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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF FROM ASME BOILER AND PRESSURE VESSEL CODE SECTION XI

REQUIREMENTS: RELIEF REQUEST NO. 3-IS1-7

FOR

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT, UNIT 3

DOCKET NUMBER: 50-269

1.0 INTRODUCTION

The Technical Specifications (TS) for Browns Ferry Nuclear Plant Unit 3 (BFN-3) state that the inservice inspection 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 (B&PV) Code and applicable addenda as required by Title 10 of the Code of Federal Regulations (10 CFR) Section 50.55a(g), except where specific written relief has been granted by the U.S. Nuclear Regulatory Commission (NRC or Commission) pursuant to 10 CFR 50.55a(g)(6)(i). Section 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 difficultly 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 first 10-year interval and subsequent intervals 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) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The applicable edition of Section XI of the ASME Code for the BFN-3 second 10-year inservice inspection (ISI) interval is the 1989 Edition.

Pursuant to 10 CFR 50.55a(g)(5), if a 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 Code requirement. After evaluation of the determination, the Commission may, pursuant to 10 CFR 50.55a(g)(6)(i), 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.

By letter dated March 26, 1999, the Tennessee Valley Authority (TVA), submitted Request for Relief No. 3-IS1-7 for the Browns Ferry Nuclear Power Plant, Unit 3 (BFN-3). The request relates to examinations of reactor vessel-to-nozzle welds.

The information provided by TVA in support of Request for Relief 3-ISI-7, from Code requirements has been evaluated and the findings are presented below. The Code of record for the BFN-3 second 10-year ISI interval, is the 1989 Edition (No Addenda) of Section XI of the ASME Boiler and Pressure Vessel Code.

2.0 DISCUSSION

2.1 Code Requirement

The Code requires essentially 100 percent examination of reactor pressure vessel (RPV) nozzle-to-vessel welds as defined by Figure IWB-2500-7.

2.2 Relief Request

TVA determined that nine components have nondestructive examination (NDE) coverage limitations (90 percent or less coverage completed), which exceeds that specified in ASME Code Case N-460, "Alternative Examination Coverage for Class 1 and Class 2 Welds, Section XI, Division 1." The components are Code Category B-D, Item B3.90, nozzle-to-vessel welds for which the calculated NDE coverage completed varied for each component, from 64 to 77 percent. Request for Relief 3-ISI-7 applies to these nine components. (Request for Relief 3-ISI-7 is similar to Unit 2 Request for Relief 2-ISI-6, which was granted February 23, 1999. Request for Relief 2-ISI-6 encompassed 19 vessel-to-nozzle welds and an instrument nozzle inside radius section.)

2.3 Basis for Relief

The licensee's basis for relief states:

> The design configuration of the RPV nozzle-to-vessel welds precludes an ultrasonic examination of essentially 100 percent of the required volume. The component design configuration limits ultrasonic examination coverage of the welds to the percentages listed in Table 1.

(Note: Information from the licensee's Table 1 is included in the attached table.)

2.4 Alternative Examination

In lieu of the Code-required essentially 100 percent volume ultrasonic examination, TVA proposes an ultrasonic examination of accessible areas to the extent practical given the component design configuration of the RPV nozzle-to vessel welds and nozzle size.

2.5 Justification for the Granting of Relief

The licensee's justification for granting of relief states:

(1) The design configuration of the nine vessel-to-nozzle welds precludes an ultrasonic examination of essentially 100 percent of the required volume. Access to the vessel-to-nozzle welds is by a series of doorways in the concrete biological shield wall. Insulation behind these doorways is designed for removal around the nozzle circumference. In order to examine the welds in accordance with the Code requirement the RPV would require extensive design modifications. The physical arrangement of the nozzle-to-vessel welds precludes ultrasonic examination from the nozzle side. The limitations are inherent to the barrel-type nozzle-to-vessel weld design and is compounded by the close proximity of the biological shield wall.

Scanning from the nozzle surface is ineffective due to the weld location and the asymmetrical inside surface where the nozzle and vessel converge. Coverage was increased by scanning from the outside blend radius of the weld where practical. Experience from the automated ultrasonic examination performed from the inside surface has shown that the nozzle-to-vessel weld coverage will not be greatly improved even if performed from the inside surface utilizing the current state-of-the-art techniques.

The configuration of the nozzle-to-vessel welds precludes ultrasonic examination from the nozzle side due to the weld location and the asymmetric inside surface where the nozzle and vessel converge. The extent of examination coverage from the vessel side provides reasonable assurance that no flaws oriented parallel to the weld are present. The areas receiving little or no examination coverage are located toward the outside surface of the nozzle outside blend radius. (The blend radius restricts the scanning movement and/or transducer contact.) The reactor vessel inner-half of the thickness and inside surface are interrogated with the ultrasonic beam. Degradation located at the inside surface or inner half of the vessel would be located. It should be noted that the nozzle inside radius section received essentially 100 percent examination coverage for these nozzles.

(2) Radiographic examination as an alternate volumetric examination method was determined to be impractical due to the radiological concerns. Gaining access to the inside surface of the RPV to place radiographic film would require off-loading of the core and draining of the vessel below the welds to be examined. This would expose examination personnel to high radiation doses (in excess of 400 millrem per hour) due to the high radiation and contamination levels. Also, due to the varying thickness of the outside blend radius of the weld, several radiographs may be required of one area to obtain the required coverage and/or film density. The additional Code coverage gained by radiography is impractical when weighed against the radiological concerns.

Therefore, TVA concludes that performing an ultrasonic volumetric examination of essentially 100 percent of the nozzle-to-vessel full penetration welds in the RPV would be impractical. Further, it would also be impractical to perform other volumetric examinations (i.e. radiography) which may increase examination

coverage. A maximum extent ultrasonic examination of the subject areas provides an acceptable level of quality and safety. TVA concludes that significant degradation, if present, would have been detected during an ultrasonic examination performed to the maximum extent practical of the subject welds. As a result, reasonable assurance of operational readiness of the subject welds has been provided. Therefore, pursuant to 10 CFR 50.55a(g)(5)(iii), TVA requests that relief be granted for the BFN Unit 3, Second 10-Year Inservice Inspection interval.

3.0 STAFF'S EVALUATION

The Code requires 100 percent volumetric examination of the subject RPV nozzle-to-vessel welds. However, complete examination of these areas is limited by component configuration (i.e., outside blend radius and set-in barrel design) and adjacent physical obstructions (i.e., biological shield wall, thermocouples, and insulation supports). These restrictions limit access and make the Code coverage requirements impractical for the nine nozzle-to-vessel welds. To meet the Code coverage requirements, design modifications would be necessary to provide access for examination. Imposition of the Code requirements would result in an undue hardship on the licensee.

The licensee has performed the Code-required examinations to the extent practical and has maximized coverage by performing supplemental manual scans. As a result, coverages of 64 to 77 percent have been achieved for the subject nozzle-to-vessel welds. This level of coverage should have detected any existing patterns of degradation and provides reasonable assurance of the continued structural integrity for the RPV nozzles at BFN-3.

4.0 CONCLUSION

The staff evaluated the licensee's submittal and has concluded that the Code-required examinations are impractical to perform to the extent required by the Code. Furthermore, the examinations performed by the licensee provide reasonable assurance of the continued inservice structural integrity of the subject components. Therefore, Request for Relief No. 3-IS1-7 is granted pursuant to 10 CFR 50.55a(g)(6)(I). Granting the relief is authorized by law, will not endanger life, property, or the common defense and security, and is otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed.

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TABLE

WELD	PIPE SIZE	PERCENT COVERAGE	REMARKS
N1A (Recirc. Outlet)	28"	72%	Nozzle-to-Vessel Weld; 0, 45, and 60 degree auto scanning was restricted due to 1) nozzle configuration, and 2) biological shield wall obstruction. Supplemental manual scans were performed to increase coverage. No exams were performed from the nozzle side.
N2B (Recirc. Inlet)	12"	77%	Nozzle-to-Vessel Weld; 0, 45, and 60 degree auto scanning was restricted due to 1) nozzle configuration and 2) insulation support obstruction. Supplemental manual scans were performed to increase coverage. No exams were performed from the nozzle side.
N2D (Recirc. inlet)	12"	77%	Nozzle-to-Vessel Weld; 0, 45, and 60 degree auto scanning was restricted due to 1) nozzle configuration and 2) insulation support obstruction. Supplemental manual scans were performed to increase coverage. No exams were performed from the nozzle side.
N2F (Recirc. Inlet)	12"	77%	Nozzle-to-Vessel Weld; 0, 45, and 60 degree auto scanning was restricted due to 1) nozzle configuration and 2) insulation support obstruction. Supplemental manual scans were performed to increase coverage. No exams were performed from the nozzle side.
N3B (Main Steam)	26"	75%	Nozzle-to-Vessel Weld; 0, 45, and 60 degree auto scanning was restricted due to 1) nozzle configuration and 2) Flange obstruction, 3) Permanent insulation. Supplemental manual scans were performed to increase coverage. No exams were performed from the nozzle side
N4B (Feedwater)	12"	68%	Nozzle-to-Vessel Weld; 0, 43, and 60 deg auto scanning was restricted due to 1) nozzle configuration and 2) insulation support obstruction. Supplemental manual scans were performed to increase coverage. No exams were performed from the nozzle side.
N4C (Feedwater)	12"	68%	Nozzle-to-Vessel Weld; 0, 45, and 60 degree auto scanning was restricted due to 1) nozzle configuration, and 2) insulation support obstruction. Supplemental manual scans were performed to increase coverage. No exams were performed from the nozzle side.
N5A (Core Spray)	10"	64%	Nozzle-to-Vessel Weld; 0, 45, and 60 degree auto scanning was restricted due to 1) nozzle configuration and 2) insulation support obstruction. Supplemental manual scans were performed to increase coverage No exams were performed from the nozzle side.
N8A (Instrument Nozzle)	4"	71%	Nozzle-to-Vessel Weld; Due to the small size: (4-inch diameter) the examination was restricted to the manual technique utilizing a 0, 45, and 60 degree shear wave. No examinations were performed from the nozzle side.