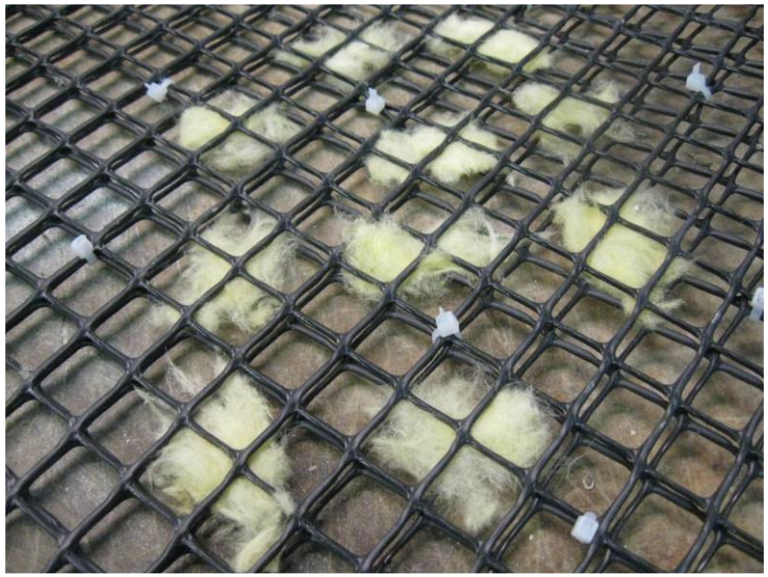
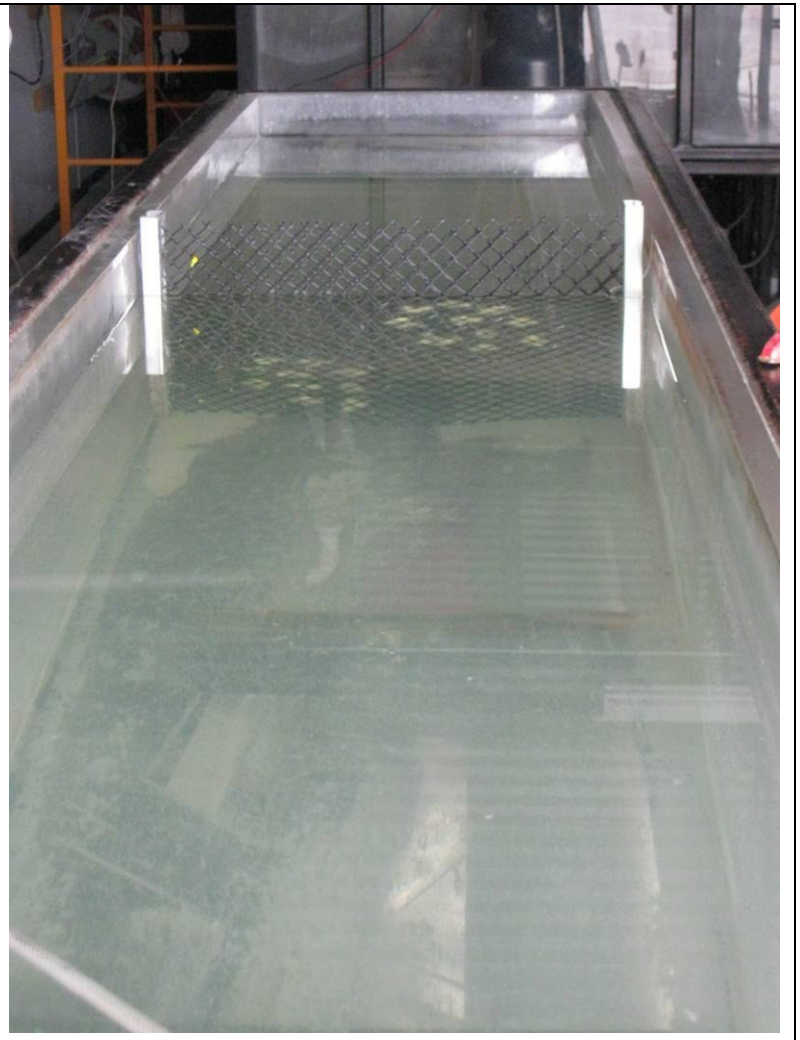
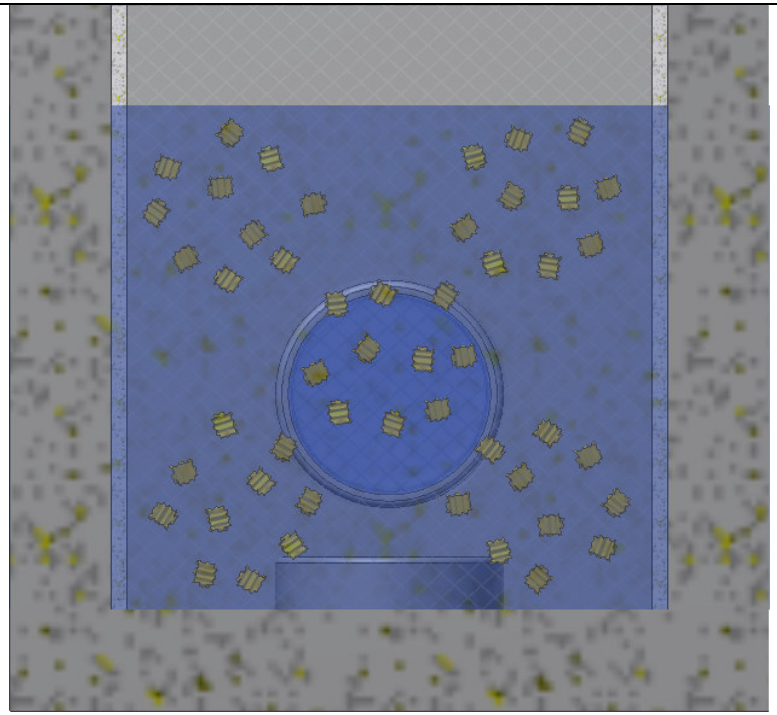
Comments By: John Lehning		Resolved By: Tim Sande
#	Comments	Resolution
1	The NRC staff cannot determine whether Alion's proposed matrix of additional tests will be adequate to justify the intended result of 10% erosion prior to the performance of the tests and review of the resultant data. While the staff concluded, based in part on the number of samples to be used and increased test procedure controls, that it is possible that the planned additional testing will provide sufficiently consistent and coherent data to justify the intended result, clearly the outcome of the additional tests cannot be predicted. The staff further stated that it was appropriate to consider both the results from the planned additional testing, as well as the existing test data, as applicable, in determining a 30-day cumulative erosion percentage.	Alion acknowledges that there may be unexpected results from the testing. However, as long as the test results match the erosion theory described in the methodology report, the planned test matrix will provide adequate justification for a specific erosion fraction. Based on our experience, Alion believes that 10% erosion is an appropriate value. However, it is possible that the results of the testing could show a higher erosion fraction. The purpose of the testing is to confirm the postulated erosion theory, and determine a final erosion fraction that can be used in plant specific analyses. It is unclear to Alion how the NRC staff expects the existing test data to be used in conjunction with the new test data to determine a 30-day cumulative erosion percentage. As stated in Section 4, page 20 of the Alion methodology report, "Due to the uncertainty in the previous erosion test results, and the various configuration and procedural changes that are being implemented in the new tests, the existing data will not be combined with the new test data to determine an overall erosion fraction. Although the new data may be compared to the previous data, the new test data will stand alone by providing a sufficient data set to determine an appropriate erosion fraction without extrapolating short-term data." Also, since the average erosion fraction from the previous test data was less than 10%, factoring that into the new test data would either lower the erosion fraction if the new test data is higher than 10% or simply confirm a low erosion fraction if the new test data is less than 10%. ALION ACTION: None, no document revision required.

2	The staff stated that one of the most critical aspects of the testing would be demonstrating that the cumulative erosion percentage is trending toward an asymptotic value that does not exceed the 30-day cumulative erosion percentage that Alion is attempting to justify. Alion's means of collecting eroded fines to determine the trend in the cumulative erosion percentage was being examined in shakedown testing at the time of the call and had not yet been demonstrated to be effective. The staff emphasized that it would be important to obtain useful data from this measurement and that this data should trend consistently with the information obtained from comparing the pre-test and post-test masses of the test debris pieces.	It is agreed that the time dependent data trend is an important aspect of the testing. Alion is still working on the pre-test activities, and does not have any additional information to report at this time. Any lessons learned from the pre-test activities will be incorporated in the final test plan and test procedures. ACTION: None, no document revision required.
3	The staff stated it would be important to minimize pre-test losses from the test debris, or else account for these losses if they cannot be reduced to a negligible level. The staff considered mass losses following the shredding of the debris into small pieces, through normal handling or preparation processes such as boiling, as representing material that would likely be removed during an erosion test. Alion stated that pre-test handling losses were expected to be minor due to procedural controls. Alion further stated that the percentage weight change observed in the debris pieces as a result of boiling was somewhat less than the weight percentage of organic binder present in manufactured fiberglass (which boiling is intended to remove). As such, Alion concluded that the release of fine fragments from the pieces of shredded fiberglass during boiling was not significant. The staff considered Alion's argument reasonable, but suggested that the vendor continue to be attentive to the potential for mass loss during handling and particularly during boiling. The staff noted that filtering the water used to boil the fiberglass samples and (if a significant amount of fines is collected) weighing any filtered fines released would reduce uncertainties associated with pre-test losses.	Procedural controls are being implemented to minimize any pre-test losses due to handling. The largest potential loss expected is the release of fiber fines during the boiling process. As part of the shakedown testing, Alion is performing more detailed analysis of the percentage of fines washed off the samples during boiling. Based on informal benchtop tests, it was estimated that the weight of the fiberglass is reduced by approximately 2% due to the release of binders when fiberglass is either boiled or baked. To account for any fiberglass fines that are washed off during the boiling process, Alion is planning to filter the boiled water and weigh the fine material as the NRC staff has suggested. ALION ACTION: Revise Test Plan to include filtering the boiled water and measuring the amount of fibers released during the boiling process.
4	The staff stated that it would be important to ensure that the debris pieces used for the erosion testing are exposed to representative flow conditions (e.g., velocity and turbulence). After reviewing results from Alion's computational fluid dynamics model of the	There will always be some flow variations in the flume. Alion has modeled some potential modifications to the flume with the intent of more evenly distributing the flow across the samples as well as generating enough turbulence to bound the plant

	erosion test flume configuration for the existing erosion testing, the staff was concerned that the lack of a fully developed velocity profile and low flume turbulence relative to plant containment pools could also be an issue for the proposed testing. In addition, the staff was concerned that Alion's placement of several sample racks in series in the test flume could further result in a "shadowing effect," by which upstream samples and sample racks would reduce the velocity and dampen the turbulence to which downstream samples would be exposed. Alion stated that the addition of a pre-filter to the test flume would help to reduce the velocity stratification apparent in the computational fluid dynamics results for the existing testing. Alion also stated that additional computational fluid dynamics modeling of the flume configuration for the planned testing was being performed to verify aspects of the turbulence modeling and demonstrate representative flow conditions for the planned testing. The staff suggested that Alion discuss the velocity and turbulence results from the additional computational fluid dynamics modeling with the staff prior to performing the planned erosion testing. The staff further suggested that Alion align the test debris pieces in a manner that would minimize the velocity and/or turbulence defect resulting from upstream samples "shadowing" downstream samples.	specific conditions. The CFD analysis and recommended test configuration is being provided in a separate PowerPoint file for NRC review. The pictures below illustrate how the samples will be exposed to flow on the sample racks. Although the samples will obstruct the flow slightly, the gap between samples allows flow to easily pass through the sample group. Also, the sample racks will be spaced far enough apart at a distance that, based on the preliminary CFD results, is well past the "shadow effect" caused by the upstream samples.  The following pictures show the placement of two of the five sample groups.

		 As shown in the figure below, the five sample groups fill up most of the cross section of the flume, and changing the sample group orientation on the downstream sample racks would not significantly affect the flow.

		 ALION ACTION: Submit the final flume configuration, (with turbulence inducers) to the NRC .
5	The staff stated that it was unclear whether the quantity of fines eroded from upstream samples and subsequently captured on downstream samples would be insignificant. Although Alion planned to consider the importance of this effect through statistical analysis, the staff was not confident that this approach would be successful due to the presence of additional variables that could also result in a discrepancy in the eroded mass for upstream and downstream samples, particularly the shadowing effect described above. The staff suggested that Alion attempt to align the test debris pieces in a manner that would simultaneously expose them to representative flow conditions (i.e., minimize shadowing) and minimize capture of fines from upstream pieces on downstream samples. If such an alignment were found to be impossible, this would indicate that the	Given the large open area between samples in each sample group, (see the pictures in response to Comment 4 above) and the fact that the fiber fines will move with the flow of water (i.e. passing around the samples), it is not likely that any significant quantity of fines released from upstream samples will be permanently captured by the downstream samples. While there are flow variations in the flume, if a significant quantity of fiber fines is being captured by downstream samples, the average weight change of the sample groups on each sample rack should show a distinct trend with weight loss from Sample Rack 1 > Sample Rack 2 > Sample Rack 3. If this turns out to be the case, it will be appropriately factored in to

	number of samples inserted in each test should be reduced.	the overall erosion fraction. Reorienting the sample groups would not guarantee that downstream capture does not occur. Also, given the planned configuration where the samples cover most of the flume cross section, it is not possible to shift the samples to ensure that no samples are directly downstream of other samples. Although reducing the number of sample groups tested may reduce the possibility of downstream capture of fiberglass fines, this would not eliminate the possibility, and would reduce the statistical data set that is being gathered. Given the low likelihood of significant downstream capture, maximizing the statistical data set is considered a higher priority than minimizing potential downstream capture. ALION ACTION: None, no document revision required.
6	The staff stated that new theories or methods used to refine the results for the planned testing should also be considered for their effect on the existing test data in order to understand the full data set. Specific discussion followed concerning Alion's plan to measure the dissolution of fiberglass in deionized water (the test fluid for the planned testing), and subtract out the corresponding mass of dissolved fiber when calculating a cumulative erosion percentage. The staff considered Alion's approach to be physically reasonable, but suggested that a sufficient number of dissolution data points applicable to the Alion test condition be used as a basis to determine a conservative dissolution percentage. The staff considered reducing uncertainties associated with the dissolution percentage to be particularly important because Alion expected the effect of dissolution to be on the same order as that of erosion. Alion further stated that informal benchtop dissolution testing for fiberglass in tap water (the test fluid for the existing erosion testing) had been performed, which suggested that the dissolution of fiberglass fibers in tap water would be minimal. The staff considered the dissolution behavior of fiberglass in tap water to be of significance to understanding the behavior of the full set of erosion data. Specifically, an understanding of this dissolution behavior could form part of the basis to justify subtracting dissolution from the results of	See response to Comment 1 regarding the previous erosion test data. Based on the informal benchtop tests that were performed, dissolution is believed to be lower in tap water than in deionized or reverse osmosis water. However, the tap water dissolution benchtop test was inconclusive due to the observation of some precipitate filtered from the water at the end of the benchtop test. Also, the data required to accurately quantify fiberglass dissolution was not gathered in the previous erosion testing. Therefore, there is no way to accurately determine the effect of dissolution on the previous erosion test data. In the planned erosion tests, the necessary test data will be gathered to accurately determine dissolution: fiber mass, water volume, time dependent pH, and time dependent temperature. Water samples will be taken periodically during the test. If necessary, ICP analysis can be performed on the water samples to confirm the calculated dissolution values. ALION ACTION: None, no document revision required.

	the planned tests in deionized water, while justifying that no correction need be applied to the existing tests in tap water.	
7	The staff suggested that Alion consider the manner in which the test debris samples are held against the sample plates in the test flume. Ideally, the samples would be held against the sample plates in a manner that would prevent them from agglomerating or shielding each other, but not compress the samples in a manner that could non-prototypically inhibit erosion.	See the first picture shown in the response to Comment 4. Although the fiberglass is slightly compressed in the center of each clump, this is not considered to be an approach that would non-conservatively inhibit erosion. Actually, this configuration is considered to be conservative compared to prototypical conditions since non-transporting pieces of fiberglass in a containment pool would be resting on the floor with flow primarily passing over only the top of each piece. ALION ACTION: None, no document revision required.