



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

August 18, 2011

Mr. David J. Bannister  
Vice President and CNO  
Omaha Public Power District  
Fort Calhoun Station  
444 South 16th St. Mall  
Omaha, NE 68102-2247

SUBJECT: FORT CALHOUN STATION, UNIT NO. 1 - REQUEST FOR RELIEF RR-12  
FROM ASME CODE CASE N-722 VISUAL EXAMINATION OF THE REACTOR  
VESSEL HOT LEG NOZZLE TO SAFE END DISSIMILAR METAL WELDS (TAC  
NO. ME4541)

Dear Mr. Bannister:

By letter dated August 16, 2010, as supplemented by letters dated January 14 and March 4, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML102300679, ML110200205, and ML110670226, respectively), Omaha Public Power District (OPPD, the licensee), requested approval by the U.S. Nuclear Regulatory Commission (NRC) of Relief Request Number RR-12, "Request for Relief from Code Case N-722 Visual Examination of the Reactor Vessel Hot Leg Nozzle to Safe End Dissimilar Metal Welds," for Fort Calhoun Station, Unit 1 (FCS).

Specifically, pursuant to paragraph 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR), OPPD requested NRC approval of an alternative to the visual examination requirements of American Society of Mechanical Engineers (ASME) Code, Section XI, Code Case N-722, "Additional Examinations for PWR Pressure Retaining Welds in Class 1 Components Fabricated With Alloy 600/82/182 Materials, Section XI, Division 1."

On March 30, 2011, NRC staff verbally authorized the licensee's proposed alternative, RR-12, at FCS for the spring 2011 refueling outage only. A summary of the verbal authorization is provided by NRC memorandum dated April 5, 2011 (ADAMS Accession No. ML110910327).

The NRC staff has completed its review of the subject relief request and has concluded in the enclosed safety evaluation that compliance with the requirements of 10 CFR 50.55a(g)(6)(ii)(F) would cause an unnecessary burden on the licensee 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), and is in compliance with the Code's requirements. Therefore, in accordance with 10 CFR 50.55a(a)(3)(ii) the NRC staff authorizes the licensee's proposed alternative, RR-12, for use at FCS during the spring 2011 refueling outage.

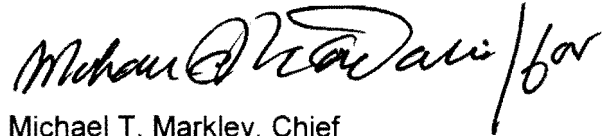
All other ASME Code, Section XI, requirements for which relief has not been specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

D. Bannister

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If you have any questions, please contact the project manager, Lynnea Wilkins, at (301) 415-1377 or via e-mail at [Lynnea.Wilkins@nrc.gov](mailto:Lynnea.Wilkins@nrc.gov).

Sincerely,

A handwritten signature in black ink, appearing to read "Michael T. Markley" followed by a stylized flourish or initials.

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

Docket No. 50-285

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 RR-12 FOR USE OF ALTERNATIVE IN LIEU OF  
VISUAL EXAMINATION REQUIREMENTS OF ASME CODE CASE N-722

OMAHA PUBLIC POWER DISTRICT

FORT CALHOUN STATION, UNIT 1

DOCKET NO. 50-285

1.0 INTRODUCTION

By letter dated August 16, 2010, as supplemented by letters dated January 14 and March 4, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML102300679, ML110200205, and ML110670226, respectively), Omaha Public Power District (OPPD, the licensee) submitted Relief Request No. RR-12 for an alternative to certain requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI, pursuant to paragraph 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR). The relief request is associated with visual examination of reactor pressure vessel (RPV) outlet hot-leg nozzle dissimilar metal (DM) butt welds at Fort Calhoun Station, Unit 1 (FCS).

On March 30, 2011, NRC staff verbally authorized the licensee's proposed alternative, RR-12, at FCS for the spring 2011 refueling outage (RFO) only. A summary of the verbal authorization is provided by NRC memorandum dated April 5, 2011 (ADAMS Accession No. ML110910327).

2.0 REGULATORY EVALUATION

The inservice inspection (ISI) of ASME Code Class 1, 2, and 3 components is to be performed in accordance with the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," and applicable editions and addenda as required by 10 CFR 50.55a(g), except where specific written relief has been granted by the Commission. Pursuant to 10 CFR 50.55a(g)(4), throughout the service life of a pressurized water-cooled nuclear power facility, components which are classified ASME Code Class 1, 2, and 3 must meet the requirements, except the design and access provisions and preservice examination requirements, set forth in the ASME Code, Section XI, to the extent practical within the limitations of design, geometry, and materials of construction of the components. Further, these regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the

Enclosure

requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in paragraph (b) of 10 CFR 50.55a on the date 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. For FCS, the ASME Code of record for the fourth 10-year ISI interval, which ends on September 25, 2013, is the 1998 Edition through the 2000 Addenda.

The regulations in 10 CFR 50.55a(g)(6)(ii) state that the Commission may require the licensee to follow an augmented ISI program for systems and components for which the Commission deems that added assurance of structural reliability is necessary. The regulations in 10 CFR 50.55a(g)(6)(ii)(E) require, in part, augmented inservice bare metal visual inspection of RPV DM welds of pressurized-water reactors (PWRs) in accordance with ASME Code Case N-722, "Additional Examinations for PWR Pressure Retaining Welds in Class 1 Components Fabricated With Alloy 600/82/182 Materials, Section XI, Division 1," subject to the conditions specified in paragraphs (2) through (4) of 10 CFR 50.55a(g)(6)(ii)(E).

Alternatives to requirements under 10 CFR 50.55a(g) may be authorized by the NRC pursuant to 10 CFR 50.55a(a)(3)(i) or 10 CFR 50.55a(a)(3)(ii). In proposing alternatives or requests for relief, the licensee must demonstrate that (1) the proposed alternatives would provide an acceptable level of quality and safety; or (2) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

By letter dated August 16, 2010, the licensee proposed an alternative (RR-12) in accordance with 10 CFR 50.55a(a)(3)(i) for the inspection of RPV outlet hot-leg DM butt welds at FCS.

### 3.0 TECHNICAL EVALUATION

#### 3.1 Components Affected by the Relief Request (as stated by the licensee)

Code class: 1  
System [Welds]: RC [Reactor Coolant System]  
Examination Categories: [Category B-F for DM welds]  
[Code Item Number]: B15.90, Inservice Inspection Program

Item	Location	Nozzle to Safe End Weld	Weld Type
1	NIA Outlet (Hot Leg) Nozzle (0°)	MRC-1/01	Shop
2	N1B Outlet (Hot Leg) Nozzle (180°)	MRC-2/01	Shop

### 3.2 Code Requirements for Which Relief is Requested

The regulations in 10 CFR 50.55a(g)(6)(ii)(E) require, in part, an enhanced bare-metal visual examination each outage of RPV outlet DM welds of PWRs in accordance with ASME Code Case N-722, subject to the conditions specified in paragraphs (2) through (4) of 10 CFR 50.55a(g)(6)(ii)(E). In its letter dated August 16, 2011, the licensee stated, in part, that

Code Case N-722, Table 1, Note (5) states that an ultrasonic examination, performed from the component inside or outside surface in accordance with the requirements of Table IWB-2500-1 and Appendix VIII (1995 Edition with the 1996 Addenda or later) shall be acceptable in lieu of the [visual examination] requirement.

### 3.3 Licensee's Proposed Alternative

In its letter dated August 16, 2010, the licensee requested relief to not perform the inspection requirements of ASME Code Case N-722 for the next two refueling outages at FCS, based on the following alternative:

1. OPPD proposes to credit examination data taken during the 2003, 2008, and 2009 refueling outages, which found no indications or change in examination data in either hot-leg nozzle DM weld.
2. OPPD proposes to take credit for Westinghouse deterministic crack-growth analyses described in Enclosures 1 and 2 of the licensee's letter dated August 16, 2010<sup>(1)</sup>.
3. OPPD proposes to take credit for a chemical program adding zinc to the reactor coolant system (RCS).
4. OPPD proposes RPV nozzles be inspected for the presence of leakage and/or boric acid accumulation on the containment floor underneath them, the bio-shield wall near them, or on the bottom of the nozzle insulation.

### 3.4 Licensee's Duration of Relief Request

The licensee requests relief for the spring 2011 and the fall 2012 RFOs at FCS.

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<sup>1</sup> Enclosure 1 to the OPPD letter dated August 16, 2010: LTR-PAFM-10-123-P, Revision 0, "Technical Justification to Support Alternative Visual Examination Intervals for Fort Calhoun Reactor Vessel Outlet Nozzle to Safe End Dissimilar Metal Welds" (Proprietary; not publicly available); Enclosure 2 to the OPPD letter dated August 16, 2010: LTR-PAFM-10-123-NP, Revision 0, "Technical Justification to Support Alternative Visual Examination Intervals for Fort Calhoun Reactor Vessel Outlet Nozzle to Safe End Dissimilar Metal Welds" (Non-Proprietary; ADAMS Accession No. ML102300642).

### 3.5 Licensee's Basis for Relief

OPPD stated that a best-effort visual examination performed each RFO coupled with favorable inspection data from the 2003, 2008, and 2009 weld examinations, use of zinc addition, and a supporting deterministic crack-growth analysis would provide an acceptable level of quality and safety in lieu of the required bare-metal visual examination.

In 2010, the NRC and industry groups worked on the development of MRP-287, "Materials Reliability Program: Primary Water Stress Corrosion Cracking (PWSCC) Flaw Evaluation Guidance," to develop an acceptable standard methodology for deterministic flaw analysis. While the report was not complete by the time OPPD submitted relief request RR-12, OPPD did use the report to support its basis for the relief request.

By letter dated January 14, 2011, OPPD provided information regarding the hardship involved with performing the required bare-metal visual examination, additional details on zinc addition, several references for the flaw evaluation, and clarification of previous examination data. Further, by letter dated March 4, 2011, the licensee clarified the inputs for the deterministic calculation used to support the proposed alternative.

### 3.4 NRC Staff's Evaluation

By letter dated August 16, 2010, OPPD requested RR-12 from the 10 CFR 50.55a(g)(6)(ii)(E) requirement to perform a bare-metal visual examination of RPV outlet nozzle-to-safe-end DM welds in accordance with ASME Code Case N-722. OPPD requested this relief for the spring 2011 and fall 2012 RFOs at FCS.

The NRC staff notes that bare-metal visual examination requirements for DM butt welds provide defense-in-depth for non-destructive examination. As such, the staff concludes that plant-specific analysis could be used to provide a basis for inspection relief if the bare-metal visual examination presents a significant hardship. As such, the staff reviewed the licensee's proposed alternative under the requirements of 10 CFR 50.55a(a)(3)(ii), such that compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

As the hot-leg RPV outlet DM welds are in sandboxes, the NRC staff concludes that OPPD had a sufficient basis for hardship. Therefore, the staff reviewed OPPD's deterministic assessment, supporting inspection results, zinc mitigation, and best-effort visual examination alternative to assess authorization of RR-12.

The NRC staff reviewed OPPD's previous inspection results and found they provided a strong basis for the initial flaw size used in the deterministic crack-growth analysis. The initial flaw size is a critical component of a flaw analysis. The staff concluded that OPPD's data and supporting eddy current inspection data provided a reasonable basis for the initial flaw size assumptions.

The NRC staff also concluded that the proposed alternative inspection, with insulation in place, for the presence of leakage and/or boric acid accumulation on the containment floor underneath each weld, the bio shield near each weld, or on the bottom of the nozzle insulation is a best-effort alternative with minimal radiological dose associated. For the period in which the

deterministic crack-growth analysis confirms that a flaw would not grow to a point of leakage, the NRC staff concludes that this alternative inspection would provide sufficient defense-in-depth to provide reasonable assurance of structural integrity for each outlet weld.

However, the NRC staff's review of the effects of the zinc addition and deterministic crack-growth analysis identified two areas of concern. The staff found insufficient time available to evaluate the effectiveness and credit the benefit of zinc addition against stress-corrosion cracking to support this relief request. Additionally, the staff determined that OPPD's plant-specific stress analysis used the incorrect safe-end length in its stress analysis model, which was a critical part of the flaw evaluation.

The NRC staff reviewed OPPD's stress analysis without the effect of a safe-end and used OPPD's methodology to develop a new crack-growth analysis. The staff's analysis did not support the full 51 calendar months requested under RR-12. However, the staff's analysis did support relief through the spring 2011 RFO, and following cycle of operation, until the fall 2012 RFO. Therefore, relief from the bare-metal visual examination requirements during the spring 2011 RFO only, is supported by the staff's analysis.

In order for the NRC staff to validate OPPD's flaw analysis and support relief through to the spring 2014 RFO, the staff would need OPPD to use the "as built" dimensions, in accordance with Item 1, "Geometry and Materials," of Section 3.6, "Attributes of an Acceptable Residual Stress Analysis," of MRP-287 to develop a robust flaw analysis under RR-12.

Therefore, given the hardship of the location of both RPV outlet nozzle-to-safe-end DM welds being in sandboxes, OPPD's best-effort visual examination during the spring 2011 RFO, and the flaw analysis performed to date, the NRC staff concludes that OPPD has provided sufficient technical basis to demonstrate that compliance with the requirements of 10 CFR 50.55a(g)(6)(ii)(E) for a bare-metal visual examination of the RPV outlet nozzle-to-safe-end DM welds at FCS during the spring 2011 RFO would cause an unnecessary hardship or unusual difficulty on the licensee without a compensating increase in the level of quality and safety.

#### 4.0 CONCLUSION

As set forth above, the NRC staff concludes that the licensee provided sufficient technical basis to demonstrate that compliance with the requirements of 10 CFR 50.55a(g)(6)(ii)(F) would cause an unnecessary burden on the licensee 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), and is in compliance with the Code's requirements. Therefore, in accordance with 10 CFR 50.55a(a)(3)(ii), the NRC staff authorizes the licensee's proposed alternative, RR-12 as supplemented by letter dated January 14, 2011, at FCS for the spring 2011 RFO.

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. Collins

Date: August 18, 2011



D. Bannister

- 2 -

If you have any questions, please contact the project manager, Lynnea Wilkins, at (301) 415-1377 or via e-mail at [Lynnea.Wilkins@nrc.gov](mailto:Lynnea.Wilkins@nrc.gov).

Sincerely,

*/ra/ (MThadani for)*

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

Docket No. 50-285

Enclosure:  
Safety Evaluation

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\*SE memo dated

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DATE	8/17/11	8/17/11	8/16/11	7/19/11	8/18/11

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