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

ATTACHMENT 1

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

FLAW INDICATION IN THE REACTOR VESSEL INLET NOZZLE (N2B)

ROCHESTER GAS AND ELECTRIC COMPANY

R. E. GINNA NUCLEAR POWER PLANT

DOCKET NO. 50-244

1.0 INTRODUCTION

During the 1979 inservice inspection (ISI) of the reactor pressure vessel (RPV) a flaw was detected in the N2B inlet nozzle. At that time the flaw was sized as 5.27" x .93". A beam spread correction was applied and the apparent flaw dimensions were reduced to 4.52" x .160". The corrected flaw size was acceptable for service without repair or augmented ISI based on ASME Code rules. In addition, a fracture mechanics analysis was performed by Teledyne Engineering which confirmed the acceptability of the flaw. At the same time, the original construction radiographs were reviewed and confirmed the presence of slag at this location. The flaw was located at the 306° position looking at the nozzle from the vessel inside diameter. The indication is at the interface of the nozzle to vessel weld preparation and was characterized as a thin planar slag inclusion near midwall.

During the 1989 refueling outage the flaw indication was examined in accordance with the second interval inspection plan. The ultrasonic testing (UT) methodology resulted from a comprehensive program to develop sizing techniques in heavy sections that was jointly sponsored by Rochester Gas and Electric Corporation, the licensee, and Wisconsin Electric Power Company. The objective of this Safety Evaluation is to report the staff's conclusions regarding the 1989 inservice inspection.

2.0 LICENSEE'S DOCUMENTATION

The licensee described the information obtained during the reactor vessel examination in a submittal dated May 4, 1989. The staff also met with the licensee and his inspection agency on January 10 - 11, 1989 at the Southwest Research Institute (SWRI), San Antonio, Texas. The purpose was to observe demonstrations of the computer-based ultrasonic testing system and new focused transducers on clad, full-scale mockups containing machined reflectors with known dimensions. A representative from NRR and our consultant, from the Sandia National Laboratories, were at the Ginna site during the RPV examination and the evaluation of the data.

A mechanized ultrasonic examination was performed on essentially 100% of the circumferential shell welds plus the base metal in 1/2 of the wall thickness on each side of the weld. The Ginna vessel was fabricated from ring forging, thus does not have longitudinal welds. The RPV examination was based on the 1974 Edition of ASME Section XI including Addenda through Summer 1975 (74E 75S) and Regulatory Guide 1.150, Revision 1. The scope of the inspection plan significantly exceeds the requirement of 74E 75S to examine 5% of each circumferential shell weld. The extent of examination included the nozzle-to-shell and nozzle to piping welds.

The flaw indication in the N2B nozzle was located and scanned with the same techniques and transducers as used in 1979 to obtain a comparison and to show that the flaw size has not changed. The size measured in 1989 with the 1979 technique was 4.04" x .78". The examinations continued with SWRI Enhanced Data Acquisition System (EDAS) to present and analyze the data. No other reportable flaw indications were detected.

The inlet, outlet, and safety injection nozzle-to-vessel welds were examined from the bore utilizing 15-degree (for inlet nozzles), 10 degree (for outlet nozzles), 10-degree (for safety injection nozzle) and 45-degree beams for detection of reflectors in the weld and base material. In addition, 45-degree and 60-degree examinations were performed from the shell inside surface for detection of reflectors oriented transverse to the weld and base material. These transverse examinations used a computer to control the X-Y-Z movements to assure accurate positioning around the nozzle during examinations. Tandem 50/70-degree search units were utilized from the bore and shell inside surface for detection of reflectors located in the clad-to-base metal interface region and the volume between the examination surface and the first Code calibration reflector.

Focus beam transducers clearly characterized the flaw indication as an elongated slag inclusion with a dimension of 4.94" x .48". Applying the ASME Section XI acceptance standards to the final 1989 flaw indication provided the following:

$a = .24"$, $2a = .48"$
$l = 4.94"$
$a/l = .048$
$a/t = 2.59\%$

The maximum allowable $a/t = 2.4\%$. The 1979 fracture mechanics analyses performed by Teledyne Engineering bounds the current flaw. Since the flaw exceeds the acceptance standards the licensee reviewed to previous analyses and concluded that the results are still valid. Based on this submittal, the licensee does not plan to perform augmented ISI of the flaw indication.

3.0 ASME CODE REQUIREMENTS (74E 75S)

Components whose examination reveals flaw indications that are in excess of the standards in Table IWB-3410 shall be unacceptable for service unless such flaws are removed or repaired to the extent necessary to meet the allowable flaw indication standards prior to placement of the component in service. A flaw

indication that exceeds the acceptance standards can be designated as conditionally acceptable provided that fracture mechanics analyses confirms the structural adequacy of the component for continued service and augmented inservice inspections are performed.

4.0 STAFF EVALUATION

At the laboratory demonstration, the staff determined that the instrumentation used during the 1989 refueling outage has the capability for a more realistic and accurate flaw sizing than the beam spread correction that was used in the past. A valid beam spread correction is dependent upon several parameters such as, the characteristics of the transducer, and the orientation and type of flaw. Focus transducers were designed for the Ginna ISI with compound curvature lenses to minimize the focal diameter in the region of interest. This tends to reduce the exaggeration in size due to beam spread for volumetric-type reflectors, such as, slag or inclusions.

The field inspection data was recorded for archival storage on laser disks. The data acquisition system permits retrieval of the data for independent interpretation, characterization and flaw sizing. The waveforms from the flaw echo and the transducer position were digitized at small incremental steps of the transducer over the entire area of the flaw. The automated, computer-based system presents color graphics displays at various orientation. Data was recorded at sensitivities that exceed the requirements of ASME Section XI.

The licensee submitted a comparison of the 1979 50% DAC amplitude plots and the 1989 EDAS color amplitude displays. The staff has reviewed this information and determined that the flaw indication has not changed in size or shape. The 1989 digitized video waveforms, signal processing and specialized transducers provides additional information about the flaw indication than was available in 1979. The EDAS display shows two separate reflectors in close proximity to each other at one extremity of the flaw indication. The staff's evaluation determined that the licensee's final dimensions of 4.94" x .48" is a realistic representation of the actual flaw size. If the flaw length were assumed to be a constant, a reduction of .036" in the depth dimension (.480" - .444") would result in a flaw indication that meets the ASME Section XI acceptance standards. The staff does not believe that the slight difference in depth between an acceptable condition can be distinguished with state-of-the-art instrumentation in this application.

The staff has reviewed the licensee's fracture mechanics analyses related to the final dimensions of the flaw indication. The staff agrees with the licensee's conclusion that flaw growth would be negligible during the remaining life of the vessel.

5.0 CONCLUSION

The staff concludes that the flaw indication detected in the N2B inlet nozzle weld is probably an embedded volumetric reflector resulting from the fabrication process that has remained unchanged since construction. The licensee used state-of-the-art instrumentation during the 1989 examination of the flaw indication.

The acceptance standards are extremely conservative for embedded flaws in vessels. The staff further concludes a reexamination of the flaw indication before the next scheduled inservice inspection is not warranted or necessary pursuant to 10 CFR 50.55a(a)(3). The licensee's 1989 inspection results and fracture mechanics analysis demonstrates that the structural integrity of the reactor pressure vessel will be maintained during service with the flaw indication in this location.