport for a short period at a time when NPSH margin is low. Better word choice would be replace “expected to be” with “many times” in the first paragraph. Replace “expected” with “likely” in the second paragraph. The overall argument would still indicate that for a transient void no NPSH effects need to be accounted for.</p>	<p>Revise attachment 4 to replace the words “expected to be” with “many times” in the first paragraph. Replace “expected” with “likely” in the second paragraph. The overall argument would still indicate that for a transient void no NPSH effects need to be accounted for.</p>

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			NEI could be enhanced by revising attachment 4 as described above.	
	<p><b>Review of Purdue Testing</b> - The WCAP summary is acceptable subject to the following comments:</p> <ol style="list-style-type: none"> <li>1. Piping lengths shorter than used in the Purdue tests can result in hydraulic jump behavior propagating downstream to a pump suction that did not occur in the tests. This potentially causes a significant increase in downstream gas flux in comparison to the test results.</li> <li>2. Empirical correlation predictions must be acceptably applied to experimental data before we will accept their application for analysis of plant configurations. Further, scaling correlation uncertainties should be increased when applied due to the effect of the assumptions, the amount of data, and the stochastic nature of the experimental data.</li> <li>3. The use of "evaluation model" in the PIRT paragraph should not be confused with the traditional "evaluation model" typical of such applications as analysis of design basis loss-of-coolant accidents. The requirements for assessing operability as less stringent than those associated with evaluation models.</li> </ol>	Ref Doc	RESOLVED BY OTHERS. This comment should be addressed and any changes made to the discussion in NEI 09-10 as part of the specific review of the parent document	
	<p><b>Review of Fauske Report</b> – The report does not acceptably establish that flow conditions at the bottom of the downcomer continue to the pump suction.</p>	Ref Doc	RESOLVED BY OTHERS. This comment should be addressed and any changes made to the discussion in NEI 09-10 as part of the specific review of the parent document	
	<p><b>Review of Simplified Equation</b> - The simplified equation has not been acceptably addressed with respect to void behavior in the region from the downcomer to the lower horizontal pipe and in the lower pipe where the data indicate void may accumulate and then move with the void fraction varying as a function of time and position. The situation is complicated by a lack of comprehensive data and variation in void behavior in otherwise identical tests. Another aspect is meeting the acceptance criterion that the instantaneous void fraction should be less than 1.7 times the</p>	Ref Doc	RESOLVED BY OTHERS. This comment should be addressed and any changes made to the discussion in NEI 09-10 as part of the specific review of the parent document	

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	average void fraction. This situation can be addressed by comparisons of simplified equation predictions with selected applicable data. (NRC wants to see examples of where the simplified equation conservatively predicts test data.)			
	<b>Review of Gas-Voids Pressure Pulsations Program</b> - Use of a Froude number of 0.54 may not be sufficient to remove gas from the vicinity of a transition from a horizontal pipe to a vertically downward pipe or in local high points where the full flow does not sweep through the high points.	Ref Doc	RESOLVED BY OTHERS. This comment should be addressed and any changes made to the discussion in NEI 09-10 as part of the specific review of the parent document	
	<b>Review of Gas-Voids Pressure Pulsations Program</b> - Application of the modeling methodology provided in FAI/08-70 to plant configurations is not acceptably substantiated due to a lack of comparisons to test data	Ref Doc	RESOLVED BY OTHERS. This comment should be addressed and any changes made to the discussion in NEI 09-10 as part of the specific review of the parent document	
	<b>Review of PWROG Position Paper on Non-condensable Gas Voids</b> – The NRC expressed the following concerns with respect to the PWREOG report: <ul style="list-style-type: none"> <li>• It does not address other aspects of gas voids such as gas in pump discharge or suction side piping</li> <li>• The report assumes that there is no delay or reduction in emergency core cooling (ECCS) flow rate beyond the point assumed in the safety analyses of record. Licensees referencing the information provided in this report must consequently establish that this assumption is correct.</li> <li>• The potential for gas causing problems with RCP seals is not addressed if gas in a non-active charging path is transported to RCP seals when the path becomes active such as due to swapping charging pumps. It also does not address potential problems if non-safety grade charging pumps are involved. 36</li> </ul>	Ref Doc	RESOLVED BY OTHERS. This comment should be addressed and any changes made to the discussion in NEI 09-10 as part of the specific review of the parent document	