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

September 4, 2014

Mr. Fadi Diya
Senior Vice President and
Chief Nuclear Officer
Union Electric Company
P.O. Box 620
Fulton, MO 65251

SUBJECT: CALLAWAY PLANT, UNIT 1 - REQUEST FOR RELIEF I3R-15, ALTERNATIVE TO ASME CODE REQUIREMENTS FOR SYSTEM LEAKAGE TESTS OF CLASS 1 PIPING AND COMPONENTS ISOLATED BETWEEN NORMALLY CLOSED VALVES (TAC NO. MF2921)

Dear Mr. Diya:

By letter dated October 17, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13291A134), as supplemented by letter dated January 29, 2014 (ADAMS Accession No. ML14029A553), Union Electric Company (dba Ameren Missouri, the licensee) submitted request for relief I3R-15 for Callaway Plant, Unit 1, to the U.S. Nuclear Regulatory Commission (NRC) proposing an alternative to certain requirements of the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code* (Code), Section XI, for the remainder of the third 10-year inservice inspection (ISI) program interval.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, paragraph 50.55a(a)(3)(ii), the licensee requested to use an alternative pressure retaining boundary during system leakage tests of ASME Code Class 1 piping isolated between normally closed valves on the basis that complying with the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Based on the enclosed safety evaluation, the NRC staff determines that the proposed alternative provides reasonable assurance of structural integrity and leak tightness of the subject lines. The NRC staff concludes that complying with the specified ASME Code requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(ii). Therefore, the NRC staff authorizes the use of I3R-15 at Callaway Plant for the third 10-year ISI interval, which is scheduled to end on December 18, 2014.

All other ASME Code requirements for which relief was not specifically requested and approved remain applicable, including the third-party review by the Authorized Nuclear In-service Inspector. If you have any questions, please contact Fred Lyon at 301-415-2296 or via e-mail at fred.lyon@nrc.gov.

Sincerely,

Eric R. Oesterle, Acting Chief
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-483

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF I3R-15 RELATED TO THE

INSERVICE INSPECTION PROGRAM FOR THE THIRD 10-YEAR INTERVAL

UNION ELECTRIC COMPANY

CALLAWAY PLANT, UNIT 1

DOCKET NO. 50-483

1.0 INTRODUCTION

By letter dated October 17, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13291A134), as supplemented by letter dated January 29, 2014 (ADAMS Accession No. ML14029A553), Union Electric Company (dba Ameren Missouri, the licensee) submitted request for relief I3R-15 for Callaway Plant, Unit 1, to the U.S. Nuclear Regulatory Commission (NRC) proposing an alternative to certain requirements of the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code* (Code), Section XI, for the remainder of the third 10-year inservice inspection (ISI) program interval.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, paragraph 50.55a(a)(3)(ii), the licensee requested to use an alternative pressure retaining boundary during system leakage tests of ASME Code Class 1 piping isolated between normally closed valves on the basis that complying with the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4), the ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals must comply with the requirements in the latest edition and addenda of Section XI of the ASME Code, incorporated by reference in 10 CFR 50.55a(b), 12 months prior to the start of the 120-month interval, subject to the conditions listed therein.

Pursuant to 10 CFR 50.55a(a)(3), alternatives to the requirements of paragraph (g) of 10 CFR 50.55a may be used, when authorized by the NRC, if the licensee demonstrates (i) the

proposed alternatives would provide an acceptable level of quality and safety or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Based on the above, and subject to the following technical evaluation, the NRC staff finds that regulatory authority exists for the licensee to request and the NRC to authorize the alternative requested by the licensee.

3.0 TECHNICAL EVALUATION

3.1 The Licensee's Request for Alternative

The components affected are ASME Code Class 1 pressure boundary components. In accordance with ASME Code, Section XI, IWB-2500 (Table IWB-2500-1), they are classified as Examination Category B-P, Item Numbers B15.50 and B15.70. The licensee identified these components in Section 1, Attachment 1 of I3R-15, and grouped, as follows.

Group 1 - Reactor coolant system (BB) drain lines
Group 2 - High pressure coolant injection (EM) cold leg injection lines
Group 3 - Residual heat removal (EJ) suction lines
Group 4 - Chemical volume and control system (BG) auxiliary spray and normal charging lines
Group 5 - Residual heat removal (EJ) and high pressure coolant injection (EM) hot leg injection lines

The Code of record for the third 10-year ISI interval at Callaway, Unit 1, is the 1998 Edition through 2000 Addenda of the ASME Code.

The ASME Code, Section XI, IWB-2500, Table IWB-2500-1, Examination Category B-P, requires the system leakage testing be conducted according to IWB-5220 and the VT-2 visual examinations according to IWA-5240, prior to plant startup following each refueling outage. In accordance with IWB-5221(a), the system leakage test shall be conducted at a pressure not less than the pressure corresponding to 100 percent rated reactor power. In accordance with IWB-5222(a), the pressure retaining boundary during the system leakage test shall correspond to the reactor coolant boundary, with all valves in the position required for normal reactor operation startup. The required VT-2 visual examination shall, however, extend to and include the second closed valve at the boundary extremity. In accordance with IWB-5222(b), the pressure retaining boundary during system leakage test conducted at or near the end of each inspection interval shall extend to all Class 1 pressure retaining components within the system pressure boundary.

Group 1 - Reactor coolant system (BB) drain lines:

In lieu of IWB-5222(b), the licensee proposed to use the boundary specified in IWB-5222(a) when conducting system leakage testing of the BB drain lines. The licensee stated that it will perform the required VT-2 visual examination of the BB drain lines with the isolation valves in closed position as required for normal reactor operation startup, and extend the examination to include the second closed valve at the system pressure boundary extremity.

The licensee stated that the BB drain lines contain double manual isolation valves that remain closed during normal operation. Opening the inboard isolation valve when the reactor coolant system (RCS) is at an operating pressure of 2235 pounds per square inch gauge (psig), to pressurize the BB drain lines, would violate the required double isolation barrier. Opening the inboard isolation valve leaves one isolation valve to protect the non-Code downstream piping that is not designed for the RCS pressure and temperature. This would cause a safety hazard to personnel. The licensee stated that one of the four BB drain lines has a fitting that might be used to externally pressurize that line, but this would also pose a safety hazard. Should the outboard isolation valve in this line leak, the non-Code downstream piping not designed for the RCS pressure may experience the RCS pressure. The downstream pipe could fail and thus cause a safety hazard to personnel. In addition, the licensee stated that exposure of personnel to radiation during performance of the ASME Code-required leakage testing of the three lines not equipped with a test connection is estimated at 100 milli roentgen equivalent man (mrem) based on general area dose rates in the respective areas. Also, the radiation exposure for setting up, performance, and removal of the external pressurization test equipment for the fourth line that is equipped with a test connection is estimated to be an additional 80 mrem. The total radiation exposure for all four lines is 180 mrem.

Group 2 - High pressure coolant injection (EM) cold leg injection lines:

In lieu of IWB-5222(b), the licensee proposed to perform system leakage tests of the EM cold leg injection lines at a pressure not less than 250 psig during pressure testing of the isolation check valves.

The licensee stated that the EM cold leg injection lines are not normally pressurized to the RCS operating pressure of 2235 psig. The licensee stated that it will perform system leakage tests of the EM cold leg injection lines during the pressure testing of the isolation check valves using a hydro pump, but the pressure is kept below the RCS pressure so that a positive reactivity addition from the water contained in the hydro pump would not occur. Furthermore, since the piping system is not heated, use of the system pumps while the RCS is at the operating temperature and pressure to pressurize the lines would cause a cold leg thermal transient and damage the piping and welds due to thermal fatigue.

Group 3 - Residual heat removal (EJ) suction lines:

In lieu of IWB-5222(b), the licensee proposed to perform system leakage tests of the EJ suction lines during the normal plant operation startup when the EJ system is in use and at a pressure not less than 300 psig.

The licensee stated that the EJ suction lines would experience the RCS operating pressure of 2235 psig only if the inboard isolation valves were to leak. The isolation valves are equipped with interlocks to prevent their opening when the RCS pressure is above 360 psig. To perform the ASME Code system leakage test of the EJ suction lines when the RCS is at full operating pressure of 2235 psig in Mode 3, the valve interlock would have to be bypassed to open the inboard isolation valve. Opening the inboard isolation valve would violate the design basis of a double isolation valve barrier during normal plant startup. The remainder of the EJ system would be protected from pressurization by one isolation valve only. This endangers the EJ system components beyond the outboard isolation valve that are not designed to the RCS

pressure and causes safety hazards, should the outboard isolation valve fail. Furthermore, system leakage testing at the RCS pressure with use of a hydro pump while in the lower modes of operation would also pose safety hazards to personnel. Hazards associated with the ASME Code-required system leakage tests would be the exposure of personnel to the temporary high-pressure connections for the hydro pump, and personnel and equipment contamination concerns with venting and draining of the EJ system piping.

The licensee stated that as part of the Callaway's ISI program, it has volumetrically examined one pipe-to-elbow weld 2-EJ-04-F034 between the valves BBPV8702A and BBHV8701A on the line EJ-001-BCA-12, and one pipe-to-elbow weld 2-EJ-04-S014-D between the valves BBPV8702B and BBHV8701B on the line EJ-008-BCA-12. The volumetric examinations did not identify any recordable indications and signs of leakage.

Group 4 - Chemical volume and control system (BG) auxiliary spray and normal charging lines:

In lieu of IWB-5222(b), the licensee proposed to perform the system leakage test of (a) the BG normal charging line when the line is isolated and the isolation valves are closed, and the RCS is at normal operating pressure, and (b) the BG auxiliary spray line when the line is in use during plant heat-up and the RCS pressure is not less than 300 psig. The licensee stated that it will extend the VT-2 visual examination to include the second isolation valve at the system pressure boundary extremity.

The licensee stated that using the system pumps to pressurize and flow water through the auxiliary spray line while the RCS is at the operating pressure in Mode 3 would constitute an auxiliary spray actuation transient cycle. This transient is undesirable because it would force cold water from the static piping into the pressurizer spray line resulting in a thermal transient cycle. The plant design only allows ten of these cycles over the plant design life. Furthermore, pressurization by an external source such as a hydro pump is not possible because this segment is not equipped with a test connection.

The licensee stated that it replaced the Class 2 portion of the auxiliary spray at Callaway, which experienced the outer-diameter stress-corrosion cracking (ODSCC). The licensee stated that additional examinations of the Class 1 and 2 portion of the auxiliary spray line have not found further signs of the ODSCC. The licensee further stated that as part of the Callaway's ISI program, it has inspected (a) the pipe-to-valve weld 2-BG-24-FW061 between the pipe and the valve BBV0084 on the line BG-027-BCA-2 of the auxiliary spray, and (b) the pipe-to-valve weld 2-BG-21-F012 between the pipe and the valve BB8378A on the line BB-004-BCA-3 of the normal charging. The volumetric examinations did not identify any recordable indications and signs of leakage.

Group 5 - Residual heat removal (EJ) and high pressure coolant injection (EM) hot leg injection lines:

In lieu of IWB-5222(b), the licensee proposed to perform system leakage tests of the EJ and EM hot leg injection lines during pressure testing of the isolation check valves, at a pressure not less than 1485 psig.

The licensee stated that the EJ and EM hot leg injection lines would experience the RCS operating pressure of 2235 psig only if the inboard isolation valves were to leak. The system pumps, safety injection, and residual heat removal cannot provide sufficient RCS operating pressure to meet the IWB-5222(b) requirements. The licensee stated that it will use the safety injection pumps to pressurize the EJ and EM hot leg injection lines when performing the pressure testing of the isolation check valve. The licensee performs this test when the RCS is at sufficient pressure such that the safety injection pumps will not unseat the inboard isolation check valves. In addition, the licensee stated that even if it would use a hydrostatic pump to pressurize the EJ and EM hot leg injection lines, the test pressure would still be set below the RCS pressure so as not to unseat the inboard isolation check valves. Furthermore, the licensee stated that bypassing the inboard check valves in Mode 3 to pressurize the EJ and EM hot leg injection lines would violate the provisions of the double isolation criteria.

The licensee stated that all lines in Groups 1, 2, 3, 4, and 5 are part of the Callaway Boric Acid Corrosion Control Program that requires the licensee perform walk-down at the beginning of each refueling outage. Any leakage leaves a sign of boron residue that the licensee is able to detect during the walk-down.

By letter dated January 29, 2014, the licensee stated that its search of the Callaway and the industry operating experience did not identify any failures within the boundaries of the subject lines.

The licensee submitted I3R-15 for Callaway, Unit 1, for the third 10-year ISI interval, which will end on December 18, 2014.

3.2 NRC Staff Evaluation

The NRC staff has evaluated I3R-15 pursuant to 10 CFR 50.55a(a)(3)(ii). The NRC staff focuses on whether compliance with the specified requirements of 10 CFR 50.55a(g), or portions thereof, would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety.

Group 1 - Reactor coolant system (BB) drain lines:

The NRC staff determined that compliance with the ASME Code, Section XI, IWB-5222(b), during system leakage test of the BB drain lines would result in hardship. The basis for the hardship is as follows. In order to pressurize the BB drain lines to perform the required system leakage test, the licensee would have to (a) manually open the inboard isolation valve, which would defeat the double isolation criteria for the RCS pressure boundary, and cause safety hazards to personnel conducting the test, or (b) pressurize the lines by an external source, which would require modifications to the existing piping configuration and use of temporary fittings and temporary hoses, which would pose safety hazards due to high pressurization. Furthermore, opening the inboard isolation valve, making modifications to existing lines, or using an external hydrostatic pump to facilitate the ASME Code compliant leakage testing exposes personnel to additional radiological dose that would lead to a as low as is reasonably achievable (ALARA) concern. Therefore, the NRC staff determines that the above parameters constitute a hardship.

The NRC staff concludes that the licensee will conduct the system leakage test of the BB drain lines in accordance with IWB-5222(a) accompanied with the required VT-2 visual examination. Specifically, the licensee will perform the VT-2 visual examination of the BB drain lines with the isolation valves in the closed position as required for normal operation, and extend the VT-2 visual examination to include the second isolation valve. The NRC staff determined that by performing the VT-2 visual examination according to IWA-5240 of the isolable and non-isolable segments of the BB drain lines with the isolation valves closed, the licensee will be able to detect any leakage in the BB drain lines without any design modifications to the existing piping.

Group 2 - High pressure coolant injection (EM) cold leg injection lines:

The NRC staff determined that compliance with the IWB-5222(b) requirement during system leakage test of the EM cold leg injection lines would result in hardship. The basis for the hardship is as follows. In order to pressurize the EM cold leg injection lines to facilitate the ASME Code compliant system leakage testing, the licensee would have to use a hydrostatic pump. Even with the use of a hydrostatic pump, the licensee would have to keep the pressure below the RCS pressure (to avoid a positive reactivity addition from the water contained in the hydrostatic pump) and would still be unable to satisfy the ASME Code-required RCS pressure to perform the system leakage testing. The licensee could use the system pumps in Mode 3 to pressurize the lines, but this would cause a cold leg thermal transient and the lines would be damaged due to thermal fatigue. Therefore, the NRC staff determines that the above parameters constitute a hardship.

The NRC staff concludes that the licensee will conduct the system leakage test of the EM cold leg injection lines at a pressure greater than 250 psig but less than the RCS operating pressure by use of a hydrostatic pump. The licensee will complete the system leakage test with the required VT-2 visual examination, and extend the VT-2 visual examination to include the second valve. The NRC staff determined that by performing the VT-2 visual examination according to IWA-5240 that accompany the system leakage test, the licensee will be able to detect any leakage in the EM cold leg injection lines without damaging the lines.

Group 3 - Residual heat removal (EJ) suction lines:

The NRC staff determined that compliance with the requirement of IWB-5222(b) during system leakage test of the EJ suction lines would result in hardship. The basis for the hardship is as follows. For the purpose of pressurizing the EJ suction lines to conduct the ASME Code-required system leakage test, the licensee would have to (a) bypass the valve interlock in Mode 3 to open the inboard isolation valve, which would defeat the double isolation criteria, or (b) modify the lines and use an external pump and temporary hoses in the lower mode of operation, which would cause personnel safety hazards. Therefore, the NRC staff determines that the above parameters constitute a hardship.

The NRC staff concludes that as an alternative, the licensee will conduct the system leakage test of the EJ suction lines when the EJ system is online during normal plant operation startup. The licensee will perform the required VT-2 visual examination when the EJ suction lines experience a pressure greater than 300 psig but less than the RCS operating pressure. The licensee will extend the VT-2 visual examination to include the outboard isolation valve. The NRC staff determined that by performing the VT-2 visual examination according to IWA-5240

that accompany the system leakage testing, the licensee will be able to detect any leakage in the lines that originates from a flaw.

Group 4 - Chemical volume and control system (BG) auxiliary spray and normal charging lines:

The NRC staff determined that compliance with the requirement of IWB-5222(b) during system leakage test of the BG auxiliary spray and normal charging lines would result in hardship. The basis for the hardship is as follows. To comply with the IWB-5222(b) requirement, the licensee would have to use the system pumps to pressurize the auxiliary line in Mode 3, which would cause cold water to be forced from the static piping into the pressurizer spray line resulting in a thermal transient cycle. In accordance with the plant design, a plant over its design life can only be subjected to ten of these cycles. Furthermore, if the licensee would use an external source to pressurize the BG auxiliary spray and normal charging lines, the licensee would have to make a design modification to the existing configuration of the lines by installing temporary connections and hoses that under high pressure would cause safety hazards. Therefore, the NRC staff determines that the above parameters constitute a hardship.

The NRC staff concludes that the licensee will conduct the system leakage test of (a) the BG normal charging line with the valves in closed position, as required for normal operation, and (b) the BG auxiliary spray line during the plant heat-up, when the line is in use and the RCS pressure is not less than 300 psig. The licensee will complete the system leakage test with the required VT-2 visual examination, and extend the VT-2 visual examination to include the second isolation valve. The NRC staff determined that by performing the VT-2 visual examination as part of the system leakage test according to IWA-5240, the licensee will be able to detect any leakage in the lines that originates from a flaw.

Group 5 - Residual heat removal (EJ) and high pressure coolant injection (EM) hot leg injection lines:

The NRC staff determined that compliance with the requirement of IWB-5222(b) during system leakage testing of the EJ and EM hot leg injection lines would result in hardship. The basis for the hardship is as follows. To comply with the IWB-5222(b) requirement, the licensee would have to bypass the inboard check valve when the RCS is at a normal operating pressure to pressurize the EJ and EM hot leg injection lines. This action would defeat the double isolation criteria. Or the licensee would use the system pump to pressurize the lines. However, the licensee would still be unable to perform the ASME Code-required system leakage testing because the resulting pressure would unseat the inboard isolation check valve. Therefore, the NRC staff determines that the above parameters constitute a hardship.

The NRC staff concludes that the licensee will conduct the system leakage test of the EJ and EM hot leg injection lines at a pressure not less than 1485 psig during pressure testing of the check valves. The licensee will perform the required VT-2 visual examination of the EJ and EM hot leg injection lines and extend the VT-2 visual examination to include the second check valve. The NRC staff determined that performing the VT-2 visual examination according to IWA-5240 that is a part of the system leakage testing, the licensee will be able to detect any leakage in the lines that originates from a flaw.

Groups 1, 2, 3, 4, and 5 lines:

The licensee stated that its review of operating experience of Callaway and survey of other similar plants did not identify any documented degradation in the above or similar lines. Similarly, based on review of operating experience, including Callaway, the NRC staff has not identified any documented degradation due to stress corrosion cracking and fatigue in the isolable sections of the subject or similar lines.

In addition, the NRC staff concludes that the lines identified in Groups 1, 2, 3, 4, and 5 are subject to a walk-down at the beginning of each refueling outage in accordance with the licensee's Boric Acid Corrosion Control Program. Should any leakage occur in these lines, the licensee will be able to detect the boron residue during the walk-down. The walk-down will provide additional monitoring of the structural integrity of the subject lines.

In summary, the NRC staff concludes that the proposed system leakage testing is adequate to provide reasonable assurance of the structural integrity and leak tightness of the subject lines.

4.0 CONCLUSION

As set forth above, the NRC staff determines that the proposed alternative provides reasonable assurance of structural integrity and leak tightness of the subject lines. The NRC staff concludes that complying with the specified ASME Code requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(ii). Therefore, the NRC staff authorizes the use of I3R-15 at Callaway Plant for the third 10-year ISI interval, which is scheduled to end on December 18, 2014.

All other ASME Code, Section XI, requirements for which relief was not specifically requested and authorized herein by the staff remain applicable, including the third-party review by the Authorized Nuclear In-service Inspector.

Principal Contributor: Ali Rezai, NRR/DE/EPNB

Date: September 4, 2014

All other ASME Code requirements for which relief was not specifically requested and approved remain applicable, including the third-party review by the Authorized Nuclear In-service Inspector. If you have any questions, please contact Fred Lyon at 301-415-2296 or via e-mail at fred.lyon@nrc.gov.

Sincerely,

/RA/

Eric R. Oesterle, Acting Chief
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-483

Enclosure:
Safety Evaluation

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ADAMS Accession No.: ML14239A097 *email dated August 26, 2014

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