



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

January 24, 2022

Ms. Cheryl A. Gayheart  
Regulatory Affairs Director  
Southern Nuclear Operating Co., Inc.  
3535 Colonnade Parkway  
Birmingham, AL 35243

SUBJECT: VOGTLE ELECTRIC GENERATING PLANT, UNITS 1 AND 2 – RELIEF  
REQUEST FOR PROPOSED ALTERNATIVE REQUIREMENTS FOR THE  
REPAIR OF REACTOR VESSEL HEAD PENETRATIONS FOR THE FOURTH  
10-YEAR INSERVICE INSPECTION INTERVAL, VEGP-ISI-ALT-04-05,  
VERSION 1.0 (EPID: L-2021-LLR-0068)

Dear Ms. Gayheart:

By letter dated September 10, 2021 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML21256A243), Southern Nuclear Operating Company (SNC, the licensee) submitted a proposed alternative VEGP-ISI-ALT-04-05, Version 1.0, for the repair of degraded reactor vessel head penetrations at Vogtle Electric Generating Plant (Vogtle), Units 1 and 2. In order to repair a degraded penetration J-groove weld, the licensee proposed to use the embedded flaw repair process described in the U.S. Nuclear Regulatory (NRC)-approved WCAP-15987-P, Revision 2-P-A report (ADAMS Accession No. ML040290233) and WCAP-18647-P, Revision 0, "Technical Basis for Westinghouse Embedded Flaw Repair of Vogtle Units 1 and 2, Reactor Vessel Head Penetrations," enclosed in the submittal dated September 10, 2021.

The NRC staff has determined that the proposed alternative in SNC's request would provide an acceptable level of quality and safety. The NRC staff has concluded that the licensee has adequately addressed the regulatory requirements set forth in Title 10 of the *Code of Federal Regulations*, Section 50.55a(z)(1). The NRC staff authorizes the use of proposed alternative VEGP-ISI-ALT-04-05 at Vogtle, Units 1 and 2, through the end of the fourth 10-year Inservice Inspection Interval ending May 30, 2027.

All other American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, requirements for which an alternative was not specifically requested and approved in this proposed alternative remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

C. A. Gayheart

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If you have any questions, please contact the Senior Project Manager, John G. Lamb, at (301) 415-3100 or via email at [John.Lamb@nrc.gov](mailto:John.Lamb@nrc.gov).

Sincerely,

Michael T. Markley, Chief  
Plant Licensing Branch II-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-424 and 50-425

cc: Listserv



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

**VOGTLE ELECTRIC GENERATING PLANT, UNITS 1 AND 2 – APPROVAL OF REQUEST FOR ALTERNATIVE VEGP-ISI-ALT-04-05 FROM CERTAIN REQUIREMENTS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS BOILER AND PRESSURE VESSEL CODE (EPID L-2021-LLR-0068)**

**LICENSEE INFORMATION**

**Licensee:** Southern Nuclear Operating Company (SNC)  
**Plant Name and Units:** Vogtle Electric Generating Plant (Vogtle), Units 1 and 2  
**Docket Nos.:** 50-424, 50-425

**APPLICATION INFORMATION**

**Submittal Date:** September 10, 2021

**Submittal Agencywide Documents Access and Management System (ADAMS) Accession No.:** ML21256A243

**Supplement Date(s):** N/A

**Supplement ADAMS Accession No.:** N/A

**Licensee Proposed Alternative No. or Identifier:** VEGP-ISI-ALT-04-05

**Applicable Regulation:** Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(z)(1)

**Applicable Code Requirements:** American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Section XI “Rules for Inservice Inspection of Nuclear Power Plant Components” Article IWA-4000 contains requirements for the removal of defects from and welded repairs performed on ASME components.

ASME Code Section XI, IWA-4411 requires that “Welding, brazing, fabrication, and installation shall be performed in accordance with the Owner’s Requirements and, except as modified below, in accordance with the Construction Code of the item.”

ASME Code, Section III “Rules for Construction of Nuclear Facility Components”, Paragraph NB-4131 requires that the defects are eliminated, repaired, and examined in accordance with Subarticle NB-2500, which requires removal of defects via grinding or machining.

**Applicable Code Edition and Addenda:** The construction Code for Vogtle 1 and 2 is ASME Code, Section III, 1971 Edition through Summer 72 Addenda. The inservice inspection (ISI) code of record for the fourth 10-year interval at Vogtle Units 1 and 2 is ASME code Section XI 2007 Edition, through 2008 Addenda

**Brief Description of the Proposed Alternative:** The licensee is proposing to use an embedded flaw repair (EFR) method for its Vessel Head Penetrations (VHP) and associated J-groove attachment welds as an alternative to the defect removal requirements of ASME Code Section XI and Section III. The proposed embedded flaw repair method is based on WCAP-15987-P, Revision 2-P-A.

## REGULATORY EVALUATION

**Regulatory Basis:** 10 CFR 50.55a(z)(1)

Adherence to Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (B&PV Code) is mandated by 10 CFR 50.55a(g)(4), which states, in part, that ASME B&PV Code Class 1, 2, and 3 components will meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME B&PV Code, Section XI.

Paragraph 10 CFR 50.55a(z) states, in part, that alternatives to the requirements of 10 CFR 50.55a(b)-(h) may be used, when authorized by the Director, Office of Nuclear Reactor Regulation, if (1) the proposed alternatives would provide an acceptable level of quality and safety or (2) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

## TECHNICAL EVALUATION

The licensee requested authorization of its alternative Relief Request VEGP-ISI-ALT-04-05 under 10 CFR 50.55a(z)(1) on the basis that the proposed alternative requirements for repair of VHP's provides an acceptable level of quality and safety.

The purpose of the licensee's proposed repair is to address primary water stress corrosion cracking (PWSCC), which typically initiates in susceptible materials, such as Alloy 600 material and Alloy 82/182 weld materials, in areas of tensile stress and certain environmental conditions, such as higher temperatures and primary coolant water environments. The reactor VHPs and their associated J-groove attachment welds at Vogtle, Unit 1 and 2, meet these conditions to be susceptible to PWSCC. The proposed repair technique, the EFR, isolates the susceptible material using a seal weld of Alloy 52 or 52M weld material, which is less susceptible to PWSCC crack initiation and growth.

The proposed EFR method is based on U.S. Nuclear Regulatory Commission (NRC) approved Westinghouse Topical Report, "Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations," WCAP-15987-P, Revision 2-P-A. The repair methods for an axial or circumferential flaw fall into four main categories, inner diameter (ID) repairs in the VHP, outer diameter (OD) repairs below the J-groove weld, OD repairs of the VHP of a flaw that extends to the J-groove weld and outer diameter repairs of the J-groove weld itself.

The licensee's proposed repair methodology differs from WCAP-15987 Revision 2-P-A in three areas. First, the minimum number of Alloy 52 weld layers applied on the ID or OD of the VHP is changed from three to two layers; second, the allowance of the repair for ID circumferential flaws; and third, the allowance for the licensee to remove and reweld part of the flaw in the J-groove weld OD surface prior to applying the seal weld. The NRC staff has reviewed these changes in other licensee proposed alternatives to use the EFR and found them acceptable. The NRC staff found the use of two layers instead of three for the ID repair of the VHP allows for less grinding on the nozzle, and, therefore less damage to the VHP and lower worker radiation dose. This along with the PWSCC resistance of the seal weld materials and the effectiveness of the non-destructive examination (NDE) requirements for volumetric or surface examinations for ISI, gives the NRC staff confidence that two layers of the seal weld are acceptable on the VHP ID or OD surface. The NRC staff considers the repair of circumferential flaws initiating from the ID surface to be adequately addressed by the EFR technique in comparison to axial flaws given the PWSCC crack resistance of the Alloy 52 or 52M seal weld material and the ISI NDE requirements. The NRC staff also agrees that the excavation of part of the indication in the J-groove weld can be performed safely in accordance with Section 2.c of the licensee's proposed alternative to refill the excavated area with Alloy 52 or 52M material. Therefore, the NRC staff found SNC's proposed repair technique was consistent with the approved methodology of WCAP-15987 Revision 2-P-A with the above three noted deviations that the NRC considers acceptable. Based on the above, the NRC finds that the licensee has provided reasonable assurance of structural integrity.

The licensee also proposed differences from WCAP-15987-P, Revision 2-P-A for the NDE requirements of Table 1 of the conditions described in the NRC Safety Evaluation on WCAP 15987-P, Revision 2-P dated July 3, 2003 (ADAMS Accession No. ML031840237). These differences were mainly to the change of VHP examination requirements to 10 CFR 50.55a(g)(6)(ii)(D) since the WCAP was approved.

Repair Location	Flaw Orientation	Repair Weld	Repair NDE	ISI NDE of the Repair Note 2
VHP Nozzle ID (inside diameter)	Axial or Circumferential	Seal	UT (ultrasonic testing) and Surface	UT or Surface
VHP Nozzle OD (outside diameter) above j-groove weld	Axial or Circumferential	Note 1	Note 1	Note 1
VHP Nozzle OD below j-groove weld	Axial or Circumferential	Seal	UT or Surface	UT or Surface
J-groove weld	Axial	Seal	UT and Surface, Note 3	UT and Surface, Notes 3 and 4
J-groove weld	Circumferential	Seal	UT and Surface, Note 3	UT and Surface, Notes 3 and 4

- Notes:
- (1) Repair method, if required, must be approved separately by the NRC.
  - (2) Preservice and inservice inspection to be consistent with 10 CFR 50.55a(g)(6)(ii)(D), which requires the implementation of Code Case N-729-6 with conditions; or NRC approved alternatives to these specified conditions.

- (3) UT personnel and procedures qualified in accordance with 10 CFR 10.55a(g)(6)(ii)(D), which requires the implementation of Code Case N-729-6 with conditions. Examine the accessible portion of the J-groove repaired region. The UT plus surface examination coverage equals to 100 percent.
- (4) Surface examination of the embedded flaw repair (EFR) shall be performed to ensure the repair satisfies ASME Code Section III, NB-5350, acceptance standards. The frequency of examination shall be as follows:
  - a. Perform surface examination during the first and second refueling outage after installation or repair of the EFR.
  - b. When the examination results of 4.a verify acceptable results, then reinspection of the embedded flaw repair will be continued at a frequency of every other refueling outage. If these examinations identify unacceptable results that require flaw removal, flaw reduction to acceptable dimensions, or welded repair, the requirements of 4.a above shall be applied during the next refueling outage.

The NRC staff notes these NDE alternatives for the EFR process repaired VHP and associated J-groove welds have been approved previously for other licensees and are consistent with the prior precedents. The examination requirements of 10 CFR 50.55a(g)(6)(ii)(D) provide the latest NRC regulatory guidance for qualification and acceptance of the NDE methods identified. Further, the NRC staff finds that the frequency of NDE required above provides reasonable assurance of structural integrity of the VHP and associated J-groove welds given the EFR process.

Based on the above, the NRC staff concludes that SNC's proposed alternative provides reasonable assurance of an acceptable level of quality and safety for the use of EFR process on VHP nozzles and its associated J-groove welds at Vogtle, Units 1 and 2, as required by 10 CFR 50.55a(z)(1).

## **CONCLUSION**

The NRC staff has determined that the proposed alternative in SNC's request referenced above would provide an acceptable level of quality and safety. The NRC staff concludes that the licensee has adequately addressed the regulatory requirements set forth in 10 CFR 50.55a(z)(1).

The NRC staff authorizes the use of proposed alternative VEGP-ISI-ALT-04-05 at Vogtle, Units 1 and 2, through the end of the fourth 10-year Inservice Inspection Interval ending May 30, 2027.

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

Principal Contributor: Jay Collins, NRR

Date: January 24, 2022

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