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

September 18, 2012

Mr. Adam C. Heflin
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 VR-01, PROPOSED ALTERNATIVE REGARDING ASME OM CODE REPLACEMENT INTERVAL FOR MAIN STEAM ISOLATION VALVE ACTUATOR RUPTURE DISKS (TAC NO. ME8319)

Dear Mr. Heflin:

By letter dated March 30, 2012, as supplemented by letters dated April 19 and September 10, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML12090A501, ML121150347, and ML12255A041, respectively), Union Electric Company (the licensee) submitted alternative request for relief VR-01 for the Callaway Plant, Unit 1, for U.S. Nuclear Regulatory Commission (NRC) review and approval.

The request pertains to inservice testing requirements for Main Steam Isolation Valve (MSIV) actuator rupture disks ABPSE0001, ABPSE0002, ABPSE0003, and ABPSE0004 at Callaway Plant, Unit 1. The licensee requested an alternative from the required replacement frequency requirement of the American Society of Mechanical Engineers (ASME) *Code for Operation and Maintenance of Nuclear Power Plants* (OM Code) Mandatory Appendix I, "Inservice Texting of Pressure Relief Devices in Light-Water Reactor Nuclear Power Plants," Paragraph I-1360, "Test Frequency, Class 2 and 3 Nonreclosing Pressure Relief Devices," as required and conditioned by Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a.

Specifically, pursuant to 10 CFR 50.55a(a)(3)(ii), the licensee requested to use an alternative on the basis that complying with the specified requirement would result in hardship or unusual difficulty, because rupture disk replacement poses elevated risk to continued plant operations if it is performed online, due to the short duration of the technical specification completion time.

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(ii). The NRC staff provided verbal authorization for relief request VR-01 during a teleconference with your staff on April 20, 2012.

All other ASME OM Code requirements for which relief was not specifically requested and approved in the subject request for relief remain applicable.

Sincerely,

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-483

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST VR-01 REGARDING

MAIN STEAM ISOLATION VALVE ACTUATOR RUPTURE DISKS

UNION ELECTRIC COMPANY

CALLAWAY PLANT, UNIT 1

DOCKET NO. 50-483

1.0 INTRODUCTION

By letter dated March 30, 2012, as supplemented by letters dated April 19 and September 10, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML12090A501, ML121150347, and ML12255A041, respectively), Union Electric Company (the licensee) submitted alternative request for relief VR-01 for U.S. Nuclear Regulatory Commission (NRC) review and approval. The licensee proposed an alternative replacement frequency for rupture disks ABPSE0001, ABPSE0002, ABPSE0003, and ABPSE0004 rather than the required frequency per the American Society of Mechanical Engineers (ASME) *Code for Operation and Maintenance of Nuclear Power Plants* (OM Code) at the Callaway Plant, Unit 1 (Callaway). Request VR-01 is applicable to the third 10-year inservice testing (IST) program interval for Callaway.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(a)(3)(ii), the licensee requested to use the proposed alternative since complying with the current ASME OM Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

2.0 REGULATORY EVALUATION

The regulations in 10 CFR 50.55a(f), "Inservice testing requirements," require, in part, that IST of certain ASME Code Class 1, 2, and 3 components must meet the requirements of the ASME OM Code and applicable addenda, except where alternatives have been authorized by the NRC pursuant to paragraphs (a)(3)(i) or (a)(3)(ii).

In proposing alternatives, a licensee must demonstrate that the proposed alternatives provide an acceptable level of quality and safety (10 CFR 50.55a(a)(3)(i)) or compliance would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety (10 CFR 50.55a(a)(3)(ii)). Section 50.55a allows the NRC to authorize alternatives from ASME Code requirements upon making necessary findings.

Callaway's third 10-year IST interval began on December 19, 2005, and is currently scheduled to end on December 18, 2015.

3.0 TECHNICAL EVALUATION

3.1 Licensee's Alternative Request VR-01

ASME OM Code, ISTC-5250, "Rupture Disks," states that, "Rupture disks shall meet the requirements for nonreclosing pressure relief devices of Mandatory Appendix I."

Mandatory Appendix I, Paragraph I-1360, "Test Frequency, Class 2 and 3 Nonreclosing Pressure Relief Devices," states that "Class 2 and 3 non-reclosing pressure relief devices shall be replaced every 5 years, unless historical data indicates a requirement for more frequent replacement."

The applicable ASME OM Code edition and addenda for Callaway is the 2001 Edition through the 2003 Addenda.

An alternative replacement interval was requested for the following Main Steam Isolation Valve (MSIV) actuator, Class 2, rupture disks: ABPSE0001, ABPSE0002, ABPSE0003, and ABPSE0004.

Reason for Request

The MSIV actuator rupture disks referenced above were originally installed on or after April 23, 2007, during Refueling Outage 15. The rupture disks were scheduled to be replaced during Refueling Outage 18, which began in October 2011. However, the work was removed from the outage scope based on an initial determination that the work could be done with the plant on-line subsequent to the outage, and was rescheduled for the spring of 2012. In its letter dated April 19, 2012, in response to the NRC staff's requests for additional information dated April 5 and 10, 2012 (ADAMS Accession Nos. ML121010479 and ML121010577, respectively), the licensee stated, in part, that

> However, when the work was evaluated by Operations management for on-line performance and scheduling after the outage, it was determined that the plant risk was too high, particularly in light of the estimated time for completing the work relative to the allowed outage time (Completion Time) specified in the Callaway Technical Specifications for an inoperable MSIV.

In its letter dated March 30, 2012, the licensee stated, in part, that

> Performing this surveillance activity will involve significant maintenance activities and out-of-service time, including the hanging of tags (workman's protection assurance), performing the rupture [disk] replacement work, clearing tags, and performing applicable post maintenance tests (PMT). Isolating the rupture [disks] for this work makes the MSIVs inoperable and requires entry into plant Technical Specification [(TS)] 3.7.2.F actions: 8 hours to restore or hot standby in the next 6 hours. Based on the short [TS] duration time and the time needed to replace these rupture [disks] online, the [TS] completion time may be exceeded during this surveillance activity. In light of the short [TS] completion time, the rupture [disk] replacement activity poses elevated risk to continued plant operations if the surveillance is performed online.

Proposed Alternative and Basis for Use

The licensee proposed an alternative from the ASME OM Code-required replacement frequency of 5 years on a one-time basis and instead proposed that the time of replacement be extended to the next plant outage providing plant conditions to replace the rupture disks (i.e., MODES 4 or 5), but not later than Refueling Outage 19, which is currently scheduled for June 2013. This would allow the replacement work to be done with the plant in a shutdown condition.

In its letter dated March 30, 2012, the licensee stated, in part, that

> The safety function of the rupture [disks] is to open to allow the lower piston chamber (LPC) of the MSIV actuators to vent and close the MSIV within the required time frame. To close an MSIV, the LPC must be open or vented. Two vent lines are provided for each MSIV actuator. The normal, non-safety vent line is routed from the actuator through a locked open manual valve and back to the condenser. The backup [safety-related] vent line is routed from the MSIV actuator through a locked open manual isolation valve to a safety-related rupture [disk] set at 150 psig [pounds per square inch gauge] to an equipment floor drain.
>
> The rupture [disks] are 1.375 inches diameter stainless steel (316SS) [SA 240 Grade 316], rated to 150 psig at 450 F [degrees Fahrenheit]. The rupture disks are subjected to day-to-day plant operating conditions of a nominal temperature of 142 F and pressure of 3.04 psia [pounds per square inch absolute]. For such conditions, the calculated stress acting on the rupture [disk(s)] was found to be significantly less than the fatigue strength or endurance limit (39,000 psi [pounds per square inch]) for 316SS stainless steel, as provided in the [American Society of Metals (ASM)] Handbook, Volume 19, Fatigue and Fracture, ASM International (1996), Page 1814.

In its letter dated April 19, 2012, the licensee stated, in part, that

> No pressure and temperature cycles are expected on the rupture disks while the plant is online. The only time pressure and temperature cycles are expected is when the MSIVs are actuated.
>
> According to the vendor for the rupture disks at Callaway, samples of rupture disks are taken and subject to cyclic testing for product certification. Specifically, each sample disk(s) is subject to 1000 cycles from vacuum to 90% of rated pressure. Although this is a pass/fail test and not a cycle-to-destruction test, it provides an indication of the rupture disks' cyclic performance capability.

The licensee has indicated that each of the rupture disks will be subject to substantially less than 1,000 cycles.

Three failure modes have been considered for the rupture disks: leakage, burst at lower than design pressure, and burst at higher than design pressure (or fail to burst). The rupture disk vendor indicates that bursting at higher than design pressure is unlikely as the minimal pressure and temperature cycling that the rupture disks would experience over time would only tend to weaken them (not strengthen them), causing them to burst at a pressure lower than design pressure. This may cause a rupture disk to prematurely burst when closing the MSIV, but the safety function of the MSIV would not be affected. If anything, the MSIV would close faster in this case. Rupture disk leakage is an indication of degradation. In its letter April 19, 2012, the licensee stated, in part, that

> The only adverse consequence of a leaking or ruptured disk is increased air inleakage into the non-safety related main condenser. The leakage into the condenser would not be significant enough to affect operation of the plant. ...[L]eakage through the rupture disks is checked monthly by the system engineer by looking for the absence of a vacuum on the drains downstream of the rupture disks. (Condensate oxygen levels and condenser vacuum pump flow rates are other indications that may be used or monitored to ensure that excessive air is not entering into the condenser. Condensate oxygen levels are continuously monitored and vacuum pump flowrates are monitored twice per day.)

Further, the rupture disks were installed using a controlled procedure which provides detailed instructions for their proper installation and replacement. In its letter dated April 19, 2012, the licensee stated, in part, that

> When the rupture disks were first installed, a leakage check was performed as a post-maintenance test, and no leakage was identified. There are no corrosion concerns associated with the rupture disks since the disks are made of stainless steel and the medium (steam) is clean water.

3.2 NRC Staff Evaluation

The safety function of the rupture disks is to open to allow the LPC of the MSIV actuators to vent and close the MSIV within the time frame required by the safety analysis. The licensee considered the following three failure modes for the rupture disks: 1) bursting at a pressure higher than the design pressure, 2) bursting at a pressure lower than the design pressure, and 3) leaking, which likely would result in a lower bursting pressure. The NRC staff reviewed the information provided by the licensee and agrees that there are no credible scenarios that would result in any of the rupture disks bursting at a pressure higher than design pressure. This is based on an analysis of this information that showed that the minimal pressure and temperature cycling that the rupture disks have experienced since being placed in service have only tended to weaken them, which would cause them to burst at a pressure lower than design pressure. Bursting at a lower pressure does not introduce any new failure modes or impact the maximum required closing time of the MSIVs. Therefore, granting the extended replacement time interval will not impact the safety-related function of the MSIVs. Rupture disk leakage is an indication of degradation and potentially results in the disks bursting at a lower pressure. The only adverse consequence to the plant from a leaking rupture disk is increased air inleakage into the non-safety-related main condenser. However, this leakage should not be significant enough to affect plant operations, and the licensee has several methods in place to detect increased air leakage into the condenser. The licensee routinely monitors whether or not the rupture disks may be leaking. The licensee has committed to inform the NRC of any increased air inleakage into the main condenser before the rupture disks are replaced.

The licensee requested an alternative from the ASME OM Code, Mandatory Appendix I requirement to replace Class 2 rupture disks at least every 5 years, since it did not replace the MSIV actuator rupture disks during Refueling Outage 18, which began in October 2011, and replacing the rupture disks on-line results in high risk to continued plant operation. Either of these options results in a hardship without a compensating increase in the level of quality and safety. The licensee proposed an alternative in which the interval for replacing the MSIV actuator rupture disks would be extended on a one-time basis to the next plant outage providing conditions to replace the disks (i.e., MODES 4 or 5), but not later than Refueling Outage 19, which is currently scheduled for June 2013. Compliance with this requirement mandated that by April 23, 2012, the rupture disks needed to be replaced. On April 20, 2012, the NRC staff held a teleconference with the licensee's staff and granted verbal authorization for VR-01.

Based on the above, the NRC staff concludes that the proposed alternative provided reasonable assurance that the MSIV actuator rupture disks are operationally ready.

4.0 CONCLUSION

As set forth above, the NRC staff concludes that the proposed alternative described in relief request VR-01 provides reasonable assurance that the MSIV actuator rupture disks ABPSE0001, ABPSE0002, ABPSE0003, and ABPSE0004 are operationally ready. 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), and is in compliance with the ASME OM Code requirements. Therefore, the NRC staff authorizes the proposed alternative described in request VR-01 until the next plant outage providing plant conditions to replace the

MSIV actuator rupture disks (i.e., MODES 4 or 5), but not later than the end of the Callaway Plant, Unit 1, Refueling Outage 19, which is currently scheduled for June 2013.

All other ASME OM Code requirements for which relief was not specifically requested and approved in the subject request for relief remain applicable.

Principal Contributors: J. Billerbeck, NRR
R. Wolfgang, NRR

Date: September 18, 2012

All other requirements of the ASME OM Code for which relief has not been specifically requested and authorized remain applicable, including a third-party review by the Authorized Nuclear Inservice Inspector.

Sincerely,

/RA/

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-483

Enclosure:
Safety Evaluation

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ADAMS Accession No. ML12258A045 *email dated April 25, 2012

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