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SUBJECT: Forwards revised response to NRC Bulletin 88-002, "Rapidly
 Propagating Fatigue Cracks in Steam Generator Tubes."

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AEP:NRC:1056A

Donald C. Cook Nuclear Plant Units 1 and 2
Docket Nos. 50-315 and 50-316
License Nos. DPR-58 and DPR-74
NRC BULLETIN 88-02; REQUEST FOR ADDITIONAL INFORMATION

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Attn: T. E. Murley

January 26, 1990

References:

- 1) Letter AEP:NRC:1056, M. P. Alexich (Indiana Michigan Power Company) to A. B. Davis (NRC), "Response to NRC Bulletin 88-02, Rapidly Propagating Fatigue Cracks in Steam Generator Tubes," dated March 31, 1988
- 2) Letter, Joseph G. Gitter (NRC) to M. P. Alexich (Indiana Michigan Power Company), "Request for Additional Information Regarding Implementation of Bulletin 88-02, 'Rapidly Propagating Fatigue Cracks in Steam Generator Tubes'," dated September 29, 1989

Dear Dr. Murley:

On March 31, 1988, Indiana Michigan Power Company (I&M) provided a response to NRC Bulletin No. 88-02, "Rapidly Propagating Fatigue Cracks in Steam Generator Tubes" (Reference 1). At the time of the submittal, our preliminary review of the Unit 1 steam generator eddy current test data concluded that the steam generators had experienced service-induced tube denting. As a result of this conclusion, we provided, as required by Bulletin Action Item C, a program for minimizing the probability of a tube rupture similar to the North Anna event from occurring at the Cook Nuclear Plant. Prior to approving our program, the NRC requested additional information (Reference 2).

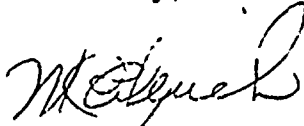
I&M is providing a revised response (attachment) to the bulletin in lieu of providing additional information on our Action Item C program. The basis for this action is that a detailed evaluation of the previous data and additional data from an April 1989 eddy

current test have led us to conclude that there is presently no service-induced denting in the Unit 1 steam generators. Because of this, Action Item B rather than Action Item C is applicable to the Cook Nuclear Plant.

Action Item B requires that plants which have experienced no tube denting review future test data for evidence of tube denting. If tube denting is detected, a preventive action program is to be provided to the NRC for approval. I&M will comply with this action item.

This document has been prepared following Corporate procedures that incorporate a reasonable set of controls to ensure its accuracy and completeness prior to signature by the undersigned.

Sincerely,



M. P. Alexich
Vice President

ldp

cc: D. H. Williams, Jr.
A. A. Blind - Bridgman
R. C. Callen
G. Charnoff
A. B. Davis - Region III
NRC Resident Inspector - Bridgman
NFEM Section Chief

ATTACHMENT TO AEP:NRC:1056A .

REVISED RESPONSE TO NRC BULLETIN 88-02

Background

NRC Bulletin 88-02 addressed the steam generator tube rupture event that occurred at Virginia Electric and Power Company's North Anna Unit 1. While operating at full power on July 15, 1987, the tube at R9C51 in SG C ruptured, with a resultant primary-to-secondary leak rate of between 550 and 637 gpm. The failure mechanism was subsequently classified as high cycle flexural fatigue superimposed on an elevated mean stress. Tube denting at the top support plate intersection was identified as the source of elevated mean stress levels as well as a significant contributor to the occurrence of excessive vibration. Denting may also have contributed to fatigue stress concentration.

Based on their review, the NRC staff concluded that all three of the following conditions must be present for a North Anna type fatigue to occur:

1. Denting at the upper support plate,
2. A fluid-elastic stability ratio approaching that for the tube ruptured at North Anna, and
3. Absence of effective AVB support.

Specified actions in the bulletin were aimed at identifying these conditions and taking appropriate steps to minimize the potential for a rapidly propagating fatigue failure such as occurred at North Anna.

By letter dated March 31, 1988, I&M submitted a response to NRC Bulletin 88-02 which reported that both Cook Nuclear Plant Units 1 and 2 had exhibited limited denting at the uppermost tube support plate. The Unit 2 steam generators were subsequently repaired with new lower assemblies incorporating stainless steel support plates, which constitutes resolution of all concerns of the bulletin for Unit 2.

By letter dated September 29, 1989, the NRC staff requested additional information relative to the submittal for Cook Nuclear Plant Unit 1 to determine if all concerns had been adequately addressed.

Basis for Revising the Original Response

The original response to Action A of NRC Bulletin 88-02 for Cook Nuclear Plant Unit 1 relied on eddy current inspection results from 1985 and 1987 to determine the presence of denting. The 45 dents at top support plate intersections reported in one or the other inspection were as-called during the outage by the on-site analysts.

Subsequently, in November 1988, a re-analysis of the 1985 and 1987 data tapes was performed to ensure that the condition of the Cook Nuclear Plant Unit 1 steam generators had been accurately assessed. The reanalysis program included review of 1985 and 1987 data for all 45 tubes previously reported as having dents and a review of 1987 data for an additional three percent of the tubes in each steam generator. No indication of corrosion-related denting at top support plates or magnetite formation in support plate crevices was found. Signal anomalies previously reported as dents were determined to be insignificant based on the following observations:

- o Signal strength was extremely low, 2.5 to 15 volts as compared to reference signals of 54.7 volts and 231.9 volts for 4 mil and 10 mil dent standards, respectively.
- o Signals appear to originate at the upper or lower edge of the support plate rather than from the center as would be indicative of corrosion-related denting.
- o No change from 1985 to 1987 was detected. Spot review of earlier inspection tapes suggests that these signals may be traceable back to pre-service (indicative of minor dings during manufacturing), although the quality of previous data prevents a firm conclusion to that effect.

Additionally, in April 1989, a complete eddy current inspection of each steam generator was performed. Specific attention was given to evaluating top support plate intersection data. Again, as with the above described re-analysis of 1985 and 1987 data, no evidence of corrosion-related denting at top support plates or magnetite formation in support plate crevices was found.

Based on the re-evaluation of previous data and the results of the most recent inspection, we now conclude that the Cook Nuclear Plant Unit 1 steam generators have not experienced service-induced denting at the uppermost support plates, and therefore a revision to our earlier response is required. The following revised response to NRC Bulletin 88-02 is offered in lieu of the specific additional information regarding Action C.2 requested in the staff letter dated September 29, 1989.

Revised Response to NRC Bulletin 88-02 For Cook Nuclear Plant Unit 1

Action A

The most recent steam generator inspection data should be reviewed for evidence of denting at the uppermost tube support plate. Inspection records may be considered adequate for this purpose if at least three percent of the total steam generator tube population was inspected at the uppermost support plate elevation during the last 40 calendar months. "Denting" should be considered to include

evidence of upper support plate corrosion and the presence of magnetite in the tube-to-support plate crevices, regardless of whether there is detectable distortion of the tubes. The results of this review shall be included as part of the 45-day report. Where inspection records are not adequate for this purpose, inspections of at least three percent of the total steam generator tube population at the uppermost support plate elevation should be performed at the next refueling outage. The schedule for these inspections shall be included as part of the 45-day report and the results of the inspections shall be submitted within 45 days of their completion. Pending completion of these inspections, an enhanced primary-to-secondary leak rate monitoring program should be implemented in accordance with paragraph C.1. below.

Response to Action A

A complete eddy current inspection of the Cook Nuclear Plant Unit 1 steam generators performed in April 1989 revealed no evidence of denting at the uppermost tube support plate. As recommended, "denting" was considered to include evidence of support plate corrosion and the presence of magnetite in tube-to-support plate crevices, as well as the more typical tube distortion.

Action B

For plants where no denting is found at the uppermost support plate, the results of future steam generator tube inspections should be reviewed for evidence of denting at the uppermost support plate. If denting is found in the future, the provisions of item C below should be implemented. Commitments to implement these actions shall be submitted when the results of A above are submitted.

Response to Action B

All future surveillance inspections in the existing Cook Nuclear Plant Unit 1 steam generators required by Technical Specifications will include a review for evidence of denting at the uppermost support plate.

In the event that evidence of denting is discovered during future inspections, Indiana Michigan Power Company will implement the provisions required by Action C of NRC Bulletin 88-02. The onset of denting is considered highly unlikely at this time, however. The steam generators have operated since 1975 without denting, and current chemistry controls (including boric acid treatment on the secondary side) should offer even greater resistance to support plate corrosion.

Action C

For plants where denting is found, the NRC staff requests that the following actions be taken:

1. Pending completion of the NRC staff review and approval of the program described in C.2 below or completion of inspections specified in item A above to confirm that denting does not exist, an enhanced primary-to-secondary leak rate monitoring program should be implemented as an interim compensatory measure within 45 days of the date of receipt of this bulletin.
2. A program should be implemented to minimize the probability of a rapidly propagating fatigue failure such as occurred at North Anna Unit 1.

Response to Action C

1. Although not specifically required since evidence of denting at top support plates has not been found, Indiana Michigan Power Company will continue to implement the primary-to-secondary leak rate monitoring program previously described in the original response to the bulletin.
2. The described program is not applicable to Cook Nuclear Plant Unit 1 since evidence of denting at top support plates has not been found.

