

UNITED STATES NUCLEAR REGULATORY COMMISSION WASHINGTON, D.C. 20555-0001

ENCLOSURE

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO REPAIR OF INTERGRANULAR STRESS CORROSION CRACKING

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY UNIT 2

DOCKET 50-260

1.0 INTRODUCTION

1.1 <u>Purpose</u>

To determine whether the licensee's overlay repair will permit Browns Ferry Nuclear Plant (BFN), Unit 2 to operate safely.

1.2 <u>Background</u>

During the BFN Cycle 6 refueling outage for Unit 2, the Tennessee Valley Authority (TVA or the licensee) inspected welds susceptible to intergranular stress corrosion cracking (IGSCC) in accordance with its commitments to Generic Letter (GL) 88-01 and NUREG-0313, Rev. 2. These inspections identified flaw indications in a Class 1 weld, TCS-2-421, in the piping of the core spray system. The weld is classified as Category D per the GL. The licensee repaired the flaw with a weld overlay and requested NRC approval for the repair.

2.0 EVALUATION

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The affected weld is a stainless to stainless weld between carbon steel (ASTM SA420 Grade WPL6) pipe clad with TP309 weld metal and stainless steel (CF8M) valve body material. It joins a 12-inch valve to a 12-to 10-inch reducing elbow. The elbow was buttered with Type 309 so a field weld could be made as a similar metal weld with Type 309. This weld, made during a piping replacement in 1978, required multiple repairs. These repairs had been made precisely where a flaw was detected during this outage by ultrasonic testing (UT) and radiography testing (RT). The licensee believes that the repairs had sensitized the weld and produced large unfavorable residual stresses and a defect. The defect probably grew during plant operation by crevice corrosion. Applying the mechanical stress improvement process during this outage produced enough stress redistribution to make the defect visible to UT and RT.



The licensee determined that the indication was interdendritic stress corrosion cracking, a type of IGSCC. Its consultant, Structural Integrity Associates, analyzed the condition and evaluated options. TVA selected a full-structural overlay. It was designed and applied by General Electric in accordance with GL 88-01.

For the overlay design, the crack was assumed to extend through the wall. The overlay was applied with a low-carbon weld metal ER309L containing 0.01 to 0.02% carbon. The design did not take credit for thickness of a weld layer until acceptable ferrite levels were recorded. The lowest average delta ferrite, 8.7 FN, more than met the minimum 7.5 FN required by the GL.

The licensee documented the effect of shrinkage on the piping system, including pipe supports and whip restraints, and evaluated the increase of deadweight and stiffness resulting from the overlay. These results were all acceptable.

As a result of finding the flaw, TVA inspected the remaining Category D welds as required by the sample expansion provisions of GL 88-01. TVA did not find any more indications.

In future augmented IGSCC inspections, weld TCS-2-421 will be inspected according to the schedule for Category E welds.

3.0 CONCLUSION

The NRC staff reviewed TVA's submittal, and supporting information, and determined that the licensee's overlay repairs were acceptable. Furthermore, the staff concluded that TVA conformed with the guidance of GL 88-01 and that BFN, Unit 2 could operate safely.

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Docket File NRC & Local PDRs BFN Reading S. Varga G. Lainas F. Hebdon B. Clayton T. Ross J. Williams M. Banic OGC ACRS (10) E. Merschoff P. Kellogg C. Patterson J. Crlenjak

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