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Constellation Energy
Nuclear Generation Group

January 10, 2008

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
Request for Additional Information Re: Long-Term Carborundum Coupon Surveillance Program

REFERENCES:

(a) Letter from Mr. J. A. Spina (CCNPP) to Document Control Desk (NRC), dated May 10, 2007, Long-Term Coupon Surveillance Program for the Unit 1 Spent Fuel Pool

(b) Letter from Mr. D. V. Pickett (NRC) to Mr. J. A. Spina (CCNPP), dated November 15, 2007, Request for Additional Information re: Carborundum Coupon Surveillance Program (TAC No. MD5509)

We submitted a license amendment request to implement a long-term carborundum coupon surveillance program at Calvert Cliffs Unit 1 (Reference a). This license amendment was in response to a license condition that required the submission of a coupon surveillance program for Unit 1. The Nuclear Regulatory Commission staff has determined that additional information is required to complete their review of the coupon surveillance program (Reference b). Our responses to the Staff's questions are contained in Attachment (1) to this letter.

A001
NRR

Should you have questions regarding this matter, please contact Mr. Jay S. Gaines at (410) 495-5219.

Very truly yours,

STATE OF MARYLAND :
: **TO WIT:**
COUNTY OF CALVERT :

I, James A. Spina, being duly sworn, state that I am Vice President - Calvert Cliffs Nuclear Power Plant, Inc. (CCNPP), and that I am duly authorized to execute and file this License Amendment Request on behalf of CCNPP. To the best of my knowledge and belief, the statements contained in this document are true and correct. To the extent that these statements are not based on my personal knowledge, they are based upon information provided by other CCNPP employees and/or consultants. Such information has been reviewed in accordance with company practice and I believe it to be reliable.

Subscribed and sworn before me, a Notary Public in and for the State of Maryland and County of St. Mary's, this 10th day of January, 2008.

WITNESS my Hand and Notarial Seal:

Janet L. Dailey
Notary Public

My Commission Expires:

March 1, 2011
Date

JAS/PSF/bjd

Attachment: (1) Response to Request for Additional Information – Long-Term Carborundum Coupon Surveillance Program

cc: D. V. Pickett, NRC
S. J. Collins, NRC
Resident Inspector, NRC
R. I. McLean, DNR

ATTACHMENT (1)

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION –

LONG-TERM CARBORUNDUM COUPON SURVEILLANCE PROGRAM

Calvert Cliffs Nuclear Power Plant, Inc.
January 10, 2008

ATTACHMENT (1)

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION – LONG-TERM CARBORUNDUM COUPON SURVEILLANCE PROGRAM

By letter dated May 10, 2007 (ML071440224), Calvert Cliffs Nuclear Power Plant, Inc., (the licensee), submitted a license amendment to implement a long-term Carborundum coupon surveillance program at Calvert Cliffs Nuclear Power Plant (CCNPP), Unit No. 1. This amendment is in response to a license condition that required the submission of a coupon surveillance program for the CCNPP Unit No. 1 spent fuel pool (SFP). This program must verify that the Carborundum degradation rates assumed in the licensee's analysis to prove criticality, as required by Title 10 of the *Code of Federal Regulations*, Section 50.68, remain valid over the 70-year life span of the Unit 1 SFP. Based on review of the information submitted by the licensee, the Nuclear Regulatory Commission (NRC) staff has determined that the following information is needed to complete its evaluation.

1. *On page 2 of Attachment 1, it is stated that the proposed long-term coupon surveillance program will consist of visual, weight, and dimensional determinations. Please provide justification for the elimination of sample thickness from your dimensional determinations.*

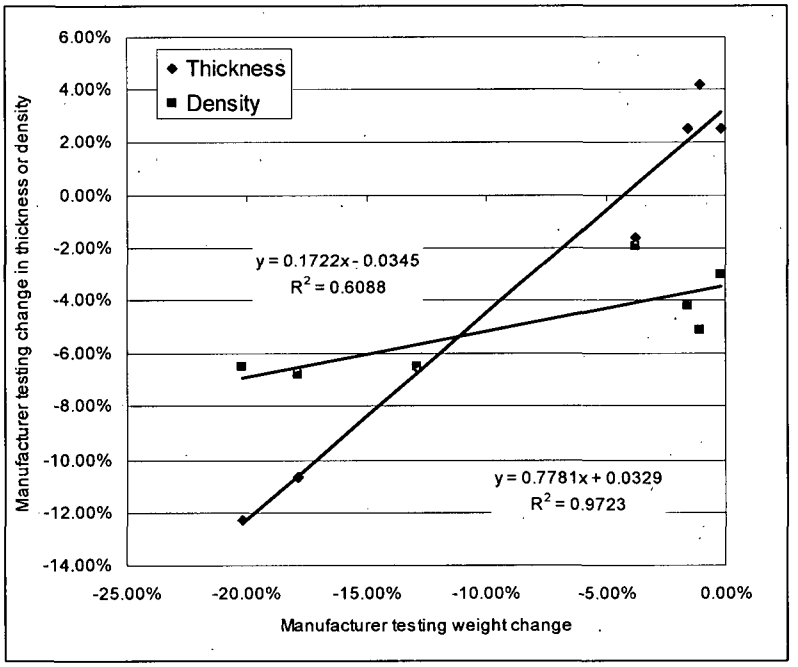
CCNPP Response

Measurement of surveillance coupon thickness is not part of the currently approved surveillance program for carborundum. As such, there are no known baseline measurements of thickness for the current long-term surveillance assembly (LTSA) coupons. The carborundum material is composed of boron carbide particles in a matrix of phenol formaldehyde resin with fiberglass reinforcement. The original manufacturer test program, detailed in Reference (1), found that there were no statistically significant changes in length or width of the test samples with irradiation to 10^{11} rad in deionized water and 10^{10} rad in borated water (Reference 1, Tables XIII & XIV). Similarly, the length and width for the CCNPP surveillance coupons have not changed significantly during irradiation. For the last accelerated surveillance assembly (ASA) coupons examined, the largest change in length was 0.485%, while the largest change in width was 1.95%. Note that these small changes are believed to result from curvature of the thin coupon during the drying process.

Since coupon length and width do not change significantly with irradiation, the change in coupon weight will be directly proportional to changes in thickness and/or density. Review of the original manufacturer's irradiation test program data (Reference 1, Tables XIII & XIV) suggest that changes in weight with irradiation are more highly correlated with changes in thickness than in density as shown below.

Manufacturers Irradiation Test Results
(Reference 1, Tables XIII & XIV)

Gamma Dose (Rad)	Weight Change %	Thickness Change %	Density Change %
1.00E+09	-0.20%	2.52%	-3.05%
1.00E+10	-1.10%	4.20%	-5.14%
1.00E+10	-1.60%	2.52%	-4.20%
3.00E+10	-3.80%	-1.61%	-1.93%
5.000E+10	-12.90%	-6.56%	-6.50%
8.000E+10	-17.90%	-10.66%	-6.76%
1.00E+11	-20.20%	-12.30%	-6.48%



Therefore, we believe that measurement of coupon thickness would add little value to the surveillance program based on the properties of the carborundum neutron absorber material, and can be inferred based on the data that is already collected by the program.

2. *Given that the performance of Carborundum is dependent on its neutron attenuation, it is necessary that a licensee demonstrate that the material's neutron attenuation properties are adequate. As discussed in the staff's safety evaluation to License Amendment No. 267 (Agencywide Documents Access and Management Systems Accession No. ML041040160), the staff noted that the surveillance coupon program for Carborundum should also include the measurement of boron carbide areal density to accurately determine the degree of any material degradation. Therefore, discuss your plans to incorporate areal density testing into your proposed long-term surveillance program.*

CCNPP Response

We do not plan to incorporate areal density testing into our surveillance program.

The original carborundum surveillance program was presented to the NRC in Reference (2). Question 7 requested a description of the method that verifies the amount of boron assumed in the criticality calculations remains in the carborundum sheets throughout the life of the racks. The response indicated that verification will be accomplished by placing samples in the high gamma areas of the SFP and then periodically removing them throughout the life of the fuel racks for various mechanical tests. This continuing verification program did not require areal density or other neutron attenuation tests. In Reference (3), the NRC stated that the tests proposed by BG&E in Reference (1) were acceptable. Thus, the surveillance program at CCNPP consists of visual, weight, and dimensional (length and width) examinations only.

Additionally, the carborundum manufacturer's test program showed that the poison material exhibited chemical stability, boron retention, and mechanical property changes within design specifications. The

only notable changes with irradiation to 10^{11} rad were a 20% weight loss and 15% boron reduction (Reference 1, p.15). Since the weight loss exceeds boron reduction under test conditions, use of weight loss in lieu of boron reduction is conservative. Therefore, we consider areal density measurements unnecessary and note that they would preclude re-insertion of the samples back into the SFP for future use, which would affect any additional life-extension considerations at CCNPP.

3. *Please provide the acceptance criteria for the visual, weight, and dimensional tests (also provide the acceptance criteria for neutron attenuation and areal density tests if added to the proposed long-term coupon surveillance program). In addition, discuss the corrective actions which will be taken when a test fails to meet the acceptance criteria.*

CCNPP Response

Dimensional

As experienced in previous tests (Reference 1), dimensions of the sample coupons do not change extensively with exposure. Much of the small changes in dimension that are observed are due to curvature of the thin coupons during the drying process. Therefore, a dimensional acceptance criteria was deemed unnecessary.

Weight

In the surveillance program, each withdrawn sample is dried and weighed. The change in weight is evaluated to determine if it exceeds expected losses.

If coupon weight loss is predicted to exceed 26% before the 70 year rack lifetime, the issue is entered into our corrective action program. Our experience with these coupons shows that the primary loss of material in the samples is due to erosion at the inspection holes and to handling losses. Additionally, because the ASA is located near freshly discharged fuel, its sample coupons receive dose at a much faster rate than the fuel racks. Any degradation due to dose exposure will be evident in the ASA samples years before the actual fuel racks.

Visual

A visual inspection is also performed for each withdrawn coupon. The visual inspection criteria are given below.

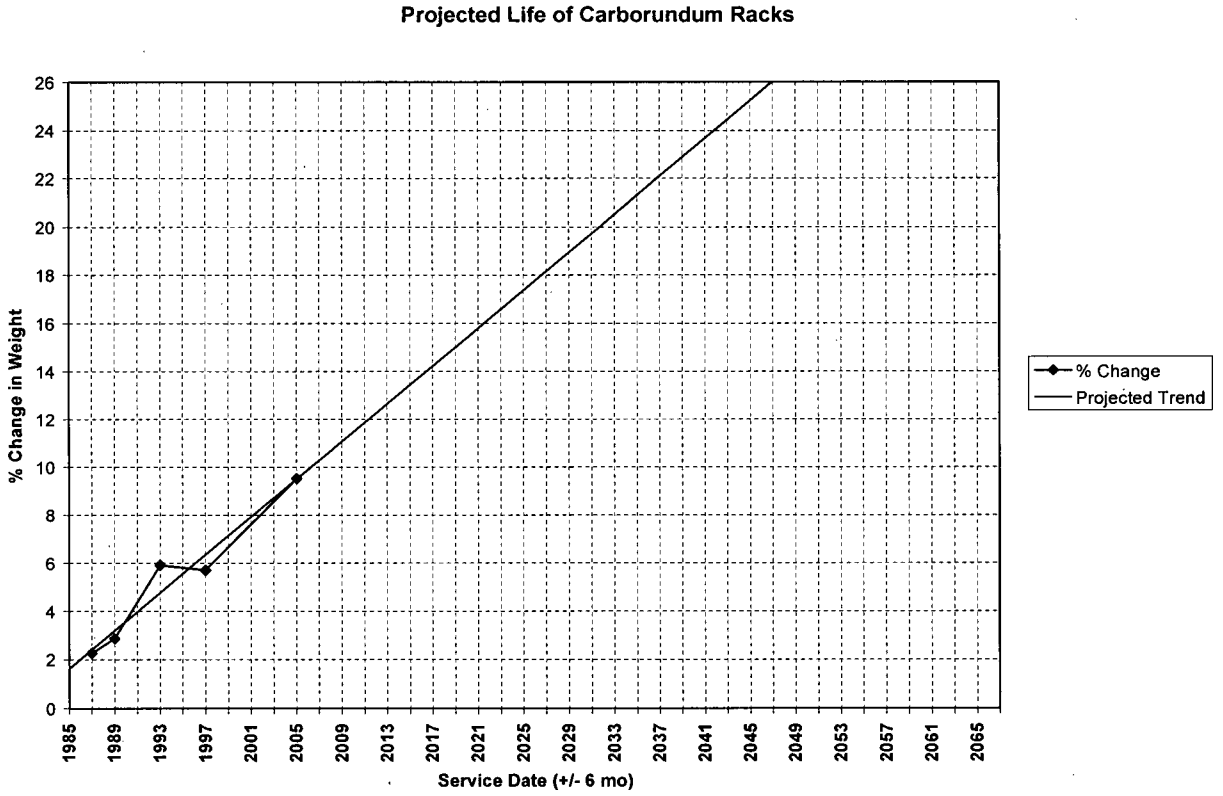
Category	Description
1	B_4C grains intact and surface texture uniform on both sides; no visible discoloration as compared to archive samples.
2	B_4C grains intact and surface texture uniform on both sides; visible discoloration as compared to archive samples.
3	Minor loss of B_4C grains at surface, either side, but no appreciable missing material
4	B_4C grains intact and surface texture uniform on both sides, however, cracks, blisters or separation of fiberglass backing and binder
5	B_4C grains at surface, either side, noticeably loose and falling off leaving significant craters.
6	Conditions more severe than above.

If the visual inspection determines that the surface features of the coupon meet criteria 4, 5, or 6 the condition of the coupon is entered into our corrective action program.

4. *Please provide the results of the coupon surveillance performed in 2005. Did the results correspond to the extrapolation performed in response to NUREG-1705, Section 3.10.2.4? With this new data point, does the expected boron loss change for the 70-year life span of the Unit 1 SFP (26.2 percent)?*

CCNPP Response

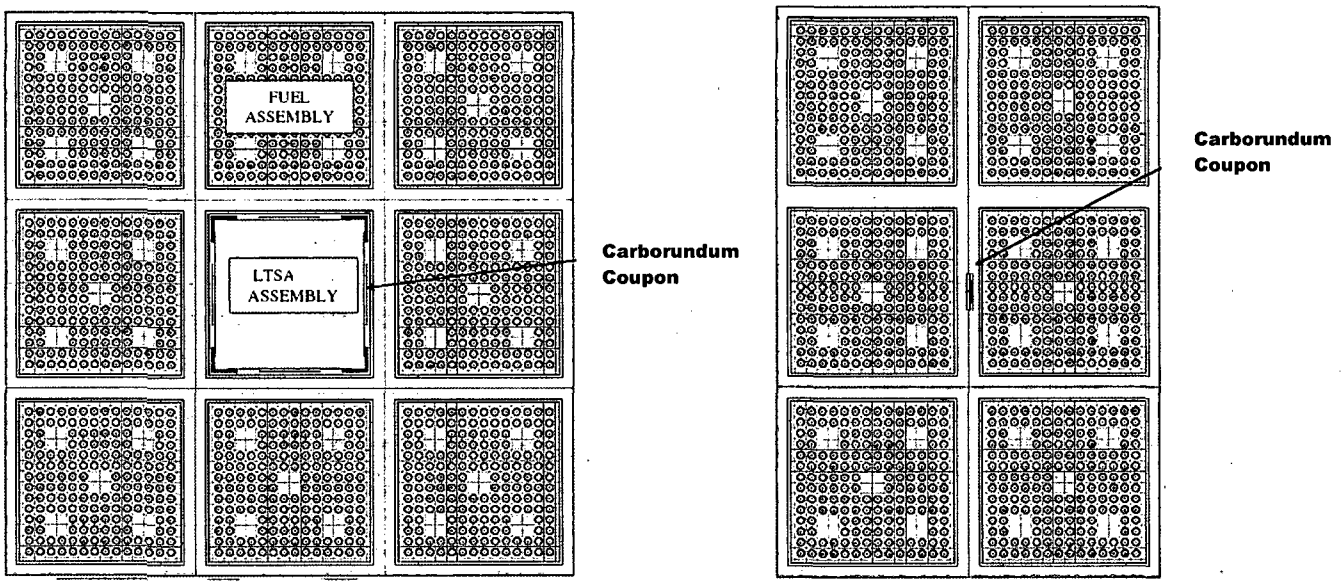
The average weight loss for the 2005 ASA coupon was 9.5 wt%. The graph below shows the projected time (2047) to reach the 26% weight loss assumed in the criticality analysis of record. This projected time is more than the 10 years beyond the period of extended operation for either Unit 1.



5. *On page 3 of Attachment 1, it is indicated that the new coupon tree for the proposed long-term surveillance program is expected to be installed in 2007. Please discuss the status of the new coupon tree being installed.*

CCNPP Response

Long-term surveillance assembly coupons 32, 33, 34, 39, 40, 41, 42, 47, and 49 were removed from the pool and the old LTSA coupon holder on September 7, 2007. They were installed on the new coupon trees and reinserted into the pool on September 10, 2007. The figure below provides a visual representation of the old and new coupon holder configurations.



Old LTSA Coupon Holder **New LTSA Coupon Holder**

6. *Given that this is a new long-term surveillance program that has only a few prior data points, we request that you submit the results of future surveillances to the staff within 6 months after completion of the surveillance. The reporting requirements should be addressed in your surveillance program. The reporting requirements should include the baseline inspection results and the results of all subsequent inspections (i.e., visual, weight, and dimensional [include neutron attenuation and areal density if added to the surveillance program]).*

CCNPP Response

We will commit to provide the results of future surveillances to the NRC within six months of completion of the surveillance. This reporting requirement will be addressed in the surveillance program. The report will provide historical as well as current inspection results (weight, visual, and dimensional).

REFERENCES:

(1) Handbook of the Effects of In-Pool Exposure on Properties of Boron-Carbide Resin Shielding Materials" by Shaffer and Blakely

(2) Letter from A. E. Lundvall, Jr. (BGE) to R. W. Reid (NRC), dated April 14, 1980, Spent Fuel Pool Modification, Supplemental Information

(3) Letter from R. A. Clark (NRC) to A. E. Lundvall, Jr. (BGE), dated September 19, 1980, License Amendment Nos. 47 and 30