



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

CLOSEOUT OF BULLETIN 88-02 ISSUES

DUKE POWER COMPANY

MCGUIRE NUCLEAR STATION, UNIT 1

DOCKET NO. 50-369

1.0 INTRODUCTION

Duke Power Company (the licensee) submitted its response to NRC Bulletin 88-02, "Rapidly Propagating Fatigue Cracks in Steam Generator Tubes" by letters dated March 24, April 25, and June 10, 1988 and by letter dated January 16, 1989. Bulletin 88-02 requested that licensees for plants with Westinghouse steam generators employing carbon steel support plates take certain specified actions to minimize the potential for a steam generator tube rupture event caused by a rapidly propagating fatigue crack such as occurred at North Anna Unit 1 on July 15, 1987.

2.0 DISCUSSION

The licensee reports that the McGuire Unit 1 steam generators exhibit evidence of denting at the uppermost support plate. Accordingly, items C.1 and C.2 of the bulletin are applicable to McGuire Unit 1.

In accordance with item C.1 of the bulletin, the licensee has implemented an enhanced primary-to-secondary leak rate monitoring program which is described in the licensee's June 10, 1988, letter. This enhanced leak rate monitoring program is an interim compensatory measure pending completion of the actions requested in item C.2 of the bulletin and NRC staff review and approval of these actions.

The licensee has implemented the generic program developed by Westinghouse to resolve item C.2 of the bulletin. The licensee's implementation of this program is described in Westinghouse report WCAP-12060 (Proprietary) which was submitted with the licensee's letter. This report describes the analyses which were conducted to establish the susceptibility of the McGuire steam generator tubes to rapidly propagating fatigue cracks and to identify any needed corrective actions.

The staff has reviewed the Westinghouse generic program and documented its evaluation in Reference 1. The staff concluded in Reference 1 that the Westinghouse program is an acceptable approach for resolving item C.2 of the Bulletin. The staff further concluded that the Westinghouse program, if properly implemented,

will provide reasonable assurance against further failures of the kind which occurred at North Anna Unit 1. The safety evaluation herein incorporates the staff's generic Reference 1 evaluation by reference.

The analyses for the McGuire Unit 1 steam generators conservatively assumed that all unsupported tubes are dented at the uppermost support plate. In addition, the stress ratio and fatigue estimates were based on the assumption of a full mean stress effect (i.e., yield stress), consistent with staff findings in Reference 1.

Stability ratios for the McGuire Unit 1 steam generator tubes were determined from detailed analyses performed for McGuire Unit 2 whose thermal-hydraulic conditions are slightly more limiting than those for Unit 1. These analyses included tube instability analyses performed with the FASTVIB computer code using thermal-hydraulic input from a 3-D ATHOS model. Flow peaking factors were determined for the actual anti-vibration bar geometry at McGuire Unit 1 on the basis of results from air model tests.

The analyses documented in WCAP-12060 show that all unsupported tubes in the McGuire Unit 1 steam generators satisfy the Westinghouse stress ratio criterion. The fatigue usage factor for the most limiting tube is calculated to be 0.95 for a 40-year operating period with the current fuel cycle parameters (e.g., steam pressure and flow, circulation ratio). Thus, the licensee has concluded that all tubes in the McGuire Unit 1 steam generators are acceptable for continued service and that no hardware modifications, preventive tube plugging, or other measures are necessary to preclude fatigue crack initiation.

3.0 CONCLUSION

The staff concludes that the actions taken by the licensee resolve the issues identified in Bulletin 88-02 and are, therefore, acceptable. Consistent with staff finding No. 11 in Reference 1, the above findings are subject to the development of administrative controls by the licensee to ensure that updated stress ratio and fatigue usage calculations are performed in the event of any significant changes to the steam generator operating parameters (e.g., steam pressure and flow, circulation ratio) relative to the reference parameters assumed in the McGuire Unit 1 analyses.

4.0 REFERENCE

1. Safety Evaluation Report, "Evaluation of Westinghouse Methodology to Address Item C.2 of NRC Bulletin 88-02" which was transmitted to Westinghouse by NRC letter dated October 2, 1987.