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

February 3, 2011

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-18, REVISION 2, FOR THE THIRD 10-YEAR INSERVICE INPSECTION INTERVAL (TAC NO. ME3442)

Dear Mr. Krich:

By letter dated February 24, 2010, the Tennessee Valley Authority (TVA, the licensee) submitted a request to the Nuclear Regulatory Commission (NRC) for relief from certain inservice inspection (ISI) requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," at the Browns Ferry Nuclear Plant (BFN), Unit 2. Specifically, the licensee has determined that three BFN Unit 2 welds had nondestructive examination coverage limitations (less than 90 percent coverage completed) that exceed that specified in ASME Code Case N-460, "Alternative Examination Coverage for Class 1 and Class 2 Welds, Section XI, Division 1." TVA proposed an ultrasonic examination of accessible areas to the maximum extent practical, given the component design configuration.

Based on our review of your submittal, the NRC staff has determined that it is impractical for the licensee to meet the ASME Code, Section XI examination requirements for the subject welds, including the alternative examination coverage discussed in Code Case N-460. The NRC staff concludes that the proposed alternative provides reasonable assurance of structural integrity. Therefore, granting relief pursuant to Title 10 of the *Code of Federal Regulations*, Section 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.

These reliefs are authorized for the remainder of the third 10-year ISI interval at BFN Unit 2, which began May 25, 2001, and ends May 24, 2011.

Sincerely,

Douglas A. Broaddus, Chief
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-18, REVISION 2

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT, UNIT 2

DOCKET NO. 50-260

1.0 INTRODUCTION

By letter dated February 24, 2010 (Agencywide Document Access and Management System (ADAMS) ML100570413), the Tennessee Valley Authority (TVA, the licensee) submitted Relief Request (RR) 2-ISI-18, Revision 2, requesting relief from certain inservice inspection (ISI) requirements specified in the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," for three Class 1, Category R-A piping welds. In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g)(5)(iii), the request proposes relief from the requirement of Code Case N-577, N-577-2500 Table 1, Examination Category R-A, Item Number R1.16, to perform an essentially 100-percent volumetric examination of the weld and adjacent base material.

The subject relief request is for the Third 10-Year ISI Interval Program at the Browns Ferry Nuclear Plant (BFN), Unit 2 which began on May 25, 2001, and ends on May 24, 2011.

2.0 REGULATORY REQUIREMENTS

The U.S. Nuclear Regulatory Commission (NRC) regulations in 10 CFR 50.55a(g) specify that ISI of nuclear power plant components shall be performed in accordance with the requirements of the ASME Code, Section XI, except where specific written relief has been granted by the NRC pursuant to 10 CFR 50.55a(g)(6)(i). As stated in 10 CFR 50.55a(g)(6)(i), the NRC may grant such relief and may impose such alternative requirements as it determines 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 the consideration of the burden upon the licensee. As stated in 10 CFR 50.55a(a)(3), 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 difficulty without a compensating increase in the level of quality and safety. As stated in 10 CFR 50.55a(g)(5)(iii), if the licensee has determined that conformance with certain code requirements is impractical for its facility, the licensee shall notify the NRC and submit, as specified in §50.4, information to support the determinations.

ENCLOSURE

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 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 ISI 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.

3.0 TECHNICAL EVALUATION

3.1 Applicable Code Edition and Addenda

The code of record for the third 10-year ISI program at BFN Unit 2 is the 1995 Edition with the 1996 Addenda of the ASME Code, Section XI.

3.2 Applicable Code Requirement

The examination requirements for the subject piping welds at BFN Unit 2 are governed by a Risk-Informed Inservice Inspection (RI-ISI) program that was developed in accordance with WCAP-14572, Rev. 1-NP-A, "Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report (WCAP)." As part of the NRC-approved program, the licensee has implemented the inspection requirements listed in ASME Code Case N-577, "Risk-Informed Requirements for Class 1, 2 and 3 Piping, Method A." Code Case N-577, N-577-2500 Table 1, Examination Category R-A, Item Number R1.16, piping inspection elements subject to intergranular stress corrosion cracking (IGSCC), requires volumetric examination of 100 percent of the weld and adjacent base material as depicted in Figure IWB-2500-8(c).

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 1.147, Revision 15, "Inservice Inspection Code Case Acceptability," 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).

3.3 Components for Which Relief is Requested

Code Class:	Class 1
Examination Category:	R-A
Description:	Two Reactor Recirculation (RECIRC) System full penetration piping welds, and one Reactor Water Cleanup (RWCU) System full penetration piping weld, as described below:

Weld	System	Configuration (Materials)	Coverage Obtained
RWCU-2-003-025	RWCU	Pipe (SA 376, TP 316 NG, S.S.) to Valve (SA351, CF8M, S.S.)	50 percent
GR-2-22	RECIRC	Pipe Saddle (A403, WP304 S.S.) to Pipe (A358, TP304 S.S.)	50 percent
GR-2-35	RECIRC	Pipe Saddle (A403, WP304 S.S.) to Pipe (A358, TP304 S.S.)	50 percent

3.4 Licensee Basis for Relief:

The licensee stated that the welds were examined with the latest ultrasonic testing (UT) techniques, procedures, equipment, and personnel qualified to the requirements of the Performance Demonstration Initiative (PDI) Program, as mandated by 10 CFR 50.55a(g)(4).

The licensee stated that an ultrasonic examination was performed on the piping welds to the maximum extent practical due to the configuration. Coverage credit for the one-sided examination of GR-2-22, GR-2-35 and RWCU 2-003-025 was limited to 50-percent because of the requirement in 10 CFR 50.55a(b)(2)(xv)(A)(2), which states in part, "Where examination from both sides is not possible on austenitic welds, full coverage credit from a single side may be claimed only after completing a successful single-sided Appendix VIII demonstration using flaws on the opposite side of the weld." At time of the examination, there was no ASME Code, Section XI, Appendix VIII program for single sided austenitic welds.

The licensee stated that coverage for the UT of Weld RWCU-2-003-025 was limited due to the pipe-to-valve joint configuration. Weld contour prevented scanning on the weld surface in the axial direction to achieve full interrogation of the required examination volume. Fifty-percent ASME Code-required coverage was obtained using 45-degree shear waves for the circumferential scans and 45- and 70-degree shear waves for the axial scans.

The licensee stated that coverage for the UT of Weld GR-2-22 was limited due to saddle-to-pipe component configuration and the requirement in 10 CFR 50.55a(b)(2)(xv)(A)(2), that requires UT of one side of austenitic stainless steel welds to be qualified to the ASME Code, Section XI, Appendix VIII Program to claim full Code coverage. Fifty-percent ASME Code-required coverage was obtained using 45-degree shear waves for the circumferential scans and 45-degree shear and 60-degree refracted longitudinal waves for the axial scans.

The licensee stated that coverage for the UT of Weld GR-2-35 was limited due to saddle-to-pipe component configuration and the requirement in 10 CFR 50.55a(b)(2)(xv)(A)(2), that requires UT of one side of austenitic stainless steel welds to be qualified to the ASME Code, Section XI, Appendix VIII program to claim full ASME Code coverage. Fifty-percent ASME Code-required coverage was obtained using 45-degree shear waves for the circumferential scans and 45-degree shear and 60-degree refracted longitudinal waves for the axial scans.

The licensee states that the performance of UT 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.

3.5 Licensee's Proposed Alternative Examination

In lieu of the ASME Code-required essentially 100 percent (i.e., greater than 90 percent) volumetric examination, TVA proposes an UT of accessible areas to the maximum extent practical, given the component design configuration of the aforementioned piping welds.

3.6 Duration of Proposed Alternative

The proposed alternative is requested for the remainder of the third 10-year ISI interval for BFN Unit 2, which ends May 24, 2011.

4.0 STAFF EVALUATION

The examination requirements for the subject piping welds at BFN Unit 2 are governed by a RI-ISI program that was approved by the NRC in a safety evaluation report dated January 19, 2001 (ADAMS ML010190294). This program assigns Examination Category R-A, Item R1.16 to piping elements subject to IGSCC, and requires inspection of 100 percent of the examination volume for Class 1 circumferential piping welds. However, the subject piping weld configurations and base materials limit volumetric examinations. In order to meet the RI-ISI program volumetric coverage requirements, these components would have to be re-designed and modified. Therefore, 100-percent volumetric examination is considered impractical for the subject piping welds.

TVA has determined that certain BFN Unit 2 welds had UT coverage limitations of less than 100 percent of the ASME Code-required weld and adjacent material volume(s). The limitations encountered during the performance of the UT on the subject welds were caused by pipe-to-valve and saddle-to-pipe component configurations (see table above). These configurations severely limit volumetric examinations and result in access to only a single side of the weld. As shown on the sketches and technical descriptions included in the licensee's submittal, examinations of the subject piping welds have been completed to the extent practical resulting in an aggregate volumetric coverage of approximately 50 percent of the ASME Code-required volume.

The licensee used personnel, procedures and equipment qualified through the industry's PDI Program to perform the UT. Examinations included 45- and 70-degree shear wave and 60-degree refracted longitudinal wave techniques, as applicable, from the accessible sides of these welds. The refracted longitudinal (RL) wave method is capable of detecting planar inside diameter surface-breaking flaws on the far-side of wrought stainless steel welds. Recent studies[1,2] recommend the use of both shear and RL waves to obtain the best detection results, with minimum false calls, in austenitic welds. No recordable flaw indications were observed during the UTs.

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1 Ammirato, F.V., X. Edelmann, and S.M. Walker, *Examination of Dissimilar Metal Welds in BWR Nozzle-to-Safe End Joints*, 8th International Conference on NDE in the Nuclear Industry, ASM International, 1987.

2 Lemaitre, P., T.D. Koble, and S.R. Doctor, *PISC III Capability Study on Wrought-to-Wrought Austenitic Steel Welds: Evaluation at the Level of Procedures and Techniques*, Effectiveness of Nondestructive Examination Systems and Performance Demonstration, PVP-Volume 317, NDE-Volume 14, ASME, 1995.

The licensee has shown that it is impractical to meet the ASME Code-required 100-percent volumetric examination coverage for the subject piping welds due to their design and access restrictions during UT. Although the ASME Code-required coverage could not be obtained, the methods employed during the UT provided full volumetric coverage for the near-side of the welds and limited volumetric coverage for the weld fusion zone and base materials on the opposite side of the welds. Based on the aggregate coverage obtained for the subject welds, and considering the licensee's performance of ultrasonic techniques used to maximize this coverage, it is reasonable to conclude that if significant service-induced degradation were occurring, evidence of it would have been detected by the examinations that were performed. Therefore, the NRC staff concludes that the proposed alternative provides reasonable assurance of structural integrity of the subject welds.

5.0 CONCLUSIONS

The NRC staff has reviewed the licensee's submittal and concludes that the ASME Code examination coverage requirements are impractical for the subject welds listed in the RR 2-ISI-18, Revision 2. Further, based on the volumetric coverage obtained, the staff concluded that, if significant service-induced degradation were occurring, there is reasonable assurance that evidence of it would have been detected by the examinations that were performed. Consequently, the NRC staff finds that the proposed alternative provides reasonable assurance of structural integrity. Therefore, for the items in RR 2-ISI-18, Revision 2, relief is granted pursuant to 10 CFR 50.55a(g)(6)(i) for the Third 10-year ISI interval at BFN Unit 2.

The NRC staff has determined that granting relief for RR 2-ISI-18, Revision 2, 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 in the subject request for relief remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: C. Nove

Date: February 3, 2011

These reliefs are authorized for the remainder of the third 10-year ISI interval at BFN Unit 2, which began May 25, 2001, and ends May 24, 2011.

Sincerely,

/RA/

Douglas A. Broaddus, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-260

Enclosure:
Safety Evaluation

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