



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
EVALUATION OF A FLAWED WELD IN THE SHUTDOWN COOLING SYSTEM AT

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

NUCLEAR PROJECT NUMBER 2 (WNP-2)

DOCKET NO. 50-397

1.0 INTRODUCTION

The NRC staff has reviewed two letters from the Washington Public Power Supply System (WPPSS) dated May 10 and 15, 1991, regarding the fracture mechanics evaluation of a flawed weld to support the continued operation of WNP-2. During the 1991 refueling outage (R6) a flaw indication was found on a pipe to valve weld (2ORRC(6)-8) in the 20-inch shutdown cooling suction line tapping off from the reactor recirculation system. The licensee's flaw evaluation showed that continued operation without repair of the flaw was acceptable for a 12-month period.

2.0 DISCUSSION

As a result of identifying indication of a flaw in an intergranular stress corrosion cracking (IGSCC) Category B weld in its initial inspection sample, WPPSS expanded the inspection scope to include three additional Category B welds. Relevant indications were not found in the expanded sample. The licensee's sample expansion met the guidelines provided in NRC Generic Letter 88-01, "Intergranular Stress Corrosion Cracking (IGSCC) in BWR Austenitic Stainless Steel Piping." Weld 2ORRC(6)-8 was treated using induction heating stress improvement (IHSI) method prior to service. Weld integrity was then confirmed by a pre-service volumetric nondestructive examination.

The flaw indication was identified by qualified ultrasonic examination personnel from General Electric during a refueling outage. The indication was found in the heat affected zone adjacent to the pipe side (304 stainless steel) of the weld. The indication was reported to have a depth of 15% through wall and a length of 4.5 inches. Nominal pipe wall thickness is one inch. A review of pre-service ultrasonic examination records and radiographs did not identify any indications due to lack of fusion, root geometry or other fabrication defects.

The licensee performed a flaw evaluation and calculated crack growth over a 12-month fuel cycle due to fatigue and intergranular stress corrosion cracking (IGSCC). The methodology used for the fatigue and IGSCC evaluations is found in Attachment 1 to the licensee's May 15, 1991, submittal. The results of the

fatigue evaluation showed that the crack growth due to such events is not significant. In the IGSCC evaluation, the licensee employed the NASCRAC flaw model developed by Failure Analysis Associates and performed a linear elastic fracture mechanics evaluation. The licensee modelled the flaw as an elliptically shaped circumferential flaw contained in a shell element and used three degrees of freedom for crack growth. The licensee indicated that the crack growth rate equation and weld residual stress distribution provided in GL 88-01 were used in the evaluation.

The licensee's results show that the final flaw depth of 0.29 inches or 28% through wall, at the end of the next 12-month fuel cycle will not exceed the ASME Code allowable value of 0.62 inches or 60% through wall. The NRC also performed an independent evaluation of crack growth due to IGSCC and also showed that flaw growth over the next 12-month cycle was acceptable.

In its response to GL 88-01, WPPSS did not endorse incorporation of two items into the technical specifications. These two items concern a 2 gallons-per-minute (gpm) rate increase in unidentified leakage within any 24-hour period or less, and the Action statement. The staff issued Supplement 1 to GL 88-01 on February 4, 1992; however, the staff's position on these two issues remain the same as stated in GL 88-01. The licensee should review its technical specifications for revision to address these two issues, if necessary.

The licensee also indicated that 67 of the 126 Category B welds have been examined for IGSCC; however, in its response to GL 88-01 dated July 20, 1989, the licensee reported that there are 148 Category B welds at WNP-2. Between the two reports, there is a difference of 22 Category B welds. The licensee should reconcile this difference and revise its response to GL 88-01, as necessary.

### 3.0 CONCLUSION

Based on the review of the licensee's submittal and the staff's independent crack growth calculation, it appears that there is reasonable assurance that the structural integrity of the shutdown cooling piping will be maintained and that WNP-2 can be safely operated until refueling outage 7, tentatively scheduled to begin in April, 1992.

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