

Proposed Alternative
In accordance with 10 CFR 50.55a (z)(1)
Alternative Provides Acceptable Level of Quality and Safety

1. ASME Code Component Affected:

- Component: Containment Liner
- Description: Instrument Tunnel Sump (Incore Pit) Liner
- Component Number: SUMPLF07DRWIT

2. Applicable Code Edition and Addenda:

ASME Boiler and Pressure Vessel Code, Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*, 2007 Edition through 2008 Addenda.

3. Applicable Code Requirement:

IWE-5220, *Tests Following Repair/Replacement Activities*

IWE-5221, *General*, paragraph (a) states the following:

Except as noted in IWE-5224, a pneumatic leakage test shall be performed in accordance with IWE-5223, *Pneumatic Leakage Test*, following repair/replacement activities performed by welding or brazing, prior to returning the component to service."

IWE-5224, *Bubble Test-Vacuum Box Technique* states the following:

- (a) As an alternative to the requirements of IWE-5223, *Pneumatic Leakage Test*, a bubble test-vacuum box technique may be performed following repair/replacement activities performed by welding or brazing on the following:
 - (1) metallic shell and penetration liners of Class CC components
 - (2) nonstructural pressure-retaining metallic liners of Class MC components embedded in, or backed by, concrete
- (b) The bubble test shall be performed in accordance with Section V, Article 10, Appendix II at a partial vacuum of at least 5 psi (35 kPa) below atmospheric pressure.
- (c) Only brazed joints and welds made in the course of the repair/replacement activity require testing.

4. Reason for Request:

Pursuant to 10 CFR 50.55a, "Codes and standards," paragraph (z)(1), an alternative to the Section XI, IWE-5221(a) pneumatic leakage test requirement is proposed. The basis of the request is that the proposed alternative would provide an acceptable level of quality and safety.

On October 20, 2023, during Callaway's refueling outage (RFO), inservice inspection (ISI) on the Instrument Tunnel Sump (Incore Pit) was performed (Reference 1) in accordance with Callaway's Containment Pressure Boundary ISI Program procedure (Reference 2). During this inspection, Quality Control (QC) inspectors identified (25) localized pits on the liner plate wall and floor. Using a pit-gauge, the depth measurements of the pits ranged from 0.0625" to 0.1875" and 0.250" to 1.125" in diameter (Reference 3). This condition was captured in Callaway's Corrective Action Program (Reference 4) and a job package was generated to repair the identified pits (Reference 5). Excavation was performed to get all indications (i.e., corroded, pitted, and eroded areas) to smooth base metal. Subsequently, a pre-weld visual examination of the defect removal areas was performed. Following the base metal repairs (BMRs) to the liner, QC inspectors performed visual (VT-1) and magnetic particle (MT) surface examinations per QC examination procedures (Reference 6 and 7). However, in the Fall of 2024, it was identified during an internal oversight audit that a pneumatic leakage test was not performed following the BMRs of the Instrument Tunnel Sump liner plate. This condition, upon identification, was captured in Callaway's Corrective Action Program (Reference 8).

In accordance with IWE-5221(a), Callaway is required to perform a pneumatic leakage test per IWE-5223 or, alternatively, a bubble test-vacuum box technique per IWE-5224, following a weld repair activity prior to returning the component to service. Therefore, this relief request is proposing that the pre-weld visual examinations, in addition to the post-weld VT-1 and MT exams completed on the Instrument Tunnel Sump liner in the Fall of 2023, are an acceptable alternative until a pneumatic leakage test can be performed in accordance with IWE-5224 (bubble test-vacuum box technique) in the Spring of 2025 during Callaway's next scheduled RFO.

The technical justification for the proposed alternative is discussed in the next section of this relief request.

5. Propose Alternative and Basis for Use:

As an alternative, Ameren Missouri proposes, in lieu of the ASME Section XI, IWE-5221(a) pneumatic leakage test requirement, that the pre-weld visual examinations and the post-weld VT-1 and MT exams performed following the BMRs of the Instrument Tunnel Sump liner in the Fall of 2023 are an acceptable alternative until a pneumatic leakage test can be performed in accordance with IWE-5224 (bubble test-vacuum box technique) in the Spring of 2025 during Callaway's next scheduled RFO.

Justification

A. Design Information

The Instrument Tunnel Sump is a collection point for reactor coolant leakage in containment and is open to containment atmospheric pressure and temperature. Sump level instrumentation is capable of detecting reactor coolant system leakage. The minimum detectable change in level is 25 gpm.

The liner plate of the Instrument Tunnel Sump is ASME Section XI, Class MC (IWE), ¼" thick Carbon Steel (SA-285). As a containment liner, the primary function of the Instrument Tunnel Sump liner plate is to ensure that the containment structure is leak tight. Behind the containment liner is the post-tensioned concrete containment structure. The concrete structure supports all structural loads, and no credit is taken for the liner for the pressure design of the containment structure.

B. Calculation Information

In 1999, the minimum wall thickness required for the containment liner was calculated for conditions of generalized and localized thinning by conservatively assuming different size voids in the concrete containment structure immediately behind the liner plate (Reference 9). This calculation concluded that a liner wall thickness of 1/8" is allowed assuming a localized defect or wall thinning of less than 5" in diameter (i.e., assuming a 5" diameter concrete void behind the liner plate).

C. Visual and Magnetic Particle Surface Examinations

During the IWE inspection of the Instrument Tunnel Sump liner in the Fall of 2023, there were (25) twenty-five localized pits identified on the liner wall and floor. Of these localized pits, (23) twenty-three caused the 1/8" minimum wall criterion to not be met, with the largest pits measuring 3/16" in depth. This condition was captured in Callaway's Corrective Action Program, and a job package was generated to repair the pits.

Excavation on the defects (i.e., pitting from corrosion) was performed to get all indications to base metal so that all corroded, pitted, and eroded areas were removed. A pit depth gage was utilized before and after excavation, and each pit was confirmed to be less than 5" in diameter. Pre-weld visual examinations were performed after excavation. These examinations verified that all excavations were to base metal with no through-wall pitting observed. Additionally, these examinations provided reasonable assurance that no unidentified flaws were left prior to performing the weld build-up.

After the BMRs were complete on the liner plate, a VT-1 and MT surface examination were completed to ensure no flaws existed that would propagate to the surface due to the new weld build-up. These post-weld examinations provided evidence that there were no surface flaws around any of the weld build-up locations and that the surface of the liner is intact (defect free). With the satisfactory completion of the post-weld VT-1 and MT examinations, there is reasonable assurance that the containment liner plate is intact and able to perform its leak tight function.

D. Containment Structure

Due to the post-tensioning of the concrete containment structure, the liner plate is under compression. As such, if no concrete voids exist behind the liner plate, the liner is able to perform its leak tight design function with only a few mils of thickness due to the strain of the liner being directly related to the strain in the concrete structure.

While the minimum wall calculation (Reference 9) conservatively assumes a concrete void behind the containment liner plate, it cannot be definitively known if voids exist. In particular, the Instrument Tunnel Sump liner is located on the base slab of the containment concrete structure which is several feet thick. This section of the liner is not in an area where tight rebar lattices exist that might hinder the placement of concrete which could result in small voids in the containment structure. Additionally, while performing a sound check in and around the identified localized pits on the Instrument Tunnel Sump liner in the Fall of 2023, engineering personnel did not detect any hollow cavities behind the Instrument Tunnel Sump liner, based on the low-frequency sounds produced and lack of high pitch echoing.

6. **Duration of Proposed Alternative:**

This relief request will remain in effect until the end of Callaway's next RFO which is scheduled in the Spring of 2025.

7. **References:**

1. Job 20513454.000, "Containment Pressure Boundary Inspection of Incore Sump"
2. ESP-ZZ-01016, "ASME Section XI IWE Containment Pressure Boundary Inspection"
3. Job 20513454.500, "General Visual Inspection Report"
4. CR 202307749, "IWE Zone 31 Incore Tunnel Sump (SUMPLF07DRWIT) Inspection Results"
5. Job 20001348.496, "Base Metal Weld Repair of Sump Liner"
6. QCP-ZZ-05040, "Visual Examination to ASME VT-1"
7. QCP-ZZ-05010, "Magnetic Particle Examination"
8. CR 202406120, "Job 20003148.496 Contains Multiple Instances of Non-Compliance with APA-ZZ-00662 and ASME Section XI"
9. Calculation ZZ-475, "Evaluate the Minimum Wall Thickness of the Containment Liner Required to for Conditions of Generalized and Localized Thinning"