October 20, 2009

MEMORANDUM TO: Harold K. Chernoff, Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

FROM: Dennis Egan, Senior Project Manager ***/ra/***
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

SUBJECT: SEABROOK STATION, UNIT NO. 1, DRAFT REQUEST FOR ADDITIONAL INFORMATION (TAC NO. MC4716)

The enclosed draft request for information (RAI) was transmitted on April 15, 2009, to Mr. Michael O'Keefe of FPL Energy Seabrook, LLC. This request is related to Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," for Seabrook Station, Unit No.1. This information was transmitted to facilitate communications to clarify the licensee's response to the GL.

This memorandum and the enclosure do not convey or represent an NRC staff position regarding the licensee's GL response.

Docket No. 50-443

Enclosure: Draft RAI

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DRAFT REQUEST FOR ADDITIONAL INFORMATION
RELATED TO GENERIC LETTER 2004-02 CORRECTIVE ACTIONS
SEABROOK STATION, UNIT NO.1
DOCKET NO. 50-443

By letters dated February 28, 2008 and August 4, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML080630273 and ML082210425), the licensee submitted supplemental responses to Generic Letter (GL) 2004-02, “Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors,”.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the licensee’s submittals. The process involved a detailed review by a team of approximately 10 subject matter experts, with a focus on the review areas described in the NRC’s “Content Guide for Generic Letter 2004-02 Supplemental Responses” (ADAMS Accession No. ML073110389). Based on these reviews, the staff has determined that additional information is needed in order to conclude there is reasonable assurance that GL 2004-02 has been satisfactorily addressed. The requests for additional information (RAIs) follow.

This draft is provided to facilitate any discussions and clarifications needed prior to formally transmitting the RAIs in a letter. It is requested that the licensee identify their desire to have a teleconference and coordinate a time, as soon as possible. The NRC will request that the licensee respond to these RAIs within 90 days of the date of the letter. However, the NRC would like to receive only one response letter for all RAIs, with the exception stated below. If the licensee concludes that more than 90 days are required to respond to the RAIs, the licensee should request additional time, including a basis for why the extended time is needed.

The exception to the above response timeline is RAI 40. The NRC staff considers in-vessel downstream effects to not be fully addressed at Seabrook Station, as well as at other pressurized water reactors. The licensee's submittal refers to draft WCAP-16793-NP, “Evaluation of Long-Term Cooling Considering Particulate, Fibrous, and Chemical Debris in the Recirculating Fluid.” At this time, the NRC staff has not issued a final safety evaluation (SE) for WCAP-16793.

The licensee may demonstrate that in-vessel downstream effects issues are resolved by showing that the licensee’s plant conditions are bounded by the final WCAP-16793 and the corresponding final NRC staff SE, and by addressing the conditions and limitations in the final SE. The licensee may also resolve the in-vessel downstream effect RAIs by demonstrating, without reference to WCAP-16793 or the NRC staff SE, that in-vessel downstream effects have been addressed for the Seabrook Station. The specific issues raised in these RAIs should be addressed regardless of the approach the licensee chooses to take.

The licensee should report how it has addressed the in-vessel downstream effects issue and the associated RAI referenced above within 90 days of issuance of the final NRC staff SE on WCAP-16793. The NRC staff is currently developing a Regulatory Issue Summary to inform licensees of the staff’s expectations and plans regarding resolution of this remaining aspect of Generic Safety Issue 191, “Assessment of Debris Accumulation on PWR Sump Performance.”

Enclosure

Debris Generation/Zone of Influence (ZOI)

1. Although the ANSI/ANS standard predicts higher jet centerline stagnation pressures associated with higher levels of subcooling, it is not intuitive that this would necessarily correspond to a generally conservative debris generation result. Please justify the initial debris generation test temperature and pressure with respect to the plant-specific reactor coolant system (RCS) conditions, specifically the plant hot and cold leg operating conditions. If ZOI reductions are also being applied to lines connecting to the pressurizer, then please also discuss the temperature and pressure conditions in these lines. Were any tests conducted at alternate temperatures and pressures to assess the variance in the destructiveness of the test jet to the initial test condition specifications? If so, provide that assessment.

2. Describe the jacketing/insulation systems used in the plant for which the testing was conducted and compare those systems to the jacketing/insulation systems tested. Demonstrate that the tested jacketing/insulation system adequately represented the plant jacketing/insulation system. The description should include differences in the jacketing and banding systems used for piping and other components for which the test results are applied, potentially including steam generators, pressurizers, reactor coolant pumps, etc. At a minimum, the following areas should be addressed:

   a. How did the characteristic failure dimensions of the tested jacketing/insulation compare with the effective diameter of the jet at the axial placement of the target? The characteristic failure dimensions are based on the primary failure mechanisms of the jacketing system, e.g., for a stainless steel jacket held in place by three latches where all three latches must fail for the jacket to fail, then all three latches must be effectively impacted by the pressure for which the ZOI is calculated. Applying test results to a ZOI based on a centerline pressure for relatively low target to nozzle (L/D) spacing would be non-conservative with respect to impacting the entire target with the calculated pressure.

   b. Was the insulation and jacketing system used in the testing of the same general manufacture and manufacturing process as the insulation used in the plant? If not, what steps were taken to ensure that the general strength of the insulation system tested was conservative with respect to the plant insulation? For example, it is known that there were generally two very different processes used to manufacture calcium silicate whereby one type readily dissolved in water but the other type dissolves much more slowly. Such manufacturing differences could also become apparent in debris generation testing as well.

   c. The information provided should also include an evaluation of scaling the strength of the jacketing or encapsulation systems to the tests. For example, a latching system on a 30-inch pipe within a ZOI could be stressed much more than a latching system on a 10-inch pipe in a scaled ZOI test. If the latches used in the testing and the plants are the same, the latches in the testing could be significantly under-stressed. If a prototypically sized target were impacted by an undersized jet it would similarly be under-stressed. Evaluations of banding, jacketing, rivets, screws, etc., should be made. For example, scaling the strength of the jacketing was discussed in the Ontario Power Generation report on calcium silicate debris generation testing.

3. There are relatively large uncertainties associated with calculating jet stagnation pressures and ZOIs for both the test and the plant conditions based on the models used in the WCAP reports. What steps were taken to ensure that the calculations resulted in conservative estimates of these values? Please provide the inputs for these calculations and the sources of the inputs.

4. Describe the procedure and assumptions for using the ANSI/ANS-58-2-1988 standard to calculate the test jet stagnation pressures at specific locations downrange from the test nozzle.

    a. In WCAP-16710-P, why was the analysis based on the initial condition of 530°F whereas the initial test temperature was specified as 550°F?

    b. Was the water subcooling used in the analysis that of the initial tank temperature or was it the temperature of the water in the pipe next to the rupture disk? Test data indicated that the water in the piping had cooled below that of the test tank.

    c. The break mass flow rate is a key input to the ANSI/ANS-58-2-1988 standard. How was the associated debris generation test mass flow rate determined? If the experimental volumetric flow was used, then explain how the mass flow was calculated from the volumetric flow given the considerations of potential two-phase flow and temperature dependent water and vapor densities? If the mass flow was analytically determined, then describe the analytical method used to calculate the mass flow rate.

    d. Noting the extremely rapid decrease in nozzle pressure and flow rate illustrated in the test plots in the first tenths of a second, how was the transient behavior considered in the application of the ANSI/ANS-58-2-1988 standard? Specifically, did the inputs to the standard represent the initial conditions or the conditions after the first extremely rapid transient, e.g., say at one tenth of a second?

    e. Given the extreme initial transient behavior of the jet, justify the use of the steady state ANSI/ANS-58-2-1988 standard jet expansion model to determine the jet centerline stagnation pressures rather than experimentally measuring the pressures.

5. Describe the procedure used to calculate the isobar volumes used in determining the equivalent spherical ZOI radii using the ANSI/ANS-58-2-1988 standard.

    a. What were the assumed plant-specific RCS temperatures and pressures and break sizes used in the calculation? Note that the isobar volumes would be different for a hot leg break than for a cold leg break since the degrees of subcooling is a direct input to the ANSI/ANS-58-2-1988 standard and which affects the diameter of the jet. Note that an under calculated isobar volume would result in an under calculated ZOI radius.

b. What was the calculational method used to estimate the plant-specific and break-specific mass flow rate for the postulated plant loss of coolant accident (LOCA), which was used as input to the standard for calculating isobar volumes?

c. Given that the degree of subcooling is an input parameter to the ANSI/ANS-58-2-1988 standard and that this parameter affects the pressure isobar volumes, what steps were taken to ensure that the isobar volumes conservatively match the plant-specific postulated LOCA degree of subcooling for the plant debris generation break selections? Were multiple break conditions calculated to ensure a conservative specification of the ZOI radii?

6. Provide a detailed description of the test apparatus specifically including the piping from the pressurized test tank to the exit nozzle including the rupture disk system.

   a. Based on the temperature traces in the test reports it is apparent that the fluid near the nozzle was colder than the bulk test temperature. How was the fact that the fluid near the nozzle was colder than the bulk fluid accounted for in the evaluations?

   b. How was the hydraulic resistance of the test piping which affected the test flow characteristics evaluated with respect to a postulated plant-specific LOCA break flow where such piping flow resistance would not be present?

   c. What was the specified rupture differential pressure of the rupture disks?

7. WCAP-16710-P discusses the shock wave resulting from the instantaneous rupture of piping.

   a. Was any analysis or parametric testing conducted to get an idea of the sensitivity of the potential to form a shock wave at different thermal-hydraulic conditions? Were temperatures and pressures prototypical of PWR hot legs considered?

   b. Was the initial lower temperature of the fluid near the test nozzle taken into consideration in the evaluation? Specifically, was the damage potential assessed as a function of the degree of subcooling in the test initial conditions?

   c. What is the basis for scaling a shock wave from the reduced-scale nozzle opening area tested to the break opening area for a limiting rupture in the actual plant piping?

   d. How is the effect of a shock wave scaled with distance for both the test nozzle and plant condition?

8. Please provide the basis for concluding that a jet impact on piping insulation with a 45° seam orientation is a limiting condition for the destruction of insulation installed on steam generators, pressurizers, reactor coolant pumps, and other non-piping components in the containment. For instance, considering a break near the steam generator nozzle, once insulation panels on the steam generator directly adjacent to the break are destroyed, the LOCA jet could impact additional insulation panels on the generator from an exposed

end, potentially causing damage at significantly larger distances than for the insulation configuration on piping that was tested. Furthermore, it is not clear that the banding and latching mechanisms of the insulation panels on a steam generator or other RCS components provide the same measure of protection against a LOCA jet as those of the piping insulation that was tested. Although WCAP-16710-P asserts that a jet at Wolf Creek or Callaway cannot directly impact the steam generator, but will flow parallel to it, it seems that some damage to the SG insulation could occur near the break, with the parallel flow then jetting under the surviving insulation, perhaps to a much greater extent than predicted by the testing. Similar damage could occur to other component insulation. Please provide a technical basis to demonstrate that the test results for piping insulation are prototypical or conservative of the degree of damage that would occur to insulation on steam generators and other non-piping components in the containment.

9. Some piping oriented axially with respect to the break location (including the ruptured pipe itself) could have insulation stripped off near the break. Once this insulation is stripped away, succeeding segments of insulation will have one open end exposed directly to the LOCA jet, which appears to be a more vulnerable configuration than the configuration tested by Westinghouse. As a result, damage would seemingly be capable of propagating along an axially oriented pipe significantly beyond the distances calculated by Westinghouse. Please provide a technical basis to demonstrate that the reduced ZOIs calculated for the piping configuration tested are prototypical or conservative of the degree of damage that would occur to insulation on piping lines oriented axially with respect to the break location.

10. WCAP-16710-P noted damage to the cloth blankets that cover the fiberglass insulation in some cases resulting in the release of fiberglass. The tears in the cloth covering were attributed to the steel jacket or the test fixture and not the steam jet. It seems that any damage that occurs to the target during the test would be likely to occur in the plant. Was the potential for damage to plant insulation from similar conditions considered? For example, the test fixture could represent a piping component or support, or other nearby structural member. The insulation jacketing is obviously representative of itself. What is the basis for the statement in the WCAP that damage similar to that which occurred to the end pieces in not expected to occur in the plant? It is likely that a break in the plant will result in a much more chaotic condition than that which occurred in testing. Therefore, it would be more likely for the insulation to be damaged by either the jacketing or other objects nearby.

Debris Transport

11. The supplemental response did not discuss the potential for fibrous debris to erode in the post-LOCA containment pool. If erosion was not modeled, please provide a justification for not modeling it. If erosion was modeled, please provide a basis for the erosion model, specifically including the following additional information.

    a. Please describe the test facility used for any testing performed and demonstrate the similarity of the flow conditions (velocity and turbulence), chemical conditions, and fibrous material present in any erosion tests performed to the analogous conditions applicable to the plant condition.

    b. Please identify the length of any erosion tests performed and how the results were extrapolated to the sump mission time.

c. Please discuss how any erosion testing performed accounts for the erosion of fibrous debris trapped on the debris interceptors, specifically considering the fact that debris trapped on interceptors may be exposed to significantly higher velocities than the incipient tumbling velocity.

12. Please identify the specific inactive volumes that are credited with trapping 15% of debris in Stage 1 of the debris transport analysis, and provide the volumes of these inactive regions compared to the volume of the active sump pool.

13. The supplemental response states on page 12 that all debris was modeled as falling directly to the containment floor. As noted in the staff's SE on NEI 04-07, this assumption is considered conservative in the context of the baseline transport methodology that assumes that all small fines in the containment pool transport to the sump. However, in a transport analysis that assumes that 90–97% of the small fines blown directly into the containment pool will be captured on debris interceptors (or otherwise settle), neglecting the modeling of debris washing down downstream of some or all of the debris interceptors is nonconservative. As noted in the staff's SE on NEI 04-07, a significant fraction of the small fines debris is actually expected to be blown into the upper containment and be subsequently washed down by containment sprays. Please provide a technical basis for neglecting the potential for debris to be washed down downstream of some or all of the debris interceptors.

14. During the pool-fill phase, the supplemental response stated that all insulation debris was assumed to transport to a debris interceptor in the bioshield doorways, or to reach the open bioshield doorway. The means of determining how much debris transports to each interceptor was not explained in detail. The staff expects that, as debris transports to and accumulates upon the bioshield doorway interceptors, their flow resistance will be increased, resulting in flow being redistributed to the open bioshield doorway. Given the potential quantities of debris generated, the vast majority of the flow may eventually be directed toward the open bioshield doorway. In light of the discussion above, please describe how the distribution of flow and debris at the bioshield doorways was determined, including any time-dependent modeling of the flow resistance at the bioshield doorways.

15. Please identify any computational fluid dynamics codes used to determine the flow pattern in the containment pool and provide an overview of the simulations run and modeling assumptions. Please specifically describe how the debris interceptors were modeled in the input deck (e.g., as a porous medium, fully blocked, time-dependent modeling, etc.).

16. The supplemental response indicates that testing was done to determine the fraction of flow that would exit the open doorway in the bioshield versus the doorways that contain debris interceptors. The supplemental response also indicates that testing was done to determine the filtration efficiency of the debris interceptors.

a. Please identify the debris types and sizes that were used for the debris interceptor testing. Please specifically identify the percentage of fine fibrous debris that was included in the testing, and describe the test debris preparation and sequenced addition into the test flume.

b. Please identify whether a single debris interceptor was tested in the fibrous debris capture tests, or whether tests were run with multiple debris interceptors in series.

c. Please summarize the results obtained from the debris interceptor testing. Please provide specific capture fractions for fines and for small pieces of fibrous debris. Please clarify whether any test cases were performed with the interceptors blocked prior to the test start.

d. Please describe how the test results were scaled and applied to determine the total fraction of fibrous debris captured on the plant debris interceptors. Please state the total fraction of fibrous debris that was assumed to be captured on all the plant debris interceptors.

e. Please describe how the debris interceptor test results were used to determine that 70% of the flow passes through the open bioshield doorway for the single-train case, and 53% of the flow passes through the open bioshield doorway for the dual-train case.

f. Please provide a summary of any analysis done to assess debris floatation over the interceptors.

g. Please provide the test report for the testing that was done to determine the amount of fiber captured at each debris interceptor and the testing used to determine the flow distribution out of the bioshield doors.

h. Please describe the methodology used to determine the differential pressure across the debris interceptors due to debris blockage to ensure structural adequacy.

i. Please compare the range of velocity and turbulence values in the test flume to the range of velocity and turbulence values in the plant condition. Please describe how changes in velocity and turbulence in the interceptor tests affected the test results.

17. Substantial credit for debris capture at interceptors assumed for breaks inside the bioshield wall would be reduced for a break outside the bioshield. For example, Break S4 is described as being located on a residual heat removal recirculation line before the second isolation valve, outside the bioshield, and directly above the sumps. Please provide the debris transport results for Break S4, and the basis for concluding that this break is bounded by the analyzed breaks inside the bioshield wall.

18. Please explain the basis for using different fibrous debris size distributions in Stages 1 and 2 of the debris transport analysis. Please specifically identify what percentage of the fibrous debris in Stage 2 is considered fines versus what percentage is considered small pieces.

19. Please identify the specific quantities of fine fibrous debris (not including small pieces of debris) that are assumed to:

    a. Reach the sump strainers.

    b. Become captured on debris interceptors.

    c. Become trapped in inactive pool volumes.

    d. Settle onto the containment pool floor.

Head Loss and Vortexing

20. Please provide the layout of the strainer modules in the plant. It is unclear whether the clean strainer head loss would change as debris builds up on the strainer due to flow changing to areas of the strainer further from the pump suction as debris builds up closer to the pump suction. It is unclear whether the clean strainer head loss determination should account for this phenomenon.

21. Please provide information that clarifies what water volumes are credited for strainer submergence during small-break LOCAs. Also state whether the cooling of RCS water to sump temperatures was accounted for in the sump minimum water level calculation. The response did not state that the water level calculated for strainer submergence included allowance for the cooling of RCS water to cooler sump temperatures (and therefore lower volume) or whether the small-break LOCA level included volume from the accumulators.

22. Please provide documentation of fiber size distribution used for testing. Verify that the fibrous debris size matched or conservatively bounded the fiber size distribution predicted to arrive at the strainer by the transport evaluation. Provide the basis for this conclusion including the effects of the debris interceptors considering information provided below. Provide the fibrous size distribution added during thin bed testing (sizing of debris in each batch). The submittal stated that double-shredded fiber was used in the testing. In general use of shredded fiber does not imply that the evaluated amount of fine fiber is created for use in testing. Additionally, for thin bed testing all fine fiber should be added prior to the addition of coarser fibrous debris. The presence of numerous debris interceptors is a major reason that less than 3% fibrous debris transport is assumed to occur in the single-train case in the transport analysis, and 10% in the two-train case. If the licensee's transport analysis is correct, the staff would expect that the remaining debris reaching the strainers would be essentially 100% fines. The fibrous debris used for testing was passed through a leaf shredder twice, as opposed to the Fort Calhoun method successfully adopted after the staff's comments from the Waterford audit (5 passes through a leaf shredder). Based on staff observations of the debris preparation process for Fort Calhoun, the staff considered the Fort Calhoun preparation method to be adequate. It is unclear that the debris preparation used for the Seabrook tests was adequate to represent a debris source term that is expected to include only fine fibrous debris. Note that open area was found to have occurred on the test strainer. While the open area could be due to the full-scale height modeling, the question is open as to whether it was not partly due to fibrous debris that had not been adequately prepared. (Reference previous request for additional information (RAI) 35, dated February 9, 2006, ML060380133)

23. Provide documentation of fibrous debris concentration during addition to the test flume and the method of addition of debris to the flume. Provide information that justifies that agglomeration of debris did not occur during addition to the test. Provide the location of debris addition. Provide the amount of fibrous debris added for each batch, the size distribution of each batch, and the time elapsed between batches.

24. Please provide the testing methodology including a description of test facility, general procedure for conducting the tests, the physical arrangement of the strainer within the pool including any dividers or flow diverters, the location of the return header, the location of the stirrers, the scaling parameters, flow rates, and the debris amounts.

25. Please provide the amount of debris that settled in the test tank. (Ref. RAI 36, dated February 9, 2006, ML060380133)

26. Please provide information and data that justifies the extrapolation method used (5% bump up) to determine the head loss expected at the end of the ECCS mission time. It is not clear what the basis for this 5% is, or why the licensee would consider there to be a "very small possibility" of continued HL rise. The termination criterion was 1% in 30 minutes. It seems clear that a head loss increase would likely continue to occur after test termination, given this criterion. Only if the criterion were 0% or negative over a sufficiently long time period, would the staff expect a very small possibility of continued head loss increase. The figure on page 54 of the supplement implies that there is a strong possibility this test would have continued to increase in head loss, regardless of the fact that the termination criterion may have been met in the last half hour of the trace.

27. Please provide data that shows that the test termination criterion was met.

28. Please provide information that justifies the flashing evaluation assumption that the vapor pressure of water at 260°F plus 1 atmosphere of air can be added to the minimum strainer submergence resulting in a flashing criterion of 1500 inches. 1500 inches is over 125 ft or 54 psi. The bases for these assumptions in not clear, nor is it clear that the calculated flashing criterion is reasonable or conservative.

29. Please provide the clean strainer head loss calculation methodology including any assumptions and their bases.

30. Please provide information that shows that the stirring and agitation used during testing did not drive non-prototypical debris onto the bed or prevent debris from collecting naturally on the strainer. Alternately show that the agitation levels in the test facility in the area of the strainer were similar to those expected in the plant (Ref. RAI 36, dated February 9, 2006, ML060380133)

31. Please provide justification for adding all coatings debris as particulate. The submittal stated that all coatings debris was added as particulate. However, a thin bed did not form during testing. Staff guidance states that it may be conservative to add some of the coatings debris as chips if a filtering bed does not form.

32. Please provide information that indicates whether there are any vents or penetrations through the strainer control surfaces that connect the strainer internal volume to the

containment atmosphere above the minimum water level. (Ref. RAI 37, dated February 9, 2006, ML060380133)

Net Positive Suction Head

33. Please provide net positive suction head margin results for both cold leg and hot leg recirculation flowpaths and describe any differences in the analytical assumptions for these two cases.

34. The NRC Content Guide requested that containment pool water sources and hold up volumes be identified and that the volume of water associated with each be specified. The supplemental responses to GL 2004-02 did not appear to provide the volume for each water source and hold up mechanism. Please provide the requested information for both the limiting large-break and small-break LOCA cases.

35. Please discuss whether the analyzed small-break LOCA scenario accounts for the possible result of the RCS (including the pressurizer) becoming refilled with cooler water, as could occur for a limiting break near the top of the pressurizer. If this hold up volume is not accounted for in that analysis, please provide a technical basis.

Upstream Effects

36. Please identify the quantity of water assumed to be held up in the refueling canal and reactor pool region, identify the size of and minimum flow restriction in all flowpaths from the refueling canal and reactor pool region to the containment pool (e.g., drain lines, the annulus around the reactor vessel flange), and provide a basis for concluding that debris blockage will not occur unless credit is not taken for any drainage from these volumes. Please also discuss the quantities and types of debris that would reach the reactor pool region and discuss obstructions (e.g., floor gratings, tortuous paths) that may prevent debris from being blown into the reactor pool region.

37. Based on the information provided in the supplemental response, if the three four-inch drain lines connecting the reactor cavity, refueling canal, and the rest of containment become blocked, it is not clear how water will drain/flow from the reactor cavity to the containment pool formed at (-)26' EL. Any water held up in the reactor cavity above the (-)26' EL would result in a reduction in the assumed containment pool water level. Please describe the flowpaths from the reactor cavity to the containment pool formed at (-)26' EL that would prevent holdup in the reactor cavity above the (-)26' EL in the case that the three four-inch drain lines become blocked.

Structural Analysis

38. The second portion of item 3.k of the revised content guide for the GL2004-02 supplemental responses requests that the licensee "Summarize the structural qualification results and design margins for the various components of the sump strainer structural assembly." Please provide the actual and allowable stresses and show the design margins for the debris interceptors and all associated components.

39. Item 3.k.3 of the revised content guide for the GL2004-02 supplemental responses requests that the licensee "Summarize the evaluations performed for dynamic effects

such as pipe whip, jet impingement, and missile impacts associated with high-energy line breaks (as applicable)." In addition to information in your September 2005, February 2008, and August 2008 responses, please submit a detailed summary along with any additional supporting information regarding your assessment that the strainers and debris interceptors are not subject to the aforementioned dynamic effects including the relationship of the new strainers to the missile shields mentioned in your September 2005 submittal.

Downstream Effects/In-Vessel

40. The NRC staff considers in-vessel downstream effects to not be fully addressed at Seabrook Station Unit 1 as well as at other PWRs. The Seabrook submittal refers to draft WCAP-16793-NP, "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 WCAP-16793-NP. The licensee may demonstrate that in-vessel downstream effects issues are resolved for Seabrook Station Unit 1 by showing that the licensee's plant conditions are bounded by the final WCAP-16793-NP and the corresponding final NRC staff SE, and by addressing the conditions and limitations in the final SE. The licensee may also resolve this item by demonstrating without reference to WCAP-16793 or the staff SE that in-vessel downstream effects have been addressed at Seabrook Station Unit 1. 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 SE on WCAP-16793. The NRC staff is developing a Regulatory Issue Summary to inform the industry of the staff's expectations and plans regarding resolution of this remaining aspect of GSI-191.

Chemical Effects

41. The attachment to your letter (page 53 of 71) dated August 4, 2008 states that chemical precipitate was simulated with the WCAP-16530-NP aluminum oxyhydroxide precipitate. The letter discusses precipitate settlement measurements that were performed and the acceptance criteria that were used to determine if the precipitate was acceptable for testing. The letter states that the acceptable one-hour settlement for the initial test at a 9.7 g/l concentration was 90% turbid and the acceptable one-hour settlement for a second sample diluted to a 2.2 g/l concentration was 40% turbid. The staff notes that WCAP-16530-NP-A indicates that the minimum one-hour settlement rate for aluminum oxyhydroxide diluted to a 2.2 g/l concentration is greater than 60% turbid (for tests that ensure the precipitate is transported to the test strainer). Please discuss the basis for your two settlement tests and their acceptance criteria including why your settlement results are acceptable with respect to the WCAP guidance. Estimate the percentage of chemical precipitate in the head loss test that settled away from the test strainer section.

Licensing Basis

42. The supplemental responses for Seabrook stated that the replacement strainer design does not include separate trash racks. However, the staff noted that existing SR 4.5.2.d.2 refers to trash racks being present. Please state whether SR 4.5.2.d.2 will be revised to remove the reference to a trash rack being present to be consistent with the current design of the Seabrook sump.