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

February 25, 2010

Mr. R. M. Krich
Vice President, Nuclear Licensing
Tennessee Valley Authority
3R Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

SUBJECT: BROWNS FERRY NUCLEAR PLANT, UNIT 2 - SAFETY EVALUATION FOR RELIEF REQUEST 2-ISI-19, REVISION 1, FOR THE THIRD 10-YEAR INSERVICE INPSECTION INTERVAL (TAC NO. ME0764)

Dear Mr. Krich:

By letter dated March 2, 2009, the Tennessee Valley Authority (TVA, the licensee) submitted a request to the Nuclear Regulatory Commission (NRC) for relief from certain requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI, "Rules for Inservice Inspection [ISI] of Nuclear Power Plant Components," at the Browns Ferry Nuclear Plant, Unit 2. Specifically, the licensee requested relief on the basis that the ASME Code requirements are impractical regarding examination coverage for several welds that were nondestructively examined during the second period of the third 10-year ISI interval. The licensee provided additional information by letter dated September 17, 2009.

Pursuant to Title 10 of the *Code of Federal Regulations* 50.55a(g)(6)(i), the NRC staff reviewed TVA's request and determined that the ASME Code requirements are impractical for the subject welds. Furthermore, the staff concluded that the examinations performed by the licensee provide reasonable assurance of structural integrity of the welds. Therefore, the NRC staff grants relief for the remainder of the third 10-year ISI interval.

Sincerely,

Brenda Mozafari

Brenda L. Mozafari, Chief (Acting)
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-260

Enclosure:
Safety Evaluation

cc w/enclosure: Distribution via Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

THIRD 10-YEAR INSERVICE INSPECTION INTERVAL

RELIEF REQUEST 2-ISI-19, REVISION 1

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT, UNIT 2

DOCKET NO. 50-260

1.0 INTRODUCTION

By letter dated March 2, 2009, the Tennessee Valley Authority (TVA, the licensee) submitted a request to the Nuclear Regulatory Commission (NRC) for relief from certain requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI, "Rules for Inservice Inspection [ISI] of Nuclear Power Plant Components," at the Browns Ferry Nuclear Plant, Unit 2 (BFN-2). Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g)(5)(iii), the licensee requested relief on the basis that the ASME Code requirements are impractical regarding examination coverage for several welds that were nondestructively examined during the second period of the third 10-year ISI interval. By letter dated September 17, 2009, the licensee provided additional information in response to a request by the NRC.

2.0 REGULATORY REQUIREMENTS

Inservice inspection of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code, and applicable addenda, as required by 10 CFR 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). It is stated in 10 CFR 50.55a(a)(3) that alternatives to the requirements of 10 CFR 50.55a(g) may be used, when authorized by the NRC, if the licensee demonstrates that (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 difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), 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, 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, which was 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 ASME Code of record for BFN-2, third 10-year interval ISI program, which began on May 25, 2001, is the 1995 Edition through the 1996 Addenda.

3.0 EVALUATION

3.1 ASME Code Requirement

ASME Code, Section XI, Examination Category B-D, Item B3.90 requires 100 percent volumetric examination, as defined by ASME Code, Section XI, Figures IWB-2500-7(a) through (d), as applicable, of reactor pressure vessel (RPV) nozzle-to-vessel welds. ASME Code Case N-460, "Alternative Examination Coverage for Class 1 and Class 2 Welds," as an alternative approved for use by the NRC in Regulatory Guide (RG) 1.147, Revision 15, "Inservice Inspection Code Case Acceptability, Section XI, Division 1," states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10 percent (i.e., greater than 90 percent examination coverage is obtained).

3.2 Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from examining 100 percent of the ASME Code-required inspection volumes for the RPV nozzle-to-shell welds shown below, based on the extent of coverage that was obtained during the examination.

ASME Code, Section XI, Examination Category B-D Welds		
Weld No.	**Weld Configuration**	**Volumetric Coverage Obtained**
N6A-NV	Nozzle-to-Head Weld	36.6%
N1B-NV	Nozzle-to-Vessel Weld	31%
N2A-NV	Nozzle-to-Vessel Weld	44%
N2B-NV	Nozzle-to-Vessel Weld	44%
N2C-NV	Nozzle-to-Vessel Weld	44%
N2D-NV	Nozzle-to-Vessel Weld	44%
N2G-NV	Nozzle-to-Vessel Weld	44%
N2H-NV	Nozzle-to-Vessel Weld	50%
N2K-NV	Nozzle-to-Vessel Weld	44%
N3A-NV	Nozzle-to-Vessel Weld	41%
N3B-NV	Nozzle-to-Vessel Weld	41%
N3C-NV	Nozzle-to-Vessel Weld	41%

ASME Code, Section XI, Examination Category B-D Welds		
Weld No.	**Weld Configuration**	**Volumetric Coverage Obtained**
N4B-NV	Nozzle-to-Vessel Weld	44%
N4C-NC	Nozzle-to-Vessel Weld	44%
N4E-NV	Nozzle-to-Vessel Weld	44%
N4F-NV	Nozzle-to-Vessel Weld	44%
N5A-NV	Nozzle-to-Vessel Weld	27%
N5B-NV	Nozzle-to-Vessel Weld	27%
N7-NV	Nozzle-to-Vessel Weld	69%
N9-NV	Nozzle-to-Vessel Weld	40%

3.3 Licensee Basis for Relief

The licensee stated that performing 100 percent ultrasonic (UT) examination of the subject welds in the RPV, as required by ASME Code, would be impractical. The physical arrangement of the nozzle-to-vessel welds precludes UT examination of essentially the 100 percent of the required examination volumes. Access to the nozzle-to-vessel welds is through several doorways in the concrete biological shield wall. The limitations result from the barrel-type nozzle-to-vessel weld design and are compounded by the close proximity of the biological shield wall. Extensive modifications would be required in order for the licensee to examine the subject welds in accordance with ASME Code requirements.

The licensee stated that scanning from the nozzle surfaces was ineffective due to the location of the welds and the asymmetrical inside surfaces where the nozzles and vessel meet. The licensee increased coverage by scanning from the outside blend radius of the welds when practical. The licensee further stated that experience taken from the automated UT examination done from the inside surfaces has shown that the coverage of the subject welds would not be greatly enhanced even if the examination was performed from the inside surfaces using the latest state-of-the-art methods. The licensee determined that radiographic (RT) examination as an alternate volumetric method would be impractical due to radiological concerns including (1) gaining access to the inside surface of the RPV to place radiographic film, and (2) the need to use several radiographs for each areas to obtain the required coverage and/or film density due to the varying thickness at the outside blend radius of the welds. The licensee determined that the benefits of achieving the additional ASME Code volume examination coverage do not justify exposure to the radiological concerns.

The licensee performed UT examination on the accessible areas of the nozzle-to-vessel welds to the maximum extent practical due to the configuration. Areas receiving little or zero examination coverage are located on the outside surface of the RPV in the area of the nozzle inside bend radius, where the bend radius limits the scanning movement and/or transducer contact. However, the inner-half of the RPV thickness and inside surface are observed with the UT beam, providing essentially 100 percent examination coverage of the nozzle inside radius sections.

The licensee determined that performance of the UT examination of the subject areas to the maximum extent practical provides an acceptable level of quality and safety because the information and data obtained from the volume examined provides sufficient information to judge the overall integrity of the piping welds. The licensee concluded that the extent of examination coverage from the RPV side provides reasonable assurance that no flaws oriented parallel to the welds are present.

3.4 Licensee's Proposed Alternative Examination

The licensee did not propose alternative examinations. Instead of the ASME Code-required 100 percent volumetric examination, TVA proposed UT examination of accessible areas to the maximum extent practical, given the component design configuration of the RPV nozzle-to-vessel welds.

3.5 Staff Evaluation

The ASME Code requires 100 percent volumetric examination of full penetration welded nozzles in the RPV. However, examinations of the subject nozzle welds are limited by the design and outside diameter (OD) surface curvature of the nozzles. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, Revision 15, states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10 percent (i.e., greater than 90 percent examination coverage is obtained). The nozzles are of the "set-in" design, which essentially makes the welds concentric rings aligned parallel with the nozzle axes in the through-wall direction of the RPV shell. This design geometry limits ASME Code-required UT angle beam examinations to generally be performed only from the shell side of these nozzle-to-vessel welds. In addition, the nozzle blend radii (OD curvature) restrict scanning on many of the subject nozzles. In order for the licensee to obtain the required coverage, the nozzles and/or the RPV would need to be redesigned and modified. This would place a burden on the licensee. Therefore, the licensee has shown that it is impractical to meet the ASME Code-required volumetric examination coverage for the subject welds due to their design.

The licensee's examinations were conducted using UT examination personnel, procedures and equipment were qualified through the industry's Performance Demonstration Initiative to meet ASME Code, Section XI, Appendix VIII requirements. The examinations involved several angle beam methods, developed through modeling of the weld geometries and sound beam projections as performed by the Electric Power Research Institute, for each BFN-2 nozzle OD UT examination. To maximize coverage, the techniques applied included both shear and refracted longitudinal methods from the RPV side of the welds, and onto the blend radius areas, where feasible. Thus, the examinations encompassed most of the weld and base materials near the inside surface of the vessel/nozzle, which is the location inservice degradation would be expected to initiate if it were occurring. Although UT scans were primarily limited to the shell side, recent studies have found that inspections conducted through carbon steel are equally effective whether the UT waves propagate just through the base metal, or also propagate through the carbon steel weldment. The licensee observed recordable flaw indications on Nozzles N2G-NV and N9-NV; these indications were evaluated in accordance with ASME Code flaw acceptance standards and were found to be acceptable. No other flaws were noted on any of the remaining nozzles.

Based on the sketches and technical descriptions included in the licensee's submittal, the NRC staff concludes that the licensee performed the examinations of the subject nozzles to the extent practical. The licensee obtained volumetric coverage ranging from approximately 27 percent to 69 percent. Based on the aggregate coverage obtained for these RPV nozzle-to-vessel welds and the licensee's UT examination techniques, the staff concludes that if significant service-induced degradation had occurred, it would have been detected by the licensee's examinations. Thus, the examinations were performed to the extent practical and provide reasonable assurance of structural integrity of the subject welds.

4.0 CONCLUSION

As set forth above, the NRC staff determined that it is impractical for the licensee to comply with the ASME Code requirements for examination coverage of the subject welds, and the examinations performed by the licensee provide reasonable assurance of structural integrity of the subject welds. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(6)(i), and is in compliance with the ASME Code's requirements. Therefore, the NRC staff grants Relief Request RR 2-ISI-19, Revision 1, at BFN-2 for the third 10-year ISI interval.

Granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property, or the common defense and security, and is otherwise in the public interest given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: T. McLellan

Date: February 25, 2010

Mr. R. M. Krich
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Sincerely,

/RA/

Brenda L. Mozafari, Chief (Acting)
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
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Enclosure:
Safety Evaluation

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