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

REQUEST FOR RELIEF 93-1

FOR

DUKE POWER COMPANY

OCONEE NUCLEAR STATION, UNIT 1

1.0 INTRODUCTION

The Technical Specifications for Oconee Nuclear Station state that the inservice inspection and testing of the American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 components shall be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable Addenda as required by 10 CFR 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). Paragraph 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulties without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the second 10-year interval comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) on the date 12 months prior to the start of the 120-month inspection interval, subject to the limitations and modifications listed therein. The applicable edition of Section XI of the ASME Code for the Oconee Nuclear Station, second 10-year inservice inspection (ISI) interval is the 1980 Edition through Winter 1980 Addenda. The components (including supports) may meet the requirements set forth in subsequent editions and addenda of the ASME Code incorporated by reference in 10 CFR 50.55a(b) subject to the limitations and modifications listed therein.

Pursuant to 10 CFR 50.55a(g)(5), if the licensee determines that conformance with an examination requirement of Section XI of the ASME Code is not practical for its facility, information shall be submitted to the Commission in support of that determination and a request made for relief from the ASME Code requirement. After evaluation of the determination, pursuant to 10 CFR 50.55a(g)(6)(i), the Commission may grant relief and may impose alternative requirements that are determined to be authorized by law, will not endanger life, property, or the common defense and security, and are otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed.

In a letter dated February 3, 1993, the Duke Power Company, the licensee, submitted Request for Relief No. 93-1 related to the examination of the reactor pressure vessel (RPV) flange to shell weld and the flange ligament area. The NRC staff is aware of significant technical information about the inservice inspection of the Oconee Unit 1 flange to shell weld that was not discussed in the licensee's submittal. Therefore, the staff retrieved pertinent documents from the NRC Document Control System and included this information in this safety evaluation. Based on this supplemental information, the NRC staff denies Relief Request 93-1 because the licensee's February 3, 1993 letter does not demonstrate that the examinations are performed to the maximum extent practical. Specifically, the licensee did not show that using other transducers, beam angles, calibration set-ups, or methods would not have reduced or eliminated the access limitations to the extent that would satisfy code requirements.

2.0 SUMMARY OF LICENSEE'S SUBMITTAL

The NRC staff evaluated the information provided by the licensee in support of the subject relief request as follows:

a. Flange To Shell Weld, Examination Category B-A, Item Number B1.30

Table IWB-2500-1 requires a volumetric examination of essentially 100% of the weld length as described in Figure IWB-2500-4. The scheduling of the examination of the weld may be partially deferred. If examinations are conducted from the flange face, the remaining volumetric examination required to be conducted from the vessel wall may be performed at or near the end of each inspection interval.

b. Threads In the Reactor Vessel Flange, Examination Category B-G-1, Item No. B6.20

Table IWB-2500-1 requires a volumetric examination of the threads in the base material of the flange when the connections are disassembled as described in Figure IWB-2500-12.

c. Licensee's Code Relief Request: The licensee has requested relief from performing the volumetric examinations, to the extent required by the Code, for the RPV circumferential flange-to-shell weld number WR-19 and the threaded area of the flange ligaments.

d. Licensee's Basis for Requesting Relief: The licensee's basis is summarized from its submittal as follows:

The Construction Permit for Oconee was issued on November 6, 1967. Paragraph 10 CFR 50.55a(g) allows for plants whose Construction Permit was issued prior to January 1, 1971, to meet the requirements of ASME Section XI to the extent practical within the limitations of design, geometry and materials of construction of the components. Due to part geometry and actual physical barriers, obtaining examination coverage on at least 90% of the weld volume as required by ASME Section XI, 1980 Edition as modified by Code Case N-460 was not possible.

The licensee estimated that the actual coverage of the reactor vessel flange weld (WR-19) was 55.8%. This estimate was derived from subtracting the cross-sectional area of the stud holes and two O-ring grooves from the area subject to examination. The licensee's submittal states that only a 0° scan is required.

The licensee estimates that the actual coverage of the flange ligaments was 84.5%. The area subject to examination was established by the licensee as a 1" cylinder around each stud hole. The estimate was derived by subtracting the area caused by a "step" in the flange sealing surface cladding. The licensee states that only a 0° scan is required.

Taking credit for the design requirements specified in Chapter 3 of Oconee's Final Safety Analysis Report (FSAR), the Reactor Coolant System is designed and constructed so as to have an exceedingly low probability of a gross rupture or significant leakage throughout its design life. Additionally, the reactor containment building is designed to sustain the initial effects of gross equipment failure. Technical Specification 3.1.6 limits the amount of unidentified reactor coolant leakage to 1 gallon per minute, if that value is exceeded, then the reactor shall be shut down within 24 hours of detection.

All of the welds contained in this request are located within the reactor building. The reactor building is designed to contain any leakage, so if these were to fail any release would be contained within the reactor building. Section 15.14 of the FSAR addresses the loss of coolant accident and documents that any releases that would occur due to this type of accident are within the limits of 10 CFR Part 100.

The welds identified in this request have been examined from the inside diameter (ID) by use of angle beam transducers during the 10-year reactor vessel examination by automated ultrasonic equipment (ARIS II). No reportable indications were identified with this examination.

Based on the above evaluations, not meeting the requirements of ASME Section XI while performing these examinations will not endanger the health and safety of the general public. No additional examinations are required.

e. Licensee's Proposed Alternative

Use of radiography as an alternative volumetric examination method is not possible on pressure vessel welds, due to the impracticality of using double wall technique, no location to place film, etc.

Ultrasonic examinations will continued to be performed to the maximum extent possible during future inservice inspections.

3.0 NRC STAFF EVALUATION

a. Examination of the Flange to Vessel Weld, Background Information

In March 1986, the licensee performed a scheduled ISI on the subject weld, WR-19. The ultrasonic examination was performed manually with the transducer in direct contact with the flange closure surface. The flange sealing surface has a stainless steel cladding and contains two O-ring grooves. The remainder of the flange face is unclad and located below on a "step" which contains the stud holes and ligaments. The centerline of the weld is approximately 32" from the examination surface. Scanning was performed on the clad flange sealing surface, the region between the O-ring grooves, and the unclad ligament. Essentially, all of the examination data were obtained with a single 1-inch diameter, 0-degree bean angle, 2.25 MHz frequency transducer.

The March 1986 examination identified 22 flaw indications in the base material of the flange above the weld. The 1-inch diameter transducer produces a beam diameter of approximately 8 inches at a depth of 32 inches (weld centerline). All indications except one were detected from the clad surface out-board of the O-ring grooves. These flaw indications were not observed during examinations from the clad region between the O-ring grooves or from the unclad surface. Only one of the indications was recordable from the unclad side of the flange. This indication is located between two stud holes and is at a depth of 24" from the flange face. This is outside (above) the area required to be examined by ASME Section XI and appeared to correspond to geometric discontinuities on the inside diameter (ID) and outside diameter (OD) of the vessel. This indication was observed between stud holes 360° around the vessel although not at a recordable level.

NRC action on this issue continued when Region II inspection personnel observed demonstrations of UT techniques on a cancelled reactor vessel, with a configuration similar to Oconee Unit 1, at the Babcock and Wilcox (B&W) facility in Mt. Vernon, Indiana. The demonstration took comparative data using the same Oconee, Unit 1, procedure (ISI-130, Revision 21) that was used in the March 1986 examination, and identified indications with similar depths, amplitudes, and transducer positions as the ones found at Oconee, Unit 1. The indications were not detected with examinations conducted from the OD surface of the vessel using 0, 45, and 60-degree angle transducers, nor from the flange face using 5, 10, and 15-degree angle transducers. The indications identified in the demonstrations were determined to be geometric reflectors. B&W

continued examining the Mt. Vernon vessel using transducers with different diameters, frequencies, and calibration set-ups. The above examinations resulted in a new procedure for Oconee, Unit 1, 2, and 3 (ISI-187, Revision 0).

During the next refueling outage for Unit 1 scheduled in September 1987, the NRC conducted an announced inspection to observe the UT examination of the RPV of the flange-to-shell weld (Inspection Report 50-269/87-37). The licensee performed the examinations using the old procedure ISI-130, Rev. 21 and the new procedure ISI-187 Rev. 0 that included a selection of transducers of different sizes, frequencies, beam angles, and calibration set-ups. B&W's evaluation of the data was submitted to the NRC in B&W report 1183505A-0 and conclusively determined that the 22 indications recorded during the March 1986 examination represented geometric reflectors caused by the flange configuration.

b. Evaluation of the Licensee's February 3, 1993 Submittal

The Duke Power Company submittal contains the form "Summation 90% or Greater Coverage" that states "Only 0° Scan Required" for the weld and flange ligament area. The ASME Section XI does not specify or require the use of a transducer with a 0-degree beam angle for these examinations. ASME Section XI, Category B-A, permits a partial deferral of examinations from the vessel wall if examinations are conducted from the flange face. Examination Category B-G-1 does not specify the angle, frequency, mode of propagation or transducer size required to perform the volumetric examination of the ligament region.

To evaluate the March 1986 examination results, the licensee evaluated different transducers, calibration set-ups, instruments and the influence of personnel performing manual contact examinations from the flange face. This information was docketed in Duke Power letters dated September 2, 1987 and December 23, 1987, as well as in Inspection Reports 50-269/86-23, 50-269/87-37, and 50-269/88-04. The evaluations show that transducers applied on the flange face with angles other than 0-degree can be used to examine the flange-to-vessel weld. In fact, the licensee used a transducer with a 5-degree angle in the 1979 examination at Oconee Unit 1, as indicated in a Duke Power letter dated April 24, 1986.

The licensee's February 3, 1993 submittal contained the page 11 of B&W Procedure No. ISI-187, Rev. 0, "Subject: Ultrasonic Examination of Reactor Vessel Flange To Shell Weld From Flange Top Surface." This improved procedure was developed as a result of the investigations at the B&W Mt. Vernon facility. The procedure contains provisions for using angle beam examinations to disposition any indications recorded with the 0-degree examinations (Duke Power letter December 23, 1987). The procedure illustrates that angle beam examinations can be used to increase the percent of flange-to-vessel weld coverage.

The licensee's February 3, 1993 submittal states that the welds identified in this request have also been examined from the ID by use of

angle beam transducers during the 10-year reactor vessel examination using automated ultrasonic equipment (ARIS II). The licensee stated that no reportable indications were identified with this examination. The licensee did not docket the percent weld coverage or when the examination occurred.

As part of the February 3, 1993 submittal, the licensee requested relief from the ASME Code of the volumetric examination to the threaded area of the flange ligaments. A UT examination of the threaded area would be conducted with a 0-degree beam angle applied to the uncladded surface of the flange. The examination coverage was stated as 84.5-percent and, therefore, cannot invoke Code Case N-460 that relaxes the volumetric examination requirement to a 90-percent minimum. The NRC recognizes that the elevation change between the cladded and uncladded surface of the flange will interfere in the UT examinations. However, UT examinations from the cladded surface and the use of small diameter transducers from the uncladded surface would increase the percent of coverage. The UT examination to the maximum extent possible was not pursued in this submittal.

4.0 CONCLUSION

Paragraph 10 CFR 50.55a(g)(4) requires that components (including supports) that are classified as ASME Code Class 1, 2, and 3 meet the requirements, except design and access provisions and preservice requirements, set forth in applicable editions of ASME Section XI to the extent practical within limitations of design, geometry, and materials of construction of the components.

Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee concluded that conformance with certain Code requirements is impractical for its facility and submitted supporting information. The staff has reviewed the licensee's submittal dated February 3, 1993, and other documents pertaining to the examination of the flange-to-shell weld and flange ligament area in the NRC Document Control System. Based on the information described above, the NRC staff concludes that Relief Request 93-1 should be denied because the licensee has not demonstrated that the examinations were performed to the extent practical within the limitations of design, geometry, and materials of construction of the components.

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