



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
EVALUATION OF AN ULTRASONIC TEST INDICATION IN THE N4A-2 FEEDWATER

NOZZLE TO SAFE-END WELD

GULF STATES UTILITIES COMPANY

RIVER BEND STATION, UNIT 1

DOCKET NO. 50-458

INTRODUCTION

The NRC staff has completed its review of Gulf States Utilities Company's (GSU's) submittal dated November 19, 1990. The licensee requested the NRC to permit operation of the River Bend Station (RBS), Unit 1 to mid-cycle (approximately September 1991) of Cycle 4 with an unrepaired N4A-2 feedwater (FW) nozzle to safe-end weld. The licensee's submittal described the results of all the examinations performed on the N4A-2 feedwater nozzle to safe-end weld. The results of these inspections revealed an increase in flaw length of 1.1 inches, and in flaw depth of 0.13 inches since the Cycle 3 mid-cycle inspection.

DISCUSSION

The indication in the N4A-2 FW nozzle to safe-end weld was first reported in the second refueling outage (RF-2) in March 1989. It is a circumferential indication and is located on the safe-end weld, in the Inconel 182 buttered area. The indication was detected and sized in RF-2 by manual examination and was approximately 6.125 inches long, with a maximum depth of approximately 0.2 inches and an average depth of 0.16 inches. Manual and automatic (P-Scan) ultrasonic examinations were conducted on the N4A-2 nozzle during the Cycle 3 mid-cycle outage (MCY-3) in March 1990. The results of these inspections revealed no increase in depth of the indication and the length of the indication had increased 0.5 inches to a total length of 6.625 inches. The manual and P-Scan examinations performed during RF-3 revealed the indication had grown to a maximum length of 7.7 inches and to a maximum depth of 0.33 inches.

The indication exhibits faceting and branching, multiple peaks, short pulse durations, and fast rise and fall time, which are indications of intergranular stress corrosion cracking (IGSCC). From this determination the licensee is treating the subject nozzle weld as an IGSCC Category "F" weld per Generic Letter (GL) 88-01. The licensee indicated that the overall growth of the indication over the past cycle was well below the predictions in its analysis provided by letter dated May 15, 1989. General Electric (GE) Company performed a fracture mechanics analysis and crack growth assessment of the indication for the licensee. A bounding indication growth rate of 5.0 E-5 in/hr , based

on the worst case reactor water conductivity, was used to determine indication growth during the fourth fuel cycle. This value bounds the growth rate estimated from the MCY-3 and RF-3 ultrasonic sizing (2.89 E-5 in/hr). The results of the evaluation indicated that the conservative estimate of flaw size after 7000 hours of operation would be 0.68 inches, which is well below the ASME Code allowable value of 0.825 inches. Therefore, the licensee has concluded that the operation of RBS, until the mid-cycle outage, scheduled for the latter half of September 1991, is acceptable in its current configuration. The licensee has committed to take the following actions:

1. The subject feedwater nozzle weld will be re-examined during the mid-cycle outage planned for Cycle 4. This outage is currently scheduled for approximately 7000 hours of operation after startup from RF-3. This corresponds to the latter half of September 1991. The results of the mid-cycle examination and evaluation of the data will be provided to the NRC for review and approval along with descriptions of any further corrective actions prior to resumption of reactor operation. Materials and personnel will be staged to permit repairs to this weld should the mid-cycle measured indication depth and length be found outside the bounds of the analysis.
2. The subject feedwater nozzle weld will also be re-examined during the fourth refueling outage per the requirements of GL 88-01. This will allow further determination and verification of growth of the indication.
3. The licensee is planning to join the recently developed EPRI Nozzle/Safe-End Research Program. This research program addresses the evaluation of repair, replacement, residual stress mitigation and examination approaches for BWR nozzle to safe-end configurations that use Inconel 182 weld filler materials.

CONCLUSION

Based on the review of the information provided, the NRC staff has concluded that there is reasonable assurance that the structural integrity of the subject nozzle to safe-end weld will be maintained and River Bend Station may continue operation at least to mid-cycle (approximately September 1991) of Cycle 4. Furthermore, the licensee has committed to re-examine the subject nozzle to safe-end weld during Cycle 4 mid-cycle outage. The results of the mid-cycle re-examination and re-evaluation are to be submitted for NRC staff review and approval prior to resumption of reactor operation.

Dated:

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