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

April 26, 2016

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

SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT 2 – RELIEF FROM THE REQUIREMENTS OF THE ASME CODE FOR REACTOR PRESSURE VESSEL FLANGE SEAL LEAKOFF PIPING (CAC NO. MF7038)

Dear Mr. Shea:

By letter dated October 30, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15303A546), as supplemented by letter dated February 29, 2016 (ADAMS Accession No. ML16060A438), Tennessee Valley Authority (TVA) submitted a request to the U.S. Nuclear Regulatory Commission (NRC) for the use of an alternative to certain American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (B&PV Code), Section XI requirements at the Watts Bar Nuclear Plant (WBN), Unit 2. TVA requested an alternative test plan in lieu of certain inservice inspection (ISI) requirements of the 2007 Edition through 2008 Addenda of the ASME B&PV Code, Section XI, for the ISI program at WBN, Unit 2, during the first 10-year ISI program interval, which is currently scheduled to begin in 2016.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(z)(2), TVA requested to use an alternative system leakage test (ISPT-02) of the reactor pressure vessel (RPV) head flange seal leakoff piping on the basis that complying with the specified requirement would result in hardship or unusual difficulty.

The NRC staff finds that the proposed alternative described in alternative request ISPT-02 provides reasonable assurance of structural integrity and leak tightness of the RPV head flange seal leakoff piping. The NRC staff finds that complying with the specified ASME B&PV Code requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that TVA has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the NRC staff authorizes the proposed alternative in request ISPT-02 for the first ISI interval at WBN, Unit 2, currently scheduled to begin in 2016.

If you have any questions, please contact the project manager, Robert Schaaf, at 301-415-6020 or Robert.Schaaf@nrc.gov.

Sincerely,

Benjamin G. Beasley, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-391

Enclosure:
Safety Evaluation

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

ALTERNATIVE REQUEST ISPT-02 REGARDING REACTOR PRESSURE VESSEL FLANGE

RELATED TO THE INSERVICE TESTING PROGRAM FIRST 10-YEAR INTERVAL

TENNESSEE VALLEY AUTHORITY

WATTS BAR NUCLEAR PLANT, UNIT 2

DOCKET NO. 50-391

1.0 INTRODUCTION

By letter dated October 30, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15303A546), as supplemented by letter dated February 29, 2016 (ADAMS Accession No. ML16060A438), Tennessee Valley Authority (TVA, the licensee) submitted alternative request ISPT-02 to the U.S. Nuclear Regulatory Commission (NRC or the Commission). The licensee requested an alternative test plan in lieu of certain inservice inspection (ISI) requirements of the 2007 Edition through 2008 Addenda of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section XI, for the ISI program at the Watts Bar Nuclear Plant (WBN), Unit 2, during the first 10-year ISI program interval, which is currently scheduled to begin in 2016.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(z)(2), the licensee proposed an alternative system leakage test of the reactor pressure vessel (RPV) flange seal leakoff piping on the basis that complying with the specified requirement would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety.

2.0 REGULATORY EVALUATION

As stated in 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except design and access provisions and preservice examination requirements, set forth in 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 inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals must 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 conditions listed therein. Exceptions are allowed where alternatives have been authorized by the NRC pursuant to paragraphs 10 CFR 50.55a(z)(1) or 10 CFR 50.55a(z)(2).

In proposing alternatives, the licensee must demonstrate that (1) the proposed alternatives provide an acceptable level of quality and safety (10 CFR 50.55a(z)(1)); or (2) compliance would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety (10 CFR 50.55a(z)(2)). Section 50.55a of 10 CFR allows the NRC to authorize alternatives from ASME, Section XI, requirements upon making necessary findings.

Based on the above, and subject to the following technical evaluation, the NRC staff finds that regulatory authority exists for the licensee to request, and the Commission to authorize, the alternative requested by the licensee.

3.0 TECHNICAL EVALUATION

3.1 Licensee's Alternative Request ISPT-02

ASME Code, Section XI, Requirements:

IWC-5221, "System Leakage Test Pressure," states:

> The system leakage test shall be conducted at the system pressure obtained while the system, or portion of the system, is in service performing its normal operating function or at the system pressure developed during a test conducted to verify system operability (e.g., to demonstrate system safety function or satisfy technical specification surveillance requirements).

The licensee states that the system/component affected at WBN, Unit 2, is the RPV head flange seal leakoff detection piping. This includes piping from the two RPV taps and terminating at the inline isolation valve 2-FCV-68-22 of the common header to the reactor coolant drain tank.

The licensee's basis for relief states, in part:

> The RPV head flange seal leak detection line is separated from the reactor pressure boundary by one (inner) O-ring located on the vessel flange. A second (outer) O-ring is located on the opposite side of the inner tap in the vessel flange. This line is required during plant operation and will indicate failure of the inner flange seal O-ring. To test this line would require the installation of plugs on the leak detection line at the vessel flange. Installing such plugs would allow the line to be leak tested, but would prevent an inservice leak test. Installing and removing the plugs or pressure connections would require installation personnel to spend time in the estimated 20-40 mRem/minute field which creates an As Low As Reasonably Achievable (ALARA) concern. With no plugs installed, when the vessel head is installed, an adequate pressure test cannot be performed due to the fact that the inner O-ring is designed to withstand pressure in one direction only. Pressurization in the opposite direction would likely damage the O-ring. Pressure testing of this line during the ASME Code, Class 1 System Leakage Test is precluded because the line will only be pressurized in the event of a failure of the inner O-ring. Purposely failing the inner O-ring to perform the ASME Code required test would require purchasing a new set of O-rings, additional time and radiation exposure to detension the reactor vessel head,

install the new O-rings, and reset and re-tension the reactor vessel head. TVA estimates the dose to perform these tasks (detension the reactor vessel head, install new O-rings, and reset and re-tension the reactor vessel head) at approximately 5 Rem. The highest dose rates for this evolution are 1 - 1.5 Rem/hour [roentgen equivalent man] at the reactor vessel flange. Therefore, this is considered to be a hardship and burden on WBN Unit 2.

The licensee proposes the following alternative examinations:

1. A VT-2 visual examination of the accessible portions (from the biological shield wall to 2-FCV-68-22) in lower containment of the ASME Code Class 2 piping of the RPV flange leak detection line will be performed during every other refueling outage, to satisfy the once per Inservice Period frequency, at ambient conditions when the RPV head is off and the reactor cavity is flooded and has been flooded above the vessel flange for a minimum of 4 hours. The static head developed with the leak detection line filled with borated water will allow for the detection of any gross indications in the line. This examination will be performed every other refueling outage (once per period) as per the frequency specified by ASME B&PV Code, Section XI, Table IWC-2500-1.

2. A VT-2 visual examination of the accessible portions (RPV flange to the point the leakoff lines enter the biological shield wall) in upper containment (reactor vessel cavity) of the ASME Code Class 2 piping of the RPV flange leak detection line will be performed during every other refueling outage, to satisfy the once per Inservice Period frequency, at ambient conditions when the RPV head is off and the reactor cavity is drained to look for indications of leakage from the flange seal leak detection lines. This examination will be performed once per period (typically every other refueling outage) as per the frequency specified by ASME B&PV Code, Section XI, Table IWC-2500-1.

3. The RPV flange leak detection line is ASME Section III Code Class 2 piping, and consists of approximately 21 feet of 3/4- and 3/8-inch piping and less than 12-inches of 1-inch piping. The piping design conditions are 2485 psig [pounds per square inch gage] and 650°F [degrees Fahrenheit]. A VT-2 visual examination of the inaccessible portions (through the biological shield wall) will be performed each refueling outage from under the vessel as part of the RCS Class 1 system leakage test.

4. The Operations staff continually monitors for leakage past the RPV Flange Seal O-rings by use of plant instrumentation (temperatures in excess of 140°F). In the event leakage is detected, plant procedures direct the header isolation valve 2-FCV-68-22 to be closed.

3.2 NRC Staff Evaluation

The NRC staff has evaluated the proposed alternative ISPT-02 pursuant to 10 CFR 50.55a(z)(2). In its review, the NRC staff focused on whether compliance with the specified requirements of 10 CFR 50.55a(g), or portions thereof, would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety.

Due to the existing design and configuration of the RPV head flange seal leakoff detection piping, system leakage testing at a pressure corresponding to ASME Code requirement IWC-5221 would be unusually difficult. To test the leakoff line, the licensee would have to install and remove temporary test connections at the vessel flange in an estimated radiation field, which represents an ALARA concern. With no temporary connections installed and the vessel head in place, an adequate pressure test cannot be completed due to the fact that the inner O-ring, which seals the RPV flange during normal operation, is designed to withstand pressure in one direction only. Pressure testing the flange to meet Code requirements would challenge, and likely damage, the RPV flange O-ring set, which then would require replacement. The licensee estimates that replacement activities of the O-ring set would yield personnel radiation exposure of approximately 5 Rem.

Based on the evaluation above, the NRC staff concludes that complying with the ASME Code, Section XI, IWC-5221 requirement for leak testing the RPV head flange seal leakoff detection piping at a pressure corresponding to pressures developed under normal operation would result in a hardship and unusual difficulty.

The licensee proposes to perform VT-2 visual examination of the accessible portions of the RPV flange and leakoff line piping when the RPV head is off and the reactor cavity is flooded above the vessel flange for a minimum of 4 hours. This configuration subjects the RPV flange and leakoff piping to a static pressure of 11 psig developed by the flooded cavity, which has a normal water level during refueling operations of about 25.5 feet above the RPV flange. The licensee also proposes to perform VT-2 visual examination of the accessible portions of the RPV flange and leakoff line piping when the RPV head is off and the reactor cavity is drained. These examination activities shall be performed every other refueling outage, which meets the requirements of the ASME Code.

Based on materials of construction, service conditions, and evaluation of industry operating experience, including WBN, Unit 1, the NRC staff did not identify any documented known degradation mechanism such as stress corrosion cracking and fatigue in the RPV flange leakoff piping and its welded connections. The NRC staff further concludes that if any significant leakage were to occur in the leakoff line during the time of pressurization, during each refueling outage, boric acid accumulation would be discernable during a visual examination. The NRC staff, therefore, finds that the proposed low test pressure will provide reasonable assurance of the leak tightness of the subject leakoff lines and demonstrate that the leakoff lines can perform their intended function. The NRC staff also finds that compliance with the system leakage test pressure requirements would result in a hardship, without a compensating increase in the level of quality and safety.

4.0 CONCLUSION

As set forth above, the NRC staff finds that the proposed alternative described in alternative request ISPT-02 provides reasonable assurance of structural integrity and leak tightness of the RPV head flange seal leakoff piping. The NRC staff finds that complying with the specified ASME Code requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2) and is in compliance with the requirements of the ASME Code, Section XI.

Therefore, the NRC staff authorizes the proposed alternative in request ISPT-02 for the first ISI interval at WBN, Unit 2, currently scheduled to begin in 2016.

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

Principal Contributor: Michael Farnan

Dated: April 26, 2016

If you have any questions, please contact the project manager, Robert Schaaf, at 301-415-6020 or Robert.Schaaf@nrc.gov.

Sincerely,

/RA/

Benjamin G. Beasley, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-391

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Safety Evaluation

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