

RS-09-024

March 2, 2009

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Quad Cities Nuclear Power Station, Units 1 and 2
Renewed Facility Operating Licenses No. DPR-29 and DPR-30
NRC Docket Nos. 50-254 and 50-265

Subject: Request for Alternative to Nozzle-to-Vessel Weld and Inner Radius Examinations

In accordance with 10 CFR 50.55a, "Codes and standards," paragraph (a)(3)(i), Exelon Generation Company, LLC (EGC), is requesting relief from the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," (ASME Section XI).

Specifically, EGC requests NRC approval to implement an alternative from ASME Section XI, Table IWB-2500-1, "Examination Category B-D, Full Penetration Welded Nozzles in Vessels - Inspection Program B," to allow reduced percentage requirements for Nozzle-to-Vessel Weld and Inner Radius Examinations at Quad Cities Nuclear Power Station (QCNPS), Unit 1 and Unit 2. This requested relief is consistent with ASME Code Case N-702, "Alternative Requirements for Boiling Water Reactor (BWR) Nozzle Inner Radius and Nozzle-to-Shell Welds." EGC is requesting this relief for the remainder of the fourth 10-year interval of the QCNPS Inservice Inspection Program, which began on March 10, 2003.

The NRC has recently approved a similar request to adopt an alternative to ASME Section XI, Table IWB-2500-1 to allow reduced percentage requirements for Nozzle-to-Vessel Weld and Inner Radius Examinations for the Duane Arnold Energy Center. This approval is documented in ADAMS Accession Number ML082040046.

The request is described in the attachment and enclosures to this letter. EGC requests approval of this request by March 3, 2010.

There are no regulatory commitments in this letter.

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If there are any questions concerning this letter, please contact Mr. John L. Schrage at (630) 657-2821.

Respectfully,

A handwritten signature in black ink, appearing to read "Patrick R. Simpson", with a long horizontal flourish extending to the right.

Patrick R. Simpson
Manager - Licensing

Attachment: Quad Cities Nuclear Power Station, Unit 1 and Unit 2, Relief Request I4R-17
Enclosure 1: Relief Request I4R-17, Applicable Nozzles
Enclosure 2: Relief Request I4R-17, Plant Specific Applicability

Attachment

Quad Cities Nuclear Power Station, Unit 1 and Unit 2

Relief Request I4R-17

**Attachment
Relief Request Number I4R-17**

**Proposed Alternative In Accordance with 10 CFR 50.55a(a)(3)(i)
Which Provides an Acceptable Level of Quality or Safety**

1.0 ASME Code Component(s) Affected

Code Class: 1
Component Numbers: N2, N3, N5, N6, N7, and N8 Nozzles (See Enclosure 1 for complete list of nozzle identifications)
Examination Category: B-D
Item Number: B3.90 and B3.100
Description: Alternative to ASME Section XI, Table IWB-2500-1 (Inspection Program B)

2.0 Applicable Code Edition and Addenda

Quad Cities Nuclear Power Station (QCNPS) is currently in the fourth 10-year Inservice Inspection (ISI) Program interval and is committed to American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," (ASME Section XI), 1995 Edition, 1996 Addenda. Additionally, for ultrasonic examinations, ASME Section XI, Appendix VIII, "Performance Demonstration for Ultrasonic Examination Systems," of the 1995 Edition is implemented, as required and modified by 10 CFR 50.55a(b)(2)(xv).

3.0 Applicable Code Requirement

Table IWB-2500-1 "Examination Category B-D, Full Penetration Welds of Nozzles in Vessels - Inspection Program B"

Class 1 nozzle-to-vessel weld and nozzle inner radii examination requirements are delineated in Item Number B3.90 "Nozzle-to-Vessel Welds" and B3.100 "Nozzle Inside Radius Section." The required method of examination is volumetric. All nozzles with full penetration welds to the vessel shell (or head) and integrally cast nozzles are examined each interval.

All of the nozzle assemblies identified in Enclosure 1 are full penetration welds.

4.0 Reason for Request

Enclosure 1 provides a complete listing of the applicable RPV nozzles.

The proposed alternative provides an acceptable level of quality and safety, and the reduction in scope could provide a dose savings of as much as 8.1 Person-Rem for Unit 1 and 9.4 Person-Rem for Unit 2, over the remainder of the interval.

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5.0 Proposed Alternative and Basis for Use

Pursuant to 10 CFR 50.55a(a)(3)(i), relief is requested from performing the required examinations on 100% of the RPV nozzle assemblies at QCNPS Unit 1 and Unit 2 identified in Tables 5-1 and 5-2 below, (i.e., and delineated in Enclosure 1). As an alternative for the welds and inner radii identified in Tables 5-1 and 5-2, EGC proposes to examine a minimum of 25% of the nozzle-to-vessel welds and inner radius sections, including at least one nozzle from each system and nominal pipe size, in accordance with Code Case N-702. For the applicable nozzle assemblies identified in Enclosure 1, this would mean one from each of the groups identified below:

Table 5-1
Unit 1 Summary

Group	Total Number	Minimum Number to be Examined	Comments
Recirculation Inlet (N2)	10	3	Five completed. Four in 2005 during Q1R18. One in 2007 during Q1R19.
Main Steam (N3)	4	1	Four completed. Two in 2005 during Q1R18. Two in 2007 during Q1R19.
Core Spray (N5)	2	1	Two completed. One in 2005 during Q1R18 and one in 2007 during Q1R19.
Nozzles on Vessel Top Head (N6, N7)	3	1	Three completed during 2007 in Q1R19.
Jet Pump Instrumentation (N8)	2	1	One completed during 2005 in Q1R18.

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Table 5-2
Unit 2 Summary

Group	Total Number	Minimum Number to be Examined	Comments
Recirculation Inlet (N2)	10	3	Five completed. Two in 2004 during Q2R17. Three in 2006 during Q2R18
Main Steam (N3)	4	1	Two completed in 2008 during Q2R19.
Core Spray (N5)	2	1	Two completed in 2008 during Q2R19.
Nozzles on Vessel Top Head (N6, N7)	3	1	Three completed in 2008 during Q2R19.
Jet Pump Instrumentation (N8)	2	1	One completed in 2008 during Q2R19.

Code Case N-702 stipulates that a VT-1 examination may be used in lieu of the volumetric examination for the inner radii (i.e., Item No. B3.100). EGC is not currently using Code Case N-648-1 at QCNPS for the identified components on enhanced magnification visual examination, and has no plans of using Code Case N-648-1 in the future. Volumetric examinations of all inner radii will be completed.

Electric Power Research Institute (EPRI) Technical Report 1003557, "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 Blend Radii," provides the basis for Code Case N-702. The evaluation found that failure probabilities at the nozzle blend radius region and nozzle-to-vessel shell weld due to a low temperature overpressure event are very low (i.e., $<1 \times 10^{-6}$ for 40 years) with or without inservice inspection. The report concludes that inspection of 25% of each nozzle type is technically justified.

This EPRI report was approved by the NRC in an SE dated December 19, 2007 (i.e., ADAMS Accession No. ML073600374). Section 5.0, "Plant-Specific Applicability," of the SE indicates that each licensee who plans 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 applicability criteria from the BWRVIP-108 report to its units in the relief request by showing that all the general and nozzle-specific criteria addressed below are satisfied (i.e., as described in Enclosure 2).

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- (1) The maximum RPV heatup/cool-down rate is limited to less than 115 °F per hour.

QCNSP Technical Specification (TS) 3.4.9, "RCS Pressure and Temperature (P/T) Limits," provides a limiting condition for operation (LCO) and a corresponding surveillance requirement (SR) that ensure the reactor coolant system heatup and cool-down rates are less than or equal to 100°F/hr. The SR (i.e., monitoring of reactor vessel heatup and cool-down rates) is implemented by QCNSP operations surveillance procedure QCOS 0201-02, "Primary System Boundary Thermal Limitations." This heatup/cool-down rate is also described in the QCNSP Updated Final Safety Analysis Report (UFSAR) Section 5.3.2, "Pressure-Temperature Limits," and UFSAR Table 5.1-1, "Reactor Coolant System Data."

- (2) For the Recirculation Inlet Nozzles, the following criteria must be met:
- a. $(pr/t)/C_{RPV} < 1.15$; The calculation for the QCNSP N2 Nozzle results in 1.065 which is less than 1.15
 - b. $[p(r_o^2 + r_i^2)/(r_o^2 - r_i^2)]/C_{NOZZLE} < 1.15$; The calculation for the QCNSP N2 Nozzle results in 0.972, which is less than 1.15.
- (3) For the Recirculation Outlet Nozzles, the following criteria must be met:
- a. $(pr/t)/C_{RPV} < 1.15$; The calculation for the QCNSP N1 Nozzle results in 1.273 which is higher than 1.15.
 - b. $[p(r_o^2 + r_i^2)/(r_o^2 - r_i^2)]/C_{NOZZLE} < 1.15$; The calculation for the QCNSP N1 Nozzle results in 0.840 which is less than 1.15.

Based upon the above information, all QCNSP RPV nozzle-to-vessel shell welds and nozzle inner radii sections, with the exception of the Recirculation Outlet Nozzles, meet the criteria and therefore Code Case N-702 is applicable. However, the Recirculation Outlet Nozzles do not meet all of the criteria and Code Case N-702 would not be applied. Additional discussion is provided in Enclosure 2.

Therefore, implementation of Code Case N-702 examination requirements provides an acceptable level of quality and safety pursuant to 10 CFR 50.55a(a)(3)(i) for all applicable, full penetration RPV nozzle-to-vessel shell welds and nozzle inner radii sections.

6.0 Duration of Proposed Alternative

The proposed alternative will be used for the remainder of the fourth 10-year interval of the QCNSP ISI Program.

7.0 Precedents

The NRC has recently approved a similar request for the Duane Arnold Energy Center. This approval is documented in ADAMS Accession Number ML082040046.

Enclosure 1
Relief Request Number I4R-17
Applicable Nozzles

Unit 1 Applicable Nozzles

Component ID	Category Number	Item Number	System	Nominal Pipe Size	Comments
N2A Nozzle	B-D	B3.90	Recirc Inlet	12"	PDI Exam 2005
N2A IRS	B-D	B3.100	Recirc Inlet	12"	PDI Exam 2005
N2B Nozzle	B-D	B3.90	Recirc Inlet	12"	PDI Exam 2005
N2B IRS	B-D	B3.100	Recirc Inlet	12"	PDI Exam 2005
N2C Nozzle	B-D	B3.90	Recirc Inlet	12"	PDI Exam 2007
N2C IRS	B-D	B3.100	Recirc Inlet	12"	PDI Exam 2007
N2D Nozzle	B-D	B3.90	Recirc Inlet	12"	PDI Exam 2005
N2D IRS	B-D	B3.100	Recirc Inlet	12"	PDI Exam 2005
N2E Nozzle	B-D	B3.90	Recirc Inlet	12"	PDI Exam 2005
N2E IRS	B-D	B3.100	Recirc Inlet	12"	PDI Exam 2005
N2F Nozzle	B-D	B3.90	Recirc Inlet	12"	
N2F IRS	B-D	B3.100	Recirc Inlet	12"	
N2G Nozzle	B-D	B3.90	Recirc Inlet	12"	
N2G IRS	B-D	B3.100	Recirc Inlet	12"	
N2H Nozzle	B-D	B3.90	Recirc Inlet	12"	
N2H IRS	B-D	B3.100	Recirc Inlet	12"	
N2J Nozzle	B-D	B3.90	Recirc Inlet	12"	
N2J IRS	B-D	B3.100	Recirc Inlet	12"	
N2K Nozzle	B-D	B3.90	Recirc Inlet	12"	
N2K IRS	B-D	B3.100	Recirc Inlet	12"	
N3A Nozzle	B-D	B3.90	Main Steam	20"	PDI Exam 2005
N3A IRS	B-D	B3.100	Main Steam	20"	PDI Exam 2005
N3B Nozzle	B-D	B3.90	Main Steam	20"	PDI Exam 2005
N3B IRS	B-D	B3.100	Main Steam	20"	PDI Exam 2005
N3C Nozzle	B-D	B3.90	Main Steam	20"	PDI Exam 2007
N3C IRS	B-D	B3.100	Main Steam	20"	PDI Exam 2007
N3D Nozzle	B-D	B3.90	Main Steam	20"	PDI Exam 2007
N3D IRS	B-D	B3.100	Main Steam	20"	PDI Exam 2007
N5A Nozzle	B-D	B3.90	Core Spray	10"	PDI Exam 2005
N5A IRS	B-D	B3.100	Core Spray	10"	PDI Exam 2005
N5B Nozzle	B-D	B3.90	Core Spray	10"	PDI Exam 2007
N5B IRS	B-D	B3.100	Core Spray	10"	PDI Exam 2007
N6A Nozzle	B-D	B3.90	Head Vent	6"	PDI Exam 2007
N6A IRS	B-D	B3.100	Head Vent	6"	PDI Exam 2007
N6B Nozzle	B-D	B3.90	Head Vent	6"	PDI Exam 2007
N6B IRS	B-D	B3.100	Head Vent	6"	PDI Exam 2007
N7 Nozzle	B-D	B3.90	Head Vent	4"	PDI Exam 2007
N7 IRS	B-D	B3.100	Head Vent	4"	PDI Exam 2007
N8A Nozzle	B-D	B3.90	Jet Pump Instrumentation	4"	PDI Exam 2005
N8A IRS	B-D	B3.100	Jet Pump Instrumentation	4"	PDI Exam 2005
N8B Nozzle	B-D	B3.90	Jet Pump Instrumentation	4"	
N8B IRS	B-D	B3.100	Jet Pump Instrumentation	4"	

Enclosure 1
Relief Request Number I4R-17
Applicable Nozzles

Unit 2 Applicable Nozzles

Component ID	Category Number	Item Number	System	Nominal Pipe Size	Comments
N2A Nozzle	B-D	B3.90	Recirc Inlet	12"	PDI Exam 2004
N2A IRS	B-D	B3.100	Recirc Inlet	12"	PDI Exam 2004
N2B Nozzle	B-D	B3.90	Recirc Inlet	12"	PDI Exam 2006
N2B IRS	B-D	B3.100	Recirc Inlet	12"	PDI Exam 2006
N2C Nozzle	B-D	B3.90	Recirc Inlet	12"	PDI Exam 2004
N2C IRS	B-D	B3.100	Recirc Inlet	12"	PDI Exam 2004
N2D Nozzle	B-D	B3.90	Recirc Inlet	12"	PDI Exam 2006
N2D IRS	B-D	B3.100	Recirc Inlet	12"	PDI Exam 2006
N2E Nozzle	B-D	B3.90	Recirc Inlet	12"	PDI Exam 2006
N2E IRS	B-D	B3.100	Recirc Inlet	12"	PDI Exam 2006
N2F Nozzle	B-D	B3.90	Recirc Inlet	12"	
N2F IRS	B-D	B3.100	Recirc Inlet	12"	
N2G Nozzle	B-D	B3.90	Recirc Inlet	12"	
N2G IRS	B-D	B3.100	Recirc Inlet	12"	
N2H Nozzle	B-D	B3.90	Recirc Inlet	12"	
N2H IRS	B-D	B3.100	Recirc Inlet	12"	
N2J Nozzle	B-D	B3.90	Recirc Inlet	12"	
N2J IRS	B-D	B3.100	Recirc Inlet	12"	
N2K Nozzle	B-D	B3.90	Recirc Inlet	12"	
N2K IRS	B-D	B3.100	Recirc Inlet	12"	
N3A Nozzle	B-D	B3.90	Main Steam	20"	
N3A IRS	B-D	B3.100	Main Steam	20"	
N3B Nozzle	B-D	B3.90	Main Steam	20"	PDI Exam 2008
N3B IRS	B-D	B3.100	Main Steam	20"	PDI Exam 2008
N3C Nozzle	B-D	B3.90	Main Steam	20"	
N3C IRS	B-D	B3.100	Main Steam	20"	
N3D Nozzle	B-D	B3.90	Main Steam	20"	PDI Exam 2008
N3D IRS	B-D	B3.100	Main Steam	20"	PDI Exam 2008
N5A Nozzle	B-D	B3.90	Core Spray	10"	PDI Exam 2008
N5A IRS	B-D	B3.100	Core Spray	10"	PDI Exam 2008
N5B Nozzle	B-D	B3.90	Core Spray	10"	PDI Exam 2008
N5B IRS	B-D	B3.100	Core Spray	10"	PDI Exam 2008
N6A Nozzle	B-D	B3.90	Head Vent	6"	PDI Exam 2008
N6A IRS	B-D	B3.100	Head Vent	6"	PDI Exam 2008
N6B Nozzle	B-D	B3.90	Head Vent	6"	PDI Exam 2008
N6B IRS	B-D	B3.100	Head Vent	6"	PDI Exam 2008
N7 Nozzle	B-D	B3.90	Head Vent	4"	PDI Exam 2008
N7 IRS	B-D	B3.100	Head Vent	4"	PDI Exam 2008
N8A Nozzle	B-D	B3.90	Jet Pump Instrumentation	4"	PDI Exam 2008
N8A IRS	B-D	B3.100	Jet Pump Instrumentation	4"	PDI Exam 2008
N8B Nozzle	B-D	B3.90	Jet Pump Instrumentation	4"	
N8B IRS	B-D	B3.100	Jet Pump Instrumentation	4"	

Enclosure 2
Relief Request Number I4R-17
Plant Specific Applicability

- (1) The maximum Reactor Pressure Vessel (RPV) heatup/cool-down rate is limited to less than 115 °F/hour.

Response: QCNPS Technical Specification (TS) 3.4.9, "RCS Pressure and Temperature (P/T) Limits," provides a limiting condition for operation (LCO) and a corresponding surveillance requirement (SR) that ensure the reactor coolant system heatup and cooldown rates are less than or equal to 100°F/hr. The SR (i.e., monitoring of reactor vessel heatup and cooldown rates) is implemented by QCNPS operations surveillance procedure QCOS 0201-02, "Primary System Boundary Thermal Limitations." This heatup/cool-down rate is also described in the QCNPS Updated Final Safety Analysis Report (UFSAR) Section 5.3.2, "Pressure-Temperature Limits," and UFSAR Table 5.1-1, "Reactor Coolant System Data."

For Recirculation Inlet Nozzles

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

$p=RPV$ Normal Operating Pressure	1005
$r=RPV$ inner radius	125.5
$t=RPV$ wall thickness	6.125
$C_{RPV} =$	<u>19332</u>

$$(pr/t)/C_{RPV} = 1.065 < 1.15$$

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

$p=RPV$ Normal Operating Pressure	1005
$r_o=$ nozzle outer radius	12.5
$r_i=$ nozzle inner radius	5.941
$C_{NOZZLE} =$	<u>1637</u>

$$[p(r_o^2 + r_i^2)/(r_o^2 - r_i^2)]/C_{NOZZLE} = 0.972 < 1.15$$

For Recirculation Outlet Nozzles

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

$p=RPV$ Normal Operating Pressure	1005
$r=RPV$ inner radius	125.5
$t=RPV$ wall thickness	6.125
$C_{RPV} =$	<u>16171</u>

$$(pr/t)/C_{RPV} = 1.273 > 1.15$$

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

$p=RPV$ Normal Operating Pressure	1005
$r_o=$ nozzle outer radius	26.5
$r_i=$ nozzle inner radius	13.1375
$C_{NOZZLE} =$	<u>1977</u>

$$[p(r_o^2 + r_i^2)/(r_o^2 - r_i^2)]/C_{NOZZLE} = 0.840 < 1.15$$