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BGE

October 5, 1995

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 NRC's Request for Additional Information Concerning Baltimore Gas and Electric Company's Response to NRC Generic Letter 95-03, "Circumferential Cracking of Steam Generator Tubes," (Units 1 & 2, TAC Nos. M92229 & M92230)

REFERENCES:

(a) Letter from Mr. D. G. McDonald, Jr. (NRC) to Mr. R. E. Denton (BGE), dated September 6, 1995, Generic Letter 95-03, "Circumferential Cracking of Steam Generator Tubes," - Calvert Cliffs Nuclear Power Plant, Units 1 & 2 (TAC Nos. M92229 & M92230)

(b) Letter from Mr. R. E. Denton (BGE) to the NRC Document Control Desk, dated June 27, 1995, Response to NRC Generic Letter 95-03: Circumferential Cracking of Steam Generator Tubes

This letter provides Baltimore Gas and Electric Company's response to your request for additional information transmitted by letter dated September 6, 1995 (Reference a). The request concerns our response to Generic Letter 95-03, "Circumferential Cracking of Steam Generator Tubes" (Reference b). Generic Letter 95-03 requested addressees to evaluate recent operating experience related to circumferential cracking and to justify continued operation until the next scheduled steam generator tube inspections. The generic letter also requested addressees to develop plans for the next steam generator tube inspection.

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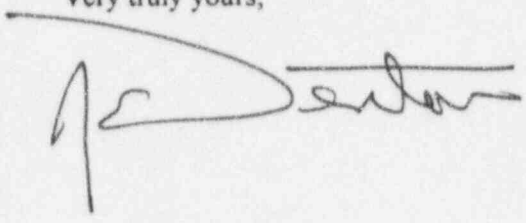
The specific requests for additional information and our responses are included in the attachment to this letter. Should you have questions regarding this matter, we will be pleased to discuss them with you.

Very truly yours,



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Attachment: Response to NRC's Request for Additional Information Concerning Baltimore Gas and Electric Company's Response to NRC Generic Letter 95-03, "Circumferential Cracking of Steam Generator Tubes"

cc: D. A. Brune, Esquire
J. E. Silberg, Esquire
L. B. Marsh, NRC
D. G. McDonald, Jr., NRC
T. T. Martin, NRC
Resident Inspector, NRC
R. I. McLean, DNR
J. H. Walter, PSC

ATTACHMENT

Response to NRC's Request for Additional Information Concerning Baltimore Gas and Electric Company's Response to NRC Generic Letter 95-03, "Circumferential Cracking of Steam Generator Tubes"

Baltimore Gas and Electric Company
Docket Nos. 50-317 and 50-318
October 5, 1995

ATTACHMENT

RESPONSE TO NRC'S REQUEST FOR ADDITIONAL INFORMATION CONCERNING BALTIMORE GAS AND ELECTRIC COMPANY'S RESPONSE TO NRC GENERIC LETTER 95-03, "CIRCUMFERENTIAL CRACKING OF STEAM GENERATOR TUBES"

Question No. 1:

The following areas have been identified as being susceptible to circumferential cracking:

a. Expansion transition circumferential cracking
b. Small radius U-bend circumferential cracking
c. Dented location (including dented TSP) circumferential cracking
d. Sleeve joint circumferential cracking

In your response, area b was not specifically addressed although it was indicated that circumferential cracking has also been observed in the U-bend region of a retired Combustion Engineering steam generator. In addition, recirculating steam generators designed by another vendor have experienced circumferential cracking in the U-bend portion of tubes with small radius U-bends. Please submit the information requested in Generic Letter (GL) 95-03 per the guidance contained in the GL for this area (and any other area susceptible to circumferential cracking). The staff realizes that some of the above areas may not have been addressed since they may not be applicable to your plant; however, the staff requests that you clarify this (e.g., no sleeves are installed; therefore, the plant is not susceptible to sleeve joint circumferential cracking).

In your response, it was indicated that dented locations (specifically dented support plate locations) are susceptible to circumferential cracking and that some of these locations were examined during the prior inspection outage. Discuss the criteria used for determining which dents were examined. If a voltage threshold was used for determining the threshold for examining dents, provide the calibration procedure used (e.g., 4.0 volts on 4-20% through-wall ASME holes at 550/130 mix). In addition, clarify the past inspection scope and your future inspection plans for dented locations.

Response

a. Expansion Transition Circumferential Cracking

This area was addressed in detail in our original response (Reference 1). We identified the first circumferential cracking at the expansion transitions in both units during their last inspections. A 100% inspection of the hot leg expansion transitions was conducted in each unit. Our plan calls for 100% inspection of the hot leg expansion transitions in both units during their next scheduled inspections. The Unit 2 inspection conducted in April 1995 used Plus Point eddy current probe. Future inspections will also be conducted using Plus Point eddy current probe, as long as it remains the most effective technology for crack detection.

b. Small Radius U-Bend Circumferential Cracking

ABB Combustion Engineering has reviewed the historical data on the retired steam generator U-bend circumferential cracking reported in our original response. The U-bend circumferential cracking that was reported did not occur in the tight radius U-bends. The circumferential cracking occurred in tubes with double 90° bends, either in the bends or in

the horizontal run between the bends. To date, there has been no occurrence of circumferential cracking in the tight radius (Rows 1 and 2) U-bends of any CE-supplied steam generator. Baltimore Gas and Electric Company is aware of the tight radius U-bend circumferential cracking that has been observed in recirculating steam generators designed by another vendor.

Because of the limited inspection history on tight radius U-bends in CE steam generators and the tight radius U-bend circumferential cracking reported at other non-CE utilities, Baltimore Gas and Electric Company will inspect the tight radius U-bends in 20% of Rows 1 and 2 tubes in each steam generator during the next scheduled inspection for each unit to assess our susceptibility to tight radius U-bend circumferential cracking. The inspections will be conducted using a Plus Point eddy current probe, as long as it remains the most effective technology for crack detection. If circumferential cracking is detected, expansion of the 20% sample will be evaluated following the guidance found in Appendix B of the EPRI [Electric Power Research Institute] Pressurized Water Reactor Steam Generator Examination Guidelines. Future inspections in the tight radius U-bend region, beyond the next scheduled inspections for both units, will be evaluated based on our own and industry experience.

c. Dented Location (Including Dented TSP) Circumferential Cracking

In our original response (Reference 1), we indicated that our dented support plate intersections are susceptible to circumferential cracking, although no circumferential cracks have been identified at dented support plate locations in either unit. In past inspections, we examined a sample of the largest voltage solid support plate dents with a motorized rotating pancake coil probe. In the Unit 2 1995 inspection, 20 of the largest dent signals were examined with the Plus Point probe. Inspections prior to that included examination of approximately 200 of the largest dent signals with a conventional 3-coil motorized rotating pancake coil probe.

The calibration procedure used to establish the voltage threshold set the 4-20% flat-bottomed ASME flaws to 4 volts on all differential channels. A 400-100 kHz differential tube support mix was used for screening. This same calibration procedure will be used in future inspections, as long as it remains the best technique for establishing the voltage threshold.

Future inspections will include inspecting a 20% sample of all dented intersections greater than 5.00 volts. The inspections will be conducted using the Plus Point probe, as long as it remains the most effective technology for crack detection. If circumferential cracking is identified, expansion of the 20% sample will be evaluated following the guidance found in Appendix B of the EPRI Pressurized Water Reactor Steam Generator Examination Guidelines.

d. Sleeve Joint Circumferential Cracking

No sleeves are installed in either unit; therefore, we are not susceptible to sleeve joint circumferential cracking.

Question No. 2

It was indicated that several tubes were removed for destructive analysis during the previous steam generator tube inspection outage at Unit 2, and that laboratory analysis and destructive examination to evaluate the performance of the in-field inspection were in progress with the results anticipated to be available late in the summer. In addition, it was indicated that qualitative comparison of the Calvert Cliffs non-destructive examination results, with similar results from tubes that have been examined metallurgically or in-situ pressure tested, indicated that the Calvert Cliffs defects were not of sufficient size to become structurally significant or exceed Regulatory Guide 1.121 criteria. If available, please summarize the destructive examination results indicating whether or not these results support your conclusions.

Response

During the Unit 2 1995 steam generator inspection outage, two tubes identified by eddy current inspection to have circumferential indications at the hot leg tube sheet expansion transition were removed for destructive analysis.

Tube Row 81 Line 81 was pulled because a field eddy current indicated single circumferential indication located at TTS +0.14 inches. The flaw size was estimated to be 255° angular extent, with a maximum through-wall of 43%. The average through-wall was calculated to be 30.5%. The flaw was believed to be outside diameter initiated. However, the destructive analysis of this tube did not reveal any circumferential indication.

Tube Row 51 Line 113 was pulled because a field eddy current indicated single circumferential indication located at TTS -0.14 inches. The flaw size was estimated to be 75° angular extent, with a maximum through-wall of 90%. The average through-wall was calculated to be 18.8%. The flaw was believed to be inside diameter initiated. Destructive analysis measured the crack to be 86° angular extent, with a maximum through-wall of 94% and a calculated average through-wall of 39%. The flaw was intergranular in nature and inside diameter initiated. A laboratory burst test was not conducted on this tube.

The results of the in-situ pressure tests conducted during the inspection outage were previously submitted to the Commission (Reference 2).

The results of the in-situ pressure tests and pulled tube destructive analyses support our previous conclusion that the circumferential defects were not structurally significant and did not exceed the Regulatory Guide 1.121 criteria.

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RESPONSE TO NRC'S REQUEST FOR ADDITIONAL INFORMATION CONCERNING BALTIMORE GAS AND ELECTRIC COMPANY'S RESPONSE TO NRC GENERIC LETTER 95-03, "CIRCUMFERENTIAL CRACKING OF STEAM GENERATOR TUBES"

REFERENCES:

(1) Letter from Mr. R. E. Denton (BGE) to the NRC Document Control Desk (NRC), dated June 27, 1995, Response to NRC Generic Letter 95-03: Circumferential Cracking of Steam Generator Tubes

(2) Letter from Mr. C. H. Cruse (BGE) to the Document Control Desk (NRC), dated June 14, 1995, Calvert Cliffs Unit 2 Steam Generator Tube Inspection Results