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BGE

October 23, 1998

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
Response to Verbal Request for Additional Information Regarding Containment Tendon Long-Term Corrective Action Plan

REFERENCES:

(a) Letter from Mr. A. W. Dromerick (NRC) to Mr. C. H. Cruse (BGE), dated January 23, 1998, Review of Containment Tendon Evaluation Report - Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 (TAC Nos. M99880 and M99881)

(b) Letter from Mr. C. H. Cruse (BGE) to NRC Document Control Desk, dated May 14, 1998, Containment Tendon Long-Term Corrective Action Plan

(c) Letter from Mr. C. H. Cruse (BGE) to NRC Document Control Desk, dated August 20, 1998, Response to Verbal Request Regarding Containment Tendon Long-Term Corrective Action Plan

(d) Letter from Mr. C. H. Cruse (BGE) to NRC Document Control Desk, dated October 28, 1997, Containment Tendon Engineering Evaluation

In response to the NRC requirement contained in Reference (a), by letters dated May 14 and August 20, 1998, we provided our long-term corrective action plan regarding the Calvert Cliffs Nuclear Power Plant Units 1 and 2 Containment tendon degradation (References b and c, respectively). On September 30, 1998, we held a teleconference with the NRC staff to discuss the long-term corrective action plan provided in References (b) and (c). This letter provides the additional information requested by the staff during the course of the September 30, 1998, teleconference.

A001

NRC Request No. 1

Provide a tabulation of the updated Containment vertical tendon wires' failure history for both Units (Table 4 of Attachment 1, Reference d), and a summary of broken wires for Unit 2 vertical tendons.

BGE Response

Attachment (1) to this letter contains the requested information.

NRC Request No. 2

The long-term action plan (Reference b) addresses the action you plan to take on the problems related to the vertical tendon wire corrosion in Units 1 and 2. In the earlier inspections (1985, 1991, 1997), you had experienced low prestressing force measurements, and reddish brown color on stressing washers of some of the sampled hoop tendons (Reference d). Root causes of these findings were not identified. In view of the fact that some of the hoop tendons (particularly those below grade) are subjected to water intrusion and may have unprotected wires, provide information as to why the hoop tendons in both units should not be included in the long-term corrective action plan.

BGE Response

As described in detail in Reference (d), we have determined that the root cause of vertical tendon wire corrosion was inadequate design of the tendons' upper end stressing washer/shim stack arrangement, coupled with a poor end cap (grease can) design. These contributed to a condition where the tendon wires directly below the upper stressing washer were not adequately coated during initial greasing, and the poor end cap design allowed intrusion of water/moist air from the outside environment. This combination created a corrosive environment that, in turn, caused wire failure either by general corrosion or by hydrogen-induced cracking.

Both the hoop and dome tendons have the same grease can design as the vertical tendons. The dome tendon grease cans are oriented such that rainwater is unlikely to pool on the grease can and leak in. They are also shielded from the weather by siding. Therefore, a failure mechanism requiring substantial water leakage is unlikely to affect the dome tendons. The hoop tendons have the potential to be affected by water in-leakage. Several hoop tendons are below ground level and have been submerged for periods of time during plant history. To determine if these hoop tendons have been affected by in-leakage, they were visually inspected. That inspection revealed no abnormal degradation or corrosion of the tendons. Since these tendons were found to have no corrosion, it is unlikely other hoop tendons will be affected. The hoop and dome tendons are also oriented so that a void would not form immediately below the stressing washer since the stressing washer surfaces are not horizontal. With adequate grease coverage, BGE believes the potential for corrosion attack is minimal. The fact that no corrosion was observed on vertical tendon wires at elevations lower than 6.5 inches below the bottom of the stressing washer, where the wires were immersed in grease in all cases, is evidence that adequate grease coverage prevents corrosion.

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

Very truly yours,

CHC/GT/dlm

Attachment: (1) Table (1) - Updated Vertical Tendon Wires Failure History - Unit 1 & 2,
Table (2) - Summary of Unit 2 Broken Vertical Tendon Wires

cc: R. S. Fleishman, Esquire
J. E. Silberg, Esquire
S. S. Bajwa, NRC
A. W. Dromerick, NRC
H. J. Miller, NRC
Resident Inspector, NRC
R. I. McLean, DNR
J. H. Walter, PSC

ATTACHMENT (1)

TABLE (1) - UPDATED VERTICAL TENDON WIRES FAILURE HISTORY - UNITS 1 & 2

TABLE (2) - SUMMARY OF UNIT 2 BROKEN VERTICAL TENDON WIRES

Table (1)

Updated Vertical Tendon Wires Failure History - Unit 1 & 2

Unit	Surveillance	Year	Sample Size (Number of Tendons)	Tendons with Failed Wires	Failed wires
1	1 year	1974	5	0	0
1	3 year	1976	6	0	0
1	5 year	1978	6	1	2*
1	10 year	1984	3	0	0
1	15 year	1991	3	0	0
1	20 year	1997	202	19	117
2	1 year	1977	5	0	0
2	3 year	1979	5	0	0
2	5 year	1982	5	0	0
2	10 year	1985	5	1	1**
2	15 year	1991	3	0	0
2	20 year	1997	204	27	102

Table (2)

Summary of Unit 2 Broken Vertical Tendon Wires

#	Tendon #	# Broken	# Ductile	# Brittle	#Indeter-minate	#During lift	Field Visual Exam Results	Laboratory Visual Exam Observations
1	12V11	1		1			heavy corrosion, no grease	
2	12V17	1	1			1	extreme corrosion, no grease	ductile-fresh break
3	12V18	1	1			1	extreme corrosion, no grease	ductile-fresh break
4	23V6	1			1		extreme corrosion, film coat of grease	
5	23V19	12	9		3	9	extreme corrosion, no grease, moisture	old, very corroded, indeterminate or ductile fresh break after lift-off
6	23V22	1	1			1	extreme corrosion, no grease	ductile-fresh break
7	23V25	1	1			1	extreme corrosion, no grease, moisture	ductile-fresh break
8	23V28	5			5		extreme corrosion, no grease	old, very corroded, indeterminate
9	34V23	1		1			extreme corrosion, little dried hard grease, moisture	old
10	34V3	2		2			heavy corrosion, no grease, moisture	
11	45V19	1		1			heavy corrosion, no grease	
12	45V25	13	7		6	7	extremely heavy corrosion, no grease	very old, probably ductile but indeterminate or fresh ductile after lift-off
13	45V33	1	1			1	extreme corrosion, hard dried grease	ductile-fresh break
14	56V11	1		1			heavy corrosion, no grease	
15	56V13	12		12			extreme corrosion, no grease, moisture	
16	56V22	9		9			extreme corrosion, no grease, moisture	old
17	56V24	8		8			extreme corrosion, little grease, moisture	
18	56V25	2		2			extreme corrosion, partial grease	
19	56V27	9		9			extreme corrosion, no grease	old
20	56V29	4	4			4	extreme corrosion, no grease	1 very thin - ductile fresh break
21	56V32	3	1		2	1	extreme corrosion, little dark hard dried grease, moisture	old, very corroded - ductile possible or fresh ductile after lift-off
22	56V4	1	1			1	extreme corrosion, no grease, moisture	ductile-fresh break
23	61V13	4	4			4	extreme corrosion, no grease	ductile-fresh break
24	61V17	5	2		3	2	extreme corrosion, no grease	old, very corroded, indeterminate or fresh ductile after lift-off
25	61V19	1		1			light corrosion, small amount of grease	
26	61V28	1		1		1	extreme corrosion, no grease	
27	61V34	1	1			1	extreme corrosion, no grease	ductile-fresh break
	Totals	**102**	**34**	**48**	**20**	**34**		