EVALUATION OF LICENSEE'S REPORTS BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REPORT 95-SDS-1401M1: EVALUATION OF SAFETY FACTOR FOR WELDS RCAJ-2, RCBJ-1A, RRJJ-4, RREJ-4, RRCJ-4, AND CUBJ-18

REPORT 96-SDS-1512M1: STRUCTURAL EVALUATION OF GAMA PLUG INDICATION IN THE CONTAINMENT COOLING SYSTEM

NORTHEAST UTILITIES

MILLSTONE, UNIT 1

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1.0 INTRODUCTION

By NRC memorandum dated August 2, 1996, Richard W. Cooper, Director of the Division of Reactor Projects (Region I) requested Steven A. Varga, Director of Region I Reactors (NRR), to assist in reviewing several weld operability calculations performed by the engineering staff of Northeast Utilities (NU) in reports 95-SDS-1401M1 and 96-SDS-1512M1 for Millstone 1. The weld calculations were obtained as part of a follow up to an open item in Inspection Report (50-245/96-01) regarding the Generic Letter (GL) 88-01 Inter-Granular Stress Corrosion Cracking (IGSCC) program at Millstone 1.

Report 95-SDS-1401M1 contains calculations of safety factor for welds RCAJ-2, RCBJ-1A, RRJJ-4, RREJ-4, RRCJ-4, and CUBJ-18 in certain piping of the reactor coolant system (RCS); Report 96-SDS-1512M1 contains the structural evaluation of gamma plug indications in the containment cooling system.

2.0 EVALUATION

2.1 REPORT 95-SDS-1401M1

Welds RRCJ-4 and CUBJ-18, which contain circumferential flaws, were evaluated by NU in accordance with IWB-3600 of Section XI of the American Society of Mechanical Engineers (ASME) Code. The material of the piping at either end of the welds is A358 TP 304 stainless steel with a yield strength of 18.5 ksi and ultimate strength of 63.5 ksi at 575 °F. NU determined that the emergency and faulted condition will always be controlling, and consequently analyzed these two partly through cracks for this condition only. The staff reviewed the details of the calculation and determined that NU followed Appendix C procedure properly. The methodology in Appendix C is appropriate for ductile materials such as A358 TP 304 stainless steel. Hence, the "safety factors" of 2 for weld RRCJ-4 and 0.47 for weld CUBJ-18 are calculated correctly. NU defined the safety factor as the ratio between the allowable bending stress based on limit load and the applied bending stress based on the formula in the ASME Code. This NU defined safety factor should not be confused with the code safety factor of 1.39, which appears in the code formula for calculating the applied bending stress for the emergency and faulted conditions. The physical meaning of the NU defined safety factor is that if a flaw in a weld has a safety factor of 1.0, then the flaw is acceptable. Since the disposition of weld CUBJ-18, of which the safety factor is 0.47, is not in this document, the staff did not evaluate the adequacy of the repair of this weld.

Welds RCAJ-2, RCBJ-1A, RRJJ-4, and RREJ-4, which contain axial through-wall flaws, were evaluated by NU using the methods in the Ductile Fracture Handbook. Again, the material of the piping at either end of the welds is of a standard grade, 304 stainless steel. As to the load, NU used a design pressure of 1250 psi for all four cracks. The staff determined that due to the lack of recommended methodology for through-wall cracks in the ASME Code, using methodology from the Ductile Fracture Handbook is acceptable. Further, loading such as dead weight, thermal, and seismic loads, which were considered for circumferential cracks in the previous case, contributes very little to the Mode I type applied stress intensity factors for axial cracks because of the orientation of the crack. Therefore, using the design pressure of 1250 psi for the emergency and faulted condition is appropriate. The staff concludes that the safety factors of 2.92 for welds RCAJ-2 and RCBJ-1A and 3.05 for welds RRJJ-4 and RREJ-4 are correct.

2.2 REPORT 96-SDS-1512M1

This report contains the evaluation of the cracking found in a gamma plug located at line number 18"-CC-14A between welds CCAJ-9 and CCAJ-10 in the containment cooling system. An evaluation of the repaired configuration with a full overlay in accordance with Code Case N-504 was also provided in the report. The flaw was characterized as having circumferential and axial, surface planar components in accordance with IWA-3310, and was of the through-wall type. The material of the piping was reported as "A312 Type 304" on page 4 and as "A358 TP 304" on page 8. The staff did not pursue this because both types of stainless steel have a yield strength of 18.5 ksi and ultimate strength of 63.5 ksi at 575 °F according to Section III of the ASME Code. For the axial flaw, the same methodology used in report 95-SDS-1401M1 was used. For the circumferential flaw, although Appendix C methodology is not suitable for through-wall flaw evaluations, it was employed to estimate the remaining margin of the circumferential flaw. This flaw evaluation became unimportant after the weld overlay was applied to the pipe and the old configuration ceased to exist. The staff reviewed the detailed calculation for the weld overlay design and determined that NU used acceptable methodologies for analyzing both circumferential and axial crack components. The report showed that adequate margins exist for both crack components of the overlay design for levels A, B, C, and D loading, and hence the new design is acceptable.

It should be pointed out that unlike cases in report 95-SDS-1401M1, the normal and upset conditions (levels A and B) are controlling now. This is because the piping expansion stress including the seismic anchor motion (SAM), which was a dominant factor in the applied stress calculations in report 95-SDS-1401M1, were negligible for cases reported in 96-SDS-1512M1.

3.0 TECHNICAL CONCLUSIONS

The Materials and Chemical Engineering Branch has completed the review. Based on the evaluation, the staff concludes that all the calculation procedures and results in reports 95-SDS-1401M1 and 96-SDS-1512M1 are correct. Although Appendix C methodology is not suitable for through-wall flaw evaluations, its use by NU in report 96-SDS-1512M1 was appropriate for a rough estimate of the remaining margin for the circumferential flaw with the old configuration. The disposition of weld CUBJ-18, of which the safety factor is 0.47, is not in report 95-SDS-1401M1, hence, the staff did not evaluate the adequacy of the repair of this weld. However, the analysis of the new design for the weld reported in 96-SDS-1512M1 is available, and the staff determined that the new design is acceptable.