August 26, 2003

Mr. Joseph M. Solymossy
Site Vice President
Prairie Island Nuclear Generating Plant
Nuclear Management Company, LLC
1717 Wakonade Drive East
Welch, MN 55089

SUBJECT: PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNIT 1 - REQUEST FOR ADDITIONAL INFORMATION REGARDING LOWER ROW TUBE DENT ROOT CAUSE ANALYSIS (TAC NO. MB8715)

Dear Mr. Solymossy:

By letter dated April 25, 2003, the Nuclear Management Company, LLC (NMC), submitted a lower row tube dent root cause analysis report for the Prairie Island Generating Plant, Unit 1. The Nuclear Regulatory Commission (NRC) staff finds that the additional information identified in the enclosure is needed.

A draft of the request for additional information was e-mailed to Mr. D. Vincent (NMC) and Mr. J. Leveille (NMC) on July 29, 2003. A phone call was held between J. Kivi (NMC), R. Pearson (NMC), J. LaClaire (NMC), S. Redmen (NMC), J. Leveille (NMC), B. Cullen (Westinghouse), J. Hall (Westinghouse), J. Tsao (NRC), and myself on August 8, 2003, to discuss the questions and to gain a mutual understanding. Also, the phone call established a mutually agreeable response date of January 9, 2004.

Please contact me at (301) 415-1446 if future circumstances should require a change in this response date.

Sincerely,

/RA/

John G. Lamb, Project Manager, Section 1
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-282

Enclosure: Request for Additional Information

cc w/encl: See next page

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REQUEST FOR ADDITIONAL INFORMATION

REGARDING THE LOWER ROW

TUBE DENT ROOT CAUSE ANALYSIS

PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNIT 1

DOCKET NO. 50-282

By letter dated April 25, 2003, the Nuclear Management Company, LLC (the licensee), submitted a lower row tube dent root cause analysis report for the Prairie Island Generating Plant, Unit 1. The Nuclear Regulatory Commission (NRC) staff has the following questions related to WCAP-10659-P, Revision 0:

1. On page 1, it is stated that no degradation was found in any of the dented locations of row 1 and 2 tubes. The NRC staff is not clear as to the licensee's inspection scope to make this determination. Discuss the inspection scope and strategy of row 1 and 2 dents during the 2001 and 2002 inspection, including the number of row 1 and 2 tubes that were inspected in 2001 and 2002 and by which eddy current probe.

2. On page 2, first paragraph, last sentence, it is stated that "...For a circumferentially uniform geometry change of about 1 mil, bobbin dent signal exceeding 6 volts are expected..." (1) Discuss the technical basis of this statement. (2) Discuss whether this is a generic statement that is applicable to all Westinghouse steam generator tubes, or whether this statement is applicable only to the heat treated row 1 and 2 tubes in the Prairie Island steam generators. (3) The statement could be interpreted as that if there is a dent-like signal less than 6 volts (e.g., near 2 volts) that the tube could have a geometry change of 0.3 mil (i.e., a dent). Therefore, discuss the threshold of a dent classification in terms of bobbin voltage and in terms of geometry change. (This question is related to question 4 below.)

3. On page 3, second paragraph, it is stated that in Table 2, the bobbin data collected in the 2001 inspection after-heat treatment indicates that almost all row 1 and 2 tubes show the presence of dent-like signals at hot leg tube support plate numbers 6 and 7; however, only voltage greater than 2 volts were reported. The NRC staff is not clear as to the extent of the denting in the row 1 and 2 tubes. (1) Provide the number of row 1 and row 2 tubes that were heat-treated in the U-bend region in 2001. (2) Discuss how many row 1 and row 2 tubes that have a dent-like signal less than 2 volts. (3) Discuss whether the voltage of those less-than-2-volt dent-like signals identified in the 2001 inspection have changed in the 2002 inspection. The NRC staff assumes that all the dent-like signals, regardless of voltage, were inspected in 2002. (4) Explain why dent-like signals less than 2 volts were not reported.

4. On page 3, third paragraph, it is stated that "...the signal that were generally near ~2 volts and hence would generally not be called as a dent..." The NRC staff is not clear how the licensee calls or classifies a dent. Discuss the criteria for classifying a dent and the technical basis.

ENCLOSURE

5. On page 8, it is stated that although tube buckling would not be projected, buckling loads were determined to be very near the critical values. (1) Provide the tube buckling loads and critical values. (2) Discuss whether the tube buckling loads were calculated based on the design-accident loads and the critical values were calculated based on the minimum material property (i.e., worst-case scenario) values. (3) Discuss whether all row 1 and 2 tubes experience the same buckling load or only certain tubes. The eddy current data show that some tubes have higher dent voltage than others, which may imply that the buckling loads could be a contributor to the size of dents (i.e., higher buckling loads result in larger dents).

6. On pages 9 and 10, in its root cause analysis, Westinghouse stated that it appears that the dent-like signals were a result of the heat-treatment process. Other licensees have performed in-situ heat treatment to their low row U-bend regions; however, the NRC staff is not aware of extensive tube denting in the low row U-bend regions of other licensees' steam generators. (1) Discuss whether the tube denting phenomena in row 1 and 2 tubes in the Prairie Island steam generators have occurred in Westinghouse steam generators at other nuclear plants. (2) Discuss whether Westinghouse has notified all relevant licensees regarding tube denting after heat treatment at Prairie Island. (3) Discuss whether Westinghouse has modified its heat treatment procedures to minimize future tube denting in steam generators. (4) Discuss whether the heat treatment performed at Prairie Island is consistent with the heat treatment performed in other licensees' steam generators.

7. On pages 9 and 10, during heat treatment of the U-bend region, a tube will expand in the diametral (circumferential) and longitudinal (axial) direction. If the clearance between the tube and tube support plate (TSP) is smaller than the circumferential thermal expansion, denting will result. The axial thermal expansion can cause tube buckling if the tube is locked at any of the TSP intersections, not just at TSP No. 7. Westinghouse stated that there is no evidence of significant deposits in the crevices of the TSP; therefore, tube may not be locked. However, the NRC staff is not clear whether Westinghouse has examined the eddy current data of all TSP intersections (from number 1 to number 7) to determine that there are no significant deposits at TSP No. 1 to TSP No. 7. A tube may be locked at a lower TSP which may produce buckling at TSP 7. (1) Discuss whether a calculation was performed to determine that the diametral expansion of the tube is within the clearance of the tube and TSP intersection. (2) Discuss whether eddy current data were studied to confirm that no significant deposits were present from TSP No. 1 to TSP No. 7 in the dented tubes.

8. On page 11, it is stated that "...Whether or not signals are actual tube deformations, or are a result of some other mechanism, such as crevice deposit changes as a result of high temperature exposure, cannot be made without further information..." Discuss what information is needed for the root cause analysis.

9. On pages 13 and 14, Tables 1 and 2 show that of the 28 tubes identified with dents, only 4 tubes are from row 1 and 24 tubes are from row 2. (1) Explain why row 2 tubes are more susceptible to denting than row 1 tubes. (2) There seems to be a specific area of the row 1 and 2 tubes that are susceptible to denting because the majority of the row 2 dents (19 tubes) are located in the tubes with high column numbers (column 52 and higher). Explain why dents occur in tubes with high column numbers. These two observations may provide insights into the root cause of the denting.

10. On page 14, Table 2, it is shown that the bobbin voltages of many dents in the 2002 data have decreased, as compared to the corresponding voltages in the 2001 data. It is also shown that there are two dents in the row 2 tubes before heat treatment. (1) Explain the cause of the decrease in the dent voltages. (2) Discuss whether the U–bend regions of the higher row tubes (i.e., row 3 tubes and higher) were inspected to determine whether dents are occurring in higher rows in light of the two dents before heat treatment.

Prairie Island Nuclear Generating Plant,
Units 1 and 2

cc:

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