Tennessee Valley Authority,1101 Market Street, Chattanooga, Tennessee 37402

CNL-16-015

April 15, 2016

10 CFR 50.55a

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Watts Bar Nuclear Plant, Unit 1
Facility Operating License No. NPF-90
NRC Docket No. 50-390

Subject: **Watts Bar Nuclear Plant Unit 1 - Request for Alternative Inspection of the Reactor Pressure Vessel Flange Seal Leak-Off Piping Number ISPT-02**

References:

1. TVA letter to NRC, "American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Section XI Code of Record for Second 10-Year Inservice Interval 2001 Edition," dated January 10, 2014 (ML14013A302)

2. TVA letter to NRC, "Response to Request for Additional Information Regarding American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Section XI Code of Record for Second 10-Year Inservice Interval 2001 Edition," dated February 21, 2014 (ML14055A271)

3. TVA letter to NRC, "Response to Request for Clarifying Information Regarding American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Section XI Code of Record for Second 10-Year Inservice Interval 2001 Edition," dated March 13, 2014 (ML14073A600)

4. NRC Letter to TVA, "Watts Bar Nuclear Plant, Unit No.1 - Request for Alternative ISPT-02 Regarding System Leakage Test of Reactor Pressure Vessel Head Flange Seal Leak-Off Piping (TAC No. MF3354)," dated March 27, 2014 (ML14079A477)

5. TVA letter to NRC, CNL-15-057, "Watts Bar Nuclear Plant Unit 2 - Request for Relief for Reactor Pressure Vessel Flange Seal Leak-Off Piping," dated October 30, 2015 (ML15303A546)

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a, "Codes and Standards," paragraph (z)(2), Tennessee Valley Authority (TVA) is requesting the Nuclear Regulatory Commission (NRC) approval of the enclosed request (ISPT-02) for an alternative to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," Section Paragraph IWC-5221 for the Watts Bar Nuclear Plant (WBN) Unit 1 for nominal pipe size (NPS) 1-inch, 3/4-inch, and 3/8-inch reactor pressure vessel (RPV) flange seal leak-off piping. This alternative request is for the third 10-year interval for WBN Unit 1, which commences on May 27, 2016. The code of record for the third 10-year interval for WBN Unit 1 is the ASME B&PV Code, Section XI, 2007 Edition through 2008 Addenda.

ASME Code, Section XI, Section IWC-5221 requires that a system leakage test be conducted at the system pressure. As described in the enclosure, compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The proposed alternative is to test the impacted piping sections at a reduced pressure for the duration required by the ASME Code for the third 10-year Inservice Inspection System Pressure Testing (ISPT) interval. This request is similar to one submitted by TVA for the WBN Unit 1 second 10-year ISPT interval in References 1, 2, and 3, and approved by the NRC in Reference 4. This request is also similar to one submitted by TVA for the WBN Unit 2 first 10-year ISPT interval in Reference 5, which is currently being reviewed by the NRC.

The enclosure provides a description and assessment of the proposed request for alternative. TVA requests approval of this request by March 1, 2017, to support the next WBN Unit 1 outage scheduled to start March 20, 2017.

There are no new regulatory commitments associated with this submittal. Please address any questions regarding this request to Mr. Gordon Arent at 423-365-2004.

Respectfully,

J. W. Shea
Vice President, Nuclear Licensing

Enclosure: Request for Alternative Number ISPT-02

cc (Enclosure):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Watts Bar Nuclear Plant
NRR Project Manager - Watts Bar Nuclear Plan

ENCLOSURE

Tennessee Valley Authority
Watts Bar Nuclear Plant, Unit 1
Third 10-Year Interval

Request for Alternative
Number ISPT-02

I. Systems/Components Affected

Watts Bar Nuclear Plant (WBN) Unit 1, reactor pressure vessel (RPV) head flange seal leak-off detection piping. This includes piping from the two RPV taps and terminating at the inline isolation valve (1-FCV-68-22) of the common header to the reactor coolant drain tank (RCDT), as shown on TVA drawing 1-47W813-1 (Attachment 3).

II. Applicable Code Edition and Addenda

For the third 10-year Inservice Inspection System Pressure Testing (ISPT) Interval, beginning May 27, 2016, the applicable Code edition and addenda are the American Society of Mechanical Engineers (ASME), Boiler and Pressure Vessel (B&PV) Code, Section XI, 2007 Edition through 2008 Addenda.

III. Applicable Code

ASME B&PV Code, Section XI, IWC-5221, "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)."

IV. Code Requirement From Which Alternative Is Requested

Relief is being requested from system pressure testing of the RPV flange seal leak-off piping at the "normal system pressure while the piping is in service performing its normal operating function."

Basis for Relief

The proposed alternative is in accordance with 10 CFR 50.55a(z)(2) on the basis that compliance with the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

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 would 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 that 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 because 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 in the 1 - 1.5 Rem/hour range at the reactor vessel flange. Therefore, this is considered a hardship and burden on WBN Unit 1.

Based on the above, TVA requests approval for the use of an alternative to the ASME Code, Section XI requirements for system leakage testing of the RPV head flange seal leak detection line.

Configuration Details

The inner and outer O-ring monitoring tube taps in the reactor vessel flange are located at elevation 723 feet-6 5/8 inches. The water level for refueling operations will be at a minimum elevation of 749 feet 1-1/2 inches, which provides a static head of about 25.5 feet or a proposed test pressure of 11 pounds per square inch gauge (psig).

As shown on Attachment 1, the approximate location of the inner O-ring monitoring tube is on the 253 degree azimuth and the approximate location of the outer O-ring monitoring tube is on the 286 degree azimuth. As shown on Attachment 2, the inner O-ring monitoring tube is located radially between the inner O-ring and outer O-ring. The outer O-ring monitoring tube is located radially outboard of the outer O-ring. The tubing for each monitoring tube travels radially around the outside of the reactor vessel to a sleeve in the Bioshield wall at the 338 degree azimuth, then travels approximately ten feet through the Bioshield wall. The inner and outer monitoring tubing travel through lower containment to a sleeve in the crane wall at the 296 degree azimuth. The inner and outer tubing connect to a common header to the RCDT downstream of their respective manual isolation valves. The Class 2 portion of the common header terminates at an air-operated valve.

Materials of Construction:

- Piping and nipples are schedule 160, SA376, TP304 material
- Fittings are 6000 psig, SA182, F304

- Tubing is 0.065" wall, SA269 or SA213, type 316
- Valves are 1500 psig, SA182, F316 with manufacturer's hydro test at 5400 psig
- Design conditions are 2485 psig at 650°F
- The reactor operating pressure is 2235 psig

Potential Degradation:

The piping and components were hydro tested to 3290 psig during construction. The components involved in the installation of the RPV flange leak-off piping were purchased and installed to ASME B&PV Section lll requirements. The components are constructed of stainless steel, which is not subject to degradation from boric acid. Piping and components within this segment, with the exception of the outer O-ring monitoring tube from the RPV flange to the closed manual isolation valve, are aligned to the RCDT. The RCDT is normally maintained between 0.5 and 2.0 psig. The design pressure for the tank is 25 psig. Nitrogen is provided to the tank as a cover gas during normal operation. Because this piping is designed for borated water, but is normally dry, exposed to nitrogen, and at essentially atmospheric pressure, there are no degradation mechanisms. Only a severe O-ring failure would be able to pressurize the leak detection line prior to isolation. The piping is routed along a wall approximately 20 feet above the floor, which prevents inadvertent damage from other work activities.

Leak Detection Capability:

The detection of Reactor Coolant System (RCS) leakage at WBN Unit 1 conforms to the requirements of Regulatory Guide (RG) 1.45, "Guidance on Monitoring and Responding to Reactor Coolant System Leakage." The instrumentation can detect a 1 gallon per minute (gpm) leak within one hour. Instrumentation credited for RG 1.45 conformance includes the reactor building floor and equipment drain sump level monitors and containment air particulate monitors. In addition, there are tank level monitors, containment radioactive gas monitors, containment temperature and humidity monitors, and for large leaks, containment pressure monitors. These instruments would detect through wall leakage in the leak detection line in conjunction with O-ring leakage.

WBN Unit 1 monitors for RPV flange O-ring leakage by use of a temperature switch (1-TS-68-21) located downstream of the Class 2 air-operated header isolation valve (1-FCV-68-22). Once temperature of the leakage monitoring header reaches 140°F increasing, annunciator window 88A (Reactor Vessel Flange Leakoff Temperature Hi) alarms in the Main Control Room. The basis for the 140°F setpoint was to establish a limit based on ambient temperature near the temperature element plus 20°F.

Plant Annunciator Response Instruction (ARI) 1-ARI-88-94, “Reactor Coolant System,” directs the Operations staff to conduct monitoring activities to validate the alarm and to determine if leakage to the RCDT is indicated. When leakage to the RCDT is indicated, the required actions are to initiate performance of abnormal operating instruction (AOI) 1-AOI-6, “Small Reactor Coolant System Leak” and to close the leakage monitoring air-operated header isolation valve. When permitted by radiological conditions, further actions are taken to determine whether one or both O-rings are leaking.

Plant procedure 1-AOI-6, “Small Reactor Coolant System Leak,” directs the Operations staff to check indicated temperature on the leakage monitoring header temperature indicator. When the indicated temperature exceeds 120°F, the Main Control Room staff is directed to isolate the leakage monitoring header by use of the air-operated valve and to evaluate the need for a unit shutdown. Technical Specification 3.4.13, “RCS Operational Leakage,” requires WBN Unit 1 to take action to reduce the leakage and/or initiate shutdown when leakage exceeds limits.

Plant Technical Instruction (TI) 0-TI-68.017, “Reactor Building Post Shutdown Walkdown,” requires walkdowns of the Reactor Building following shutdown for refueling outages and for forced outage of sufficient duration to practically allow for performance of the walkdown. These areas are walked down at the beginning of each refueling outage. The keyway under the vessel and the heat exchanger room are excluded from normal forced outage walkdowns. Performance of this procedure would identify any leakage from the vessel flange leak detection lines from the biological shield wall to the end of the Class 2 piping boundary. A keyway entry would be required to check for leakage that may have occurred in this piping from the vessel flange to the biological shield wall. In the event that RPV flange leakage was detected within the leak detection lines and the unit was not shutdown, the only piping accessible for visual examination would be outside the polar crane wall and located in the raceway. Locating leakage inside the polar crane wall would require attempting to insert a camera through penetrations to detect through-wall leakage that may exist coincident with leakage past the vessel O-rings.

Alternative Examinations

1. A VT-2 visual examination of the accessible portions (from the biological shield wall to 1-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 four hours. The static head of 25.5 feet or 11 psig provided by the filled reactor cavity on the leak detection line 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 (see Attachment 3). The piping design conditions are 2485 psig and 650°F. 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. Leakage past the RPV Flange Seal O-rings is monitored by plant instrumentation (temperatures in excess of 140°F). In the event leakage is detected, plant procedures direct the header isolation valve 1-FCV-68-22 to be closed.

V. Justification for the Authorization of Relief

In order to perform the required test, TVA could pressurize between the reactor vessel head O-rings, but this could possibly damage the inner O-ring. If the inner O-ring were damaged, TVA would need to replace the O-ring set. The time and radiation exposure to remove and reinstall the RPV head to replace the O-rings would be a significant burden with no safety benefit. TVA proposes performing a VT-2 visual examination of the accessible areas each period on the piping subjected to the static pressure head when the reactor cavity is filled. Additionally, TVA proposes performing a VT-2 visual examination of the inaccessible areas each refueling outage by observing the area beneath the reactor vessel for evidence of leakage. If any significant leakage does occur, boric acid accumulation should be detected in the VT-2 visual examination. Further, TVA will monitor for any signs of O-ring leakage through the leak detection line temperature instrumentation. There is reasonable assurance that any problems in the subject piping would be detected through these measures. The proposed alternative provides reasonable assurance of structural integrity. Requiring compliance with the IWC-5221 system pressure test requirements results in an unnecessary hardship without a compensating increase in the level of quality and safety.

VI. Implementation Schedule

Relief is requested for the third 10-year ISPT Interval, currently scheduled to begin in May 27, 2016.

VII. Precedents

Similar relief requests have been previously authorized by the NRC.

1. NRC Safety Evaluation dated December 19, 2011 (TAC No. ME5214), Comanche Peak Nuclear Power Plant, Unit 1, Docket No. 50-445. (ML113110092)

2. NRC Safety Evaluation dated April 4, 2013 (TAC Nos. MF0447, MF0448, and MF0449), Palo Verde Nuclear Generating Station, Units 1, 2, and 3, Docket Nos. 50-528, 50-529, and 50-530. (ML13085A254)

3. NRC Safety Evaluation dated August 5, 2013 (TAC No. ME9491), Oyster Creek Nuclear Generating Station, Docket No. 50-219. (ML13175A100)

4. NRC Safety Evaluation dated August 13, 2013 (TAC No. MF1745), Callaway Plant, Unit 1, Docket No. 50-483. (ML13221A091)

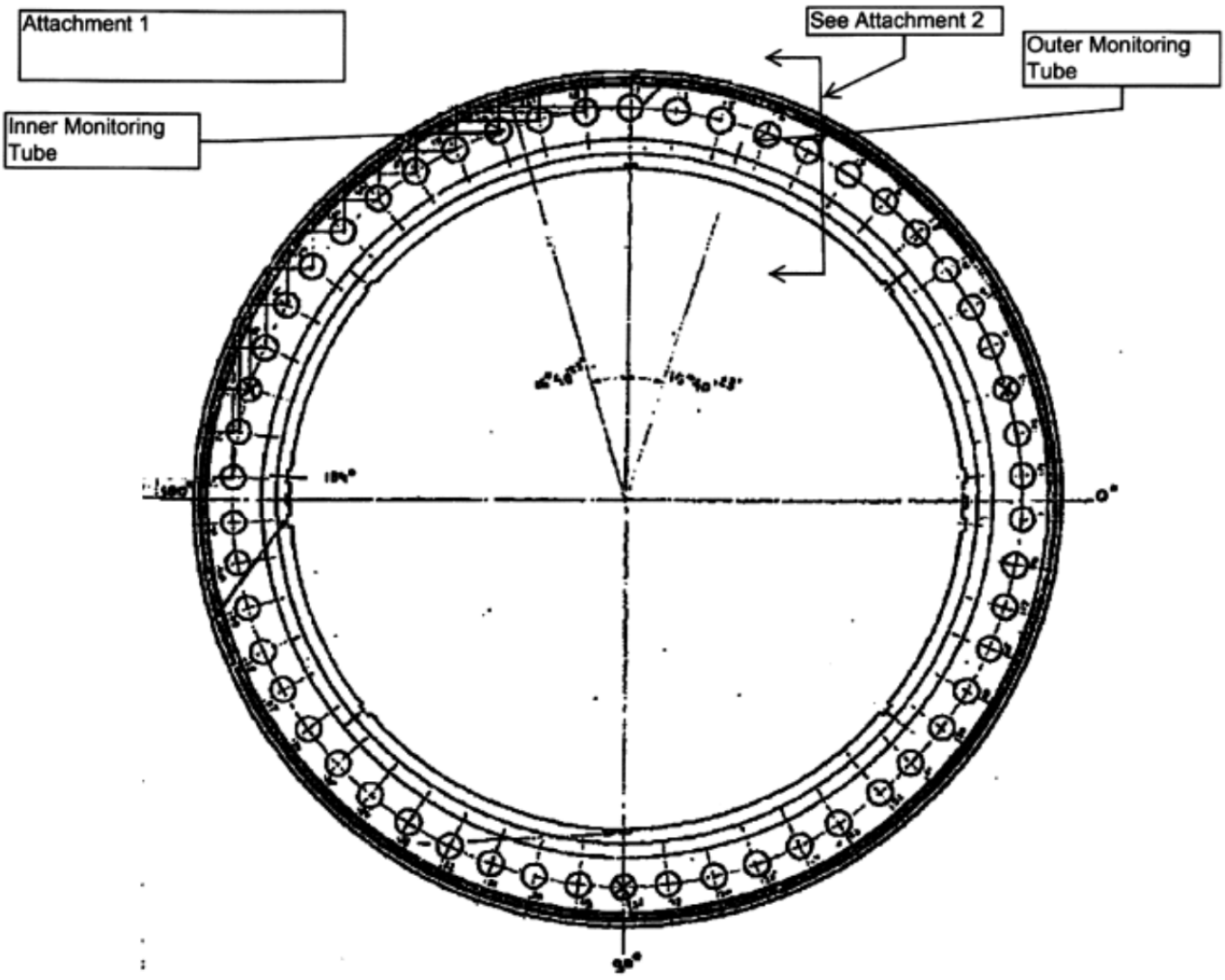
5. NRC Safety Evaluation dated September 12, 2013 (TAC Nos. MF0408 and MF0409), Diablo Canyon Power Plant, Units 1 and 2, Docket Nos. 50-275 and 50-323. (ML13192A354)

6. NRC Safety Evaluation dated March 27, 2014 (TAC No. MF3354), Watts Bar Nuclear Plant, Unit 1, Docket No. 50-390. (ML14079A477)

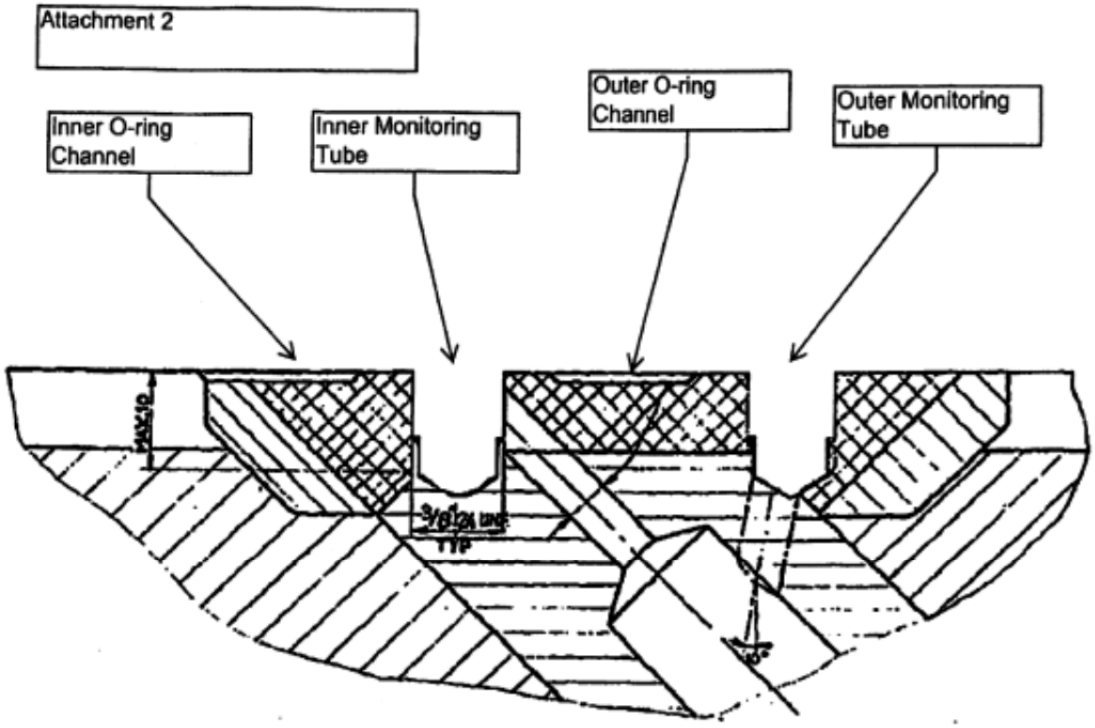
VIII. Attachments

1. Reactor Vessel Flange
2. Flange Detail
3. Excerpt from Drawing 1-47W813-1, Reactor Vessel Flange Seal Leak-Off Piping

Attachment 1



Attachment 2



Flange Detail

Attachment 3
Excerpt from Drawing 1-47W813-1
Reactor Vessel Flange Seal Leak-Off Piping