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

February 16, 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 – RELIEF REQUEST I3R-13 FROM ASME CODE REQUIREMENTS FOR REACTOR PRESSURE VESSEL FLANGE INSERT NON-DESTRUCTIVE EXAMINATION DURING THIRD 10-YEAR INSERVICE INSPECTION INTERVAL (TAC NO. ME7504)

Dear Mr. Heflin:

By letter dated October 31, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML113050122), Union Electric Company (the licensee) requested approval from the U.S. Nuclear Regulatory Commission (NRC) for relief from paragraph IWB-2420(b) of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI, at the Callaway Plant, Unit 1. Relief Request I3R-13 proposed to defer the second successive examination from refueling outage RF-18 in fall 2011 to the next scheduled refueling outage, RF-19, in spring 2013, and the third successive examination be rescheduled to the first period of the fourth 10-year inservice inspection (ISI) interval. On November 1, 2011, the NRC staff verbally authorized the use of Relief Request I3R-13.

The NRC staff has completed the review of the subject relief request and, based on the enclosed safety evaluation, concludes that it is acceptable to defer the required examination from fall 2011 to spring 2013 because the licensee has demonstrated that the structural integrity of Weld 2-BB-01-F302 will not be challenged and that the proposed alternative provides an acceptable level of quality and safety.

Pursuant to paragraph 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations*, the NRC staff authorizes the use of Relief Request I3R-13 to defer the second successive examination of Weld 2-BB-01-F302 in 'C' cold leg piping to refueling outage RF-19, scheduled for spring 2013, and the third successive examination rescheduled to the first period of the fourth 10-year ISI interval at Callaway Plant, Unit 1.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

If you have any questions regarding this letter, please feel free to contact Mohan Thadani at (301) 415-1476 or e-mail mohan.thadani@nrc.gov.

Sincerely,

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

Enclosure:
As stated

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 I3R-13 FROM ASME CODE REQUIREMENTS FOR REACTOR PRESSURE VESSEL FLANGE INSERT NON-DESTRUCTIVE EXAMINATION

THIRD 10-YEAR INSERVICE INSPECTION INTERVAL

UNION ELECTRIC COMPANY

CALLAWAY PLANT, UNIT 1

DOCKET NO. 50-483

1.0 INTRODUCTION

By letter dated October 31, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML113050122), Union Electric Company (the licensee) requested approval from the U.S. Nuclear Regulatory Commission (NRC) for relief from paragraph IWB-2420(b) of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI, at the Callaway Plant, Unit 1. Relief Request I3R-13 proposed to defer the second successive examination from refueling outage RF-18 in fall 2011 to the next scheduled refueling outage, RF-19, in spring 2013, and the third successive examination be rescheduled to the first period of the fourth 10-year inservice inspection (ISI) interval. On November 1, 2011, the NRC staff verbally authorized the use of Relief Request I3R-13 (ADAMS Accession No. ML113120087). This safety evaluation documents the NRC staff's technical basis for the verbal authorization of the subject relief request.

2.0 REGULATORY EVALUATION

The regulations in paragraph 50.55a(g)(4) of Title 10 of the *Code of Federal Regulations* (10 CFR) specify that ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME Code, Section XI, "Rules for ISI of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that in-service examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals 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 limitations and modifications listed therein.

Enclosure

The regulations in 10 CFR 50.55a(a)(3) state that 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.

The Code of record for the current (third) 10-year ISI interval for the Callaway Plant is the 1998 Edition up to and including the 2000 Addenda of the ASME Code, Section XI.

3.0 Technical Evaluation

3.1 Licensee's Relief Request

3.1.1 ASME Code Components Affected

Component: Reactor Coolant System Loop C Cold Leg Stainless Steel Safe-End to Pipe Weld
Weld Number: 2-BB-01-F302
ASME Code Class: Code Class 1
Examination Category: R-A (was B-J)
Item Number: R1.20 (was B5.10)

3.1.2 Applicable Code Edition and Addenda

ASME Section XI, 1998 Edition up to and including 2000 Addenda.

3.1.3 Applicable Code Requirement (as stated by the licensee)

> IWB-2420(b) states, in Part, "If a component is accepted for continued service in accordance with IWB-3132.3 or IWB-3142.4, the areas containing flaws or relevant conditions shall be reexamined during the next three inspection periods listed in the schedule of the inspection program of IWB-2400."

3.1.4 Proposed Alternative and Basis for Use

The licensee identified an indication (flaw) in the stainless steel safe end-to-pipe Weld 2-BB-01-F302 of the Loop C cold leg nozzle during refueling outage Refuel 13, in 2004. The ISI Summary Report for Refuel 13 reported that the indication exceeded the ASME Code, Section XI, IWB-3514 requirements. The licensee evaluated the flaw in accordance with the ASME Code, Section XI, IWB-3600 and determined it to be acceptable.

In its letter dated October 31, 2011, the licensee stated, in part, that

> A root cause analysis was performed for the identified flaw, and as stated in the root cause analysis report, "The preponderance of evidence supports that this crack indication is from original plant construction" [This was documented in Callaway Action Request (CAR) 200403580 (Reference 2 [of the licensee's letter dated October 31, 2011]) under Callaway's Corrective Action Program.] The root

cause analysis concluded that this indication was first identified in 2004 due to improved technology (performance demonstration initiative) which was not available during construction and earlier examinations.

Subsequent to Refuel 13, 2-BB-01-F302 was re-examined in the next period (as required by [IWB-2420(b)]), in Refuel 15, and the indication was determined to be unchanged in size, as expected.

The second successive examination of 2-BB-01-F302 was scheduled to be performed during Refuel 18 which is now ongoing [at the time of submittal] at Callaway. Due to challenges experienced during the outage, but based on the stable nature and negligible impact of the noted flaw, [the licensee] proposes to not perform the required second successive examination during Refuel 18, but to instead perform the required examination during the next refueling outage, Refuel 19 (Spring 2013).

Basis for Use: The indication has been evaluated by Structural Integrities and Westinghouse and found to not pose a threat to the structural integrity of the reactor coolant system, nor is the flaw likely to grow to a size of concern within the lifetime of the plant. Additionally, the indication has been examined following one ISI period of operation and found to be unchanged in size. Based on these determinations, Callaway requests to defer the second successive examination from Refuel 18 (Interval 3, Period 2) to Refuel 19 (Interval 3, Period 3). (The third successive examination required by [IWB-2420(b)] would be rescheduled to Interval 4, Period 1, thereby completing the three required successive examinations prior to returning to the inspection frequency required by Examination Category R-A, Item Number R1.20.

3.1.5 Duration of Proposed Alternative (as stated by the licensee)

This relief is requested for the duration of the operating cycle following Refuel 18. Weld 2-BB-01-F302 will be examined in Refuel 19 (Spring 2013).

3.2 NRC Staff Evaluation

The licensee detected a circumferential indication in the stainless steel safe end-to-elbow Weld 2-BB-01-F302 of the "C" cold leg nozzle at the reactor pressure vessel during refueling outage RF-13 in spring 2004. The flaw length was 2.625 inches and the depth was 0.94 inches. The weld thickness is 2.32 inches and the nominal inside diameter is 27.5 inches. The flaw is approximately 40.5 percent through-wall, which exceeds the acceptance standards of the ASME Code, Section XI, IWB-3514. In accordance with IWB-3142.4, the licensee performed a flaw evaluation to accept the flaw for continued service in accordance with the ASME Code, Section XI, IWB-3640 as shown in Westinghouse Electric Company's report WCAP-16280-P, "Flaw Evaluation Handbook for Callaway Unit 1 Reactor Vessel Inlet Nozzle Safe-End Weld Region," May 2004 (proprietary). The licensee submitted the WCAP report in a letter dated December 13, 2004 (ADAMS Accession No. ML043650441).

The ASME Code, Section XI, IWB-3142.4 requires that "...[a] component accepted for continued service based on analytical evaluation shall be subsequently examined in accordance with IWB-2420(b) and (c)..." In accordance with the ASME Code, Section XI, IWB-2420(b), the licensee needs to examine the indication during each of the three subsequent, successive inspection periods.

The licensee completed the first successive examination in 2007 during refueling outage RF-15, and confirmed that the flaw did not grow. The licensee reported the flaw depth as 37.5 percent through-wall. The difference in the flaw depth measurement between the 2004 and 2007 examinations (40.5 versus. 37.5 percent) is due to measurement uncertainties. The second successive examination should be performed during refueling outage RF-18 in fall 2011. In lieu of performing the second successive examination, the licensee requested to defer the examination to the next refueling outage, RF-19, in spring 2013. The licensee's basis for the relief request is the flaw evaluation in WCAP-16280-P and the results of ultrasonic examinations performed in 2004 and 2007.

The NRC staff concludes that WCAP-16280-P assumed the fatigue degradation mechanism to predict slow crack growth for the indication in Weld 2-BB-01-F302. The NRC staff notes that as presented in WCAP-16280-P, crack growth due to thermal fatigue is small for a 40-year period. Therefore, the crack growth for an approximate 6-year period (2007 to 2013) during which the weld is not examined will be minimal.

Attachment 2, "Examination Results for RF-13 and RF-15," to the licensee's letter dated October 31, 2011, shows that the flaw in Weld 2-BB-01-F302 is connected to the inside surface of the pipe. WCAP-16280-P also assumes that the flaw is inside surface connected. This implies that the indication is in contact with primary coolant and thus may experience potential primary water stress-corrosion cracking (PWSCC). The licensee stated in WCAP-16280-P that stress-corrosion cracking does not occur in pressurized-water reactors (PWRs) and did not consider crack growth due to PWSCC. The NRC staff notes that certain stainless steel piping in PWRs has experienced stress-corrosion cracking due to halogens (e.g., chlorides) and sensitization of thin-wall stainless steel piping as reported in NRC Information Notice 2011-04, "Contaminants and Stagnant Conditions Affecting Stress Corrosion Cracking In Stainless Steel Piping in Pressurized Water Reactors," dated February 23, 2011 (ADAMS Accession No. ML103410363). However, stress-corrosion cracking has not been reported in the cold leg of PWRs because the cold leg would not likely be in contact with chlorides. Also, the cold-leg pipe-wall thickness is thick (approximately 2.32 inches) which minimizes the potential for sensitization. The NRC staff concludes that if stress-corrosion cracking were occurring, crack growth would have been identified in the subject weld during the first successive examination performed in 2007, but was not.

As reported in the relief request, the indication is approximately 37.5 percent to 40.5 percent through-wall (crack depth). The maximum allowable for the circumferential flaw depth is 75 percent through-wall in accordance with the ASME Code, Section XI, Tables IWB-3641-1 and IWB-3641-2. Therefore, the indication has sufficient margin before it would reach the maximum allowable depth.

The NRC staff concludes that the indication will most likely not propagate significantly between 2007 and 2013 to challenge the structural integrity of Weld 2-BB-01-F302 because the examination results of 2004 and 2007 show essentially no crack growth, the analytical evaluation shows low fatigue crack growth, and PWSCC is not likely to occur.

4.0 Conclusion

Based on the information submitted, the NRC staff concludes that it is acceptable to defer the required examination in fall 2011 to spring 2013 because the licensee has demonstrated that the structural integrity of Weld 2-BB-01-F302 will not be challenged and that the proposed alternative provides an acceptable level of quality and safety.

Pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the use of Relief Request I3R-13 to defer the second successive examination of Weld 2-BB-01-F302 in 'C' cold leg piping to refueling outage RF-19, scheduled for spring 2013, and the third successive examination rescheduled to the first period of the fourth 10-year ISI interval at Callaway Plant Unit 1.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: J. Tsao

Date: February 16, 2012

If you have any questions regarding this letter, please feel free to contact Mohan Thadani at (301) 415-1476 or email mohan.thadani@nrc.gov

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:
As stated

cc w/encl: Distribution via Listserv

DISTRIBUTION:
PUBLIC
LPLIV Reading
RidsAcrsAcnw_MailCTR Resource
RidsNrrDorlLpl4 Resource
RidsNrrDeEpnb Resource
RidsNrrPMCallaway Resource
RidsNrrLAJBurkhardt Resource
RidsOgcRp Resource
RidsRgn4MailCenter Resource
JTsao, NRR/DE/EPNB

ADAMS Accession No.: ML120190748 *SE dated

OFFICE	NRR/LPL4/PM	NRR/LPL4/LA	NRR/DE/EPNB/BC	NRR/LPL4/BC
NAME	MThadani	JBurkhardt	TLupold*	MMarkley
DATE	1/26/12	1/20/12	11/30/11	2/16/12

OFFICIAL RECORD COPY