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July 31, 2013

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

SUBJECT: Duke Energy Carolinas, LLC (Duke Energy)
McGuire Nuclear Station, Units 1 and 2
Docket Nos. 50-369 and 50-370

McGuire Nuclear Station Closure Option 1 Response to In-Vessel Downstream Effects Request for Additional Information for Generic Safety Issue (GSI) 191, "Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance" in resolution of Final Issues related to Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors"

On May 8, 2013, McGuire Nuclear Station submitted a letter of intent per SECY-12-0093 "Closure Options for Generic Safety Issue – 191, Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance" indicating McGuire would pursue Closure Option 1 of the SECY recommendations (Compliance with 10 CFR 50.46 Based on Approved Models). The final outstanding issue for McGuire with respect to GSI-191 (identified as RAI Question #31) is the in-vessel downstream effects evaluation, which addresses whether long term core cooling (LTCC) can be adequately maintained for all postulated accident scenarios.

On April 8, 2013, the NRC issued a safety evaluation relating to WCAP-16793-NP, Revision 2 "Evaluation of Long Term Cooling Considering Particulate, Fibrous, and Chemical Debris in the Recirculating Fluid". As the WCAP-16793-NP, Revision 2 methodology represents an NRC-approved model, successful completion of the in-vessel downstream effect analysis in accordance with the associated NRC SER shows compliance with 10 CFR 50.46, and resolves the final outstanding RAI question for McGuire Nuclear Station.

The in-vessel downstream effect analysis has been successfully completed for McGuire Nuclear Station, and is documented in Attachment 1. This satisfies the final GSI-191 commitment identified in the May 8, 2013 Closure Option letter.

If any questions arise or additional information is needed, please contact P.T. Vu of Regulatory Affairs at (980) 875-4302.

Very truly yours,

SD Capps

Steven D. Capps

Attachment

A116
NRR

xc (with Attachment):

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Steven D. Capps affirms that he is the person who subscribed his name to the foregoing statement, and that all the matters and facts set forth herein are true and correct to the best of his knowledge.

SD Capps

Steven D. Capps, Vice President, McGuire Nuclear Station

Subscribed and sworn to me: July 31, 2013
Date

Lori C. Gibby, Notary Public

My commission expires: July 1, 2017
Date

SEAL

Attachment 1

McGuire Nuclear Station
Generic Letter 2004-02 Supplemental Response

Response to Request for Additional Information
Question #31: In-Vessel Downstream Effects

July 31, 2013

31. The NRC staff considers in-vessel downstream effects to not be fully addressed at McGuire, as well as at other pressurized-water reactors. The supplemental response for McGuire refers to the evaluation methods of Section 9 of Topical Report (TR) WCAP-16406-P, Revision 1, "Evaluation of Downstream Sump Debris Effects in Support of GSI-191", for in-vessel downstream evaluations and makes reference to a comparison of plant-specific parameters to those evaluated in TR WCAP-16793-NP, Revision 0, "Evaluation of Long Term Cooling Considering Particulate, Fibrous, and Chemical Debris in the Recirculating Fluid." The NRC staff has not issued a final Safety Evaluation (SE) for TR WCAP-16793-NP. The licensee may demonstrate that in-vessel downstream effects issues are resolved for McGuire by showing that the licensee's plant conditions are bounded by the final TR WCAP-16793-NP and the conditions and limitations identified in the final NRC staff's SE. The licensee may also resolve this item by demonstrating without reference to TR WCAP-16793 or the NRC staff's SE that in-vessel downstream effects have been addressed at McGuire. In any event, the licensee should report how it has addressed the in-vessel downstream effects issue within 90 days of issuance of the final NRC staff's SE on TR WCAP-16793. The NRC staff is developing a Regulatory Issue Summary to inform the industry of the NRC staff's expectations and plans regarding resolution of this remaining aspect of GSI-191.

McGuire Response:

In accordance with the SECY-12-0093 letter recommendation and as identified in Duke Energy letter to NRC dated May 8, 2013, McGuire Nuclear Station elected to pursue GSI-191 Closure Option 1 since both Units 1 and 2 meet the requirements of 10 CFR 50.46, “Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors,” based on approved models for analyses, strainer head loss testing, and in-vessel downstream effects. As the WCAP-16793-NP, Revision 2 methodology represents an NRC-approved model, successful completion of the analysis in accordance with the associated SER shows compliance with 10 CFR 50.46 as it relates to in-vessel downstream effects, and resolves this final outstanding RAI question for McGuire Nuclear Station.

Compliance with WCAP-16793-NP, “Evaluation of Long-Term Cooling Considering Particulate, Fibrous and Chemical Debris in the Recirculating Fluid”, Rev. 2 and the associated NRC Safety Evaluation issued on April 8, 2013 can be demonstrated by examining ECCS strainer bypass testing results, scaling the results to overall debris quantities predicted to be transported to the reactor vessel, evaluation of in-core response based on application of the LOCADM models, and successful application of the limitations and conditions imposed in the Safety Evaluation issued by the staff.

Background

As stated in the McGuire Supplemental Response dated February 28, 2008 and amended on April 30, 2008, as well as subsequent RAI responses submitted on July 2, 2012, the McGuire Replacement ECCS Sump Strainers utilize a modular "Top Hat" design with the individual Top Hats mounted to a suction plenum structure. The sump strainer structure is mounted to the containment floor (no sump pit) with the Top Hats mounted horizontally. Each Top Hat module consists of two concentric perforated plates (3/32" diameter holes) with a debris bypass eliminator stainless steel knitted wire mesh sandwiched between them. The Top Hats range in length between 24 and 45 inches. The gross and net surface areas for the McGuire Unit 1 and Unit 2 ECCS sump strainers are shown below in Table 31S-1.

Table 31S-1

McGuire Replacement ECCS Sump Strainer Surface Area

	Gross Surface Area (ft^2)	Net Surface Area (ft^2)
Unit 1	1761	1578
Unit 2	1773	1593

ECCS Sump Strainer Bypass Testing

Catawba and McGuire contracted with Alion Science and Technology to perform strainer bypass testing in 2006 while designing the Replacement ECCS Sump Strainers and compiling information required to address the Generic Letter 2004-02 Supplemental Response. The purpose of the testing was to determine the volume and characteristics of fibrous material that might bypass the Top Hat module perforated plate surfaces, both with and without the debris bypass eliminator mesh. The testing apparatus and protocol were developed to ensure a robust and conservative test. The following sections will detail pertinent aspects of the strainer bypass testing series.

- Test Flume Design

  Alion's test flume design consisted of a clear plexiglass tank/flow loop built around a plywood mount for a single 36" long Top Hat module. The plywood mount was constructed with side walls to simulate the proximity of adjacent Top Hats and provide a representative interstitial volume for debris collection around the test module.

  A filtering system was incorporated into the flow loop to capture all the fibrous debris that bypassed the test Top Hat module. The entire flow downstream of the Top Hat test module passed through the parallel filter cartridge assembly with the required full flow capacity and a capture efficiency of at least 90% at 5μm.

- Test Flowrate

  It is known that higher approach velocities produce more debris bypass; the flow rate chosen for the bypass tests was therefore representative of the highest flowrates predicted to exist at the start of post-LOCA sump recirculation. At the time of testing, this flow rate was representative of two Residual Heat Removal pumps and two Containment Spray pumps taking suction from the ECCS containment sump. In addition, the area of the strainer available for flow was based on the smallest designed strainer reduced by sacrificial strainer area predicted to be lost to miscellaneous latent debris (i.e., tags and labels), and the effect of the inherent non-free flow areas of the Top Hat itself (i.e., the longitudinal seams and stiffener rings). After this base approach velocity was determined, it was increased by approximately a factor of two to accommodate the "inrush" flow that will occur in the Top Hat modules located hydraulically closest to the ECCS suction inlet piping (reference also McGuire GL 2004-02 RAI Response submittal dated July 2, 2012).

  Since 2006, several changes have been made in the plant that provide additional conservatism with respect to the test approach velocity. Most significant is the implementation of an ECCS Water Management Initiative. This results in only one train of containment spray being operated at a time while taking suction from the ECCS sump pool, thus reducing the overall flow through the ECCS strainer by approximately 25%. Additional conservatisms are noted in that the area calculations performed during testing were based on the as-designed ECCS Sump Strainers; the as-built configurations have a greater surface area than the original design. Also, compared to the initial containment debris evaluations, the quantity of tags and labels that transport to the ECCS Sump Strainers has been reduced.

- Fibrous Debris Preparation
  To reproduce the conditions that would be experienced by fiber insulation within a break zone of influence in the plant, the fiber insulation was pre-baked and double shredded by two passes through a leaf shredder. This insulation was then boiled for a minimum of ten minutes to simulate the predicted residence time in the hot sump pool as the fiber transports to the strainer. This process was effective at producing fiber sizes that readily transported in the test flume and were capable of bypassing the perforated plate of the straining surface area.

- Fibrous Debris Introduction
  The prepared fibrous debris was added to the test flume in small batches over a period of time; each batch was weighed and mixed with water prior to introduction. This strategy built a debris bed on the Top Hat test module in controlled increments so that the test loop and downstream filter system head loss limits were not exceeded. Upon the introduction of each batch of fibrous debris, the next batch was added only after it was visually confirmed that the previous batch had completely transferred to the test module. The point at which the Top Hat test module was completely covered with fibrous debris was noted in the test log but the test continued until the interstitial volume of the test module was completely filled with debris.

- Fibrous Debris Transport Efficiency
  Care was taken in the test procedure to avoid the settling of the debris in the test flume. This was accomplished by periodically stirring the test flume to keep the fibrous debris suspended. The design of the plywood enclosure prevented the disturbance of the debris bed during stirring.

- Capture/Quantification of Bypassed Debris
  Following each bypass test, the control filter bag and test filter bags from the cartridges were dried using a minimum of two drying/weighing cycles to ensure that residual moisture content was minimal. Following the drying/weighing cycles, the final weight of the control filter bag and test filter bags were compared to the previously recorded clean weight in order to determine the amount of fibrous debris captured by the filter bags.

- Characterization of Captured Downstream Fibrous Debris
  The fibers collected in the filter bags during the strainer bypass testing were examined using both optical microscopy and scanning electron microscopy (SEM). It was concluded that over 84% of the fibers collected inside the filter bags were shorter than 500 μm in length. Additionally, over 98% of the fibers collected inside the filter bag were shorter than 1000 μm in length. The SEM observation also determined that 100% of the fibers stuck inside the weave of the filter bags were shorter than 1000 μm.

- Bypass Testing Results
  Results of the Duke Top Hat Module Bypass Testing are provided in the following section which outlines the post processing of the testing results as well as determination of overall fiber bypass quantity that can be expected at McGuire.

Post Processing of Bypass Test Results and Determination of In-Vessel Debris Quantities

The fiber bypass testing described previously determined the quantity of fiber that can be expected to bypass the Top Hat modules and Debris Bypass Eliminators used in the McGuire replacement ECCS Sump Strainers. This information, in conjunction with a series of experiments sponsored by the NRC performed by Los Alamos National Laboratory (LANL) to determine the type and quantity of debris that will pass through sump screens and openings of various sizes, are utilized to determine the predicted debris bypass quantity of the as-built ECCS Sump Strainer. In order to correlate the bypass testing results to the quantity of fibrous debris predicted to transport to the strainer, it was necessary to determine the maximum potential area of gaps and openings within the ECCS Sump Strainer assembly and determine the bypass fraction based on both LANL Bypass testing and Top Hat Module Bypass testing.

- Area of Gaps/Openings within ECCS Sump Strainer Plenums
  Potential gaps/openings can exist between the strainer plenums and sealing plates, between the Top Hat base plates and the plenums, and inspection ports and vent holes in the strainer plenum. The replacement ECCS Sump Strainer was designed such that any gaps or openings between connecting parts of the strainer that provide entry into the strainer internals would not exceed 3/32" diameter or be larger than 1/16" in characteristic dimension. Therefore, the debris bypass evaluation assumed 1/16" gaps at all bolted connections and a 3/32" diameter for all vent holes. This is considered conservative as this is the maximum allowable clearance and the majority of these connections have little or no gaps present, and the existence of a continuous peripheral gap around each joint is not considered credible. In addition, even if a small gap does exist, debris would have to travel a torturous path to pass through the gap, thus increasing the likelihood of the fiber being trapped. Although not credited in the evaluation, it is expected that after a short period of time, a build-up of debris would clog the gaps and prevent further bypass. It should also be noted that all accessible bolted connections are inspected during refueling outages to ensure compliance with design tolerances. Review of design drawings in conjunction with the assumptions stated above results in a bounding total gap/opening area of 5.82 ft^2 available for fibrous debris to bypass the McGuire ECCS Sump Strainer Top Hat modules.

- Fiber Bypass Through Strainer Gaps/Openings
  A series of tests to address the tendency of different types of insulation debris to penetrate sump screens with various size openings were performed under the direction of LANL to generate data needed to support the resolution of GSI-191. A test case from the LANL testing utilized a screen size of 1/16" and an approach velocity of 0.208 ft/sec, and resulted in a bypass fraction of 3.92%. This test case was chosen to serve as the basis for determining the bypass through the gaps/openings in the McGuire ECCS strainer design. The 1/16" screen size in the LANL test is equivalent to the maximum allowable width of gaps in the McGuire strainer, and is

very similar to the 3/32" drain/vent hole size as well. The 0.208 ft/sec approach velocity is much larger than the maximum approach velocity of 0.051 ft/sec expected for the McGuire ECCS Sump Strainer. Given that the LANL testing determined a direct relationship between higher approach velocities and increased bypass fractions, the use of this test case is considered conservative.

- Fiber Bypass through the Top Hat Module
  The results of the Duke ECCS sump strainer bypass testing described previously are provided below in Table 31S-2. For McGuire, the bypass test of record is Test #2 due to the higher bypass fraction.

Table 31S-2
Results of Duke Top Hat Module Bypass Testing

Test Number*	Strainer Approach Velocity (ft/s)	Total Fiber Load Used for Testing (lbm)	Fiber Bypass (grams)	Fiber Amount for Full Coverage** (lbm)	Fiber Bypass Fraction
2	0.045	13.44	23.45	2.88	1.80%
3	0.075	8.64	26.94	7.68	0.77%

* Note: Test #1 was a bypass test without the knitted steel Debris Bypass Eliminator (DBE) mesh installed, and the results of this test are not applicable to the as-built McGuire ECCS Sump Strainer configuration.
**Note: "Full coverage" is the minimum fiber quantity required to just cover the Top hat surface. For Test #2 this occurred after the value shown in the table, but prior to the value shown for Test #3.

The fiber bypass fraction presented above is the ratio between the fiber bypass quantity and the minimum fiber quantity required for full Top Hat coverage. As stated previously, this testing was performed in 2006 before guidance was widely available for performing Sump Strainer Bypass testing. As a result, determining the exact point at which the Top Hat became covered was not an objective of the testing. However, a review of the test logs identified notes indicating when the Top Hat module surface was likely covered for each test, and allowed conservative determination of the fiber quantity that had been introduced.

As identified in previous submittals, plant modifications have been performed to remove a large portion of the fibrous insulation in the McGuire containment, and also to reduce the ECCS recirculation flow rate. The fiber loads and test velocities used in the original strainer bypass tests therefore reflect plant fibrous debris loads and flow rates significantly higher than the existing McGuire configuration. In the bypass test of record in Table 31S-2, the amount of fiber bypass was measured to be 23.45 grams, which was generated by introducing 13.44 lbm of fiber into the test tank. This total fiber load was originally designed to fill the interstitial volume of the strainer test rig (which it did), and as a result there was likely continued bypass beyond Top Hat module coverage alone due to increased compression of the debris bed. The fiber quantity replicating current transported fibrous debris loads would be much less than the 13.44 lbm used in the original test; as a result, the 23.45 grams of fiber bypass measured in the test of record is considered bounding.

By determining the bypass fraction as a ratio of the fiber bypass quantity and the minimum fiber amount required for full Top Hat coverage during testing, no credit is taken for additional filtering from the debris bed itself. This also increases the computed bypass fraction by nearly a factor of five over a proportion based on the total test fiber debris load introduced to the test tank.

The preceding discussion forms the basis for the use of a Top Hat bypass fraction of 1.80% as a valid and conservative value.

- Total Fiber Bypass
  Using the information presented previously for strainer plenum gap/opening bypass (3.92%) and also for Top Hat module bypass (1.8%), the overall amount of fiber that passes through the McGuire ECCS Sump Strainer can be determined. For each flow path (plenum gap/opening bypass and Top Hat module bypass) the quantity of entrained fibrous debris is first calculated by correlating the free flow area of the plenum gaps/openings and Top Hat module perforated plate. Overall fibrous debris load is then split between the two flow paths and then multiplied by the fiber bypass fraction associated with the flow path to determine the amount of fiber bypass. The fiber bypass quantities of the two flow paths are then combined to obtain the total fiber bypass for the ECCS strainer.

  Following this process, the bounding fiber bypass volume for McGuire is 1.475 ft^3, generated by a total expected fibrous debris load transporting to the strainer of 80.9 ft^3. This corresponds to 8.3 g/fuel assembly based on a density of 2.4 lb/ft^3 for the fibrous debris and the total number of fuel assemblies of 193.

Analysis of In-Vessel Downstream Effects

The Pressurized Water Reactor Owners Group (PWROG) and Westinghouse developed a methodology for evaluating the effect of debris and chemical products on core cooling for Pressurized Water Reactors, as documented in report WCAP-16793-NP, Revision 2. The entry point for using this methodology is the determination, via test, of the fiber bypass quantity reaching the core.

The quantity of fiber bypassing the ECCS Sump Strainer and subsequently transported to the McGuire reactor core has been established as described previously as 8.3 g/FA.

The remainder of the acceptance criterion associated with the WCAP report is met by use of the LOCA Deposition Model (LOCADM) contained as part of WCAP-16793-NP, Rev. 2. This model predicts the scale thickness due to deposition of bypass debris on the fuel rod surfaces and then evaluates the resulting peak cladding temperature of the fuel rods. The scale thickness is combined with the thickness of existing fuel cladding oxidation and crud build-up to calculate the total deposition thickness.

The results of the WCAP-16793-NP, Revision 2 evaluation conclude the accumulation and deposition of fibrous and chemical precipitate debris at the reactor core will not challenge the ability to maintain post-accident Long Term Core Cooling (LTCC) at McGuire.

- Application of the bypass testing performed specifically for the Top Hat modules in use at McGuire as well as LANL testing concluded that the amount of fibrous debris at the reactor core translates to 8.3 grams per fuel assembly. This debris load is within the bounds of the 15 gram per fuel assembly limit given in the WCAP report. Therefore, accumulation of fibrous debris at the reactor core spacer grids will not block long term core cooling flow.

- Utilizing the methodology outlined in WCAP-16793-NP, LOCADM runs were performed for two different cases: minimum initial ECCS sump volume (Case 1) and maximum initial ECCS sump volume (Case 2). Table 31S-3 below summarizes the peak cladding temperature, scale thickness and deposition thickness of the two cases.

Table 31S-3
McGuire LOCADM Model Results

Case	Peak Cladding Temperature PCT (°F)	Scale Thickness ST (microns)	Deposition Thickness DT (mils)
1 (Min ECCS Sump Volume)	350	18.7	12.2
2 (Max ECCS Sump Volume)	350	6.8	11.8

For either case, the PCT is much lower than the acceptance criterion of 800°F and the DT value is well within the acceptance criterion of 50 mils. Therefore, deposition of post-LOCA debris and chemical precipitate product on the fuel rods will not block the long term core cooling flow through the core nor create unacceptable local hot spots on the fuel cladding surfaces.

Compliance with Limitations and Conditions

The NRC Safety Evaluation dated April 8, 2013 provides analysis and recommendations on the usage of Westinghouse's WCAP-16793-NP, Revision 2 evaluations. Specifically, the SE points out 14 Limitations and Conditions that must be addressed when applying the WCAP methodology. These 14 Limitations and Conditions are addressed for the McGuire configuration below.

WCAP-16793-NP, Revision 2 Safety Evaluation
Limitations and Conditions

1. Assure the plant fuel type, inlet filter configuration, and ECCS flow rate are bounded by those used in the FA testing outlined in Appendix G of the WCAP. If the 15 g/FA acceptance criterion is used, determine the available driving head for a HL break and compare it to the debris head loss measured during the FA testing. Compare the fiber bypass amounts with the acceptance criterion given in the WCAP.

   McGuire Response:
   - Utilizing the methodology identified in RAI #18 of PWROG letter OG-10-253, "PWROG Response to Request for Additional Information Regarding PWROG Topical Report WCAP-16793-NP, Revision 1", dated August 2010, the available driving head for a hot leg break at McGuire is determined to be 16.4 psi. This driving head is favorably higher than the appropriate head losses measured for both AREVA (2.7 psi) and Westinghouse (6.26 psi) fuels in the FA testing.
   - The maximum ECCS injection flow rate expected for a cold leg break at McGuire is 8041 gpm. This corresponds to a flow rate of 41.7 gpm/FA which is within the bounds of the FA testing flow rate of 44.5 gpm/FA. In a cold leg break scenario some coolant flow would be expected to exit the break in the faulted RCS loop, but no reduction in ECCS flow is assumed for this evaluation which ensures conservatism by forcing maximum downstream debris flow through the reactor core.
   - The McGuire fuel type (17×17 Westinghouse) and inlet filter configuration (standard Westinghouse P-Grid) are covered by the FA testing program in Appendix G of WCAP-16793-NP, Revision 2.
   - As determined earlier, the amount of fiber bypass at McGuire translates to 8.3 g/FA, which is within the bounds of the 15 g/FA acceptance criterion limit identified in WCAP-16793-NP, Revision 2.

2. Each licensee's GL 2004-02 submittal to the NRC should state the available driving head for a HL break, ECCS flow rates, LOCADM results, type of fuel and inlet filter, and amount of fiber bypass.

   McGuire Response:
   See the Analysis of In-Vessel Downstream Effects Section of this RAI response for the plant-specific LOCADM results. For the available hot leg break driving head, ECCS flow rate, type of fuel and inlet filter, and the amount of fiber bypass, see the response to Limitations and Conditions item #1 above.

3. If a licensee credits alternate flow paths in the reactor vessel in their LTCC evaluations, justification is required through testing or analysis.

   McGuire Response:
   McGuire is not crediting alternate flow paths. Therefore, no additional justification is required.

4. The numerical analysis discussed in Section 3.2 and 3.3 of the WCAP should not be relied upon to demonstrate adequate LTCC.

   McGuire Response:
   McGuire does not use any of the conclusions drawn based on the fuel blockage modeling discussed in Sections 3.2 and 3.3 of the WCAP-16793-NP, Revision 2 report. Instead, the fibrous debris amount at the core obtained from McGuire strainer bypass testing and evaluation (discussed previously) is compared with the reactor core fibrous debris acceptance criterion established from the FA testing to show that the debris will not form impenetrable blockage at the core spacer grid, thereby demonstrating adequate LTCC.

5. Assure the plant meets the 15 g/FA fiber bypass acceptance criteria limit.

   McGuire Response:
   See the Post Processing Bypass Test Results section of this RAI response for derivation of the 8.3 g/FA expected for the McGuire reactor core. As noted, this bypass quantity meets the 15 g/FA acceptance criteria limit identified in the SE.

6. The Debris acceptance criterion can only be applied to fuel types and inlet filter configurations evaluated in the WCAP FA testing.

   McGuire Response:
   As stated in the response to Limitations and Conditions item #1, McGuire's fuel type (Westinghouse 17×17) and inlet filter configuration (standard Westinghouse P-grid) are covered by the Westinghouse FA testing described in WCAP-16793-NP, Revision 2. Therefore, the in-vessel fibrous debris acceptance criterion given in the WCAP is applicable to the McGuire fuel type and inlet filter configuration.

7. Each licensee's GL 2004-02 submittal to the NRC should compare the PCT from LOCADM with the acceptance criterion of 800°F.

   McGuire Response:
   The McGuire PCT is determined to be 350°F as described in the Analysis of In-Vessel Downstream Effects Section of this RAI response, which is well within the acceptance criterion of 800°F.

8. When utilizing LOCADM to determine PCT and DT, the aluminum release rate must be doubled to more accurately predict aluminum concentrations in the sump in the initial days following a LOCA.

   McGuire Response:
   The appropriate modeling methodology was followed, including the doubling of the aluminum release rate, in the LOCADM analysis.

9. If refinements specific to the plant are made to the LOCADM to reduce conservatisms, the licensee should demonstrate that the results still adequately bound chemical product generation.

   McGuire Response:
   McGuire did not credit any refinements provided in the model.

10. The recommended value for scale thermal conductivity of 0.11 BTU/(h-ft-°F) should be used for LTCC evaluations.

    McGuire Response:
    The recommended scale thermal conductivity was used in the McGuire LTCC evaluation. This represents the lowest (and most limiting) value as discussed in Appendix E of WCAP-16793-NP, Revision 2. Lower thermal conductivities inhibit heat transfer from the fuel rods and increase PCT.

11. The quantity of fiber bypass should be determined by strainer bypass testing using information specific to the plant.

    McGuire Response:
    See the ECCS Sump Strainer Bypass Testing section of this RAI response for discussion of the plant-specific strainer bypass testing that was performed for McGuire.

12. If a licensee intends to increase the 15 g/FA acceptance criterion for fiber bypass, additional justification is required.

    McGuire Response:
    As stated previously in this RAI response, the McGuire in-vessel fibrous debris quantity is within the bounds of the 15 g/FA acceptance criterion limit. No increase in the stated acceptance criteria limit is being pursued.

13. The size distribution of fibrous debris that passes through the sump strainer at the plant must represent the size distribution of the debris used in the FA testing.

    McGuire Response:
    The fibers collected in the filter bags during the strainer bypass testing were examined using both optical microscopy and scanning electron microscopy (SEM). Over 84% of bypassed fibers were shorter than 500 microns in length, 14% were between 500 and 1000 microns, and 2% were longer than 1000 microns. For the WCAP-16793-NP, Revision 2 FA tests, 67%-87% of the fibers were shorter than 500 microns, 8%-28% were between 500 microns and 1000 microns, and between 0%-15% were longer than 1000 microns. Therefore, the size distribution of the fibrous debris predicted to bypass the McGuire ECCS Sump Strainers is consistent with that of the fibers used in the FA testing. This provides assurance that the fibrous debris bypass acceptance criterion developed from the FA testing is applicable to McGuire.

14. Each licensee's GL 2004-02 submittal to the NRC should not utilize the "Margin Calculator" as it has not been reviewed by the NRC.

    McGuire Response:
    The McGuire in-vessel downstream effects evaluation does not utilize the "Margin Calculator".

Summary

The preceding evaluation of the McGuire in-vessel downstream effects issue described in RAI question 31 of NRC letter dated November 18, 2008 verifies that long term core cooling can be adequately maintained in the predicted post-accident scenarios.