Ameren MISSOURI

Callaway Plant

June 27, 2017

ULNRC-06378

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

10 CFR 2.201

Ladies and Gentlemen:

DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
UNION ELECTRIC CO.
RENEWED FACILITY OPERATING LICENSE NPF-30
SUPPLEMENTAL RESPONSE TO NOTICE OF VIOLATION
INSPECTION REPORT NO. 50-483/2016002

References:

1. Letter dated August 12, 2016 from Nicholas H. Taylor, USNRC, to Fadi Diya, Union Electric Company, "Callaway Plant – NRC Integrated Inspection Report 05000483/2016002 and Notice of Violation" (ADAMS Accession Number ML16225A577)
2. ULNRC-06326, "Reply to a Notice of Violation Inspection Report No. 50-483/2016002," dated September 9, 2016 (ADAMS Accession Number ML16253A225)
3. Letter dated September 14, 2016 from Nick Taylor, USNRC, to Fadi Diya, Union Electric Company, "Callaway Plant – Response to Notice of Violation (NRC Inspection Report 05000843/2016002)" (ADAMS Accession Number ML16258A043)
4. ULNRC-06365, "Updated Response to Notice of Violation Inspection Report 50-483/2016002," dated April 27, 2017 (ADAMS Accession Number ML17117A275)

On August 12, 2016, Union Electric Company (dba Ameren Missouri) received a Notice of Violation (NOV) identified for the Callaway Plant (per Reference 1). Ameren Missouri's 30-day response to the NOV was provided in Reference 2, and the NRC's review and acknowledgement of the response to the NOV was provided in Reference 3.

In Reference 2, Ameren Missouri committed to perform an Essential Service Water (ESW) system transient analysis and identify non-conforming structural components by April 30, 2017. Further, a supplemental response identifying actions required as a result of the transient analysis was committed to be provided by June 30, 2017.

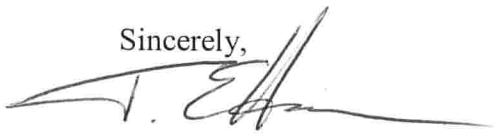
In Reference 4, Ameren Missouri reported that, as of April 2017, the preliminary results from the Essential Service Water (ESW) system transient analysis were still being finalized. It was noted that the commitment to provide a supplemental response identifying actions required as a result of the transient analysis would still be provided by June 30, 2017.

Based on the above, and in accordance with Ameren Missouri's intent to provide a supplemental response to the subject NOV, including identification of actions required as a result of the analyses that have been performed for the ESW system, the attachment to this letter provides the necessary information. The information is provided by addressing each of the three concerns/actions identified as requiring further resolution in Ameren Missouri's September 9, 2016 NOV response.

None of the material in the response is considered proprietary. Further, this letter does not contain new commitments.

If there are any questions concerning this letter, please contact Ms. Sarah Kovaleski, Director, Engineering Design at (573) 489-9435.

Sincerely,



T.E. Herrmann
Site Vice President

Attachment 1: Updated Response to Notice of Violation

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Updated Response to Notice of Violation

In Ameren Missouri's September 9, 2016 response to the Notice of Violation (NOV) identified in NRC Inspection Report 05000483/2016002, as documented in Ameren Missouri letter ULNRC-06326, the following concerns associated with Essential Service Water (ESW) corrosion and pressure transients were identified as requiring action or further resolution:

1. Corrosion issues affecting safety-related ESW-supplied copper-nickel room coolers will be resolved through room cooler coil replacements to be completed by the end of Refueling Outage 22 (Fall 2017).

2. Corrosion issues affecting containment air coolers will be resolved by replacing the coils with a design to enhance corrosion resistance of the coils. Replacement of the coils in all four containment air coolers will be completed by the end of Refuel 25 (Spring 2022).

3. The ESW System transient analysis and identification of non-conforming structural components (piping, hangers, and major components) will be completed by April 30, 2017. A supplemental response identifying actions required as a result of the analysis will be provided by June 30, 2017.

As an update/supplement to the NOV response, Ameren Missouri hereby provides the following information regarding resolution of the actions identified above.

1. The safety-related ESW-supplied room coolers installed in the plant no longer contain copper-nickel tubes. The copper-nickel tube bundles have been replaced with a stainless steel alloy constructed tube bundle design. Additionally, the replacement ESW room cooler bundle configuration facilitates inspection for corrosion. Installation of the replacement tube bundles significantly reduces the susceptibility of the safety-related ESW room coolers to corrosion in the future.

2. The containment air coolers will be replaced with like-kind coils in Refuel 22 scheduled for the fall of 2017. Chemistry control changes are in progress to better balance protection of copper-nickel and stainless steel components and increase the longevity of the like-kind replacement bundles. Replacement of the containment air cooler coils with a corrosion-resistant material is being reevaluated and will depend, in part, on the effectiveness of the chemistry control improvements. This is part of a long term asset management plan for copper-nickel material in the ESW system, which is being tracked under Callaway's Corrective Action Program.

3. Analysis

A transient analysis of the ESW system has been performed using RELAP5 software. The analysis evaluates the current system configuration against the design criteria (ASME Section III, Paragraphs NC-3600 and ND-3600) and load combinations for Normal, Upset, Emergency, and Faulted Conditions described in Tables 3.9(B)-2 and 3.9(B)-7 of Callaway's Final Safety Analysis Report (FSAR). Additionally, the report identifies the locations where the water columns rejoin (upon restart of the ESW pumps after load shedding by the sequencers) and provides insights into system design margins for this transient. The analysis determined pressures and dynamic forces that would theoretically be experienced by components near the water column rejoining locations in the ESW system during the column closure. Additionally, a comparison of peak momentary pressures and forces to design requirements was performed for these components. The results of this analysis confirmed that full design compliance of the ESW system, as defined in FSAR Tables 3.9(B)-2 and 3.9(B)-7, cannot be restored without system modification to mitigate the column closure water hammer.

Callaway also completed a best estimate load analysis. This best estimate load analysis investigated the differences between the design loadings and the loads that would likely be experienced in the system. The pressure response of the ESW system in the best estimate analysis mimicked the data taken during the simulated Loss of Offsite Power (LOOP) test that was performed near the end of Refuel 21. Dynamic forces were calculated and evaluated, and the results provide reassurance of prior evaluations that the system is operable but non-conforming.

The results of the best estimate load analysis identified two snubbers as the limiting components, one in each train at the outlet of each train's Component Cooling Water (CCW) Heat Exchanger, whose function could not be guaranteed by analysis. Historical plant surveillance testing, however, suggests that these snubbers are not experiencing loads as high as those predicted by analysis. Callaway has removed these snubbers from service and replaced them with snubbers qualified by testing to the original manufacturer's acceptance criteria. As-found performance testing was completed on the removed snubbers, and verified that they remained fully functional and that no damage had occurred. These test results indicate that the best estimate load analysis is conservative when compared to actual effects.

Callaway has applied the completed RELAP5 model of the ESW system to perform a study evaluating several broad mitigation concepts that would generally prevent or mitigate the water hammer event. These concepts include preventing drain-down from occurring, slowing the fill rate to limit closure velocities, or adding non-condensable gas to the system to reduce the pressure response.

Through modeling, several design concepts have emerged that would provide effective potential solutions for Callaway. These concepts include installation of vacuum breakers tied to air accumulators at key locations to allow an "air cushion" to dampen pressure pulses, modifying piping configurations to introduce loop seals and orifices, and redesigning and modifying selected components (e.g., pipe supports) to be more robust. An engineering change(s) is presently in the conceptual design stage, and the final design is expected to include a combination of these concepts to restore design compliance and gain margin.

Remaining Actions

Following the completion of the conceptual design, an engineering change package will be developed to implement the selected strategy. The design change(s) will be fully implemented and tested no later than completion of Refuel 23 (Spring 2019). Implementation will bring the ESW system and its subcomponents into full design compliance with ASME Section III per the requirements of the Final Safety Analysis Report. Implementation of the engineering change package is being tracked under Callaway's Corrective Action Program.