



UNITED STATES
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OFFICE OF NUCLEAR REACTOR REGULATION

EVALUATION OF LONG-TERM CORRECTIVE ACTION PLAN

DEGRADATION OF CONTAINMENT VERTICAL TENDONS

CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 1 & 2

1.0 INTRODUCTION

On August 28, 1997, Baltimore Gas and Electric Company (BGE, the licensee) submitted a letter report informing the NRC of the discovery of abnormal degradation of Calvert Cliff Nuclear Power Plant Unit 1 vertical tendons during the 20th year tendon surveillance. On October 28, 1997, the licensee submitted the "Containment Tendon Engineering Evaluation Report" (Reference 1). The NRC staff review of the licensee's submittals is documented in Reference 2.

In Reference 2, the staff evaluated the five options being considered by the licensee for long-term corrective actions. Option 3, "replace the affected tendons with new tendons" was considered by the staff as most reassuring. By letter dated May 14, 1998 (Reference 3), the licensee submitted its proposed long-term corrective action plan. This evaluation addresses the adequacy of the licensee's plan.

2.0 EVALUATION

Reference 2 was based on the findings of the Unit 1 tendon surveillance. In Reference 3, the licensee made reference to Unit 2 vertical tendon degradation, but did not provide any details as to the extent of degradation, or the character of degradation (i.e., the type of tendon-wire failures). In response to the staff's request for additional information, the licensee provided the relevant information in references 4 and 5. The information contained in references 2, 4 and 5 are summarized below:

- 117 wires in 19 of 202 vertical tendons in Unit 1 and 102 wires in 27 of 204 vertical tendons in Unit 2 were found broken.
- The wire fractures in all tendons were observed at 4 to 8 inches below the buttonheads of the top anchors of the vertical tendons.
- More than one-third of the broken wires were shown to have brittle fractures.
- The root cause had been identified as (1) formation of voids in the packing grease near the top anchors, (2) ingress of water and/or humid air through the grease can, (3) sustained exposure in the unprotected wire areas.

The short term corrective action plan (STP), which has been implemented, consists of local regreasing and sealing of the grease cans with silicone to slow further degradation and to ensure operability until the long-term corrective actions are implemented.

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Enclosure

The licensee is proposing the following procedure and schedule for the long-term corrective action plan (LTP):

- By December 31, 1998, BGE will complete research to determine an effective method for removing as much of the old grease (Visconohurst 2090-P) as practical from the tendon ducts.
- By December 31, 1999, BGE will reinspect all of the vertical tendons previously identified as containing severely corroded wires, in an effort to monitor the potential for additional tendon wire degradation.
- By December 31, 2000, BGE will replace all severely corroded vertical containment tendons with new tendons. Currently, BGE estimates that 63 of 202 vertical tendons in the Unit 1 containment, and 64 of 204 vertical tendons in the Unit 2 containment will be replaced. All of the remaining vertical tendons will have their old grease removed to the maximum extent practical and replaced with new corrosion inhibiting grease (Visconohurst 2090-4P) that will encapsulate the wires and prevent corrosion.

Considering the difficulty and complexity involved in removing the hardened grease (tendon by tendon), assuring that the tendon degradation is not continuing in spite of the implementation of the short-term corrective action plan, and replacing the identified degraded tendons with new tendons, the staff believes that, in general, the procedure outlined for the proposed long-term corrective action plan is reasonable. However, the plan has the following weaknesses:

1. Lack of provisions to ensure the effectiveness of the STP in preventing corrosion in the non-corroded tendons through detailed inspection.
2. Lack of provisions to ensure the effectiveness of the LTP through frequent inspections subsequent to the completion of the LTP.

3.0 CONCLUSION

Based on the review of the licensee's submittals, the staff finds that, in general, the procedure established for the long-term corrective action plan is reasonable. However, the plan could be strengthened by: (1) Adding provisions to ensure the effectiveness of the STP in preventing corrosion in the non-corroded tendons through detailed inspection, and (2) Adding provisions to ensure the effectiveness of the LTP through frequent inspections subsequent to the completion of the LTP.

REFERENCES

1. Letter from C.H. Cruse (BGE) to NRC, "Containment Tendon Engineering Evaluation Report, Calvert Cliff Nuclear Power Plant, Units 1,2," October 28, 1997.
2. Letter from A.W. Dromerick (NRC) to C.H. Cruse (BGE), "Review of the Containment Tendon Evaluation Report," January 23, 1998.
3. Letter from C.H. Cruse (BGE) to NRC, "Containment Tendon Long-Term Corrective Action Plan" May 14, 1998.
4. Letter from C.H. Cruse (BGE) to NRC, "Response to Request for Additional Information Regarding Containment Tendon Long-Term Corrective Action Plan," August 20, 1998.
5. Letter from C.H. Cruse (BGE) to NRC, "Response to Request for Additional Information Regarding Containment Tendon Long-Term Corrective Action Plan," October 23, 1998.