



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

October 8, 2010

Mr. Brian J. O'Grady
Vice President-Nuclear and CNO
Nebraska Public Power District
72676 648A Avenue
Brownville, NE 68321

SUBJECT: COOPER NUCLEAR STATION - REQUEST FOR RELIEF NO. RI-04 FOR THE
FOURTH 10-YEAR INSERVICE INSPECTION INTERVAL REGARDING
INSPECTION OF REACTOR VESSEL NOZZLE-TO-VESSEL SHELL WELDS
(TAC NO. ME3319)

Dear Mr. O'Grady:

By letter dated February 5, 2010, to the U.S. Nuclear Regulatory Commission (NRC), Nebraska Public Power District (NPPD, the licensee) submitted request for relief No. RI-04 from certain inservice inspection (ISI) requirements of Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) at Cooper Nuclear Station (CNS). Specifically, the licensee requested in RI-04 to perform alternative examinations of certain reactor vessel nozzle-to-shell welds and nozzle inner radius welds instead of performing the examinations required by the ASME Code. The applicable ASME Code at CNS for the fourth 10-year ISI interval, which commenced on March 1, 2006, is the 2001 Edition through the 2003 Addenda.

The request for relief was proposed pursuant to the provisions of paragraph 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR). Based on the information you provided in your request for relief, the NRC staff concludes that the proposed alternative examinations provide an acceptable level of quality and safety and applies to all requested CNS reactor pressure vessel (RPV) nozzles, with the exception of the RPV recirculation inlet nozzles, feedwater nozzles, and control rod drive return nozzles. Therefore, the proposed alternative is authorized in accordance with 10 CFR 50.55a(a)(3)(i) for the fourth 10-year ISI interval, which commenced on March 1, 2006.

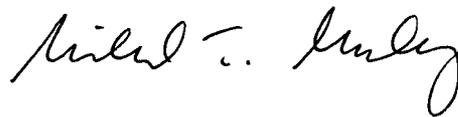
All other ASME Code, Section XI, requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

B. O'Grady

- 2 -

The detailed results of the NRC staff review are provided in the enclosed safety evaluation. If you have any questions concerning this matter, please contact Ms. L. Wilkins of my staff at (301) 415-1377 or via e-mail at Lynnea.Wilkins@nrc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael T. Markley". The signature is written in a cursive style with a large, looping "M" and "y".

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

Docket No. 50-298

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

FOURTH 10-YEAR INSERVICE INSPECTION INTERVAL

REQUEST FOR RELIEF NO. RI-04

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

DOCKET NO. 50-298

1.0 INTRODUCTION

By letter dated February 5, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML100470703), Nebraska Public Power District (NPPD, the licensee) submitted request for relief No. RI-04 for the fourth 10-year inservice inspection (ISI) interval for Cooper Nuclear Station (CNS). The fourth 10-year ISI interval at CNS began on March 1, 2006. Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) paragraph 50.55a(a)(3)(i), the licensee requested to use an alternative to American Society of Mechanical Engineers *Boiler and Pressure Vessel Code* (ASME Code), Section XI inspection requirements regarding examination of certain reactor pressure vessel (RPV) nozzle-to-vessel welds and nozzle inner radii at CNS. The proposed alternative is in accordance with ASME Code Case N-702, "Alternative Requirements for Boiling Water Reactor (BWR) Nozzle Inner Radius and Nozzle-to-Shell Welds," without using the visual (VT-1) examination specified in the Code Case. The technical basis for ASME Code Case N-702 was documented in an Electric Power Research Institute (EPRI) report for the Boiling Water Reactor Vessel and Internals Project (BWRVIP), "BWRVIP-108: BWR Vessel and Internals Project, Technical Basis for the Reduction of Inspection Requirements for the Boiling Water Reactor Nozzle-to-Vessel Shell Welds and Nozzle Inner Radii." The BWRVIP-108 report was approved by the NRC in a safety evaluation report (SER) dated December 19, 2007 (ADAMS Accession No. ML073600374).

The December 19, 2007, SER for the BWRVIP-108 report specified plant-specific requirements which must be met for applicants proposing to use this alternative. The licensee's submittal intended to demonstrate that the relevant CNS RPV nozzle-to-vessel welds and their inner radii meet these plant-specific requirements so that RI-04 can be approved.

2.0 REGULATORY EVALUATION

ISI of the ASME Code Class 1, 2, and 3 components is performed in accordance with Section XI of the ASME Code and applicable addenda as required by 10 CFR 50.55a(g), except where

Enclosure

specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). The regulations in 10 CFR 50.55a(a)(3) state that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if: (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 regulations in 10 CFR 50.55a(g)(4) state further that ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except 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. The regulations require that inservice 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. The applicable ISI Code of record for the fourth 10-year ISI interval for CNS is the 2001 Edition, 2003 Addenda of ASME Code, Section XI.

For all RPV nozzle-to-vessel shell welds and nozzle inner radii, ASME Code, Section XI requires 100 percent inspection during each 10-year ISI interval. However, ASME Code Case N-702 proposes an alternative which reduces the inspection of RPV nozzle-to-vessel shell welds and nozzle inner radius areas from 100 percent to 25 percent of the nozzles for each nozzle type during each 10-year interval. As mentioned earlier, the NRC has approved the BWRVIP-108 report, which contains the technical basis supporting ASME Code Case N-702. The December 19, 2007, SER regarding the BWRVIP-108 report specified plant-specific requirements to be satisfied by applicants who propose to use ASME Code Case N-702.

3.0 TECHNICAL EVALUATION

The following plant-specific requirements are specified in the December 19, 2007, SER for the BWRVIP-108 report supporting use of the ASME Code Case N-702:

However, each licensee should demonstrate the plant-specific applicability of the BWRVIP-108 report to their units in the relief request by showing that all the following general and nozzle-specific criteria are satisfied:

- (1) the maximum RPV heatup/cooldown rate is limited to less than 115 °F/hour;

For recirculation inlet nozzles

- (2) $(pr/t)/C_{RPV} < 1.15$

p = RPV normal operating pressure,

r = RPV inner radius,

t = RPV wall thickness, and

$C_{RPV} = 19332 \dots$;

(3) $[p(r_o^2 + r_i^2) / (r_o^2 - r_i^2)] / C_{NOZZLE} < 1.15$

p = RPV normal operating pressure,
r_o = nozzle outer radius,
r_i = nozzle inner radius, and
C_{NOZZLE} = 1637 . . . ;

For recirculation outlet nozzles

(4) $(pr/t) / C_{RPV} < 1.15$

p = RPV normal operating pressure,
r = RPV inner radius,
t = RPV wall thickness, and
C_{RPV} = 16171 . . . ; and

(5) $[p(r_o^2 + r_i^2) / (r_o^2 - r_i^2)] / C_{NOZZLE} < 1.15$

p = RPV normal operating pressure,
r_o = nozzle outer radius,
r_i = nozzle inner radius, and
C_{NOZZLE} = 1977

This plant-specific information was required by the NRC staff to ensure that the probabilistic fracture mechanics (PFM) analysis documented in the BWRVIP-108 report applies to the RPV of the applicant's plant.

3.1 Licensee Evaluation

ASME Code Requirement for which Alternative is Requested

The licensee requested an alternative to the following requirements of ASME Code, Section XI, 2001 Edition, 2003 Addenda:

ASME Section XI Code Class 1 nozzle-to-vessel weld and nozzle inner radii section examination requirements are provided in Subsection IWB, Table IWB-2500-1 "Examination Category B-D, Full Penetration Welded Nozzles in Vessels - Inspection Program B." Items B3.90 ["Nozzle-to-Vessel Welds"] and B3.100 ["Nozzle Inside Radius Section"] require a volumetric examination of all the [RPV] nozzle-to-vessel welds and associated nozzle inner radius sections, respectively.

Component(s) for which Alternative is Requested (as stated by the licensee)

[ASME] Code Class: 1
Examination Category: B-D
Item Number: B3.90, B3.100
Description: Inspection of [RPV] Nozzle-to-Vessel Shell Welds
and Nozzle Inner Radius Sections
Component Numbers: [As specified in Table RI-04-1^[1]]

[The RPV recirculation inlet nozzles, feedwater nozzles, and control rod drive return nozzles are not included.]

Proposed Alternative to the ASME Code (as stated by the licensee)

As an alternative, for all welds and nozzle inner radius sections identified in Table RI-04-1, CNS proposes to examine a minimum of 25% of the nozzle-to-vessel shell welds and nozzle inner radius sections to include at least one nozzle from each system and nominal pipe size, in accordance with [ASME] Code Case N-702

[ASME] Code Case N-702 stipulates that Visual Test (VT) VT-1 examination may be used in lieu of volumetric examination for the nozzle inner radius section (Item No. B3.100). CNS currently credits the enhanced magnification VT-1 examination of the nozzle inner radius sections in accordance [with ASME] Code Case N-648-1 [“Alternative Requirements for Inner Radius Examinations of Class 1 Reactor Vessel Nozzles, Section XI, Division 1”] subject to the conditions placed upon the use of that Code Case by Regulatory Guide [(RG) 1.147, Revision 15, “Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1”]. The specific aspect of utilizing VT-1 visual examinations as allowed by [ASME] Code Case N-702 is not part of this request. Volumetric examinations of the nozzle inner radius sections of the selected core spray and jet pump instrumentation nozzles will still be performed, as their nozzle inner radius sections are not fully accessible from inside the vessel for enhanced magnification VT-1 examination.

Basis for Alternative (as stated by the licensee)

The [NRC] issued [an SER] dated December 19, 2007 . . . approving the use of BWRVIP-108 as a basis for using [ASME] Code Case N-702. In the [SER], Section 5.0 “Plant Specific Applicability” states that licensees who plan to request relief from the ASME Code, Section XI requirements for [RPV] nozzle-to vessel shell welds and nozzle inner radius sections may reference the BWRVIP-108 report as the technical basis for the use of ASME Code Case N-702 as an alternative. However, each licensee should demonstrate the plant-specific

[1] This refers to the table on page 1 of the Attachment to the licensee's February 5, 2010, submittal, which shows a complete list of applicable nozzles. This table is not included in this safety evaluation.

applicability for the BWRVIP-108 report to its units in the relief request by showing that all the general and nozzle specific criteria are satisfied:

[Criterion 1: the maximum RPV heatup/cool-down rate is limited to less than 115° F/hour]

This criterion is met by adherence to CNS Technical Specifications Surveillance Requirement 3.4.9.1 which requires verification that the Reactor Coolant System heatup and cool-down rates are $\leq 100^\circ\text{F}$ when averaged over a one hour period.

[Criterion 2 (for recirculation inlet nozzles): $(pr/t)/C_{RPV} < 1.15$]

The CNS result is 0.847, which is less than 1.15, therefore, the CNS N2 nozzles meet [Criterion] 2.

[Criterion 3 (for recirculation inlet nozzles): $[p(r_o^2 + r_i^2)/(r_o^2 - r_i^2)]/C_{NOZZLE} < 1.15$]

The calculation result is 1.344, which is greater than 1.15, therefore, the CNS N2 nozzles do not meet [Criterion] 3.

[Criteria 4 (for recirculation outlet nozzles): $(pr/t)/C_{RPV} < 1.15$]

The calculation result is 1.013, which is less than 1.15, therefore, the CNS N1 nozzles meet [Criterion] 4.

[Criteria 5 (for recirculation outlet nozzles): $[p(r_o^2 + r_i^2)/(r_o^2 - r_i^2)]/C_{NOZZLE} < 1.15$]

The calculation result is 1.080, which is less than 1.15, therefore, the CNS N1 nozzles meet [Criterion] 5.

Based upon the above information, all RPV nozzle-to-vessel shell welds and nozzle inner radius sections, with the exception of the Recirculation Inlet N2 Nozzles, meet the criteria. Therefore, [ASME] Code Case N-702 is applicable. Since the recirculation inlet nozzles do not meet all of the criteria, Code Case N-702 will not be applied to these nozzles.

Therefore, use of [ASME] Code Case N-702 provides an acceptable level of quality and safety pursuant to 10 CFR 50.55a(a)(3)(i) for all RPV nozzle-to-vessel shell welds and nozzle inner radius sections, with the exception of the Recirculation Inlet Nozzles.

3.2 NRC Staff Evaluation

The December 19, 2007, SER for the BWRVIP-108 report specified five plant-specific criteria that licensees must meet to demonstrate that the BWRVIP-108 report results apply to their plants. The five criteria are related to the driving force of the PFM analyses for the recirculation inlet and outlet nozzles. It was stated in the December 19, 2007, SER that the nozzle material fracture toughness-related reference temperature (RT_{NDT}) used in the PFM analyses was based

on data from the entire fleet of boiling-water reactor (BWR) RPVs. Therefore, the BWRVIP-108 report PFM analyses are bounding with respect to fracture resistance, and only the driving force of the underlying PFM analyses needs to be evaluated. It was also stated in the December 19, 2007, SER that, except for the RPV heatup/cooldown rate, the plant-specific criteria are for the recirculation inlet and outlet nozzles only because the probabilities of failure, P(F|E)s, for other nozzles are an order of magnitude lower. The plant-specific heatup/cooldown rate that the NRC staff established in Criterion 1 regards the rate under the plant's normal operating condition, which is limiting. Events with excursions of heatup/cooldown rates exceeding 115 °F/hour are considered transients. According to the December 19, 2007, SER, the PFM results with a very severe low-temperature overpressure transient is not limiting, largely because the event frequency for that transient is 1×10^{-3} as opposed to 1.0 for the normal operating condition.

The licensee provided in its submittal NPPD's plant-specific data for the CNS RPV and its evaluation of the five driving force factors, or ratios, against the criteria established in the December 19, 2007, SER. The NRC staff verified the licensee's evaluation, which indicated that, except for the third criterion (related to recirculation inlet nozzles), all other criteria are satisfied. As a result, the reduced inspection requirements in accordance with ASME Code Case N-702 do not apply to CNS RPV recirculation inlet nozzles. The NRC staff agrees with the licensee's decision to exclude the recirculation inlet nozzles from the scope of this request based upon the licensee's evaluation. Considering that the driving force factor for the recirculation inlet nozzles (1.344) is only moderately higher than the plant-specific criterion (1.15) and the P(F|E)s for other RPV nozzles are an order of magnitude lower than the recirculation inlet nozzles, the NRC staff concluded that the licensee's proposed alternative for all CNS RPV nozzles included in this application (see Section 3.1 of this SE) provides an acceptable level of quality and safety. It should be noted that RPV feedwater nozzles and control rod drive return line nozzles are outside the scope of ASME Code Case N-702 and are, therefore, outside the scope of this application.

ASME Code Case N-702 permits a VT-1 visual examination of the nozzle inner radius without performing a sensitivity demonstration of detecting a 1-mil width wire or crack. This is not consistent with the NRC position established in RG 1.147 regarding ASME Code Case N-648-1. However, since the licensee stated in the submittal that, "the specific aspect of utilizing VT-1 visual examinations as allowed by [ASME] Code Case N-702 is not part of this request," the inconsistency between ASME Code Case N-702 and the NRC position regarding VT-1 is not an issue in this application.

4.0 CONCLUSION

The NRC staff has reviewed the submittal regarding the licensee's evaluation of the five plant-specific criteria specified in the SER dated December 19, 2007, SER for the BWRVIP-108 report, which provides technical bases for use of ASME Code Case N-702, to examine RPV nozzle-to-vessel welds and nozzle inner radii at CNS. Based on the evaluation in Section 3.2 of this safety evaluation, the staff concludes that the licensee's proposed alternative, pursuant to 10 CFR 50.55a(a)(3)(i), provides an acceptable level of quality and safety and applies to all requested CNS RPV nozzles, with the exception of the RPV recirculation inlet nozzles, feedwater nozzles, and control rod drive return nozzles. Therefore, the proposed alternative is authorized in accordance with 10 CFR 50.55a(a)(3)(i) for the fourth 10-year ISI interval, which commenced on March 1, 2006.

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

Principal Contributor: S. Sheng

Date: October 8, 2010

B. O'Grady

- 2 -

The detailed results of the NRC staff review are provided in the enclosed safety evaluation. If you have any questions concerning this matter, please contact Ms. L. Wilkins of my staff at (301) 415-1377 or via e-mail at Lynnea.Wilkins@nrc.gov.

Sincerely,

/RA/

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

Docket No. 50-298

Enclosure:
As stated

cc w/encl: Distribution via Listserv

DISTRIBUTION:

PUBLIC

LPLIV r/f

RidsAcrsAcnw_MailCTR Resource

RidsNrrDciCvib Resource

RidsNrrDorlLpl4 Resource

RidsNrrPMCooper Resource

RidsNrrLAJBurkhardt Resource

RidsOgcRp Resource

RidsRgn4MailCenter Resource

SSheng, CVIB

LTrocine, EDO RIV

ADAMS Accession No. ML102220449

*email dated

OFFICE	NRR/LPL4/PM	NRR/LPL4/LA	DCI/CVIB/BC	NRR/LPL4/BC	NRR/LPL4/PM
NAME	FLyon	JBurkhardt	MMitchell*	MMarkley	LWilkins
DATE	10/4/10	10/4/10	8/9/10	10/8/10	10/8/10

OFFICIAL RECORD COPY