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**From:** Wengert, Thomas  
**Sent:** Wednesday, October 13, 2021 6:25 PM  
**To:** Keele Jr, Riley D; Gaston, Ronald William  
**Cc:** Clark, Robert; Mitchell, Matthew; Dixon-Herrity, Jennifer; Collins, Jay; Agrawal, Ami; Taylor, Nicholas; Bywater, Russ; Tseng, Ian; Buford, Angie; Tsao, John; Anchondo-Lopez, Isaac; Basavaraju, Chakrapani; Sanchez, Alfred; Lee, Samson; Hsu, Kaihwa  
**Subject:** Arkansas Nuclear One, Unit 2 - Verbal Authorization of Relief Request ANO2-R&R-012 (EPID L-2021-LLR-0082)  
**Attachments:** Verbal Authorization for RR ANO2-R&R-012 dated 10-13-21.pdf

By telephone conversation on October 13, 2021, the U.S. Nuclear Regulatory Commission (NRC) staff provided a verbal authorization to Entergy Operations, Inc. (Entergy, the licensee) for the proposed alternative ANO2-R&R-012 for Arkansas Nuclear One, Unit 2 (ANO-2). In ANO2-R&R-012, the licensee stated that a flaw located in Reactor Vessel Closure Head (RVCH) Penetration Nozzle #46 was determined to be unacceptable based on requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code). The licensee stated that it has developed a strategy to perform a local excavation of penetration Nozzle #46 and the adjacent J-groove weld to remove the indication to repair this nozzle. However, the proposed flaw removal would reduce the weld joint to below the requirements of the 1968 Edition with Addenda through Summer 1970 of ASME Code Section III, N-462.4(d), Figure N-462.4(d), "Attachment of Connections Using Partial Penetration Welds." Therefore, the licensee proposed an alternative to the required weld and nozzle dimensions to ensure structural integrity for one cycle of operation after flaw removal, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(z)(1), "Acceptable level of quality and safety." The NRC staff's evaluation and verbal authorization is repeated in the attachment to this e-mail.

The following NRC and licensee personnel participated in the conference call:

#### NRC

Jennifer Dixon-Herrity - Chief, Plant Licensing Branch IV (LPL4)  
Matthew Mitchell - Chief, Piping and Head Penetrations Branch (NPHP)  
Ian Tseng – Acting Chief, Mechanical Engineering and IST Branch (EMIB)  
Angie Buford – Chief, Vessels and Internals Branch (NVIB)  
Nick Taylor - Chief, Region 4, Engineering Branch 2  
Ami Agrawal – Acting Chief, Region 4, Division of Reactor Projects Branch D (DRP D)  
Jay Collins – Senior Materials Engineer (NPHP)  
John Tsao – Senior Materials Engineer (NVIB)  
Isaac Anchondo, Materials Engineer (NVIB)  
Chakrapani Basavaraju – Mechanical Engineer (EMIB)  
Fred Sanchez – Senior Project Engineer (DRP D)  
Russ Bywater – ANO Senior Resident Inspector  
Samson Lee – Senior Project Manager (LPL4)  
Tom Wengert – Senior Project Manager (LPL4)

#### Entergy

Riley Keele – ANO Licensing Manager  
Bob Clark – ANO Senior Licensing Specialist  
Joe Weicks – Entergy Engineering, Senior Staff Technical Specialist  
Joseph Cole – Entergy Corporate Regulatory Assurance  
Ron Gaston – Entergy Director, Regulatory Compliance  
Phil Couture – Entergy Senior Manager, Fleet Regulatory Assurance  
Ken Panther – ANO Contractor NDE

Bob Allen – Entergy NDE Level III

Blake Hogue – ANO Supervisor, Design and Programs Engineering

Please contact me if you have any questions.

Tom Wengert

Project Manager – Arkansas Nuclear One

U.S. Nuclear Regulatory Commission

Division of Operating Reactor Licensing

Plant Licensing Branch IV

[Thomas.Wengert@nrc.gov](mailto:Thomas.Wengert@nrc.gov)

VERBAL AUTHORIZATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION FOR  
PROPOSED ALTERNATIVE ANO2-R&R-012  
ALTERNATE REPAIR OF A REACTOR VESSEL CLOSURE HEAD PENETRATION #46  
ENTERGY OPERATIONS, INC.  
ARKANSAS NUCLEAR ONE, UNIT 2  
DOCKET NO. 50-368  
OCTOBER 13, 2021

**Technical Evaluation Read by Matthew Mitchell, Branch Chief, Piping and Head Penetration Branch, Division of New and Renewed Licenses, Office of Nuclear Reactor Regulation**

By letter dated October 10, 2021 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML21283A001), as supplemented by letter dated October 12, 2021 (ADAMS Accession No. ML21285A326), Entergy Operations, Inc. (the licensee) submitted proposed alternative ANO2-R&R-012 for Arkansas Nuclear One, Unit 2 (ANO-2). In ANO2-R&R-012, the licensee stated that a flaw located in Reactor Vessel Closure Head (RVCH) Penetration Nozzle #46 was determined to be unacceptable based on requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code). The licensee stated that it has developed a strategy to perform a local excavation of penetration Nozzle #46 and the adjacent J-groove weld to remove the indication to repair this nozzle. However, the proposed flaw removal would reduce the weld joint to below the requirements of the 1968 Edition with Addenda through Summer 1970 of ASME Code Section III, N-462.4(d), Figure N-462.4(d), "Attachment of Connections Using Partial Penetration Welds." Therefore, the licensee proposed an alternative to the required weld and nozzle dimensions to ensure structural integrity for one cycle of operation after flaw removal, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(z)(1), "Acceptable level of quality and safety."

The licensee provided and analyzed the proposed mechanical excavation to be limited by:

- 1) The maximum extent of the depth of excavation of the nozzle would be 0.35-inch radially from the outside diameter of the nozzle,
- 2) The maximum extent of the vertical (axial distance along nozzle) length of excavation for the nozzle and J-groove weld would be beginning 0.25-inch relative to the thread relief datum and extend to the top of the indication (0.78-inch from the datum) plus an allowance of 0.12-inch for grinding access and blending for a total vertical length of 0.90-inch from the thread relief datum for a total excavation height of 0.65-inch,
- 3) A maximum circumferential length of the weld and nozzle excavation (at the weld area) based on a 20° arc in evaluating the reduction of the weld area (or approximately 0.7-inch), and
- 4) The circumferential length of the excavation into the nozzle (outside of the weld area) is not expressly limited since the basis for material removal in this area is that the minimum required nozzle wall thickness ( $t_{min}$ ) will be maintained and therefore not sensitive to limiting the circumference of material removed.

The NRC staff reviewed the following information: (1) the maximum extent of excavation of penetration Nozzle #46 and the associated J-groove weld; (2) the licensee's structural analysis of the as-left condition for one cycle of operation; (3) the licensee's nondestructive examination activities to verify flaw removal; (4) susceptibility of the new configuration to additional cracking; and (5) the program of enhanced leakage monitoring during the upcoming cycle of operation.

The U.S. Nuclear Regulatory Commission (NRC) staff found the licensee's structural analysis bounds the maximum extent of excavation of penetration Nozzle #46 and the associated J-groove weld. The NRC staff determined there is adequate margin in primary stress such that Nozzle #46 will not dislodge for one cycle of operation. The NRC staff found in the consideration of fatigue, the usage factor is extremely low for the original design, and any increase in the usage factor due to removal of material from excavation is judged acceptable for one cycle of operation. Therefore, the NRC staff found that for one cycle of operation, there is reasonable assurance of structural integrity of penetration Nozzle #46 and the associated J-groove weld based on the licensee's proposed maximum extent of excavation.

The NRC staff reviewed the licensee's nondestructive examinations identified in the submittal to verify the removal of the identified primary water stress corrosion cracking (PWSCC) in penetration Nozzle #46 and any potential flaws in the J-groove weld. This included liquid dye penetrant (PT) examinations performed after (1) mechanical removal of the flaw, and (2) final emery cloth buffing of the final excavated surface, to be followed by a volumetric examination of the nozzle in accordance with ASME Code Case N-729-6. The acceptance criteria for the PT examinations is no indications (linear or rounded) of any size (i.e., "PT White"). The NRC staff finds that the licensee's volumetric examination of the penetration nozzle and use of the same surface examination acceptance criteria of paragraph -3132.1(b) of ASME Code Case N-729-6 for penetration nozzles or welds with a relevant condition of possible nozzle leakage, provides reasonable assurance that the original PWSCC flaw in the penetration nozzle and associated J-groove weld has been removed. Further, in the unlikely circumstance of a missed flaw segment or initiation of a new flaw in the excavated area, the NRC staff finds the licensee's identified leakage monitoring actions will provide defense-in-depth by detection of the onset or increase in leakage through a penetration nozzle or associated J-groove weld prior to it presenting a significant challenge to structural integrity of the RVCH. Finally, during the next refueling outage, the licensee will perform a volumetric examination of the penetration nozzle, including a volumetric leak path assessment and bare metal visual examination to verify no indication of PWSCC or leakage from the penetration Nozzle #46, in accordance with 10 CFR 50.55a(g)(6)(ii)(D).

Hence, the NRC staff finds that the licensee's proposed alternative provides reasonable assurance of the structural integrity of the RVCH and repaired penetration nozzle #46 for the next operating cycle at ANO-2. Therefore, the NRC staff concludes the licensee's proposed alternative provides an acceptable level of quality and safety.

**NRC Staff Conclusion Read by Jennifer Dixon-Herrity, Chief of Plant Licensing Branch IV, Division of Operating Reactor Licensing, Office of Nuclear Reactor Regulation**

As Chief of Plant Licensing Branch IV, I concur with the Piping and Head Penetration Branch's determinations.

The NRC staff concludes that proposed alternative ANO2-R&R-012 will provide an acceptable level of quality and safety for the reactor vessel closure head and repaired penetration Nozzle #46 and associated J-groove weld. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1) and is in compliance with the requirements of the ASME Code, Section XI. Therefore, as of October 13, 2021, the NRC authorizes proposed alternative ANO2-R&R-012 for one cycle of operation at ANO-2, which is scheduled to end in the spring of 2023.

All other requirements of the ASME Code or 10 CFR 50.55a, for which an alternative was not specifically requested and authorized by the NRC staff remain applicable, including the third party review by the Authorized Nuclear Inservice Inspector.

This verbal authorization does not preclude the NRC staff from requesting additional clarification information regarding the licensee's proposed alternative while preparing the subsequent written safety evaluation.