ATTACHMENT (1)

REQUEST FOR EXTENSION OF THE COMPLETION DATE FOR CORRECTIVE ACTIONS RELATED TO GENERIC LETTER 2004-02

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1.0 BACKGROUND

In Reference (1), the Nuclear Regulatory Commission (NRC) staff summarized their bases for concluding that existing pressurized-water reactors (PWRs) could continue to operate through December 31, 2007, while implementing the required corrective actions for NRC Generic Safety Issue (GSI)-191, "Assessment of Debris Accumulation on PWR Sump Performance." In References (2) and (3), Calvert Cliffs submitted a request for an extension to complete the required corrective actions. The NRC approved the extension request in Reference (4).

During the ensuing work to complete the Generic Letter (GL) 2004-02 corrective actions, it has become apparent that certain activities to resolve the containment sump issues cannot be completed within the current schedules, and, therefore, an additional extension to complete the corrective actions are necessary. Calvert Cliffs has completed all currently scheduled testing and is in the process of completing and verifying the required evaluations. The evaluations have identified that certain additional corrective activities may be required.

The following information provides the basis for the extension request. Specifically, in the following discussion, Calvert Cliffs has addressed the "Criteria for Evaluating Delay of Hardware Changes," as described in Reference (5). This discussion supports Calvert Cliffs' request for an extension of the modification completion date to ensure that the necessary actions have been completed to facilitate resolution of GSI-191 issues.

2.0 REASON FOR THE PROPOSED EXTENSION

As of December 31, 2007, Calvert Cliffs Units 1 and 2 have completed the following GL 2004-02 actions, analyses, and modifications.

- Debris generation analysis (was revised)
- Containment debris transport analysis (was revised)
- Hydraulic model of the Emergency Core Cooling System (ECCS)
- Bypass testing
- Detailed structural analysis of the new strainers (confirmed by the vendor)
- Calcium-silicate insulation removal or banding within the zone of influence (ZOI) (Unit 2)
- Latent debris walkdowns
- Installed 6000 ft^2 surface area replacement strainer system in Unit 2

As of June 30, 2008 the following activities are complete or expected to be completed for Calvert Cliffs Units 1 and 2.

- Installed 6000 ft^2 surface area replacement strainer system in Unit 1
- High pressure safety injection (HPSI) and Containment Spray (CS) System net positive suction head (NPSH) analysis
- Vendor strainer head loss testing
- Calcium-silicate insulation removal or banding within the ZOI (Unit 1)
- Downstream wear and blockage analysis of pumps and piping components
- HPSI cyclone separator blockage testing
- Aluminum abatement – material removal (Unit 1)
- Sump vortex analysis
- Augmented latent debris walkdowns (Unit 1)

- HPSI seal water cyclone separator replacement
- Downstream fuel effects analysis

The vendor strainer head loss testing was completed in early June 2008 and preliminary results provided information that was used in a conservative re-evaluation of the NPSH available for the CS and HPSI pumps. There are a total of four CS pumps (two per Unit) and six HPSI pumps (three per Unit). The resulting NPSH evaluation has shown that the NPSH requirements were met for all HPSI pumps and two of the CS pumps. The other two CS pumps (one on each Unit) do not meet the required NPSH by a small margin. Containment spray pump 12 does not meet the required NPSH by approximately 0.2 inches and CS pump 21 does not meet the required NPSH by approximately 4.0 inches.

The preliminary results of the vendor strainer head loss testing showed that a significant portion of the strainer head loss is due to chemical effects. Two primary options were identified for regaining strainer head loss margin. The first option considered would be to request a change to the licensing basis for Calvert Cliffs to credit containment backpressure as described in Section 3.0. The second option would be to change the buffering agent in Containment from trisodium phosphate to sodium tetraborate. We anticipate the buffer change may recover approximately 18 inches of available NPSH for the CS pumps (and other ECCS pumps). Since the second option provides additional physical margin, we currently plan to replace the buffering agent in both Unit 1 and 2 to gain adequate NPSH margin to meet the generic letter design basis requirements. Note that this change will require a change to our Technical Specifications prior to implementation. Therefore, we request an extension to July 31, 2008 to permit the preparation and submittal of a license amendment request to allow the change of the containment buffering agent from trisodium phosphate to sodium tetraborate. We understand that, if approved, we would be expected to implement the containment buffer change for Unit 2 during the Spring 2009 refueling outage (scheduled to start February 24, 2009) and within 90 days of approval, but no later than June 1, 2009 for Unit 1.

In addition, the preliminary results of the vendor strainer head loss testing confirmed that the previously completed removal of aluminum materials in the Unit 1 Containment was necessary to produce acceptable chemical precipitant results. Therefore, we also need to remove aluminum materials from the Unit 2 Containment to ensure that the design basis NPSH requirements can be met. Due to the high dose rates in the Unit 2 Containment when the Unit is operating, and the substantial manual labor required to remove aluminum materials (such as scaffolding) in a high heat environment, this activity must be performed during a plant outage. Therefore, we request an extension for this aluminum material removal to the next Unit 2 refueling outage, which is scheduled to begin about February 24, 2009.

In addition, Calvert Cliffs is requesting an extension to September 30, 2008 to finalize the required evaluations, complete owner acceptance reviews and verifications, and submit the revision to the supplemental response. The evaluations are underway and the preliminary results to date have been acceptable. However, final acceptance reviews have not yet been completed for all evaluations. This review process does not generally result in major changes to the results and, therefore, we expect the preliminary results will remain acceptable. Note that the containment buffer change will require additional testing and evaluations to verify the change is acceptable. While we anticipate activities associated with a containment buffer change would be completed before September 30, 2008, the required testing and evaluations may not be able to be scheduled to support that date due to the unavailability of facilities or personnel to perform those activities. However, completion of those activities will occur on a schedule to support a containment buffer change as requested by our proposed license amendment request.

Testing and evaluations reflecting the new buffer will be performed at the earliest opportunity to support confirmation that the currently planned modifications will be sufficient to show satisfactory strainer performance. Contingency planning for potential additional modifications will be performed such that strainer testing reflecting these potential modifications can be performed at the same time as the testing reflecting the buffer change. This planning will also support near-term (Unit 2, Spring 2009 refueling outage; Unit 1, yet to be determined) installation of these potential modifications should testing show them to be necessary.

3.0 JUSTIFICATION FOR THE PROPOSED EXTENSION

The justification for continued operation that was previously provided (Reference 2) for Units 1 and 2 is updated below. This justification assumes the installation of a new, larger strainer which has smaller openings in the strainer mesh and uses knowledge gained from recent strainer testing.

1. Containment Backpressure

   For NPSH evaluations Calvert Cliffs follows Safety Guide 1, which does not allow crediting a containment air pressure greater than the minimum that might exist at the start of an accident. Therefore, our design basis evaluation has determined that we have negative NPSH margin for two CS pumps at the start of sump recirculation when the sump temperature is still above 200°F, and saturation pressure is greater than the minimum containment air pressure that might exist at the start of an accident. If containment pressure during the event was allowed to be equal to atmospheric pressure, then acceptable NPSH margin would exist for all ECCS pumps.

   While a specific analysis for this purpose has not been performed, a review of existing analyses indicates there would be at least a 4 psig backpressure over 80 hours into a large-break loss-of-coolant accident (LOCA). A large-break LOCA is needed to generate the limiting debris loads for which the sump strainer was tested. In approximately eight hours the sump temperature would have dropped low enough that even atmospheric pressure would not have to be credited in order to have positive NPSH margin. Therefore, it is reasonable to credit a containment pressure equal to at least that of atmospheric pressure during the initial hours of large-break LOCA.

2. Design Debris Load Conservatisms

   Per Figure 5-2 of NUREG/CR-6808, individual shreds of fiber insulation have a settling velocity of 1 mm/sec. Assuming a conservatively high sump level after the blowdown phase (62 inches) and a settling velocity of 1 mm/sec means that all the insulation would be settled to the floor within 26.25 minutes. The earliest a recirculation actuation signal could be received is 30 minutes. Therefore, there is time for the insulation to settle to the floor prior to the onset of containment sump recirculation. Once insulation and other debris has settled to the floor its transportability is greatly diminished.

3. Operator Training & Actions

   The above discussion and testing performed by others indicates that debris accumulation on the sump strainer would be gradual, building up over time. As part of the defense-in-depth strategy, procedural guidance exists which identifies actions to be taken to mitigate this condition.

   Pump cavitation would be detected by the Operators who have procedural guidance to monitor the pumps for evidence of pump cavitation. The training the Operators received in response to NRC Bulletin 2003-01 instructed them to consider reducing the total sump flow when pump cavitation was detected. This would be achieved by first throttling HPSI flow, and then if necessary turning off

the CS pumps and relying on the containment air coolers for atmosphere control. Only one HPSI pump at throttled flow is needed to provide adequate cooling for the core.

4. Mitigative Measures

a. Physical Modifications

Calvert Cliffs Units 1 and 2 completed the installation of an approximately 6000 ft^2 surface area replacement strainer system and replaced or banded calcium-silicate insulation that could contribute to a limiting debris bed in Containment. Additionally, the cyclone separators are being replaced on all of the HPSI pumps (will be completed before June 30, 2008). Aluminum material was removed from the Unit 1 Containment.

b. Containment Cleanliness

Calvert Cliffs has a procedure in place to ensure containment cleanliness as documented in the response to NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors." A detailed containment inspection is performed prior to closing Containment following a containment entry at power or prior to startup from a unit outage. The procedure specifically directs the inspection for, and removal of, loose debris (e.g., rags, trash, clothing, etc.) in the Containment that could be transported to the containment recirculation sump or that could block containment drainage paths. Additionally, the procedure directs the removal of temporary material that is used in Containment and the restraint of any temporary material that is to be left in Containment. Containment sump inspections are required by Technical Specifications.

c. Information Notice 2005-26

On September 16, 2005, the NRC issued Information Notice (IN) 2005-26, "Results of Chemical Effects Head Loss Tests in a Simulated PWR Sump Pool Environment."

Information Notice 2005-26 applies to plants with installed calcium-silicate insulation and trisodium phosphate as a buffering agent inside Containment. Calvert Cliffs Units 1 and 2 had calcium-silicate insulation on some small bore piping which was susceptible to damage from a limiting break. In References (6) and (7), Calvert Cliffs updated the results of a review of compensatory measures in light of IN 2005-26. During the last refueling outages on each Unit, calcium-silicate insulation was removed or banded in the ZOI to prevent it from being a contributing debris source for a limiting break.

d. Consideration of Smaller Break Sizes

With the installation of the new sump strainer and other associated changes and evaluations, there has been a significant reduction in the vulnerability to debris blockage and component wear in the recirculation system when mitigating a LOCA. For small- and intermediate-break LOCAs, it is expected that there will be a significant reduction in debris generation of at least one order of magnitude less than that of a large-break LOCA. With this type of reduction in the fibrous and particulate sources, a functional strainer will be assured for small- and intermediate-break LOCAs given the very small negative NPSH margin of the CS pumps for the large-break LOCA case.

e. Probabilistic Risk Assessment Risk Evaluation

The quantitative risk evaluation addresses potential vulnerability for large-break LOCAs only since small- and medium-break LOCAs are dispostioned in Section 3.0.4.d above. The frequency of this initiating event is low (1.33E-6/reactor yr per NUREG/CR-6928). As noted in Section 2.0, all HPSI pumps and one CS pump on each Unit meet design NPSH pump requirements for large-break LOCAs. These evaluations are very conservative and there is a significant potential that the pumps would function in an actual event. Further, as noted above, Operators have been trained to reduce flow on signs of any pump cavitation. However, for purposes of this evaluation, CS pumps 12 and 21 are assumed to fail on a large-break LOCA. Thus, there is assumed to be only one CS pump available for long-term cooling. The failure probability of this pump and supports is assumed to be 5%. This is extremely conservative given the current probabilistic risk assessment value for pump hardware or unavailability of approximately 0.6%. The probability that electrical supports fail, loss-of-offsite power and two available diesel generators is negligible. The remaining CS pump has been evaluated to have sufficient NPSH. If CS pumps 12 or 21 fail due to inadequate NPSH, the reduction in flow and head loss across the sump strainer will provide greater NPSH for the remaining CS pump. Thus, the annual increase in core damage frequency is very conservatively calculated as 1.3E-6/yr multiplied by 5%. This results in an annual core damage frequency (CDF) increase of 7E-08 on each Unit.

The large early release frequency (LERF) is negligible based on the Level 2 Probabilistic Risk Assessment model.

No credit is taken for recovery actions, which Calvert Cliffs would normally use, to ensure continued supply from the sumps. The base CDF and base LERF values for Calvert Cliffs Units 1 and 2 are shown below along with the CDF and LERF values that were calculated for the proposed extension.

Unit	Base CDF	CDF for the extension	Base LERF	LERF for the extension
CCNPP 1	7.3E-5/yr	7E-8	5.7E-6/yr	<1E-07*
CCNPP 2	7.8E-5/yr	7E-8	7.1E-6/yr	<1E-07*

* If sump clogging or downstream and chemical effects cause a failure of ECCS, then core damage will occur relatively late in the event. Further, the Reactor Coolant System pressure will be low and minimize the probabilities of thermally induced steam generator tube ruptures and core ejection. Thus the ratio of CDF to LERF will be much great then a factor of ten.

Regulatory Guide 1.174 states that, when calculated changes in risk are < 1E-6/yr, a permanent change is "very small" if the total plant CDF is less than 1E-4/yr. For LERF, a "very small" change is a calculated risk < 1E-7/yr if the total LERF is less than 1E-5/yr. This Regulatory Guide sets criteria for permanent plant changes with associated risk increases. In this case, it may be conservatively used to evaluate the risk impact of the extension to complete the GL 2004-02 corrective actions. The assumption that CS pumps 12 and 21 are unavailable for large-break LOCAs is additionally conservative. Therefore, based on Regulatory Guide 1.174, the risk associated with proposed extension to complete the GL 2004-02 corrective actions for Calvert Cliffs Units 1 and 2 is not considered to be significant.

f. Safety Features and Margins in Current Configuration/Design Basis

In addition to the measures described above, there are design features that would facilitate mitigation of this issue. Calvert Cliffs has NRC approval to invoke the leak-before-break methodology to eliminate the dynamic effects (pipe whip and jet impingement) of postulated reactor coolant piping ruptures from the design basis of the plant. This approval was based on a plant specific evaluation (CEN-367-A) of the inherent toughness of the cold leg and hot leg piping at Calvert Cliffs which concluded that the probability of a pipe failure before noticeable leakage could be detected and the plant brought into a safe-shutdown condition was negligibly small. While leak-before-break is not being used to establish the design basis load on the sump strainer, it does provide a basis for safe continued operation until the completion of the GL 2004-02 corrective actions.

4.0 COMPLIANCE WITH SECY-06-0078 CRITERIA

SECY-06-0078 (Reference 5) specifies two criteria for short duration GL 2004-02 extensions, limited to several months and a third criterion for extensions beyond several months. These three criteria and the associated responses for Calvert Cliffs are provided below.

4.1 SECY-06-0078 Criterion No. 1

The licensee has a plant-specific technical/experimental plan with milestones and schedule to address outstanding technical issues with enough margin to account for uncertainties.

Response

Calvert Cliffs has completed currently scheduled testing as described in Section 2.0. Evaluations are ongoing and are expected to be completed and owner accepted or verified before September 30, 2008 and a final supplemental response will be provided to the NRC. The testing recently completed resulted in changes to the corrective actions required to complete our response. We currently plan to submit a license amendment request to allow change out of the containment buffer material in both Units by July 31, 2008. The actual buffer change out would occur following approval of the license amendment request. We also plan to remove excess aluminum in Unit 2 during the next refueling outage for Unit 2, starting in February 2009.

4.2 SECY-06-0078 Criterion No. 2

The licensee identifies mitigative measures to be in place prior to December 31, 2007, and adequately describes how these mitigative measures will minimize the risk of degraded ECCS [emergency core cooling system] functions during the extension period.

Response

Mitigative measures have already been implemented to minimize the risk of degraded ECCS functions during the requested extension period as described in Section 3.0.

4.3 SECY-06-0078 Criterion 3

For proposed extensions beyond several months, a licensee's request will more likely be accepted if the proposed mitigative measures include temporary physical improvements to the ECCS sump or materials inside containment to better ensure a high level of ECCS performance.

Response

Calvert Cliffs has implemented the following physical improvements to the containment sump to better ensure a high level of ECCS performance:

- Strainer Installation

  Calvert Cliffs completed the installation of the Units 1 and 2 replacement strainer system. The new strainer system represents a significant improvement over the previous design. The total surface area of the new strainer is approximately 6000 ft^2. This replaced the previous screen, which had a surface area of approximately 115 ft^2.

- Replacement of the HPSI Cyclone Separators

  Testing and evaluation has shown that the HPSI pump cyclone separators need to be replaced to mitigate the effect of debris laden water passing through them. The replacement is underway and is expected to be completed prior to June 30, 2008.

- Calcium-Silicate Insulation Mitigation

  Calvert Cliffs Units 1 and 2 banded or removed calcium-silicate insulation from susceptible areas inside Containment. There is no longer any credible high-energy line break that can impact the remaining calcium-silicate insulation in Containment. The remaining calcium-silicate insulation is located outside of the LOCA ZOIs. Further, metal jacketing or banding protecting the remaining calcium-silicate insulation prevents significant damage due to CS. Finally, any remaining calcium-silicate insulation would not become submerged.

- Removal of Aluminum from Containment

  During the 2008 Refueling Outage action was taken to remove, shield, or otherwise mitigate the aluminum source in the Unit 1 Containment to reasonably ensure successful testing to meet design basis requirements for Unit 1. Specifically, scaffolding pick boards and a portable man lift were removed from Containment in Unit 1, thereby reducing the aluminum debris source by over 80%.

5.0 CONCLUSION

An extension of the Unit 1 and 2 completion dates from June 30, 2008 to:

- July 31, 2008 – license amendment request for containment buffer change. Buffer change out will occur following the implementation schedule in the license amendment.
- September 30, 2008 – completion of the required engineering evaluations (excluding those associated with the buffer change) and submission of the revision to the supplemental report.
- Late February 2009 – removal of the excess aluminum material in Unit 2 (outage start date scheduled for February 24, 2009).

is acceptable because:

- Calvert Cliffs has completed considerable work on both Units to further promote a high level of ECCS pump performance including replacement strainer installation, calcium-silicate insulation mitigation, and replacement of the HPSI pump cyclone separators. Additionally, aluminum has been removed from the Unit 1 Containment.
- The design basis NPSH evaluation demonstrates that 8 of the 10 required ECCS pumps are acceptable and the remaining 2 pumps are close to an acceptable NPSH limit.

- The core damage and large early release probabilities associated with the six month extension are very conservatively evaluated as 7E-8 and negligible, respectively. This risk impact is the same at both Unit 1 and 2 and is characterized as "very small" per NRC Regulatory Guide 1.174.
- Calvert Cliffs has implemented mitigative measures to minimize the risk of degraded ECCS functions during the extension period.
- Calvert Cliffs has a plant-specific plan with milestones and schedule to address the outstanding technical issues with sufficient conservatism to address uncertainties.

6.0 REFERENCES

1. Generic Letter 2004-02, dated September 13, 2004, Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors
2. Letter from Mr. D. R. Bauder (CCNPP) to Document Control Desk (NRC), dated December 10, 2007, Request for Extension for Completion of Activities Related to Generic Letter 2004-02
3. Letter from Mr. J. A. Spina (CCNPP) to Document Control Desk (NRC), dated December 20, 2007. Request for Additional Information -- Request for Extension for Completion of Activities Related to Generic Letter 2004-02
4. Letter from Mr. D. V. Pickett (NRC) to Mr. J. A. Spina (CCNPP), dated December 27, 2007, Extension for Completion of Activities Related to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design basis Accidents at Pressurized Water Reactors," Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2
5. SECY 06-0078, dated March 31, 2006, Status of Resolution of GSI-191, "Assessment of [Effect of] Debris Accumulation on PWR Sump Performance"
6. Letter from Mr. J. A. Spina (CCNPP) to Document Control Desk (NRC), dated May 2, 2007, Revision to Generic Letter 2004-02 Response
7. Letter from Mr. J. A. Spina (CCNPP) to Document Control Desk (NRC), dated May 2, 2008, Revision to Generic Letter 2004-02 Response