UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 4, 2008

Mr. James A. Spina, Vice President
Calvert Cliffs Nuclear Power Plant, Inc.
Calvert Cliffs Nuclear Power Plant
1650 Calvert Cliffs Parkway
Lusby, MD 20657-4702

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION RE: SUPPLEMENTAL RESPONSE TO GENERIC LETTER 2004-02, "POTENTIAL IMPACT OF DEBRIS BOLCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED WATER REACTORS" - CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2 - (TAC NOS. MC4672 AND MC4673)

Dear Mr. Spina:

By letter dated February 29, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML080640751), Calvert Cliffs Nuclear Power Plant, Inc. (the licensee) submitted a supplemental response to Generic Letter (GL) 2004-02.

The Nuclear Regulatory Commission (NRC) staff has reviewed the licensee's submittal. 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 for the Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 (Calvert Cliffs). The enclosed document describes these requests for additional information (RAIs).

The NRC requests that the licensee respond to these RAIs within 90 days of the date of this letter. However, the NRC would like to receive only one response letter for all RAIs with exceptions 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 extension is needed.

If the licensee concludes, based on its review of the RAIs, that additional corrective actions are needed for GL 2004-02, the licensee should request additional time to complete such corrective actions as needed. Criteria for such extension requests are contained in SECY-06-0078 (ADAMS Accession No. ML053620174), and examples of previous requests and approvals can be found on the NRC's sump performance website, located at: http://www.nrc.gov/reactors/operating/ops-experience/pwr-sump-performance.html.

Any extension request should also include results of contingency planning that will result in near term identification and implementation of any and all modifications needed to fully address GL 2004-02. The NRC strongly suggests that the licensee discuss such plans with the staff before formally transmitting an extension request.

The exception to the above response timeline is RAI 28 in the enclosure. The NRC staff considers in-vessel downstream effects to not be fully addressed at Calvert Cliffs, 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 for Calvert Cliffs 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 RAI 28 by demonstrating, without reference to WCAP-16793 or the NRC staff SE, that in-vessel downstream effects have been addressed at Calvert Cliffs. The specific issues raised in RAI 28 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."

Please contact me at 301-415-1364 if you have any questions.

Sincerely,

Douglas V. Pickett

Douglas V. Pickett, Senior Project Manager
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-317 and 50-318

Enclosure:
As stated

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CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2

REQUEST FOR ADDITIONAL INFORMATION

SUPPLEMENTAL RESPONSE TO GENERIC LETTER (GL) 2004-02

1. Please state whether the testing identified in the WCAP-16710-P and WCAP-16720-P test reports was specific to the Calvert Cliffs insulation systems named below. If not, please provide information that compares the Calvert Cliffs encapsulation and jacketing systems structures with the systems that were used in the WCAP testing showing that the testing conservatively or prototypically bounded potential damage to the Calvert Cliffs insulation materials. Please provide information relative to impact of differences in jet size and target size, geometry, materials, and methods of construction in the WCAP-16710-P and WCAP-16720-P testing versus those which will be in effect during loss-of-coolant accidents (LOCAs) at Calvert Cliffs. In doing so, please provide a basis for the debris generation conclusions reached for Calvert Cliffs NUKON, Transco Thermal wrap, calcium silicate, generic fiberglass and Temp Mat insulation systems.

2. Page 2 of the supplemental response states that the debris generation analysis is being revised. When the final supplemental response is submitted, please include a discussion of any changes that have been made that are associated with debris characterization at a level of detail consistent with the NRC supplemental response revised content guide. The staff will review this information when the licensee submits it, and as a result of such review, the staff could request additional information in this subject area if needed.

3. The supplemental response states that Marinite board is currently assumed to be 100% small fines, but that a revision will be made that will reduce the assumed quantity of small fines. Please provide the revised size distribution for Marinite board and provide a justification for the assumed size distribution.

4. Please explain the determination of 4.29 ft^3 of latent particulate and 0.57 ft^3 of labels particulate from the walk down assessment of 20 lbm of latent debris and 270 ft^2 of sacrificial area. The walkdown assessed the containment latent debris quantity as 20 lbm. However the debris generation table included 4.29 ft^3 of particulate and zero latent fibers. This equates to 420 lbm of latent particulate. Further, the procedure for calculating miscellaneous debris sacrificial area is not completely described and insufficient to judge the adequacy of the calculation. 0.57 ft^3 of label particulate was assumed, which equates to 57 lbm of labels which become particulate. The physical process by which labels become particulate is not understood. Please provide an explanation for material condition conversion.

5. Please provide a detailed summary of the methodology for estimating the latent fiber and particulate total masses. Please include a description of surface types sampled and extrapolation methods.

6. Please identify the percentage of fiber and the percentage of particulate in the collected latent debris samples.

Enclosure

7. Please provide a description of the tag, label and placard latent debris walk down procedure.

8. Please provide the total areas of tags, labels and placards latent debris that were found in containment.

9. Please provide a technical justification for neglecting the valve tag labels and placards in the latent debris walk down results.

10. Page 2 of the supplemental response states that the containment debris transport analysis is being revised. When the final supplemental response is submitted, please include a discussion of the changes that have been made to the transport calculation at a level of detail consistent with the NRC supplemental response content guide. The staff will review this information when the licensee submits it, and as a result of such review, the staff could request additional information in this subject area if needed.

11. The supplemental responses indicates that, while a computational fluid dynamics analysis of the containment pool during recirculation was not performed, coating chips were observed to fall to the flume floor during head loss testing. Therefore, a lack of transportability for coatings was assumed in the containment pool, and the NUREG/CR-6916 results were assumed to be applicable to Calvert Cliffs. Please identify the size range of the coating chips that were tested and provide a basis for considering the fluid velocity and turbulence in the head loss test flume as being similar to the range of values expected in the Calvert Cliffs containment pool. This will enable the NRC staff to evaluate the technical basis and methodology used to derive the unqualified coating transport fraction of 0.0624.

12. A two-category debris size distribution (small fines and large pieces) was assumed for the debris characteristics and transport analyses. Please identify how debris was categorized into sizes for head loss testing and provide a technical basis for concluding that a prototypical or conservative quantity of fine (readily suspendable) debris was included in the head loss testing for Calvert Cliffs.

13. Please provide details of the debris preparation and additional procedures used. Please include a description of fibrous concentration during debris addition, the debris addition location, the method of adding fibrous debris to the test tank, and the sequence of debris addition. Please provide verification that the debris preparation and introduction processes did not result in non-prototypical settling, agglomeration, or deposition of debris.

14. The NRC staff noted that for a small-break LOCA, strainer submergence could be as little as 1 inch. Please describe the results of the vortexing evaluation for both the limiting small-break and large-break LOCA cases, and please provide a technical basis to demonstrate that vortexing will not occur for the Calvert Cliffs strainer. Please include a discussion of how the vortexing analysis accounts for the potential for non-uniform flow (caused by both the suction force applied at the suction pipe inlets and the external containment pool flow pattern) to result in increased flow rates for some strainer modules.

15. In light of the potential for strainer submergence depths as little as 1 inch for small-break LOCAs, please discuss whether any significant sources of water drainage could enter

the containment pool directly above or in the immediate vicinity of the strainer, and whether this drainage could result in significant splashing and/or disturbances at the containment pool surface and therefore lead to unacceptable air entrainment through the strainer surface. In addition, please clarify whether the top surface of the strainer modules (i.e., the upper face of the cartridges) is perforated or solid plate.

16. Please provide the results and methodology for the final strainer qualification testing for head loss and vortexing with a level of detail consistent with the information requested in the NRC staff's content guide for supplemental responses. The staff will review this information when the licensee submits it, and as a result of such review, the staff could request additional information in this subject area if needed.

17. The supplemental response's discussion of previously conducted testing for Calvert Cliffs indicates that debris settling was observed in the test flume. However, a sufficient basis for demonstrating the prototypicality of this observed settling was not provided, such as a comparison of the velocity and turbulence in the test flume to the velocity and turbulence fields in containment predicted by computational fluid dynamics. Please estimate the quantity of debris that settled in the flume during the final qualification head loss testing for Calvert Cliffs and provide a technical basis to justify any significant quantities of settled debris (including chemical precipitates).

18. If agitation was utilized to prevent debris settling in the final strainer qualification testing, please verify that the debris bed on the strainer was not non-conservatively disturbed by the agitation and that non-prototypical transport in the flume did not result.

19. The supplemental response states that head loss results will be scaled by viscosity to a temperature of 100 °C. However, the supplemental response also states that previous testing identified borehole formation in the debris bed, a condition under which viscosity scaling is considered inappropriate. Please state whether boreholes were observed during the final strainer qualification testing and state whether viscosity scaling was used. Technical justification should be provided if boreholes were observed and viscosity scaling was performed.

20. The supplemental response states that containment accident pressure is not credited in evaluating whether flashing would occur across the strainer surface. Final head loss results were not provided in the supplemental response, but the staff noted that the minimum submergence of the strainer is only 1 inch for a small-break LOCA and 7 inches for a large-break LOCA. Please provide an updated discussion of the strainer flashing analysis when the final head loss results are submitted.

21. Please provide the test termination criteria and the methodology by which the final head loss values were extrapolated to the emergency core cooling system (ECCS) mission time or some predicted steady state value. Please provide a graph of head loss versus time from the design basis head loss test and discuss the application of the extrapolation methodology to the data.

22. Please identify the debris loading conditions for which the final strainer maximum head loss occurs and confirm that testing has been performed to verify that the strainer, when laden with a thin bed or maximum debris loading, will not result in unacceptable head losses. In particular, based on Item 3f6 in the supplemental response, it is unclear to the staff that the thin bed test protocol for Calvert Cliffs examined the most limiting thin bed

condition. Although some complex strainer surfaces may resist the formation of a uniform debris bed with only enough debris introduced to form a theoretical thickness of 1/8 inch, the introduction of additional debris can still result in thin bed formation.

23. Please provide complete detail concerning the potential impact and mitigation of the single failure assumptions relevant to pump operation and sump performance at Calvert Cliffs. Specifically, the supplemental response indicated that failure of a low pressure safety injection pump to stop at the initiation of recirculation was identified as the worst-case single failure at Calvert Cliffs, and that a future supplemental response would provide supporting information as to how this failure would be mitigated successfully.

24. Please confirm and justify that the degraded qualified coatings systems used at Calvert Cliffs are of a comparable nuclear grade to the coating systems tested by Keeler and Long (K&L Report No. 06-0413) in order to show that the degraded qualified coatings fail completely as chips. The degraded qualified coating chips were assumed by the licensee to settle in the pool based on NUREG/CR-6916 for certain chip sizes and flow velocities. However, the chip sizes were not provided in the supplemental response. Please provide the size distribution of the degraded qualified coatings chips.

25. If it is determined that degraded qualified coatings debris at Calvert Cliffs is in the form of particulates, please provide the quantity of this material that is generated during a LOCA.

26. Please describe how the Calvert Cliffs containment cleanliness and foreign material exclusion (FME) programs assure that latent debris in containment will be monitored and maintained below the amounts and debris characterization assumed in the ECCS strainer design. In particular, what monitoring and cleaning is planned for areas/components that are normally inaccessible or not normally cleaned (containment crane rails, cable trays, main steam/feed water piping, tops of steam generators, etc.)?

27. The supplemental response dated September 30, 2008, indicates that two refueling pool compartments could retain water up to the level of the refueling pool seal ring since the drain to these compartments is a 1-inch drain. Once the water level reaches the level of the seal ring, the response notes that water would spill into the reactor cavity. The response indicates that the reactor cavity is drained through a 2-inch pipe that contains a valve. The supplemental response did not provide adequate basis to conclude that debris washed down by spray drainage (which could include reflective metallic insulation, fiber, particulate, foreign materials, etc.) would be precluded from blocking the drains to the refueling pool compartments or the reactor cavity. Instead, a water volume of 3,792 ft^3 was assumed be trapped in the reactor cavity and an unspecified volume of water was assumed to be trapped in the refueling pool below the seal ring elevation. However, based on the information in the supplemental response, the staff noted that, if the refueling pool and reactor cavity drains (or drain valve) become blocked and the reactor cavity fills with water, it is unclear that additional water would not subsequently be held up in the refueling pool in excess of the quantity assumed by the licensee to be retained in the two compartments below the seal ring elevation. Please provide adequate technical basis to demonstrate that the assumed quantity of water hold up for the refueling pool is conservative.

28. The NRC staff considers in-vessel downstream effects to not be fully addressed at Calvert Cliffs, as well as at other PWRs. Constellation Energy's 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 SE for WCAP-16793-NP. The licensee may demonstrate that in-vessel downstream effects issues are resolved for Calvert Cliffs 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 alternatively resolve this item by demonstrating, without reference to WCAP-16793-NP or the staff SE, that in-vessel downstream effects have been addressed at Calvert Cliffs. 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-NP. 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.

29. The NRC staff has been interacting with Control Components, Incorporated (CCI), the Calvert Cliffs chemical test vendor, to better understand the precipitation process that occurs in the multi-function test loop (MFT). In the CCI letter dated April 29, 2008, "Position Paper on Evaluation of Chemical Effects; Precipitates formed by adding Chemicals to Borated Test Loop Water" (ADAMS Accession No. ML081360162), the table on the last page of the document identifies a significant loss of boron and silica from solution in MFT Test 3 on March 23, 2007. The amount of dissolved material that is captured by the debris (0.546 Kg for boric acid and 0.1 Kg for silica for the 200 L loop) does not seem consistent with other industry tests performed with similar chemical systems. The November 2007 test without debris did not have the same loss of soluble boron and silica. If these test results are relevant to the Calvert Cliffs chemical effects testing at CCI, please discuss what precipitates may be forming to cause the decreased boron and silica measured in solution. Also, please discuss why the November test results may be different from the March 2007 test results.

30. Please estimate the percentage of chemical precipitate that settled in the test flume at CCI relative to the percentage that was contained in the strainer pockets.

31. In Attachment 1 to the Constellation letter to the NRC dated June 18, 2008 (ADAMS Accession Number ML081710105), you indicated that Calvert Cliffs may be taking additional actions, such as switching the buffer used for control of pH following a LOCA, that would change potential chemical effects. Therefore, please provide the results (e.g., a head loss plot) from any additional chemical effects testing and analysis that has not been previously provided. Please discuss why the overall plant-specific chemical effects evaluation is conservative.

The exception to the above response timeline is RAI 28 in the enclosure. The NRC staff considers in-vessel downstream effects to not be fully addressed at Calvert Cliffs, 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.

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Please contact me at 301-415-1364 if you have any questions.

Sincerely,

/RA/
Douglas V. Pickett, Senior Project Manager
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-317 and 50-318

Enclosure:
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