

TPSTAT

REPORT OF TECHNICAL EVALUATION
MISCELLANEOUS NOZZLE CRACKING: PILGRIM STATION, UNIT 1
NRC TAC No. 07064
FRC Task No. 88

Prepared by: J. E. Prior

Performing Organization

Franklin Research Center
The Parkway at Twentieth Street
Philadelphia, PA 19130

FRC Project No.
C5257

Sponsoring Agency

Nuclear Regulatory Commission
Washington, D.C. 20555

NRC Contract No.
NRC-03-79-118

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, or any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for any third party's use, or the results of such use, of any information, apparatus, product or process disclosed in this report, or represents that its use by such third party would not infringe privately owned rights.

REPORT OF TECHNICAL EVALUATION

UNIT: PILGRIM STATION, UNIT 1
DOCKET NO. 50-293

LICENSEE: BOSTON EDISON COMPANY
TAC NO. 07064

1. SUMMARY

As a result of ultrasonic testing (UT) in 1974, reportable cracks were detected in Nozzles N2B and N4A of the reactor vessel at Pilgrim Station, Unit 1. These defects were monitored by UT in 1976 and again in 1977. Based upon an evaluation of these data, it is concluded that Nozzles N2B and N4A are acceptable for continued operation and that:

- Nozzle N2B should be monitored by UT at subsequent refueling outages to ensure that crack growth has not occurred.
- Nozzle N4A may be returned to a normal In-Service Inspection (ISI) schedule.

2. INTRODUCTION

The results of the 1977 UT examination of the N2B recirculation inlet nozzle-to-shell weld and the N4A feedwater-nozzle-to-shell weld in the Pilgrim Station Unit 1 reactor pressure vessel were submitted to the NRC for review. The object of this FRC Technical Evaluation is to assess the adequacy of these welds with respect to their continued use and return to the normal ISI schedule. The review is confined to the issue of the pressure-boundary integrity as influenced by nozzle-weld cracking.

3. BACKGROUND

Experience has shown that cracks have occasionally been detected in nozzle welds in boiling water reactor (BWR) pressure vessels. In 1974 and 1976, UT inspection revealed indications in nozzle-to-shell welds in Nozzles N2B and N4A at Pilgrim Station, Unit 1. Due to changes in inspection requirements, a calibration block, fabricated from a prolongation of the actual pressure-vessel plate, was used in 1976 to ensure more accurate and reliable UT results. The

calibration block used in 1974 was made of a material of similar class but not of actual vessel material. A review by an independent consultant of the UT data taken in 1974 and 1976 concluded that:

The change in calibration blocks reduces the gain setting of the ultrasonic instruments substantially. This results in a reduction of the reported size of the flaw due to the reporting procedure required by the applicable ASME Codes. The reported apparent size of the flaw at a single location would be about four times less than the 1.5 inches if the lower instrument gain were used.

Because of the instrument recalibration, indications of flaws found in Nozzle N4A were so reduced in size in the 1976 inspection that they were characterized as not reportable. The flaw in the Nozzle N2B weld was found to be of reportable size in the 1976 inspection; however, it was determined that no flaw growth had occurred. A review by an independent consultant also concurred that no growth was evident in the flaw of the Nozzle N2B weldment between 1974 and 1976.

Unfortunately, the dedicated transducers used in the 1976 inspection could not be located and, therefore, were not used in the 1977 inspection. Transducers with similar characteristics were utilized. Calibration Block PIL-5A, used in 1976, was available and was used in the 1977 inspection.

4. TECHNICAL EVALUATION

4.1 RECIRCULATION INLET NOZZLE N2B

UT inspection of the N2B nozzle-to-shell weld was conducted by Southwest Research Institute (SWRI) during the August to November refueling outage in 1977. It was concluded that no significant flaw growth had occurred in the weldment between the 1976 and 1977 examination of Nozzle N2B. A review of the data by an independent consultant (Sandia Laboratories) concurred that no change in flaw size had occurred.

In 1976, it was established through fracture-mechanics analysis that a conservative, maximum, acceptable through-wall dimension at the flaw location would be 2.5 inches. Since the maximum flaw size measured by UT examination was 1.5 inches in through-wall dimension--considerably less than the calculated acceptable size--Nozzle N2B was acceptable for continued operation at that time. Therefore,

since no crack growth occurred between 1976 and 1977, Nozzle N2B is still acceptable for continued operation.

4.2 FEEDWATER NOZZLE N4A

A review of the results of the 1976 inspection of N4A feedwater-nozzle-to-shell weld shows that some indications were detected but no reportable flaw indications were found. It should be noted that no flaw indication of any kind was located in 1977. It is apparent that some of the confusion arising during the 1974 and 1976 inspections of this weldment was caused by inadequate baseline data and a change in calibration blocks. Since no reportable indications were found in the weld in 1976 and no flaw indication whatever was located in 1977, Nozzle N4A can be returned to the normal ISI schedule.

5. CONCLUSION

It is concluded that the Recirculation Inlet Nozzle N2B is acceptable for continued operation, since no indication of crack growth was found between the 1976 and 1977 inspections. UT examination should be conducted on the Nozzle N2B weld during the next refueling outage using the results of the 1976 inspection as baseline data. Monitoring the weld cracking will ensure that crack dimensions remain within the limits of the allowable flaw size established by Section XI of the ASME code. Should crack growth be indicated in the Nozzle N2B weld during the next scheduled inspection, justification must be submitted before continued operation is approved. This UT examination of the weldment is not intended to supplant the regularly scheduled ISI program. Additionally, the licensee should submit for approval, a continuing inspection program to monitor Nozzle N2B.

No evidence of flaw indications was noted during the examination of Feedwater Nozzle N4A in 1977. It is, therefore, concluded that this nozzle is adequate for continued service and that it may be returned to the normal ISI schedule.