Proposed Alternative in accordance with 10 CFR 50.55a (z)(2) -
Complying with Requirement Would Result in Hardship or Unusual Difficulty Without a Compensating Increase in the 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, B*ubble 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)(2), an alternative to Section XI, IWE-5221(a) pneumatic leakage test requirement is proposed. The basis of the request is that

complying with the IWE-5221(a) requirement would result in hardship or unusual difficulty without a compensating increase in the 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 localized pits on the liner plate wall and floor. This condition was captured in Callaway's Corrective Action Program (Reference 3) and a job package was generated to repair the identified pits (Reference 4). However, following the base metal repairs (BMRs) of the Instrument Tunnel Sump liner plate, an IWE-5221(a) pneumatic leakage test was not performed. This condition was not identified until the conduct of an internal oversight audit in the Fall of 2024 (Reference 5).

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. To restore compliance with IWE-5221(a), Callaway must perform the missed pneumatic leakage test which would require a plant shut down. This relief request is proposing to postpone a plant shutdown until Callaway's next scheduled RFO in the Spring of 2025 to perform the pneumatic leakage test on the Instrument Tunnel Sump liner.

The 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 postponing the performance of the ASME Section XI, IWE-5221(a) pneumatic leakage test requirement, that was not performed in the Fall of 2023 and perform the test during Callaway's next scheduled RFO in the Spring of 2025. The basis for the proposed alternative is that an unplanned plant shut down to comply with this requirement would result in hardship or unusual difficulty without a compensating level of quality or safety.

Justification

A. Instrument Tunnel Sump 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.

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. 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.

It is noted, however, that Callaway calculated the minimum wall thickness required for the containment liner for conditions of generalized and localized thinning by conservatively assuming different size voids in the concrete containment structure immediately behind the liner plate (Reference 6). This calculation concluded that a liner wall thickness of 1/8" (or 0.125") is allowed conservatively 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).

B. Instrument Tunnel Sump Liner Inspection and Examinations

During the IWE inspection of the Instrument Tunnel Sump liner in the Fall of 2023, QC inspectors identified (25) twenty-five localized pits on the liner wall and floor. Using a pit-gauge, the measurements of the pits ranged from 0.0625" to 0.1875" in depth and 0.250" to 1.125" in diameter (Reference 7). The minimum wall criterion of 1/8" was not met for (23) twenty-three of these localized pits. This condition was captured in Callaway's Corrective Action Program (Reference 3), and a job package was generated to repair the pits (Reference 4).

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 of the defect removal areas were performed after excavation. These examinations verified that all excavations were to base metal with no through-wall pitting observed. These examinations provided reasonable assurance that no unidentified flaws were left prior to performing the weld build-up. Engineering personnel also performed a sound check in and around the identified localized pits and did not detect any hollow cavities behind the liner, based on the low-frequency sounds produced and lack of high pitch echoing.

The BMRs on the liner plate were completed by qualified welders and the weld filler material used was in accordance with Callaway's welding program procedure (Reference 8). Following the BMRs, QC inspectors performed visual (VT-1) and magnetic particle (MT) surface examinations per QC examination procedures (Reference 9 and 10). 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.

C. Hardship or Unusual Difficulty

To restore compliance with ASME Section XI, IWE-5221(a), Callaway must perform the pneumatic leakage test on the Instrument Tunnel Sump which would require a plant shut down. In particular, Callaway would need to shut down the plant to at least MODE 5, Cold Shutdown, to remove reactor vessel incore instrumentation to access the Instrument Tunnel Sump. Consequently, immediately restoring compliance with IWE-5221(a) would necessitate an unplanned shutdown.

In general, a plant shut down is complex in nature and involves a significant amount of time to schedule, plan, and execute. Accordingly, executing an unplanned shutdown involves greater risks to plant personnel and equipment. Elevated risks include a higher potential for human performance errors, plant transients (i.e., reactivity, pressure, temperature), and risk management challenges, potentially resulting in challenges to plant and personnel safety. Additionally, plant personnel would be exposed to higher radiological dose due to performing the pneumatic leakage test in a cold shutdown mode. Finally, it is noted that only two months remain before the start of Callaway's next scheduled RFO in the Spring of 2025. Consequently, there is a very low probability of risk to the health and safety of the public until compliance with ASME Section XI, IWE-5221(a) is restored.

In conclusion, the pre- and post-weld examinations that were performed on the Instrument Tunnel Sump liner in the Fall of 2023, along with the overall design of the Instrument Tunnel Sump liner, provide reasonable assurance that the containment liner plate is intact and able to perform its leak tight function. Further, executing an unplanned plant shutdown to immediately restore compliance with ASME Section XI, IWE-5221(a) would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, this relief request is proposing to postpone performance of the pneumatic leakage test on the Instrument Tunnel Sump liner until Callaway's next scheduled RFO in the Spring of 2025.

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. CR 202307749, "IWE Zone 31 Incore Tunnel Sump (SUMPLF07DRWIT) Inspection Results"
4. Job 20003148.496, "Base Metal Weld Repair of Sump Liner"
5. CR 202406120, "Job 20003148.496 Contains Multiple Instances of Non-Compliance with APA-ZZ-00662 and ASME Section XI"
6. Calculation ZZ-475, "Evaluate the Minimum Wall Thickness of the Containment Liner Required to for Conditions of Generalized and Localized Thinning"
7. Job 20513454.500, "General Visual Inspection Report"
8. APA-ZZ-00661, "Administration of Welding"
9. QCP-ZZ-05040, "Visual Examination to ASME VT-1"
10. QCP-ZZ-05010, "Magnetic Particle Examination"