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

May 21, 2014

Mr. Joseph W. Shea
Vice President, Nuclear Licensing
Tennessee Valley Authority
1101 Market Street, LP 3D-C
Chattanooga, Tennesee, TN 37402-2801

SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT NO. 2 – RELIEF FROM THE REQUIREMENTS OF THE ASME CODE TO UTILIZE HEAT EXCHANGER MECHANICAL PLUGS PER ASME CODE CASE N-836 (TAC NO. MF3462)

Dear Mr. Shea:

By letter dated February 10, 2014, the Tennessee Valley Authority (TVA) submitted a request to the Nuclear Regulatory Commission (NRC) to use an alternative to certain requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section III at the Watts Bar Nuclear Plant (WBN), Unit 2.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Section 55a(a)(3)(i), TVA requested to use the proposed alternative on the basis that the alternative provides an acceptable level of quality and safety. The proposed alternative is based on ASME Code Case N-836, "Heat Exchanger Tube Mechanical Plugging, Class 1, Section III, Division 1." TVA has installed mechanical plugs in the steam generators that are typically installed under ASME Code Section XI for operating plants, not plants that are under construction such as WBN Unit 2.

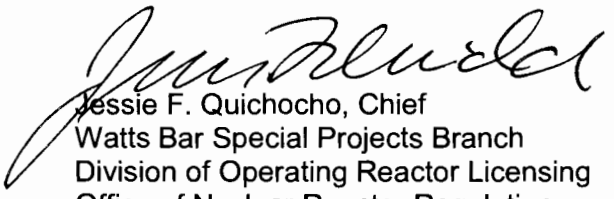
The NRC staff determines that the proposed alternative, based on ASME Code Case N-836 provides an acceptable level of quality and safety for the repair of steam generator tubes. Accordingly, the NRC staff concludes that TVA has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(i) and, therefore, authorizes use of the proposed alternative at WBN Unit 2 until such time as the WBN Unit 2 steam generator ASME N-1 Code Data Reports are completed, the steam generators are ASME stamped, and the Reactor Coolant System N-5 Code Date Package is completed.

The NRC's authorization of the relief request does not constitute NRC's approval of ASME Code Case N-836 for the generic application.

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

If you have any questions, please contact the Project Manager, Justin Poole at 301-415-2048 or via e-mail at Justin.Poole@nrc.gov.

Sincerely,



Jessie F. Quichocho, Chief
Watts Bar Special Projects Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-391

Enclosure:
Safety Evaluation

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UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF TO UTILIZE HEAT EXCHANGER MECHANICAL PLUGS

PER ASME CODE CASE N-836

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT, UNIT NO. 2

DOCKET NO. 50-391

1.0 INTRODUCTION

By letter dated February 10, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14045A299), Tennessee Valley Authority (TVA) requested to use an alternative from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section III, to allow installation of mechanical plugs in Class 1 heat exchangers (i.e., the steam generators) at Watts Bar Nuclear Plant (WBN), Unit 2.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Section 55a(a)(3)(i), TVA requested to use the proposed alternative on the basis that the alternative provides an acceptable level of quality and safety. The proposed alternative is based on ASME Code Case N-836, "Heat Exchanger Tube Mechanical Plugging, Class 1, Section III, Division 1." TVA has installed mechanical plugs in the steam generators that are typically installed under ASME Code Section XI for operating plants, not plants that are under construction such as WBN Unit 2.

2.0 REGULATORY EVALUATION

As stated in 10 CFR 50.55a, systems and components of nuclear power reactors must meet the requirements of the ASME Code. The WBN Unit 2 steam generators were designed and constructed to meet ASME Section III 1971 Edition through 1971 Addenda, as the Code-of-Record.

ASME Code, Section III, Section NB, provides requirements for the construction, fabrication, examination, and testing of plugs that are used on heat exchangers (e.g., steam generators).

It specifies in 10 CFR 50.55a(g)(2) that a boiling or pressurized water-cooled nuclear power facility whose construction permit was issued on or after January 1, 1971, but before July 1, 1974, components (including supports), which are classified as ASME Code Class 1 and Class 2 must be designed and be provided with access to enable the performance of inservice

examination of such components (including supports) and must meet the preservice examination requirements of ASME Section XI.

Pursuant to 10 CFR 50.55a(g)(4), *Inservice Inspection Requirements*, ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and access provisions and the pre-service 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 inspection interval and subsequent 10-year inspection 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 inspection interval, subject to the conditions listed therein.

Paragraph 55a(a)(3) of 10 CFR 50 states, in part, that alternatives to the requirements of 10 CFR 50.55a(g) may be used, when authorized by the Nuclear Regulatory Commission (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.

Based on analysis of the regulatory requirements, the staff finds that the NRC has the regulatory authority to authorize the proposed alternative on the basis that it provides an acceptable level of quality and safety. Accordingly, the staff has reviewed TVA's proposed alternative pursuant to 10 CFR 50.55a(a)(3)(i).

3.0 TECHNICAL EVALUATION

3.1 TVA's Request for Alternative

The affected components are the Alloy 690 mechanical plugs that have been installed in tubes of the WBN Unit 2 steam generators. The WBN Unit 2 steam generators were designed and constructed to meet ASME Section III 1971 Edition through 1971 Addenda.

TVA proposed using Code Case N-836 as an alternative to installing welded plugs into the steam generators. This Code Case explicitly authorizes a Nuclear Certificate Holder to use mechanical plugs to plug tubes of ASME Section III Division 1, Class 1 heat exchangers, in addition to welded plugs currently allowed by ASME Section III.

TVA proposed the subject relief request to permit those mechanical plugs that have already been installed in the WBN Unit 2 steam generators to remain in place, and to permit the use of mechanical plugs in steam generator tubes in the future. TVA stated that the proposed mechanical plugs are the same design of Westinghouse "ribbed" mechanical plugs that are installed in the steam generators of many operating plants in the U.S. and international nuclear fleet. These plugs have been in use for over three decades and there have not been any observed failures of these plugs.

The first 10-year inservice inspection (ISI) interval has not yet started for WBN Unit 2; however, the preferred method of plugging steam generator tubes in service (under ASME Section XI) is

by mechanical means, rather than using a welded plug. The steam generators at WBN Bar Unit 2 are under the requirements of ASME Section III, Division 1, Class 1 heat exchangers during construction. Initially, Westinghouse used ASME Code Interpretation III-1-10-20 (dated May 11, 2010) as a basis to install mechanical plugs into the steam generators at WBN Unit 2. In addition to meeting the requirements of ASME Section III Division 1 and Code Interpretation III-1-10-20, Westinghouse complied with the qualification process delineated in Section XI, IWA-4713, "Heat Exchanger Tube Plugging by Expansion," for the mechanical plugs.

While performing inspections at WBN, the Authorized Inspection Agency noted that the plugs, if installed under ASME Code Interpretation III-1-10-20, might not meet all the requirements of ASME Section XI. The wording of Interpretation III-1-10-20 is such that a Certificate Holder could do less than the current requirements of ASME Section XI, IWA-4713.

After review, the ASME Section XI Code Committee deemed it unacceptable to use ASME Code Interpretation III-1-10-20 to install mechanical plugs in an ASME Section III component, when the mechanical plugs actually did meet the qualification requirements of the ASME Section XI process. Therefore, the industry proposed that an ASME Section III Code Case be used in place of Code Interpretation III-1-10-20.

ASME Code Case N-836 requires that the provisions of Section XI, 2007 Edition with the 2008 Addenda and the 2013 Edition, IWA-4713, Heat Exchanger Tube Plugging by Expansion, shall be met, except for IWA-4713.1(a) and IWA-4713.5. These exceptions are discussed below.

IWA-4713.1(a) states, "Plugs shall meet the requirements of IWA-4200." IWA-4200 defines the requirements for items used for ASME Section XI repair or replacement activities as opposed to ASME III Construction of new components. Because the WBN Unit 2 steam generators are governed by ASME Section III Division 1 Section NB, Code Case N-836 states that the mechanical plug's pressure-retaining material shall comply with the requirements of Subsection NB. Specifically, the Code Case states, "this material shall meet the requirements of SB-166, UNS N06690." This requirement ensures that thermally treated Alloy 690 material is used to plug the Alloy 600 tubes. The Alloy 690 material provides increased stress corrosion cracking resistance over Alloy 600 tube plug material. TVA used the 1989 Edition of ASME Section III, along with ASME Code Case N-474-1, "Design Stress Intensities and Yield Strength Values for UNS N06690 with a Minimum Specified Yield Strength of 35 ksi, Class 1 Components, Section III, Division 1," March 5, 1990, to meet the requirement for using Alloy 690 mechanical plugs.

IWA-4713.5 states, "The following records, in addition to those required by IWA-6000 (ASME Section XI Records and Reports), shall be maintained by the Owner:

(a) Plugging Procedure Specifications
(b) record of procedure qualification for the plugging method, including the essential variables and results of all tests required by IWA-4713.3
(c) record of performance qualification for each individual, including the PPS number and revision
(d) Certified Material Test Report for installed plugs
(e) location of all plugged tubes

(f) results of post-installation examinations and evaluations
(g) evaluations performed in accordance with IWA-4713.3(a)(4)"

As the construction activities of the WBN Unit 2 steam generator are governed by ASME Section III Division 1 Section NB, Code Case N-836 restates the IWA-4713.5 requirements with minor changes, so that the requirements of both ASME Section III Division 1 and ASME Section XI are met. The distinctions between ASME Section III Division 1 and ASME Section XI are shown in the bold text below:

"The following records, in addition to those required by **NCA-4134.17**, shall be maintained by **the Certificate Holder and transferred to the Owner as required by Section III**:

(1) plugging procedure specification (PPS)
(2) records of procedure qualification for the plugging method, including the essential variables and results of all tests required by IWA-4713.3
(3) records of performance qualification for each operator, including the PPS, identification, such as number and revision
(4) certified material test reports for the **pressure-retaining portion of** the installed plugs
(5) **identification of all plugged tubes as shown in final drawings for the heat exchanger**
(6) results of post installation examinations and evaluations
(7) evaluations performed in accordance with IWA-4713.3(a)(4)"

ASME Code Committees approved Code Case N-836 on October 22, 2013, and it is now part of Supplement 3 to the 2013 ASME Edition Code Cases. However, the NRC has not approved the code case in NRC Regulatory Guide 1.84, "Design, Fabrication, and Materials Code Case Acceptability, ASME Section III," and thus, it is not available for application at nuclear power plants without specific NRC approval.

TVA's commitment stated that, "Application of the provisions of this request will commence upon approval of this relief request and site approval of implementing instructions and will continue until such time as the WBN Unit 2 Steam Generator N-1 Code Data Report and Reactor Coolant System N-5 Code Data Report are completed and signed by the responsible Certificate Holder, or the use of the Code Case is no longer necessary, nor allowed, in accordance with the provisions of the Code Case. Should the NRC impose additional requirements, they will be implemented prior to completion of the Reactor Coolant System N-5 Code Data Report."

3.2 NRC Staff Evaluation

The NRC staff's review of this request was based on 10 CFR 50.55a(a)(3)(i), on the basis that the proposed alternative provides an acceptable level of quality and safety.

ASME Code Case N-836 contains the specific requirements in IWA-4713 of ASME Section XI, regarding the general requirements, plugging procedure specification, plug and procedure qualification, plugging performance qualification, and records retention; and also contains the specific requirements in NCA-4134.17 of ASME Section III, regarding plug material and records retention. In areas where ASME Section III and Section XI have different requirements, Code

Case N-836 provides provisions that meet the requirements for both Sections XI and III of the ASME Code.

Mechanical plugs consist of a cylindrical shell with one closed end and one open end. The shell is inserted into the end of a steam generator tube and mechanically expanded until the outside diameter of the shell makes firm mechanical contact with the inside diameter of the tube. The contact area between the shell and the tube is what seals the tube. Plugs are used in both ends of a steam generator tube to remove the tube from service.

To qualify for 10 CFR 50.55a(a)(3)(i), a proposed alternative needs to provide an acceptable level of quality and safety. In this instance, "acceptable" is interpreted by the staff to mean "equivalent." Because of the extensive, successful, operational experience that industry has with this type of mechanical plug, and because the qualification, testing, and recording requirements of Code Case N-836 have been designed to provide an equivalent level of quality and safety that meets the requirements of both Section XI and Section III, the NRC staff finds that TVA's proposal is consistent with the requirements of 10 CFR 50.55a(a)(3)(i).

TVA proposes to apply the provisions of this relief request upon approval and to continue until 1) the WBN Unit 2 Steam Generator ASME N-1 Code Data Reports are completed, 2) the Steam Generators are ASME stamped, and 3) the Reactor Coolant System N-5 Code Date Package is completed. The NRC staff finds this acceptable because once TVA satisfies these three conditions, the construction of WBN Unit 2 is complete and the steam generator components will automatically transition from the purview of ASME Code Section III to ASME Code Section XI. Under ASME Code Section XI, use of mechanical plugs is permitted, so long as TVA does not request relief from ASME Code Section XI with regard to the use of the plugs. At that time, this relief request is no longer needed. The NRC staff also finds the commitment made by TVA acceptable for the same reason (i.e., construction is complete and the components transition from the purview of ASME Code Section III to ASME Code Section XI).

4.0 CONCLUSION

As set forth above, the NRC staff determines that the proposed alternative, based on ASME Code Case N-836, provides an acceptable level of quality and safety for the repair of steam generator tubes. Accordingly, the NRC staff concludes that TVA has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(i) and, therefore, authorizes use of the proposed alternative at WBN Unit 2 until such time as the WBN Unit 2 steam generator ASME N-1 Code Data Reports are completed, the steam generators are ASME stamped, and the Reactor Coolant System N-5 Code Date Package is completed.

The NRC's authorization of the relief request does not constitute NRC's approval of ASME Code Case N-836 for the generic application.

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

Principal Contributor: Andrew Johnson

Date: May 21, 2014

If you have any questions, please contact the Project Manager, Justin Poole at 301-415-2048 or via e-mail at Justin.Poole@nrc.gov.

Sincerely,

/RA/

Jessie F. Quichocho, Chief
Watts Bar Special Projects Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-391

Enclosure:
Safety Evaluation

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