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

CNL-17-078

June 30, 2017

10 CFR 50.55a

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

Browns Ferry Nuclear Plant, Unit 3
Renewed Facility Operating License No. DPR-68
NRC Docket No. 50-296

Subject: **Response to NRC Request for Additional Information Regarding Browns Ferry Nuclear Plant, Unit 3, American Society of Mechanical Engineers Section XI, Inservice Inspection (ISI) Program, Unit 3 Third Ten Year Interval Request For Relief 3-ISI-28 (CAC No. MF9257)**

References:
1. Letter from TVA to NRC, CNL-17-013, "Browns Ferry Nuclear Plant Unit 3, American Society of Mechanical Engineers Boiler and Pressure Vessel Code Section XI, Inservice Inspection (ISI) Program, Unit 3 Third Ten Year Interval Request for Relief for 3-ISI-28 and 3-ISI-29," dated January 31, 2017 (ML17031A351),

2. NRC Electronic Mail to TVA, "RAI for Browns Ferry RR 3-ISI-28", (CAC No. MF9257)," dated June 8, 2017

In Reference 1, the Tennessee Valley Authority (TVA) submitted a request for relief from inservice inspection (3-ISI-28), pertaining to Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code for the Browns Ferry Nuclear Plant (BFN), Unit 3. The proposed relief request would provide relief from examinations of reactor vessel nozzle welds which received less than the required examination coverage, as currently required by ASME Code for the third Inservice Inspection interval, ending January 31, 2016. In Reference 2, the Nuclear Regulatory Commission (NRC) sent a request for additional information (RAI) and requested a response by July 10, 2017. The enclosure to this letter provides TVA's response to the NRC RAI.

There are no new regulatory commitments contained in this submittal. Please address any questions regarding this submittal to Mr. Edward D. Schrull at (423) 751-3850.
Respectfully,

J. W. Shea
Vice President, Nuclear Regulatory Affairs and Support Services

Enclosure: Response to NRC Request for Additional Information Regarding Browns Ferry Nuclear Plant, Unit 3, American Society of Mechanical Engineers Section XI, Inside Radius and Nozzle-to-Vessel Welds, Third Ten Year Interval Request For Relief 3-ISI-28

cc (Enclosure):

NRC Regional Administrator – Region II
NRC Senior Resident Inspector – Browns Ferry Nuclear Plant
NRC Project Manager - Browns Ferry Nuclear Plant

ENCLOSURE

Response to NRC Request for Additional Information Regarding Browns Ferry Nuclear Plant, Unit 3, American Society of Mechanical Engineers Section XI, Inside Radius and Nozzle-to-Vessel Welds Third Ten Year Interval Request For Relief 3-ISI-28

NRC RAI No. 1

INTRODUCTION

By letter dated January 31, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession Number ML17031A351), Tennessee Valley Authority (TVA, the licensee) submitted relief requests 3-ISI-28 and -29, requesting relief from the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, for Browns Ferry Nuclear Plant (Browns Ferry) Unit 3. Specifically, pursuant to Title 10 of the Code of Federal Regulations (10 CFR) 50.55a(g)(5)(iii), the licensee requested relief from the "essentially 100 percent" volumetric examination coverage requirements of ASME Code Section XI for the welds on the basis that the code requirement is impractical. The NRC has determined that the following additional information is necessary to complete its review and make a regulatory decision.

RAI 1

The examinations performed during this ten-year inservice inspection (ISI) interval show a significant drop in coverage from those reported in the previous interval. The table below compares the coverages reported in this relief request and those reported in Browns Ferry request for relief 3-ISI-18:

	Coverage Obtained in the Second ISI Interval (3-ISI-18)	*Coverage Obtained in the Third ISI Interval (3-ISI-28)*
N1B-NV	*77%*	*25%*
N4A-NV	*77%*	*32%*
N4B-NV	*68%*	*32%*
N4C-NV	*68%*	*32%*
N4D-NV	*94.37%*	*32%*
N4E-NV	*94.37%*	*32%*
N4F-NV	*77%*	*32%*
N8A-NV	*71%*	*77%*
N9-NV	*74%*	*27%*
N10-NV	*97.31%*	*74%*

Please discuss what caused the decrease in obtainable coverage and justify how this examination provides an equivalent or greater standard of quality and safety.

TVA Response

As discussed during a clarification phone between TVA and the Nuclear Regulatory Commission (NRC) on June 8, 2017, this response addresses the components from Reference 1 that are listed in the table of RAI 1 that reported a reduction in achieved code required examination volume. As agreed during this phone call, this response does not address the N8A-NV nozzle to shell weld because there was no decrease in obtained coverage.

During the second ISI interval (Reference 2), coverage was calculated in accordance with TVA Procedure N-GP-28 (now retired), which did not provide specific details for reactor pressure vessel (RPV) Nozzle-Shell weld coverage calculations. After completion of the second ISI interval examinations, and prior to the third ISI interval examinations, TVA recognized the inconsistency with the examination coverage estimates and generated a condition report (PER 99581) to develop an industry-standard procedure to aid and standardize the calculation process. This action resulted in the development of TVA Procedure N-GP-31, "Calculation of ASME Code Coverage for Section XI." The coverage calculations for the RPV nozzle to shell welds performed in the third ISI interval were performed in accordance with the more conservative methods of N-GP-31 as explained in the following paragraphs.

RPV nozzle to shell welds N1B, N4A, N4B, N4C, N4F, and N9 were examined in the second (2nd) ISI interval, prior to the enactment of ASME Section XI, Appendix VIII as implemented by the Performance Demonstration Initiative (PDI) using procedures that met the requirements of ASME Section XI at the time they were performed. The examinations were based on ASME Section V, Article 4 and 5 techniques using transducers and wedge combinations that were not ideal for obtaining meaningful data in the radial direction nor optimized for proper orientation in the axial direction from the nozzle blend radius. The 2nd interval coverage calculations allowed credit for much of this volume in the outer 85 percent (%)T because there was no industry standard for establishing which of the data could be credited as obtained coverage.

In the third (3rd) interval, these same nozzles were examined with demonstrated procedures, qualified in accordance with ASME Section XI, Appendix VIII Supplements 4, 6, and 7. This process used modeling to ensure the maximum possible coverage was achieved using complex-curved transducers from the blend radius for the inner 15%T. Through the modeling, 100% of the inner 15%T was achieved on RPV nozzle to shell welds N1B, N4A, N4B, N4C, and N4F, for axially oriented flaws. The techniques described for the 3rd interval provided a higher quality of examination than those previously utilized, because the examination is focused on ensuring that demonstrated coverage is in the area a flaw might initiate. However, the reported coverages are lower because TVA's current procedures are more restrictive, especially in the outer 85%T areas.

RPV nozzle to shell welds N4D, N4E, and N10 were examined in the 2nd interval using similar demonstrated procedures and techniques as those applied during the 3rd interval. Both processes apply examination techniques for the tangential scanning and outer 85%T for the circumferential scanning using standard search units. Both processes also apply techniques that are modeled for optimization using special designed contoured search unit wedges that fit the nozzle blend radius allowing excellent coverage of the inner 15%T of the examination volume during circumferential scanning. Third interval examinations achieved 100% of the inner 15%T on nozzles N4D and N4E, while 97% of the inner 15%T was achieved on N10-NV,

for axially oriented flaws. Despite the similar examination technique, the less conservative calculation methodologies applied in the 2nd interval (i.e., taking credit for areas that were not conducive to adequate transducer contact in the outer 85%T) resulted in higher claimed coverage for the 2nd interval examinations compared to the examinations conducted in the 3rd interval on the same components.

In summary, the examinations performed on the nozzle to shell welds were conducted to the extent possible given the inherent design of the reactor vessel and conducted in accordance with industry requirements at the time they were conducted. The examination coverage deviations noted in the RAI are due to changes in examination methodologies and continued process improvements. There were no physical plant configuration changes that contributed to the reduction in reported coverage. With the introduction of ASME XI, Appendix VIII, as implemented by the PDI process, ultrasonic examinations of applicable components require more stringent processes than prior examinations as the procedures and personnel are qualified through actual demonstrations. Therefore, the quality and reliability of ultrasonic examinations have improved to a significant extent. Prior to conducting the third interval examinations, TVA recognized inconsistency with the examination coverage estimates and generated a procedure (N-GP-31) to aid and standardize the calculation process, and better align with industry methods. Due to improvements in NDE techniques, equipment, and qualification standards, the 3rd interval examinations provide an equivalent or greater standard of quality and safety from previous interval examinations, even though the use of TVA's more conservative coverage calculation procedure yields a lower overall coverage percentage.

Reference

1. Letter from TVA to NRC, CNL-17-013, "Browns Ferry Nuclear Plant Unit 3, American Society of Mechanical Engineers Boiler and Pressure Vessel Code Section XI, Inservice Inspection (ISI) Program, Unit 3 Third Ten Year Interval Request for Relief for 3-ISI-28 and 3-ISI-29," dated January 31, 2017 (ML17031A351)
2. Letter from TVA to NRC, "Browns Ferry Nuclear Plant Unit 3, American Society of Mechanical Engineers (ASME) Section XI, Inservice Inspection (ISI) Program- Requests for Relief 2-ISI-22, and 3-ISI-18 for Examination of Reactor Pressure Vessel (RPV) Nozzle-to-Vessel Shell Welds and Nozzle Blend Radii," dated July 25, 2003 (ML032190543)