May 10, 2005

Mr. Christopher M. Crane, President
and Chief Nuclear Officer
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: QUAD CITIES, UNITS 1 AND 2 - RELIEF REQUEST CR-39 FOR THIRD 10-YEAR INSERVICE INSPECTION INTERVAL (TAC NOS. MC2427 AND MC2428)

Dear Mr. Crane:

By letter dated March 8, 2004, Exelon Generation Company, LLC (Exelon), submitted a Request for Relief CR-39, from certain examination coverage requirements of the American Society of Mechanical Engineering (ASME) Boiler and Pressure Vessel Code (Code), Section XI, for the Quad Cities Nuclear Power Station (QCNPS), Units 1 and 2. By letter dated October 5, 2004, Exelon submitted Revision 1 to request for Relief CR-39.

The U. S. Nuclear Regulatory Commission (NRC) staff, with technical assistance from its contractor, the Pacific Northwest National Laboratory (PNNL), has reviewed and evaluated the information provided by Exelon related to Request for Relief CR-39. The NRC staff concludes that ASME Code, Section XI examination coverage requirements are impractical for the subject welds listed in Request for Relief CR-39, Revision 1. Furthermore, the NRC staff concluded that the examinations that were performed provide reasonable assurance of the structural integrity of the subject components. Therefore, pursuant to Section 50.55a(g)(6)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR), Request for Relief CR-39, Revision 1, is granted for the third 10-year inservice inspection interval at QCNPS, Units 1 and 2, which concluded on March 9, 2003. The NRC staff has determined that granting the Request for Relief CR-39, Revision 1, pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property, or the common defense and security and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

The NRC staff's evaluation and conclusions are provided in the enclosed safety evaluation. If you have any questions about this review, please contact Lawrence Rossbach at (301) 415-2863.

Sincerely,

/RA/

Gene Y. Suh, Chief, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-254 and 50-265

Enclosure: Safety evaluation w/atts

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

THIRD 10-YEAR INTERVAL INSERVICE INSPECTION

REQUEST FOR RELIEF CR-39

QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2

EXELON GENERATION COMPANY

DOCKET NUMBERS 50-254 AND 50-265

1.0 INTRODUCTION

The U. S. Nuclear Regulatory Commission (NRC) staff, with technical assistance from its contractor, the Pacific Northwest National Laboratory (PNNL) has reviewed and evaluated the information provided by Exelon Generation Company (the licensee) in its letter dated March 8, 2004, which proposed its third 10-Year Interval Inservice Inspection Program Plan Request for Relief CR-39 for Quad Cities Nuclear Power Station (QCNPS), Units 1 and 2. The licensee provided additional information in its Revision 1 letter dated October 5, 2004.

2.0 REGULATORY REQUIREMENTS

Inservice inspection of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Class 1, 2, and 3 components is performed in accordance with Section XI of the ASME Code and applicable addenda as required by Section 50.55a(g) of Title 10 of the *Code of Federal Regulations* (10 CFR), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). 10 CFR 50.55a(a)(3) states 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.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall 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 Inservice Inspection (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 inservice examination of components and system pressure tests conducted during the first ten-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) twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The ASME Code of record for the QCNPS, Units 1 and 2, third 10-year interval ISI programs, which began on March 10, 1993, is the 1989 Edition of ASME Section XI with no addenda.

3.0 TECHNICAL EVALUATION

3.1 Request for Relief CR-39, Revision 1, Examination Category B-A, Pressure Retaining Welds in Reactor Vessel

ASME Code Requirement:
ASME Code, Section XI, Examination Category B-A, Items B1.22, B1.30, B1.40, and B1.51 require "essentially 100%" volumetric examination, as defined by Figures IWB-2500-1, -2, -3, and -4, of the length of Class 1 pressure retaining welds in the reactor pressure vessel (RPV). "Essentially 100%," as clarified by ASME Code Case –460, is greater than 90 percent coverage of the examination volume, or surface area, as applicable.

Licensee's ASME Code Relief Request:
In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from "essentially 100%" volumetric examination coverage for pressure retaining RPV shell and head welds. Component descriptions, along with percent coverage and stated limitations are also shown in Table 3.1.[1]

Staff Evaluation:
The licensee performed ultrasonic examinations on the RPV shell-to-flange, head-to-flange, and top head meridional welds from the outside surface using 0, 45, and 60 degree beam angles which resulted in obtaining coverage from approximately 58 percent to 85 percent of the Code-required volumes. The NRC staff determined, that based on the cross-sectional geometries of the welds and outside surface features of these components, the ASME Code required examinations are impractical and that the examinations were performed to the maximum extent possible. Based on coverages obtained, the examinations performed should have detected any significant patterns of degradation, providing reasonable assurance of the continued structural integrity of the subject RPV head and shell welds.

For QCNPS, Unit 1 RPV shell beltline repair RPV-BMR-016-295, the licencee obtained 0 percent coverage. This area is located between two jet pump risers, restricting access by the existing RPV robotic inspection tool to perform examinations from the inside of the vessel. Access is not possible from the outside surface of the RPV due to the presence of permanent insulation and limited annular space between the vessel outside surface and the biological shield wall. Therefore, it is impractical for the licensee to perform the ASME Code required examination. However, two other base metal fabrication repair areas adjacent to RPV-BMR-016-295 were inspected and resulted in approximately 63 percent and 100 percent coverage, respectively. The licensee found no unacceptable flaws during these examinations. In addition, similar fabrication and environmental conditions are present in all of the base metal repair areas. Therefore, based on the results of the examinations performed in adjacent base metal repaired areas, the NRC staff determined that if significant service-induced degradation were

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1. Table 3.1 is contained in PNNL's Technical Letter Report (TLR) Attachment 2 which lists component descriptions, along with percent coverage and stated limitations, and is reproduced from the licensee's submittal dated March 8, 2004.

occurring in these areas, there is reasonable assurance that evidence of it would have been detected during the examinations in the adjacent areas. Therefore, reasonable assurance of continued structural integrity has been provided for repair RPV-BMR-016-295.

3.2 Request for Relief CR-39, Revision 1, Examination Category B-D, Full Penetration Welded Nozzles in Vessels

ASME Code Requirement:
Examination Category B-D, Items B3.90 and B3.100 require 100 percent volumetric examination, as defined in Figures IWB-2500-7(a) through (d), as applicable, of RPV nozzle-to-vessel welds during each inspection interval. At least 25 percent of the nozzles must be examined by the end of the first inspection period, with the remainder being examined by the end of the interval. Code Case –460, an alternative approved for use by the NRC Staff, states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10 percent, i.e., greater than 90 percent examination coverage is obtained.

Licensee's ASME Code Relief Request:
In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the 100 percent volumetric coverage requirement for full penetration RPV nozzle-to-vessel welds listed in Table 3.2.[2]

Staff Evaluation:
The licensee is unable to obtain 100 percent volumetric coverage for all the Class 1 RPV nozzle-to-shell and head welds listed in Table 3.2[2]. Component geometries limit scanning so that 100 percent of the ASME Code required examination coverage cannot be completed. For the licensee to achieve the ASME Code-required volumetric coverage, the subject nozzles would have to be redesigned and modified. This would place a significant burden on the licensee, thus the ASME Code-required 100 percent volumetric examinations, performed from both sides of the weld, are impractical.

The licensee obtained coverages, ranging from approximately 15 percent to 84 percent of the required volumes for the subject nozzle welds. The licensee used various beam angles from the vessel side of the weld and from the head side to improve the volumetric coverage based on head-to-nozzle alignment angles. Although the licensee was unable to obtain full volumetric coverage from both sides of the subject welds, as required by the ASME Code, a substantial amount of the lower weld zone portions (nearest the vessel/head inner surface) were completed. It is reasonable to assume that if service-induced degradation were to occur, it would likely begin in the lower weld zone region.

Therefore, if significant service degradation were occurring in these areas, there is

2. Table 3.2 is contained in PNNL's TLR Attachment 2 which lists the RPV shell-to-nozzle welds along with percent coverage and stated limitations, and is reproduced from the licensee's submittal dated March 8, 2004.

reasonable assurance that evidence of it would have been detected by the examinations that were completed. The NRC staff determined that the examinations performed provide reasonable assurance of structural integrity of the subject RPV nozzle-to-shell and head welds.

3.3 Request for Relief CR-39, Revision 1, Examination Category B-—1, Pressure Retaining Welds in Valve Bodies

ASME Code Requirement:
ASME Code, Section XI, Examination Category B-—1, Item B12.40, requires "essentially 100%" volumetric examination, as specified by Figure IWB-2500-17, of the length of valve body welds nominal pipe size (NPS) 4 inches or larger in diameter. "Essentially 100%," as clarified by ASME Code Case –460, is greater than 90 percent coverage of the examination volume, or surface area, as applicable.

Licensee's ASME Code Relief Request:
In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the 100 percent volumetric examination requirement specified in the ASME Code for Electromagnetic Relief Valve (ERV) Body Weld 1-203-3E-S1 on the QCNPS Unit 1 main steam system.

Staff Evaluation:
The ASME Code, Section XI requires that the subject welds are to be examined in two directions from both sides of the weld. However, the geometry of ERV Body Weld 1-203-3E-S1 does not allow the licensee to complete examination coverage as required by the ASME Code. For the licensee to achieve the ASME Code-required volumetric coverage, the subject valve body weld would have to be redesigned and modified. The staff determined that it would be a significant burden on the licensee to perform the ASME Code-required 100 percent volumetric examination and it is impractical to perform the examination from both sides of the subject weld.

The licensee obtained approximately 66 percent aggregate coverage of the Code-required volume of the subject weld. The coverage was obtained using 45 and 60 degree ultrasonic beam angles applied from the carbon steel valve body, up to and across the full penetration weld. No scans could be made from the opposite side of the weld due to the extreme taper on the flange bonnet. The NRC staff determined that if service-induced degradation were occurring in this area, there is reasonable assurance that evidence of it would have been detected by the examinations that were completed. Therefore, volumetric coverage obtained provides reasonable assurance of structural integrity of the ERV Body Weld 1-203-3E-S1.

3.4 Request for Relief CR-39, Revision 1, Examination Category C-C, Integral Attachments for Vessels, Piping, Pumps and Valves

ASME Code Requirement:
ASME Code, Section XI, Examination Category C-C, Items C3.10 and C3.20, require 100 percent surface examination, as defined in Figure IWC-2500-5, for integrally welded attachments on Class 2 vessels and piping. Code Case –460, an alternative approved for use by the NRC staff, states that a reduction in examination coverage due

to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10 percent, i.e., greater than 90 percent examination coverage is obtained.

Licensee's ASME Code Relief Request:
In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the 100 percent surface examination coverage requirement for integrally welded attachments on the boron injection tank, residual heat removal system heat exchanger, and main steam and safety injection system piping. More detailed descriptions, along with percent coverages and stated limitations are shown in Table 3.4.[3]

Staff Evaluation:
The ASME Code requires 100 percent surface examination of the welds and adjacent base materials for integrally welded supports on selected Class 2 vessels and piping. The NRC staff determined that due to the design and interference from adjacent structural support members it is impractical for the licensee to perform the ASME Code-required surface examination on the subject integrally welded attachments on the boron injection tank, residual heat removal system heat exchanger, and main steam and safety injection system piping. This would place a significant burden on the licensee because the subject components would have to be redesigned.

The licensee completed approximately 80 percent or greater of the ASME Code-required surface examinations using the magnetic particle nondestructive examination method. The exception is Weld 1403-W-204A, where only 43 percent of the weld and base metal were accessible due to four (4) of the eight (8) welded lugs on this piping support being completely covered by the structural steel in the clamp and restraint. The staff determined that the examinations performed by the licensee would have, with reasonable assurance, detected evidence of significant service-induced degradation or deformation in the subject welded attachments. Therefore, based on the significant coverage(s) obtained on these components, reasonable assurance of their continued structural integrity has been provided.

4.0 CONCLUSIONS

The QCNPS, Units 1 and 2, Request for Relief CR-39 from the ASME Code requirements has been reviewed by the NRC staff with the assistance of its contractor, PNNL. The technical letter report (TLR) in Attachment 3 provides PNNL's evaluation of this request for relief. The staff has reviewed the TLR and adopts the evaluations and recommendations for authorizing the licensee's request for relief.

The NRC staff has reviewed the licensee's submittal and concludes that ASME Code, Section XI examination coverage requirements are impractical for the subject welds listed in Request for Relief CR-39, Revision 1. Furthermore, the staff concludes that the examinations that were performed provide reasonable assurance of the structural integrity of the subject components.

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3. Table 3.4 is contained in PNNL's TLR Attachment 2 which lists the integral attachment limitations along with percent coverage and stated limitations, and is reproduced from the licensee's submittal dated March 8, 2004.

Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), Request for Relief CR-39, Revision 1 is granted for the third 10-year interval at QCNPS, Units 1 and 2, which concluded on March 9, 2003.

The NRC staff has determined that granting Request for Relief CR-39, Revision 1 pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property, or the common defense and security and is otherwise in the public interest giving due consideration to the significant burden upon the licensee that could result if the requirements were imposed on the facility. All other requirements of the ASME Code, Section XI for which relief has not been specifically requested and approved remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Attachments: 1. Summary of Relief Requests
2. Technical Letter Report

Principal Contributor: T. McLellan

Date: May 10, 2005

TABLE 1
SUMMARY OF RELIEF REQUESTS

Relief Request Number	PNNL TLR RR Sec.	System or Component	Exam. Category	Item No.	Volume or Area to be Examined	Required Method	Licensee Proposed Alternative	Relief Request Disposition
RR-39, Rev. 1	3.1	Reactor Pressure Vessel Shell Welds	B-A	B1.22 B1.30 B1.40 B1.51	100% of full penetration RPV shell, flange and head welds	Volumetric	Use achieved volumetric coverage	Granted 10CFR50.55 a(g)(6)(i)
RR-39, Rev. 1	3.2	Reactor Pressure Vessel Nozzles	B-D	B3.90 B3.100	100% of full penetration nozzle-to-vessel welds	Volumetric	Use achieved volumetric coverage	Granted 10CFR50.55 a(g)(6)(i)
RR-39, Rev. 1	3.3	ERV Body Weld	B—1	B12.40	100% of pressure retaining valve body Weld ERV-1-203-3E-S1	Volumetric	Use achieved volumetric coverage	Granted 10CFR50.55 a(g)(6)(i)
RR-39, Rev. 1	3.4	Integral Attachment Welds	C-C	C3.10 C3.20	100% of integral attachment welds on vessels and piping	Surface	Use achieved surface coverage	Granted 10CFR50.55 a(g)(6)(i)

TECHNICAL LETTER REPORT
ON THIRD 10-YEAR INSERVICE INSPECTION INTERVAL
REQUEST FOR RELIEF CR-39, REVISION 1
FOR
EXELON GENERATION COMPANY
QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2
DOCKET NUMBERS 50-254 and 50-265

1.0 SCOPE

By letter dated March 8, 2004, the licensee, Exelon Generation Company, submitted Request for Relief No. CR-39 from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*. In response to an NRC Request for Additional Information (RAI), the licensee revised the request and provided further information in a letter dated October 5, 2004. The request is for the third 10-year inservice inspection (ISI) interval at Quad Cities Nuclear Power Station (QCNPS), Units 1 and 2. Pacific Northwest National Laboratory (PNNL) has evaluated the revised request for relief and supporting information submitted by the licensee in Section 3.0 below.

2.0 REGULATORY REQUIREMENTS

Inservice inspection (ISI) of the ASME Code Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code (B&PV Code), and applicable addenda, as required by 10 CFR 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). The regulation at 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the U.S. Nuclear Regulatory Commission (NRC), if the licensee demonstrates that (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.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection (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 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, which was 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 ASME Code of record for Quad Cities, Units 1 and 2, third 10-year interval ISI programs, which began on March 10, 1993, is the 1989 Edition of ASME Section XI with no addenda.

3.0 TECHNICAL EVALUATION

The information provided by Exelon Generation Company, in support of the request for relief from Code requirements has been evaluated and the bases for disposition are documented below. For clarity, the request has been evaluated in multiple parts, according to ASME Code Examination Category.

3.1 Request for Relief CR-39, Revision 1, Examination Category B-A, Pressure Retaining Welds in Reactor Vessel

ASME Code Requirement: Examination Category B-A, Items B1.22, B1.30, B1.40, and B1.51 require "essentially 100%" volumetric examination, as defined by Figures IWB-2500-1, -2, -3, and -4, of the length of Class 1 pressure retaining welds in the reactor pressure vessel (RPV). "Essentially 100%," as clarified by ASME Code Case –460, is greater than 90 percent coverage of the examination volume, or surface area, as applicable.

Licensee's ASME Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from "essentially 100%" volumetric examination coverage for pressure retaining RPV shell and head welds designated by the licensee as shown in Table 3.1 below. Component descriptions, along with percent coverage and stated limitations are also shown in Table 3.1.

TABLE 3.1 - Reactor Pressure Vessel Weld Coverage And Limitations

Drawing/ Component	Unit	Item	Description	Coverage %	Limitation/ Comment
RPV-CW-C4FLG	1	B1.30	Vessel-Flange	84.54	Flange Configuration
RPV-THHF	1	B1.40	RPV Top Head Weld to Flange (Reactor Head)	70.59	Head to Flange configuration
RPV-BMR-016-295	1	B1.51	RPV Weld Beltline Repair Area	0	RPV internal Jet Pump Riser braces & guide rod
RPV-CW-C4FLG	2	B1.30	Vessel Flange (Reactor Vessel)	73	Flange configuration, Main Steam Nozzles & Thermocouple Pads
RPV-THMS-0	2	B1.22	RPV Top Head 0 Degree Meridional Seam (Reactor Vessel)	85	Flange configuration Lifting Lug
RPV-THMS-180	2	B1.22	RPV Top Head 180 Degree Meridional Seam (Reactor Vessel)	85	Flange configuration Lifting Lug
RPV-THHF	2	B1.40	RPV Top Head Weld to Flange (Reactor Head)	58	Head to Flange configuration

Licensee's Basis for Relief Request (The licensee provided the following information to provide a basis for all Class 1 and 2 limited examinations in CR-39, Revision 1):

In accordance with 10 CFR 50.55a(g)(5)(iii), relief is requested on the basis that the required "essentially 100%" coverage examination is impractical due to physical obstructions and limitations imposed by geometry of the subject components, as shown in Figures CR-39.1 through CR-39.8[1].

Quad Cities Nuclear Power Station (QCNPS), Units 1 and 2, obtained Construction Permits on February 15, 1967 (CPPR-23 and CPPR-24, respectively). QCNPS piping systems and associated components were designed and fabricated before the examination requirements of ASME Section XI were formalized and published. Since this plant was not specifically designed to meet the requirements of ASME Section XI, literal compliance is not feasible or practical within the limits of the current plant design, inspection tools, and procedures.

Typical physical obstructions imposed by design, geometry, and materials of construction include vessel appurtenances and sacrificial shield, insulation support rings, structural and component support members, adjacent component weldments in close proximity, and unique component configurations. Performing additional examinations to achieve greater than 90 percent coverage would require significant modification and/or significant disassembly of the outside surface of components, supports, and/or adjacent structural members.

The Unit 1 RPV Base Metal Repair, RPV-BMR-016-295, originally submitted in Relief Request CR-32 and inspected during the first period of the Third 10-Year Interval, is an example of limited accessibility. The base metal repair was performed during original fabrication of the RPV. Specifically, the reactor internals configuration limited the GERIS 2000 in-vessel inspection tooling from gaining access to volumetrically examine the base metal repair area. The jet pump riser brace at jet pumps 1 and 2, along with the guide rod at the 200 azimuth, preclude access to the area of RPV-BMR-016-295. In the case of RPV-BMR-016-295, the two adjacent base metal repair areas were accessible (RPV-BMR-018-310 with 62.6% coverage and RPV-BMR-017-318 with 100% coverage). These areas are located above the jet pump riser brace, whereas RPV-BMR-016-295 is located below the riser brace and was not physically accessible to the inspection tooling. Examinations of RPV-BMR-018-310 and RPV-BMR-017-318, which are in close proximity to RPV-BMR-016-295, concluded that there are no unacceptable flaws.

These results provide reasonable assurance of the acceptability of RPV-BMR-016-295 and that the underlying objectives of the examination requirements have been met. In Reference 8.2, the NRC provided a Safety Evaluation (SE) accepting a similar alternative examination of the RPV shell welds, which were performed utilizing the GERIS 2000 system. Manual supplemental examination of the area was not feasible due to the bioshield to vessel wall clearances. As indicated in CR-32, total examination coverage was zero percent (0%) during the Third Interval examination (RPV-BMR-016-295 is included in Table CR-39.1).

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1. Licensee drawings submitted in support of CR-39, Revision 1, are not included in this report.

During the Fourth Interval, a more advanced inspection tool (that was not in existence when the examination was performed during the Third Interval) is planned to be utilized and increased coverage is expected.

Licensee's Proposed Alternative Examination (The licensee provided the following information to address alternative examinations for all Class 1 and 2 limited examinations in CR-39, Revision 1):

To the extent practical, all components received the required examination(s) with the exception of those that could not be performed due to limited accessibility. The examinations confirmed satisfactory results with no unacceptable flaws present, even though "essentially 100%" coverage was not attained. Exelon Generation Company, LLC (EGC) has concluded that any service-induced degradation would have been identified in the examinations performed. Since the examinations were completed to the extent practical, and the results showed no unacceptable flaws present, the underlying objectives have been met.

Additionally, a VT-2 examination on the subject components, performed each refueling outage during system pressure tests per examination category B-P, and performed each period per examination category C-H, provides additional assurance that the structural integrity of the subject pressure retaining components is maintained. EGC maintains continuing alliances with the Electric Power Research Institute (EPRI), the Performance Demonstration Initiative (PDI), Inservice Inspection (ISI) vendors and other industry sources to encourage the development and awareness of improved examination techniques that enhance coverage and flaw detection commensurate with radiation dose reduction.

No alternative provisions are proposed for this relief request. EGC will continue to evaluate the development of new or improved examination techniques with the intent of applying these techniques, where practical, to improve component examinations.

Evaluation: The ASME Code requires essentially 100 percent volumetric examination of the length of selected reactor pressure vessel (RPV) head and shell welds to be performed during each inservice inspection interval. However, access limitations restrict volumetric coverages on the subject RPV welds at QCNPS, Units 1 and 2. For the licensee to achieve 100 percent volumetric coverage, the RPV, and it's appurtenances, would have to be redesigned and modified. This would place a significant burden on the licensee, thus the ASME Code-required 100% volumetric examinations are impractical.

Ultrasonic examinations on the RPV shell-to-flange, head-to-flange, and top head meridional welds (see Table 3.1 for Unit 1 and 2 designations) were conducted from the outside surface using 0, 45, and 60 degree beam angles and resulted in the licensee obtaining coverages from approximately 71 percent to 85 percent of the ASME Code-required volumes. Based on the cross-sectional geometries of the welds and outside surface features of the these components, as indicated in drawings and descriptions[2] included in the licensee's submittal, it has been shown that the

2. Licensee submitted drawings and descriptions of the weld geometries are not included in this report.

examinations were performed to the maximum extent possible. Based on coverages obtained, if significant patterns of service-induced degradation were present in the subject RPV head and shell welds, there is reasonable assurance that evidence of it would have been detected by the examinations performed.

For QCNPS, Unit 1 RPV shell beltline repair RPV-BMR-016-295, this area of base material is located between two jet pump risers restricting access by the existing RPV robotic inspection tool to perform examinations from the inside of the vessel. The jet pump riser braces and guide rod prevent the automated inspection tool from being positioned over this area. In addition, access is not possible from the outside surface of the RPV due to the presence of permanent insulation and limited annular space between the vessel outside surface and the biological shield wall. Therefore, no coverage is possible for this fabrication repair area. However, two other base metal fabrication repair areas adjacent to RPV-BMR-016-295 were inspected and resulted in approximately 63 percent and 100 percent coverage, respectively. No unacceptable flaws were discovered as a result of these examinations. Similar fabrication and environmental conditions are present in all of the base metal repair areas. Based on the results of the examinations performed in base metal repaired areas, it is concluded that if significant service-induced degradation were occurring in these areas, there is reasonable assurance that evidence of it would have been detected during the examinations in the adjacent areas.

Based on the impracticality of examining 100 percent of the subject RPV welds, and the examination coverages obtained on these and other vessel welds, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

3.2 Request for Relief CR-39, Revision 1, Examination Category B-D, Full Penetration Welded Nozzles in Vessels

ASME Code Requirement: Examination Category B-D, Items B3.90 and B3.100 require 100 percent volumetric examination, as defined in Figures IWB-2500-7(a) through (d), as applicable, of RPV nozzle-to-vessel welds during each inspection interval. At least 25 percent of the nozzles must be examined by the end of the first inspection period, with the remainder being examined by the end of the interval. Code Case –460, as an alternative approved for use by the NRC Staff, states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10 percent, i.e., greater than 90 percent examination coverage is obtained.

Licensee's ASME Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the 100 percent volumetric coverage requirement for full penetration RPV nozzle-to-vessel welds listed in Table 3.2 below.

TABLE 3.2 - RPV Nozzle-to-Shell Weld Coverage And Limitations					
Drawing/ Component	**Unit**	**Item**	**Description**	**Coverage %**	**Limitation**
N3C NOZ	1	B3.90	Vessel-Nozzle (Main steam)	62.4	Nozzle configuration
N3D NOZ	1	B3.90	Vessel-Nozzle (Main steam)	62.4	Nozzle configuration
N5B NOZ	1	B3.90	Vessel-Nozzle (Core spray)	68.9	Nozzle configuration
N6B NOZ	1	B3.90	Head-Nozzle (Spare)	57.3	Nozzle configuration
N9 NOZ	1	B3.90	Vessel-Nozzle (CRD Return)	47.7	Nozzle configuration
N6B IRS	1	B3.100	Head-Nozzle (Spare)	83.6	Nozzle configuration
N1B NOZ	2	B3.90	Vessel-Nozzle (Recirculation)	15	Nozzle configuration
N2F NOZ	2	B3.90	Vessel-Nozzle (Recirculation)	38	Nozzle configuration
N2G NOZ	2	B3.90	Vessel-Nozzle (Recirculation)	38	Nozzle configuration
N2H NOZ	2	B3.90	Vessel-Nozzle (Recirculation)	38	Nozzle configuration
N2J NOZ	2	B3.90	Vessel-Nozzle (Recirculation)	38	Nozzle configuration
N2K NOZ	2	B3.90	Vessel-Nozzle (Recirculation)	38	Nozzle configuration
N5B NOZ	2	B3.90	Vessel-Nozzle (Core spray)	39	Nozzle configuration
N6B NOZ	2	B3.90	Head-Nozzle (Spare)	43	Nozzle configuration
N8B NOZ	2	B3.90	Head-Nozzle (Jet Pump Inst)	89	Nozzle configuration
N9 NOZ	2	B3.90	Vessel-Nozzle (CRD return)	72	Nozzle configuration
N6B IRS	2	B3.90	Head-Nozzle (Spare)	83	Nozzle configuration

Licensee's Basis for Relief Request:

See licensee's basis for CR-39, Revision 1, in Section 3.1 of this report.

Licensee's Proposed Alternative Examination:

See licensee's alternative for CR-39, Revision 1, in Section 3.1 of this report.

Evaluation: The ASME Code requires 100 percent volumetric coverage of all Class 1 RPV nozzle-to-shell and head welds, however, component geometries limit scanning so that 100 percent of the required examination coverage cannot be completed. For the licensee to achieve the ASME Code-required volumetric coverage, the subject nozzles would have to be redesigned and modified. This would place a significant burden on the licensee, thus the ASME Code-required 100 percent volumetric examination, performed from both sides of the weld, is impractical.

As shown on the sketches and technical descriptions provided by the licensee[3], varied levels of coverage, ranging from approximately 15 percent to 84 percent of the required volumes, was obtained for the subject nozzle welds (see Table 3.2). On the RPV shell-to-nozzle welds, this aggregate coverage includes examinations of the Code-required volumes using 0, 45 and 60 degree ultrasonic beam angles from the vessel side of the weld. On RPV upper head-to-nozzle welds, the licensee used 60, 70 and 80 degree beam angles performed from the head side to improve the volumetric coverage based on head-to-nozzle alignment angles. The welds are carbon steel-to-carbon steel with a "set-in" nozzle configuration having a short radius of curvature on the nozzle outside surface transition region. This makes ultrasonic access from the nozzle side of the weld impractical, and severely limits coverage of volumes in the upper weld zones (portions of the weld nearest the outside surface of the vessel/head).

Although the licensee was unable to obtain full volumetric coverage from both sides of the subject welds, as required by ASME Code, a substantial amount of the lower weld zone portions (nearest the vessel/head inner surface) were completed. It is expected that if service degradation were to occur, it would typically be manifested near the vessel inner surface of these welds, and should have been detected by the examinations that were completed. Furthermore, round robin tests, as reported in NUREG/CR-5068, have demonstrated that ultrasonic examinations of ferritic material from a single side provide high probabilities of detection (usually 90% or greater) for both near- and far-side cracks in blind inspection trials. For these reasons, if significant service-induced degradation were occurring in the subject welds, there is reasonable assurance that evidence of it would be detected by the examinations that were performed. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), it is recommended that relief be granted.

3.3 Request for Relief CR-39, Revision 1, Examination Category B-—1, Pressure Retaining Welds in Valve Bodies

ASME Code Requirement: Examination Category B-—1, Item B12.40, requires "essentially" 100 percent volumetric examination, as specified by Figure IWB-2500-17, of the length of valve body welds, national pipe size (NPS) 4 or larger in diameter. "Essentially 100%," as clarified by ASME Code Case –460, is greater than 90 percent coverage of the examination volume, or surface area, as applicable.

Licensee's ASME Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the 100 percent volumetric examination requirement specified in the ASME Code for Electromagnetic Relief Valve (ERV) Body Weld 1-203-3E-S1 on the QCNPS, Unit 1 main steam system.

Licensee's Basis for Relief Request (as stated):

See licensee's basis for CR-39, Revision 1, in Section 3.1 of this report.

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3. Drawings and descriptions of examinations provided as part of the licensee's submittal are not included in this report.

Licensee's Proposed Alternative Examination (as stated):

See licensee's alternative for CR-39, Revision 1, in Section 3.1 of this report.

Evaluation: The ASME Code requires essentially 100 percent volumetric examination of the length of welds in Class 1 valve bodies greater than NPS 4-inches in diameter be performed during each inspection interval. The weld entire volume, as shown in the ASME Code, is required to be examined in two directions from both sides of the weld, however, the geometry of ERV Body Weld 1-203-3E-S1 in QCNPS Unit 1 does not allow complete examination coverage to be obtained. For the licensee to achieve the ASME Code-required volumetric coverage, the subject valve body weld would have to be redesigned and modified. This would place a significant burden on the licensee, thus the ASME Code-required 100 percent volumetric examination, performed from both sides of the weld, is impractical.

As shown in the sketches[4] supplied by the licensee, approximately 66 percent aggregate coverage of the ASME Code-required volume was obtained using 45 and 60 degree ultrasonic beam angles applied from the carbon steel valve body, up to and across the full penetration weld. The coverage obtained includes ultrasonic scans of the entire inner weld zone portion (nearest the valve inside surface) and much of the heat-affected areas of the weld. It is expected that if service degradation were to occur, it would typically be manifested near the valve inner surface of these welds, and should have been detected by the examinations that were completed. No scans could be made from the opposite side of the weld due to the extreme taper on the flange bonnet. However, as previously reported in NUREG/CR-5068, round robin tests have demonstrated that ultrasonic examinations of ferritic material from a single side provide high probabilities of detection (usually 90% or greater) for both near- and far-side cracks in blind inspection trials. For these reasons, if significant service-induced degradation were occurring in the subject weld, there is reasonable assurance that evidence of it would be detected by the examination that was performed. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), it is recommended that relief be granted.

3.4 Request for Relief CR-39, Revision 1, Examination Category C-C, Integral Attachments for Vessels, Piping, Pumps and Valves

ASME Code Requirement: Examination Category C-C, Items C3.10 and C3.20, require 100% surface examination, as defined in Figure IWC-2500-5, for integrally welded attachments on Class 2 vessels and piping. Code Case –460, as an alternative approved for use by the NRC staff, states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10 percent, i.e., greater than 90 percent examination coverage is obtained.

Licensee's ASME Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the 100 percent surface examination coverage requirement for integrally welded attachments on the boron injection tank, residual heat

4. Licensee sketches showing UT completion regions are not included in this report.

removal system heat exchanger, and main steam and safety injection system piping. More detailed descriptions, along with percent coverages and stated limitations are shown in Table 3.4 below.

Table 3.4 - Category C-C Integral Attachment Limitations

Drawing/ Component	Unit	Item	Description	Exam Coverage	Drawing/Component
1003A-W-201A	1	3.10	Support Welded to RHR HTXR	79	29" of lower horizontal inaccessible due to I-Beam
1003A-W-202A	1	3.10	Support Welded to RHR HTXR	79	Limited to 3 sides due to 18" clamp interference
1008B-W-201A	1	3.20	VSC w/4 lugs welded to pipes (RHR)	84	Limited to 3 sides due to 18" clamp interference
1008A-W-203A	1	3.20	VSC w/4 lugs welded to pipes (RHR)	84	Limited to 3 sides due to 18" clamp interference
1008A-W-204A	1	3.20	VSC w/4 lugs welded to pipes (RHR)	84	Limited to 3 sides due to 18" clamp interference
2307-W-201.1A	1	3.20	VSC w/4 lugs welded to pipes (RHR)	83	Limited to 3 sides due to 18" clamp interference
1403-W-204A	2	3.20	1403-W-204A	43.2	Welded bracket interference
1406-W-203A	2	3.20	1406-W-203A	88.3	Welded box support interference
1009B-W-206A	2	3.20	1009B-W-206A	87.6	Component configuration and support bracket interference
1009B-W-210A	2	3.20	1009B-W-210A	85.5	Component configuration and support bracket interference

Licensee's Basis for Relief Request (as stated):

See licensee's basis for CR-39, Revision 1, in Section 3.1 of this report.

Licensee's Proposed Alternative Examination (as stated):

See licensee's alternative for CR-39, Revision 1, in Section 3.1 of this report.

Evaluation: The ASME Code requires 100 percent surface examination of the welds and adjacent base materials for integrally welded supports on selected Class 2 vessels and piping. However, due to their design and interference from adjacent structural support members, the integrally welded attachments cannot be examined to the extent required by the ASME Code. For the licensee to achieve the ASME Code-required surface coverage, the subject integrally welded attachments would have to be redesigned and

modified. This would place a significant burden on the licensee, thus the ASME Code-required 100 percent surface examinations are impractical.

> As shown in the sketches and photographs[5] provided by the licensee, the surface examinations of the subject welded attachments have been performed to the maximum extent practical, with high levels of coverage being obtained for the majority of these welds. The licensee completed approximately 80 percent or greater of the ASME Code-required surface examinations (see Table 3.4 above) using the magnetic particle NDE method. The exception is Weld 1403-W-204A, where only 43 percent of the weld and base metal were accessible due to four (4) of the eight (8) welded lugs on this piping support being completely covered by the structural steel in the clamp and restraint. Similar, but to a lesser extent, accessibility limitations have been encountered on the remaining welded attachments based on their design features and adjacent structural support members. However, it is believed that significant service-induced degradation or deformation in the subject welded attachments would have been detected by the examinations performed.
>
> It is concluded that 100 percent surface examinations on the subject integrally welded attachments are impractical, and based on the coverage(s) obtained on these components, if significant service-induced degradation were occurring in the subject welds, there is reasonable assurance that evidence of it would be detected by the examinations that were performed. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), it is recommended that relief be granted.

4.0 CONCLUSIONS

The PNNL staff has reviewed the licensee's submittal and concludes that ASME Code examination coverage requirements are impractical for the subject welds listed in Request for Relief CR-39, Revision 1. Further, if significant service-induced degradation were occurring in the subject components, there is reasonable assurance that evidence if it would have been detected by the examinations that were performed. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), it is recommended that Request for Relief CR-39, Revision 1, be granted for the third 10-year interval at Quad Cities Nuclear Power Station (QCNPS), Units 1 and 2, which concluded on March 9, 2003. All other requirements of the ASME Code, Section XI for which relief has not been specifically requested and approved remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

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5. The licensee submitted sketches and photographs are not included in this report.

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