George Vanderheyden
Vice President
Calvert Cliffs Nuclear Power Plant
Constellation Generation Group, LLC

1650 Calvert Cliffs Parkway
Lusby, Maryland 20657
410 495-4455
410 495-3500 Fax

Constellation Energy Group

September 25, 2003

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit No. 1, Docket No. 50-317
Response to Request for Additional Information Concerning the License Amendment Request to Increase Unit 1 Spent Fuel Pool Maximum Enrichment Limit with Soluble Boron Credit

REFERENCES:

(a) Letter from Mr. G. S. Vissing (NRC) to Mr. P. E. Katz (CCNPP), dated July 9, 2003, "Request for Additional Information, Technical Specification Change to Increase Spent Fuel Pool Maximum Enrichment Limit with Soluble Boron Credit (TAC No. MB 8896)"

(b) Letter from Mr. P. E. Katz (CCNPP) to NRC Document Control Desk, dated May 1, 2003, "License Amendment Request: Increase to the Unit 1 Spent Fuel Pool Maximum Enrichment Limit with Soluble Boron Credit"

This letter provides the information requested in Reference (a), and supports and/or clarifies the information provided in Reference (b). This information does not affect the No Significant Hazards Consideration Determination or the Environmental Impact Review of Reference (b).

Requested Information:

1. ***The licensee stated in its submittal that it has a coupon surveillance program to test the condition of the carborundum material exposed to the spent fuel pool environment. Provide the following information on the program:***

   1a. The spent fuel pool has non uniform radiation fields due to different distributions of fuel assemblies having different enrichments and different burnups. Also, axial power distribution in individual fuel rods is not uniform. Describe the locations chosen for the coupons relative to the fuel assemblies in order to make them exposed to the most conservative (highest) dose rates.

   CCNPP Response:

   The Calvert Cliffs Poison Surveillance Program is designed to provide both accelerated and long-term exposure to gamma radiation and borated pool water. Accelerated exposure is achieved by providing a poison sample holder that is moved each outage to a new storage location surrounded

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by freshly discharged fuel. For the accelerated program, the carborundum coupons are surrounded by freshly discharged fuel, where the radial radiation levels are uniformly evaluated. In addition, the coupons are located in the active fuel region of the neighboring assemblies, where the burnups, and thus, radiation fields are axially uniform. Long-term exposure is achieved by providing a second poison sample holder that will be initially surrounded by freshly discharged fuel but that will occupy the same location in the fuel rack throughout the surveillance program. The long-term surveillance samples are more representative of the actual dose rates experienced by the fuel racks. All coupons are stored in the active fuel region for maximum axial exposure.

1b. Describe what inspections were performed on the test coupons and how was the real density determined. Provide a brief summary of the results.

CCNPP Response:

Each post-irradiation examination of exposed poison samples consists of visual, weight, and dimensional determinations. In the visual examination, the poison material is inspected for evidence of gross changes or deterioration (e.g., B_4C grain intactness, surface texture uniformity, lack of visible discoloration). The weight of each sample to within 0.001 gram is compared against the sample initial weight using a calibrated scale. The length and width of each sample to within 0.001 inch is compared against the sample initial length and width using a calibrated caliper. Note that the mass of the coupons are measured, not the boron density. Initial tests have indicated that mass loss exceeds boron density loss and is thus a conservative indicator.

The coupon samples are designed to house poison material samples between 304 stainless steel sheets and expose them to the borated pool water in a configuration essentially the same as exists in the spent fuel storage racks. The sample coupons are centralized around the active fuel length of the adjacent assemblies.

The accelerated poison sample surveillance program initially had 12 coupons and extracted a coupon for analysis every two years. The duration was increased to eight years to account for plant life extension, with a final withdrawal scheduled for 2037. The affected coupons are re-inserted for possible future examination. The surveillance program has demonstrated that the weight loss results for the accelerated coupon program has been less than 6 percent weight loss over a 14 year period.

The long-term poison sample surveillance program initially had 12 coupons and extracted a coupon for analysis every four years. The duration was increased to five years to account for plant life extension, with a final withdrawal scheduled for 2040. The affected coupons are re-inserted for possible future examination. The surveillance program has demonstrated that the weight loss results for the long-term coupon program has been less than 5 percent weight loss over a 17 year period.

Thus, the weight loss values are well within those assumed in the criticality analyses.

1c. What were the acceptance criteria?

CCNPP Response:

The Carborundum Company conducted a comprehensive test program on the type of poison material used in the Calvert Cliffs Unit 1 fuel storage racks. Poison material samples were

simultaneously exposed to 10^{11} Rad gamma radiation and borated water simulating a 40-year lifetime. The results of the Carborundum test program showed that the poison material exhibited chemical stability, boron retention, and mechanical property changes within design specifications. The only notable changes reported were a 20% weight loss and a 15% boron reduction. Carborundum also stated that the recorded weight losses were unrealistically high and primarily attributable to test sample handling.

The original minimum loading was 0.024 g/cm^2. Thus, 0.020 g/cm^2 represents the amount of the original boron remaining after 40 years assuming a 15% loss. Section 2.1.3.7 of the CCNPP License Renewal Application indicates that CCNPP will perform an analysis to demonstrate that the Carborundum can perform its criticality control function for a 70-year service life. The NRC acknowledged this commitment in NUREG-1705, Section 3.10.2.4. Therefore, it was necessary to account for the additional boron that could be lost between 40 and 70 years. In addition, previous criticality calculations have also considered a 10% uncertainty in addition to using the worst-case B-10 loading. This uncertainty is to account for the experimental variation in boron loss rate measurement.

A B-10 loading of 0.020 g/cm^2 represents a 15% loss over 40 years. Linearly extrapolating this loss rate to 70 years yields (with the implicit assumption that the rate remains constant) a B-10 loading of 0.0177 g/cm^2 (0.024 – 70/40*0.15*0.024) and 0.01593 g/cm^2 for the 10% uncertainty case. Note that the Carborundum test data indicates that the boron loss plateaus at gamma exposures in excess of 10^{11} Rads. Thus, the use of a linear extrapolation in poison weight loss is very conservative.

The purpose of the Calvert Cliffs onsite surveillance test program is to verify that, under the combined environmental effects in the Calvert Cliffs fuel storage pool, the affect on the poison material will not be significantly different than that predicted by the Carborundum test program.

Thus, the new acceptance criteria is a 26.25% loss of B-10 (to a B-10 loading of 0.0177 g/cm^2), which is conservatively assumed to be the gross weight loss.

2. ***Besides the coupon surveillance program, do you perform any tests on the full length panels in the fuel racks? If such tests have been performed, provide the following information:***

CCNPP Response:

No tests are performed on the full length panels in the fuel racks. Insufficient free space exists in the fuel racks to effectively perform any sort of blackness testing. The current licensing basis at Calvert Cliffs only requires a coupon surveillance program to monitor the condition of the rack poison materials (UFSAR 9.7.2).

3. ***Describe the mechanism by which carborundum neutron absorbing material in the fuel racks degrades when exposed to the spent fuel pool environment.***

CCNPP Response:

The company that manufactured the carborundum is no longer is business, and this material is no longer manufactured by another company. Therefore the technical information concerning the degradation mechanism for carborundum is no longer available. However, the results of the carborundum test program showed that over a 40-year lifetime, the poison material exhibited

chemical stability, boron retention, and mechanical property changes within design specifications. The only notable change reported was a minor loss in weight and boron content primarily attributable to test sample handling and minor erosion of surface material at the viewing port.

I declare under penalty of perjury that the foregoing is true and correct. Executed on September 25, 2003.

Should you have questions regarding this matter, we will be pleased to discuss them with you.

Very truly yours,

GV/DJM/dlm

cc: J. Petro, Esquire
J. E. Silberg, Esquire
Director, Project Directorate I-1, NRC
G. S. Vissing, NRC
H. J. Miller, NRC
Resident Inspector, NRC
R. I. McLean, DNR