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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION OF THE SECOND TEN-YEAR INTERVAL INSERVICE INSPECTION RELIEF REQUEST NO. 93-08 FOR OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3 DOCKET NOS. 50-269, 50-270, AND 50-287

1.0 INTRODUCTION

In a letter of December 21, 1993, Duke Power Company (Duke or licensee), submitted a request to delay the required surface examination of the reactor pressure vessel (RPV) core flood nozzle-to-safe end and safe end-to-pipe and the reactor cooling system (RCS) nozzle-to-pipe welds (welds) until the first refueling outage of the third 10-year inservice inspection (ISI) interval for Oconee Units 1, 2, and 3. The one-time delay would be until refueling outage No. 16 for Unit 1 (October 1995), refueling outage No. 15 for Unit 2 (March 1996), and refueling outage No. 15 for Unit 3 (May 1995). This delay would give the licensee sufficient time to resolve NRC concerns about the adequacy of the proposed alternate examination used in the demonstrations conducted in 1989 and 1993. The alternate examination applied ultrasonic techniques (UTs) on the inside diameter of the welds to detect surface flaws on the outside diameter.

2.0 BACKGROUND

On September 13, 1984, Duke submitted a relief request that proposed an alternate examination method to the surface examination requirements in the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, 1980 Edition through the Winter 1980 Addenda, Table IWB-2500-1, Category B-F (Item B5.10) and Category B-J (Item B9.11) and IWB, Inspection Program B (Code). The licensee stated that performing the required surface examinations on the welds would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety, created by exposing personnel to excessive radiation. The alternate examination method would use UTs applied from the inside diameter (ID) to detect and size surface flaws on the outside diameter (OD) of the welds.

On August 8, 1989, Babcock and Wilcox attempted to demonstrate (NRC Inspection Report No. 50-302/89-21) the proposed alternate examination method. The demonstration showed that a transmitted signal from the ID could detect machined notches 2.3-percent through-wall on the OD at the mockup welds using a two-direction examination in carbon steel, one-direction examination in Inconel butter, and one direction examination in stainless steel, but could not detect notches in the Inconel weld. The demonstration was conducted using

a shear wave transducer. An impromptu demonstration conducted the same day using an axial scan with a 45-degree refracted longitudinal wave transducer could detect machined notches in carbon steel, stainless steel, Inconel butter, and Inconel material, but the demonstration did not determine the size of notches, nor was it performed using a procedure. The limitations observed with the 1989 demonstration were incorporated in the approved relief request with conditions that was issued on May 14, 1991. These conditions were:

1) the volumetric examination include the entire weld volume and heat affected zone instead of only the inner one-third of the weld.

2) the ultrasonic testing instrumentation and procedures are demonstrated to be capable of detecting OD surface connected defects, in the circumferential orientation, in a laboratory test block. The defects should be cracks and not machined notches.

On August 11, 1993, the B&W Owners Group (B&WOG) sponsored a demonstration to address the conditions contained in the approved relief request. The demonstration consisted of two mockups with implanted fatigue cracks that ranged from 7.0- to 73.0-percent through-wall using the flaw size distribution described in Appendix VIII of Section XI of the ASME Code, 1992 Edition (as of this date, not accepted by the NRC). For carbon steel, the cracks were sized using shear waves. For stainless steel and Inconel, the cracks were sized using refracted longitudinal waves. Although all the cracks were found, the demonstration did not examine short lengths and/or shallow flaws that would satisfy ASME Code requirements for the surface examination method.

On November 18, 1993, the licensee sent the NRC a letter requesting it to reconsider its position on the 1993 demonstration. In support of this request, the licensee submitted additional information for review. The NRC has reviewed the data received to date and finds insufficient justification to change its present position on the 1993 demonstration. The NRC is reaffirming its position in a letter to the licensee that transmitted a list of questions. In the letter, the NRC recommended meeting with the licensee to discuss the questions and the licensee's responses.

3.0 DESCRIPTION

The ASME Code requires both volumetric and surface examination of the RPV core flood nozzle-to-safe end welds and RCS nozzle-to-pipe welds. The volumetric examination covers the inner one-third of the welds. The licensee proposed using an alternate examination technique that would examine the through-wall thickness of the heat-affected zone and welds from the ID. The alternate technique would use the same UT test head manipulators and data analysis systems that would be used for the ASME Code-required volumetric examination. The UT test heads would be fitted with special transducers and would use operating procedures that can detect and determine the size of flaws extending into the material from the OD. Upon successfully demonstrating the alternate examination technique, the implementation of a surface examination would be redundant; this forms the basis for the licensee's relief request.

By waiving the surface examination in lieu of the alternate volumetric examination, radiation exposures to personnel and the associated maintenance costs would be reduced. In the November 18, 1993, submittal, the licensee included the radiation and costs estimates that were generated by Florida Power Corporation (a participant in the B&WOG 1993 demonstration), which estimated over 2,000 manhours and 5 man-rem would be used to perform the surface examination of each weld.

4.0 EVALUATION

The ASME Code volumetric examinations method supplemented with the alternate examination technique has already been completed during refueling outage No. 13 for Unit 1 (August 1991), refueling outage No. 12 for Unit 2 (January 1992), and refueling outage No. 14 for Unit 3 (December 1993). The alternate examination technique observed in the 1993 demonstration was used on all three units. The technique was sensitive enough to detect large flaws and inspected more through-wall area than the ASME Code requires for the volumetric examination method. The detection and sizing capabilities of the technique were apparently limited by flaw selection in the mockup and not by examination technique.

The surface examination is recognized as a conservative examination. The likelihood of a surface crack initiating and growing to a rejectable size before March 1996 is small, especially since OD cracks have historically been absent from the RPV core flood nozzle-to-safe end and safe end-to-pipe welds and the RCS nozzle-to-pipe welds. In light of the through-wall volumetric examination being free of rejectable indications (with the limitations identified in the 1993 demonstration), a one-time delay of the ASME Code required surface examination on the RPV core flood nozzle-to-safe end and safe end-to-pipe welds and the RCS nozzle-to-pipe welds until the end of the first refueling outages of the third 10-year ISI for Oconee Units 1, 2, and 3 will provide an acceptable level of quality and safety.

5.0 CONCLUSION

The NRC staff concludes that a one-time delay of the ASME Code-required surface examination of the RPV core flood nozzle-to-safe end and safe end-to-pipe welds and the RCS nozzle-to-pipe welds until the end of the first refueling outages of the third 10-year ISI for Oconee Units 1, 2, and 3 will provide an acceptable level of quality and safety and, therefore, the alternative is approved pursuant to 10 CFR 50.55a(a)(3)(i).

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