



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

July 20, 2023

Mr. James Barstow
Vice President, Nuclear Regulatory
Affairs and Support Services
Tennessee Valley Authority
1101 Market Street, LP 4A-C
Chattanooga, TN 37402-2801

SUBJECT: BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3 – PROPOSED
ALTERNATIVE TO THE REQUIREMENTS OF THE ASME CODE REGARDING
VOLUMETRIC INSPECTION OF STANDBY LIQUID CONTROL NOZZLES
(EPID L-2022-LLR-0062)

Dear Mr. Barstow:

By letter dated August 22, 2022, the Tennessee Valley Authority (TVA) submitted Alternative Request BFN-0-ISI-32 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 (BPV) Code, Section XI requirements at Browns Ferry Nuclear Plant (Browns Ferry), Units 1, 2, and 3.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), section 50.55a(z)(2), TVA requested to use an alternative on the basis that complying with the specified requirement would result in hardship or unusual difficulty.

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that complying with the specified requirements described in Alternative Request BFN-0-ISI-32 would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that TVA has adequately addressed all the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the NRC authorizes the use of alternative BFN-0-ISI-32 for the remainder of the third, fifth, and fourth inservice inspection intervals at Browns Ferry, Units 1, 2, and 3, respectively.

All other ASME BPV Code, Section XI requirements for which an alternative was not specifically requested and approved remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

If you have any questions, please contact Ms. Kimberly Green at 301-415-1627 or via email at Kimberly.Green@nrc.gov.

Sincerely,

David J. Wrona, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-259, 50-260, 50-296

Enclosure:
Safety Evaluation

cc: Listserv



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**BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3 – AUTHORIZATION AND SAFETY
EVALUATION FOR ALTERNATIVE REQUEST NO. BFN-0-ISI-32**

LICENSEE INFORMATION

Licensee: Tennessee Valley Authority (TVA)
Plant Name and Unit: Browns Ferry Nuclear Plant, Units 1, 2, and 3
Docket Nos.: 50-259
50-260
50-296

APPLICATION INFORMATION

Submittal Date: August 22, 2022

Agencywide Documents Access and Management System (ADAMS) Accession No.:
ML22234A271

Supplement Date: March 11, 2023

Supplement ADAMS Accession No.: ML23070A004

Applicable Inservice Inspection (ISI) Program Interval: The applicable ISI program intervals are listed in the following table.

Plant	ISI Interval	Start Date	End Date
Browns Ferry, Unit 1	Third	February 1, 2016	January 31, 2026
Browns Ferry, Unit 2	Fifth	February 1, 2016	January 31, 2026
Browns Ferry, Unit 3	Fourth	February 1, 2016	January 31, 2026

Alternative Provision: The applicant requested an alternative under Title 10 of the *Code of Federal Regulations* (10 CFR), paragraph 50.55a(z)(2).

ISI Requirements: American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (BPV) Code, Section XI, Table IWB-2500-1, Examination Category B-D, Item No. B3.100, requires a volumetric examination to be performed on the inner radius section of all reactor vessel nozzles each inspection interval and refers to the nozzle configurations shown in Figure No. IWB-2500-7. The licensee stated that ASME Code Case N-648-1 allows for VT-1 visual examination in lieu of the volumetric examination requirements of Table IWB-2500-1. The NRC staff has conditionally approved Code Case N-648-1 in Regulatory Guide 1.147, Revision 16. However, the NRC staff noted that Code Case N-648-2 is approved in Regulatory Guide 1.147, Revision 20.

Enclosure

Applicable Code Edition and Addenda: The applicable ASME BPV Code, Section XI editions are listed in Table 1.

Table 1: Applicable ASME Code, Section XI Editions

Plant	Edition
Browns Ferry, Units 1, 2, and 3	2007 Edition with 2008 Addenda

Brief Description of the Proposed Alternative: In section IV of alternative request BFN-0-ISI-32, the licensee described the geometric configuration of the Browns Ferry, Units 1, 2, and 3 standby liquid control (SLC) nozzles (N10). The licensee stated that performing the required volumetric examination of the SLC nozzles would result in a hardship or unusual difficulty without a compensating increase in the level of quality or safety. The licensee proposed to perform a VT-2 visual examination of the SLC nozzles as part of the Class 1 leakage test as an alternative to the volumetric examination. In the supplement dated March 11, 2023, the licensee stated that it maintains compliance with the technical specification surveillance requirements for reactor coolant pressure boundary leakage.

STAFF EVALUATION

The licensee cited several hardships for this case, including the SLC nozzle location in the bottom head of the vessel, complex configuration of the nozzle, imbedded ultrasonic beam reflectors in the nozzle design, and high radiation dose rates for plant personnel. The NRC staff reviewed these factors and determined that when considered together, they constitute a hardship.

As part of its review of the proposed alternative, the NRC staff requested additional information on whether any repairs had been made to SLC nozzle N10 inner radii (N10-IR) at Browns Ferry, Units 1, 2, and 3, the potential to perform a VT-1 examination from the inside surface, and details regarding the proposed VT-2 visual examination, including the ability to differentiate SLC nozzle leakage from other nozzle leakage. By letter dated March 11, 2023, the licensee responded that there have been no repairs made to the SLC nozzle N10-IR at Browns Ferry, Units 1, 2, and 3. The licensee stated that with the exception of the first 10-year ISI interval for all three units, in which it was exempt from examination based on Section IWB-1220(b)(1) of the Code of Record that was in effect, and the second 10-year ISI interval for Browns Ferry, Unit 2, which relief was requested and granted, ultrasonic examination results have been obtained as required for each successive interval (i.e., second, third, and third ISI intervals for Browns Ferry, Units 1, 2, and 3, respectively). The licensee confirmed that the completed ASME Section XI ultrasonic testing non-destructive examination reports from the SLC N10 nozzles showed no prior indications identified for the inner radius area. Additionally, based on the SLC nozzle design as described in the licensee's submittal and UFSAR section 3.8 (ML21286A281), the NRC staff finds that the SLC nozzle N10-IR is not subjected to turbulent mixing conditions due to the subject nozzle being attached to piping that injects boron at locations that are far removed from the nozzle itself. Based on the previous inspection history of the SLC N10 nozzles, and the SLC N10 nozzle design, the NRC staff finds it reasonable that if significant service-induced degradation had occurred, evidence of it would have been previously detected or identified by the examinations that the licensee performed and provides confidence in the performance of the nozzle inner radius.

The licensee stated that for Browns Ferry, Units 1, 2, and 3, the N10-IR surface is located in the reactor pressure vessel (RPV) lower plenum, and even with extensive reactor internal disassembly, a VT-1 examination would not be possible. The licensee stated that the VT-2

visual examinations are performed each refueling outage in accordance with (1) ASME BPV Code, Section XI, Table IWB-2500-1, Examination Category B-P, Item Number B15.10 and (2) IWA-5000 and IWB-5220. The SLC nozzle, as shown in Figure 1 of the licensee's request, is designed with an integral socket to which the boron injection piping is fillet welded. The SLC nozzle is located in the bottom head of the vessel, in an area that is inaccessible without extensive disassembly, hindering the ability to complete the Code-required volumetric or approved Code Alternative VT-1 examinations from the inside surface of the RPV. The NRC staff noted that the ultrasonic (UT) examinations would need to be performed on the outside diameter of the RPV. As a result of the configuration, the NRC staff determined that in order for the licensee to perform a UT examination, the UT scans would need to travel through the full thickness of the vessel into a complex cladding/socket configuration.

Regarding the potential for a VT-1 examination, the NRC staff determined that the Browns Ferry, Units 1, 2, and 3, SLC nozzle design is a different configuration than that shown in ASME BPV Code, Figure No. IWB-2500-7, and removal of lower plenum vessel internal components to invoke Code Case N-648-1 to perform a VT-1 examination or to perform the required ultrasonic examination of the SLC nozzle inner radius constitutes a hardship. The NRC staff finds the licensee would not be able to perform a meaningful examination on the SLC nozzle N10-IR due to the geometric and material reflectors inherent in the design. The licensee also stated that, in accordance with Browns Ferry, Units 1, 2, and 3, Technical Specification 3.4.4, "RCS Operational LEAKAGE," no reactor coolant system pressure boundary leakage is permitted, and the leak investigation process would differentiate any SLC nozzle leakage from other leakage sources.

The NRC staff has determined that the proposed alternative will provide reasonable assurance of the structural integrity of the SLC N10 nozzles because (1) the licensee will perform a VT-2 examination associated with the system leakage test in accordance with ASME BPV Code, Section XI, Table IWB-2500-1, Examination Category B-P during every refueling outage, (2) the licensee has reactor coolant system leakage detection systems to detect potential leakage, and (3) the plant technical specification does not permit reactor coolant system pressure boundary leakage.

CONCLUSION

The NRC staff determines that compliance with the specified ASME BPV Code requirements results in a hardship or unusual difficulty without a compensating increase in quality or safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the NRC staff authorizes the use of proposed alternative BFN-0-ISI-32 at Browns Ferry, Units 1, 2, and 3 for the third, fifth, and fourth inservice inspection intervals, respectively. All other ASME BPV Code, Section XI requirements for which an alternative was not specifically requested and approved remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Principal Contributors: E. Haywood, NRR
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Date: July 20, 2023

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