From: Poole, Justin
Sent: Monday, January 04, 2010 9:57 AM
To: 'COSTEDIO, JAMES'; Flentje, Fritzie
Cc: Scott, Michael
Subject: DRAFT Request for Additional Information RE: Generic Letter 2004-02

Jim,

By letter to the U.S. Nuclear Regulatory Commission (NRC) dated July 31, 2009, FPL Energy Point Beach, LLC, submitted responses to the NRC staff's January 7, 2009, request for additional information regarding Generic Letter 2004-02.

The NRC staff has reviewed the information provided and determined that in order to complete its evaluation, additional information is required. We would like to discuss the questions, in draft form below, with you in a conference call later this month. The NRC staff would like to have a public phone conference to discuss your planned responses to each RAI during the February or early March timeframe.

This e-mail aims solely to prepare you and others for the proposed conference call. It does not convey a formal NRC staff position, and it does not formally request for additional information.

Justin C. Poole
Project Manager
NRR/DORL/LPL3-1
U.S. Nuclear Regulatory Commission
(301)415-2048
email: Justin.Poole@nrc.gov

~~~~~~

DRAFT

Debris Generation/Zone of Influence (ZOI)

Initial review of the licensee's 2008 submittals in the debris generation/ZOI area did not identify RAIs. However, the licensee had not completed the overall evaluation. Staff review of the July 31, 2009, responses to the NRC staff's January 7, 2009, RAIs in other areas revealed that the debris generation calculation was revised based on the removal of significant amounts of fibrous debris from containment. The response to RAI 2 also stated that previous calculations at Point Beach have credited a 5-pipe diameter (D) ZOI for jacketed Nukon® based on Westinghouse testing. The information provided for that RAI also stated that the site has contingencies to remove additional Nukon as necessary to preclude Nukon involvement in debris generation. Staff review identified the following questions:

1. Please provide an updated debris generation evaluation based on the insulation configuration determined to provide an acceptable overall head loss evaluation. The licensee should provide the information requested in the content guide for the debris generation area. For areas where the evaluation and assumptions are unchanged, the licensee may state that there are no changes from the original debris generation evaluation provided to the staff for review.
~~~~~~

2. Please provide the zones of influence (ZOIs) used for the final debris generation calculation. If the ZOIs are not those specified by the safety evaluation (SE) on NEI Guidance Report 04-07, provide a justification for the ZOI used. The following issues should be addressed for any ZOIs that use the Westinghouse testing or other testing that has not been evaluated by the NRC staff.

3. The set (9 sub-parts) of issues listed below constitute a generic RAI that is asked for licensees that credit ZOI reductions based on Westinghouse testing conducted at Wyle Laboratories. Some questions may not apply to all licensees as they are dependent on the type of insulations for which ZOI reduction are being credited. If the licensee believes that a particular question is not applicable to its use of the test results, this should be stated and a short reasoning provided. The PWROG has committed to consider resolving some of the issues generically. The success of this effort is not clear as of this time. The staff notes that the licensee's July 31, 2009, supplemental response stated that it is supporting industry efforts to substantially reduce the ZOI for jacketed NUKON insulation and that then-current efforts would eliminate NUKON to the extent necessary to ensure it does not remain within the ZOI of large diameter, limiting pipe breaks.

(1) Please 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:

i. 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 length to diameter (L/D) target to nozzle spacing would be non-conservative with respect to impacting the entire target with the calculated pressure.

ii. 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.

iii. 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 was 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.

(2) 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.

(3) WCAP-16710-P discussed the direct impingement of a jet on a woven fiberglass blanket that did not result in the failure of the cloth-covered blanket material. Later discussions with Westinghouse determined that all tests included stainless steel jacketing covering the fiberglass blankets. Apparently the 5D ZOI test resulted in the removal of the steel jacket without significant damage to the fiberglass blanket underneath. The claim that the 5D ZOI jet did not damage an unjacketed blanket is questionable since the test started with a jacketed sample and it is unknown when the jacket was removed from the test sample. Based on the test data, the jet pressure was likely reduced from the initial pressure by the time the blanket was subjected to the jet without the protection of the jacket. Explain how it was determined that direct impingement at 5D ZOI equivalent would not fail a woven fiberglass blanket. What was the jet pressure that the blanket was subjected to after the jacket was removed? What would the equivalent ZOI be for this condition?

(4) Please 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.

   i. 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?
   ii. 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.
   iii. 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.
   iv. 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?

v. 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) Please 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.

i. 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.

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

iii. 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) Please 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.

i. 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?

ii. 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?

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

(7) 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 steam

generator 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.

(8) 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.

(9) 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 Characteristics

The licensee noted in the July 31, 2009, supplemental response that the Nukon and mineral wool insulation may all be removed from the containment in the projected post-Generic Safety Issue-191 configuration (pg. 26). However, there is significant fiber currently in containment, and it is not clear that the licensee is committing to the projected configuration on pg. 26. The projected configuration may depend on the assumption of a 5D ZOI being accepted, which is uncertain at this time. Therefore, the staff identified the following RAIs for these materials.

4. For any reduced ZOIs that are credited that are less than the size specified in the SE on NEI 04-07, please discuss whether the corresponding debris size distribution was assumed to have an increased generation of fines and small pieces that is sufficient to account for the higher destruction pressures that would exist within the smaller ZOIs relative to the larger SE-approved ZOIs.

5. The July 31, 2009, supplemental response states that 30% of mineral wool was assumed to be destroyed into fines due to exposure to the blowdown from a ruptured pipe, based on the

similarity of this material to low-density fiberglass. Specifically, this comparison was based on relating mineral wool to Kaowool, which is actually a type of ceramic fiber. However, evidence exists that mineral wool can be more fragile than low-density fiberglass, as discussed in NEA/CSNI/R (95)11, "Knowledge Base for Emergency Core Cooling System Recirculation Reliability," and NUREG/CR-6224. In light of this evidence of the potential for increased fragility of mineral wool as compared to low-density fiberglass, please provide a basis for concluding that the mineral wool installed at Point Beach would generate a quantity of fine debris equivalent to that of fiberglass.

6. The July 31, 2009, supplemental response states in response to RAI 2 that calcium silicate was conservatively assumed to be 100% reduced to particulates to bound erosion effects that may occur. The staff does not understand this statement in light of the information presented on page 26 of the July 31, 2009, supplemental response. The table on page 26 appears to indicate that only about 35% of the calcium silicate was assumed to be destroyed into fine particulate, whereas the majority was assumed to be small pieces (i.e., non-particulate), 85% of which were assumed to settle to the containment pool floor. Although it appeared that the analytically transported debris (a mixture of fines along with some small pieces) may have been modeled using fine particulate for head loss testing, it did not appear to the staff that erosion effects could be considered bounded, since no erosion appeared to be assumed for the majority of the calcium silicate small pieces of debris generated that was assumed to be settled in the containment pool. Please clarify the size distribution assumed for calcium silicate debris and provide justification for the assumed distribution.

Debris Transport

The staff does not accept that a number of the transport assumptions that lead to the "analytical results for current configurations" are prototypical or conservative. On the other hand, based on the information provided on page 26 of the July 31, 2009, supplemental response, for the "projected configuration," the licensee plans to remove much of the problematic insulation from the containment. If the licensee carries through and achieves the projected configuration, the majority or possibly all of the staff's concerns would be addressed. However, it is not clear to the staff that the licensee has committed to complete the removal of this significant quantity of insulation. It also appears likely that going from a 5D ZOI to the SE-approved 17D ZOI (or something closer to this size) for fiberglass may not have been fully accounted for in the licensee's projected configuration. As a result, the staff does not consider the transport analysis acceptable based on the information currently provided and existing licensee commitments. If the licensee were to commit to removing insulation to the degree that is currently projected to occur (see page 26 of July 31, 2009, supplemental response), the testing that has been performed would bound the plant condition for the quantity of debris generated, and many or possibly all of the questions below on the transport analysis would be easily addressed.

7. The July 31, 2009, supplemental response did not adequately describe the assumptions made concerning the washdown mechanism of debris transport. Please describe any credit taken for retention of debris in upper containment (e.g., on gratings, structures, floors, etc.), such that, after the completion of the blowdown and washdown processes, the retained debris is assumed not to reach the containment sump pool. Please identify the types, sizes, and quantities of the debris assumed to be retained above the containment sump pool.

8. The July 31, 2009, supplemental response included some discussion of the erosion of frangible debris (e.g., fiber, calcium silicate, asbestos). However, based on the staff's review of the information provided on pages 13 and 14, it appeared that, while erosion due to exposure to a blowdown jet had been considered, erosion due to exposure of settled debris to water flows in the containment sump pool over the sump mission time had not been adequately considered. Please describe how erosion of frangible debris settled in the containment pool resulting from pool flows was addressed in the analysis and provide a justification for assumptions that deviate from the SE on NEI 04-07. If erosion testing was performed to support the assumptions being made, please also provide the following information:

   a. Please describe the test facility used and demonstrate the similarity of the flow conditions (velocity and turbulence), chemical conditions, and debris material present in the erosion tests to the analogous conditions applicable to the plant condition.
   b. Please provide justification for any erosion tests conducted at a minimum tumbling velocity if debris settling was credited in the test flume for velocities in excess of this value.
   c. Please identify the duration of the erosion tests and how the results were extrapolated to the sump mission time.

9. Please describe whether/how erosion of debris that settles in the test flume is accounted for in the sump performance evaluation. The July 31, 2009, supplemental response indicates that a significant percentage of small and large pieces of debris were analytically assumed to transport to the strainers. For example, in one case for which results were reported in the supplemental response, approximately 60% of large pieces of Temp-Mat® were analytically assumed to reach the strainers, as were 30% of large pieces of Nukon and 34% of small pieces of fiberglass. These analytical assumptions reduced the quantity of settled small and large pieces of frangible debris that were analytically assumed to erode in the containment pool. However, for the strainer head loss testing conducted by Performance Contracting, Inc. (PCI), the NRC staff considers it likely that a significant fraction of large and small debris pieces that were analytically considered transportable actually settled in the test flume rather than transporting to the test strainer. The head loss testing did not model the erosion of this debris that was analytically assumed to have transported. The licensee's consideration of debris erosion, therefore, appears to be non-conservative, because neither the analysis nor the head loss testing accounted for the erosion of debris that settled during the head loss testing. Please estimate the quantity of eroded fines from small and large pieces of frangible debris (e.g., fiber, calcium silicate, and asbestos) that would result, had erosion of the debris settled in the head loss test flume been accounted for, and justify the neglect of this material in the head loss testing program. If this eroded debris is not accounted for in a prototypical or conservative manner, then please provide a basis for the conservatism of the analytical debris erosion results given that the analysis may significantly underestimate the total quantity of settled debris (when debris that settled in the test flume is considered).

10. The July 31, 2009, supplemental response states on page 14 that streamline and vector plots were used to identify isolated eddies that had velocities higher than the incipient tumbling velocity but did not contribute to debris transport from the zone. Please identify the types and quantities of debris assumed to be trapped in eddies of this sort, and provide the basis for considering debris assumed to be present in these areas at the switchover to recirculation to not transport to the strainers considering the following points:

a. Even in steady-state flow problems, chaotic perturbations result in variance in the solution that will alter the flow pattern in isolated eddies and allow fluid and debris elements in these eddies to escape as time progresses (or the number of computational iterations increases).

b. Sophisticated turbulence models are expected to be necessary to accurately predict the behavior of eddies if they are credited with the retention of debris. Please discuss the fidelity of the turbulence model used in the computational fluid dynamics code and discuss whether the converged solution was run further and checked at various intervals after convergence was reached to demonstrate evidence of the stability of any eddies credited with debris hold up.

c. Suspended phases and floor-transporting debris do not precisely follow streamlines of fluid flow. Phase slip can be particularly significant when the streamlines exhibit significant curvature, such as in an eddy.

d. There are significant uncertainties associated with modeling blowdown, washdown, and pool fill transport mechanisms. The initial debris distribution at switchover can vary significantly.

11. Based upon the information provided on page 26 of the July 31, 2009, supplemental response, it appeared to the staff that higher debris transport fractions were calculated for large pieces of Nukon and Temp-Mat debris than for small pieces of these debris types. This result is unexpected, since small pieces of debris typically are more transportable. Please provide the basis for the calculated transport fraction for small debris pieces being lower than that of large debris pieces for Nukon and Temp-Mat.

12. A number of assumptions were made in the transport analysis that are not consistent with, or are not included in, the baseline guidance approved in the SE on NEI 04-07 and for which insufficient justification was provided, including the following:

    a. 50% of small pieces are held up on interior structures during blowdown.
    b. 15% of debris is assumed to be large enough not to be transportable by blowdown or pool-fill effects.
    c. The 75% / 25% distribution of debris on the refueling floor.
    d. The modeling of debris retention in the broken loop compartment during pool fill.
    e. The post-LOCA reactor coolant system water level is such that ruptured pipe is completely filled with water during the recirculation phase.
    f. Distribution of debris during blowdown is based on compartment exit areas.
    g. The tapered containment wall dissipates the momentum of streams of spray water falling into the containment pool.

    Please provide adequate basis for these assumptions, or demonstrate that they did not significantly reduce the quantity of debris transported to the strainers.

13. Please provide the basis for concluding that debris blockage will not occur at the debris interceptors (including the submerged perforated surface area and 4-inch slots) at Unit 1 to an extent that would result in starvation of flow to the sump strainers.

14. Sufficient information was not provided in the July 31, 2009, supplemental response to provide assurance that the flow conditions simulated in the strainer head loss test flume are prototypical or conservative with respect to the plant conditions. Therefore, please provide plots of velocity and turbulence contours in the containment pool for the bounding computational fluid dynamics cases with respect to these two parameters that include the

entire pool and which are based on the computational fluid dynamics model used in the debris transport analysis. Please also provide close--up plots of the velocity and turbulence contours in the region of the strainer and its immediate surroundings from the computational fluid dynamics model, showing the flow streams that were used to determine the flume velocities and turbulence levels for head loss testing. Please identify the bounding break scenario that was used to derive the flow parameters (e.g., velocity and turbulence) that were simulated in the head loss test and identify which of the strainers is modeled in the test. Please identify the velocity and turbulence values used for the strainer qualification testing and provide the basis for concluding that they are prototypical or conservative with respect to the plant condition.

15. The July 31, 2009, supplemental response indicates that debris was added to the test flume approximately 20 ft from the strainers. Due to transport modes not modeled by the head loss test protocol (e.g., blowdown, washdown, and pool fill), a fraction of the debris could be within one flume-length of the strainers at the initiation of recirculation. As a result of adding all the debris at a distance of one flume-length from the strainer, the head loss test may under predict debris transport. Please provide justification for adding essentially all of the test debris one flume-length away from the strainer during head loss testing.

16. Please provide a photograph or diagram of the ramp used to introduce debris slurries into the head loss test flume and provide further information that demonstrates that the simulated entry of debris into the test flume via the ramp was prototypical or conservative with respect to the plant condition.

17. In response to Question 6 in the July 31, 2009, supplemental response, the licensee indicated that water streams splashing down into the containment pool are located significantly further than 2 inches from strainer surfaces. However, it was not clear to what extent streams of water splashing down into the containment pool would exist within the range of distances modeled in the head loss test flume used for the strainer qualification test (i.e., roughly 20 ft). Please discuss any sources of drainage that enter the containment pool within the range of distances modeled in the head loss test flume. Please identify whether the drainage would occur in a dispersed form (e.g., droplets) or a concentrated form (e.g., streams of water running off of surfaces). Please discuss how these sources of drainage are modeled in the test flume to create a prototypical level of turbulence in the test flume.

Head Loss and Vortexing

The staff found most of the RAI responses in this area to be adequate. However, the responses to RAIs 4, 8, 9, and 25 were either lacking in some respect or led to additional questions. These are discussed below. One new issue was noted during staff review of the latest licensee submittal:

18. The licensee stated that the head loss would be limited to less than 10 ft by one of three methods. These are (1) limiting cooldown, (2) requiring flow reduction, or (3) re-testing. The licensee did not provide information such that the staff has assurance that adequate provisions have been made to assure that the 10 ft limit on head loss is not exceeded. Please provide information demonstrating that measures have been taken to ensure that the limit is not exceeded.

19. RAI 4 requested that the licensee provide head loss and vortexing testing-related information. In general, the information provided in the licensee's response is acceptable. However, the additional information led the staff to question some areas of the testing. The testing was conducted at Alden Laboratory and allowed debris settling. Some issues, listed below, that have been identified by previous staff review of testing that allows near-field settling are applicable to the Point Beach testing;

a. The licensee stated that the velocities and turbulence in the test flume were conservative with respect to the plant. The staff considers this not adequately justified. The licensee should provide information that shows that the velocities and turbulence in the test flume were prototypical or conservative with respect to the conditions expected in the plant.

b. The licensee stated that the sacrificial area assigned to account for miscellaneous tags and labels was 100 ft^2. The area of tags and labels identified in each unit was higher than this. The licensee stated that testing was conducted to determine whether some miscellaneous material transported. The licensee should justify that the amount of material that was identified as transportable supports the assumption of 100 ft^2 of sacrificial area.

c. The licensee referenced the PCI debris preparation procedure as the controlling document for the test debris preparation. The staff has noted inconsistencies with debris preparation during PCI testing. The staff believes that most debris preparation and introduction during the PCI testing is adequate, but requests additional information that justifies that the preparation and introduction of fine fibrous debris met the staff expectations. The use of an inclined ramp to introduce the debris may have reduced the ability of the debris to unagglomerate.

d. The staff is aware that PCI sometimes removes fine fibers from the small pieces of fibrous debris. The licensee should state whether this was done for the Point Beach testing. The staff is concerned that removal of fine fibers from other size classifications may be non-conservative because there is no assurance such removal would occur in the plant and may be non-prototypical.

20. In its response to RAI 8, the licensee provided clean strainer head loss (CSHL) and total head loss values for multiple temperatures. The information supplied for this RAI is acceptable. However, during review of the vendor head loss calculation the staff questioned the methodology used to calculate the total strainer head loss. The question is with respect to the CSHL portion of the overall head loss. In Table 7 of the PCI calculation attached to the RAI responses (TDI-6007-06), the total debris laden head loss (TDLHL) is calculated by adding the debris head loss, the plenum head loss, and the Alden Research Laboratory CSHL. According to the calculation definitions, the TDLHL is the total corrected clean strainer head loss (TCCSHL) added to the Alden test results debris laden head loss (A-DLHL). For example, the table 7 value for the TDLHL at 212 °F is listed at 3.474 ft. If TDLHL is calculated using the TCCSHL added to the A-DLHL the value is 3.626. Please provide an explanation for the methodology used to calculate the TDLHL and verify that all components of head loss are included in the calculation.

21. Regarding RAI 9, the final debris generation and transport calculations had not been completed at the time of the licensee's submittal. Because the testing credited near-field settling, the size debris distribution assumed and used in the testing are critical to the test result. Please verify that the debris amounts and size distribution used in the head loss testing bound those predicted to reach the strainer after the final design configuration has been determined. In

addition, the licensee stated that the amount of latent fibrous debris assumed to reach the strainer during testing was less than the amount assumed in the design basis. This discrepancy is being resolved through the removal of insulation from the plant. Please state how this issue has been resolved.

22. In response to RAI 25, the licensee provided the calculated deaeration for both hot and cold conditions. However, the licensee did not provide information regarding how any required correction to net positive suction head required ($NPSH_R$) would affect the margin available for the emergency core cooling pumps. Please provide information that describes how NPSH margin is affected by the $NPSH_R$ correction described in Regulatory Guide 1.82, Revision 3, Appendix A.

Chemical Effects

Point Beach is a sodium hydroxide buffer plant that contains both calcium-silicate and Nukon insulating materials. The licensee performed testing with WCAP 16530 precipitates using the AREVA/PCI test protocol. The July 31, 2009, RAI response addressed the questions that the staff had based on the material provided in the earlier submittal. The staff has remaining questions for two of its earlier RAIs based on review of the July 31, 2009, supplemental response.

23. RAI 21 requested additional information demonstrating that the maximum aluminum concentration in the containment sump will be less than 20 parts per million (ppm). The July 31, 2009, response Enclosure 6 Table 1 showed 12 different calculations of aluminum concentrations, some of which are not credible since they combine accident scenarios that are not possible. The response identifies case 2.5 as the limiting credible case. However, the aluminum concentration for case 2.5 is 30 ppm, which contradicts the licensee's statement that the concentration will be less than 20 ppm. Please address the discrepancy.

24. The response to RAI 22 in the July 31, 2009, submittal includes a table that provides a measure of precipitate as a function of sump volume but did not relate this back to the sump pH. Please clarify how the mass of precipitate formed varies as a function of sump volume and pH.