

December 6, 2001

Mr. Oliver D. Kingsley, President  
Exelon Nuclear  
Exelon Generation Company, LLC  
4300 Winfield Road  
Warrenville, IL 60555

SUBJECT: QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2 - RELIEF  
REQUEST CR-36, ALTERNATIVE REQUIREMENTS TO APPENDIX VIII,  
SUPPLEMENT 4, "QUALIFICATION REQUIREMENTS FOR THE CLAD/BASE  
METAL INTERFACE OF REACTOR VESSEL (TAC NOS. MB2767 AND  
MB2768)

Dear Mr. Kingsley:

By letter dated August 16, 2001, Exelon Generation Company, LLC (the licensee) submitted relief request CR-36 for Quad Cities Nuclear Power Station, Units 1 and 2 (Quad Cities), requesting relief from certain requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), for inservice inspection (ISI) of reactor pressure vessel welds at Quad Cities. Specifically, the licensee proposed to use the depth and length sizing requirement contained in 10 CFR 50.55a(b)(2)(xv)(C)(1), revised on March 26, 2001, in the Federal Register (66 FR 16390), in lieu of the requirements contained in Section XI, 1995 Edition, 1996 Addenda, Appendix VIII, Supplement 4, Subparagraph 3.2(a) and 3.2(b) of the Code.

The U.S. Nuclear Regulatory Commission (NRC) staff has completed the review of the subject relief request. The NRC staff's safety evaluation (SE) is enclosed. The staff concludes that the proposed alternative in relief request CR-36 will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the proposed alternative for the third 10-year inservice inspection interval at Quad Cities.

O. Kingsley

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If you have any questions about this review, please contact Stewart Bailey at (301) 415-1321 or by e-mail at [snb@nrc.gov](mailto:snb@nrc.gov).

Sincerely,

***/RA/***

Anthony J. Mendiola, 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

cc: See next page

Mr. O. Kingsley

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If you have any questions about this review, please contact Stewart Bailey at (301) 415-1321 or by e-mail at snb@nrc.gov.

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Units 1 and 2

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Units 1 and 2

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
RELATED TO REQUEST FOR RELIEF FOR  
THIRD TEN-YEAR INTERVAL OF THE INSERVICE INSPECTION PROGRAM  
EXELON GENERATION COMPANY, LLC  
AND  
MIDAMERICAN ENERGY COMPANY  
QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2  
DOCKET NUMBERS 50-254 AND 50-265

1.0 INTRODUCTION

The inservice inspection of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code and applicable edition and addenda as required by Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). Pursuant to 10 CFR 50.55a(a)(3), 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 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 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 components (including supports) may meet the requirements set forth in subsequent editions and addenda of the ASME Code incorporated by reference in 10 CFR 50.55a(b) subject to the limitations and modifications listed therein and subject to Commission approval.

ENCLOSURE

By letter dated August 16, 2001, Exelon Generation Company, LLC (the licensee) submitted relief request CR-36, seeking relief from certain requirements of the ASME Code, for ISI of reactor pressure vessel (RPV) welds at the Quad Cities Nuclear Power Station, Units 1 and 2 (Quad Cities). Specifically, the licensee proposed to use the 0.15-inch root mean square (RMS) depth sizing criterion and 0.75-inch RMS length sizing criterion contained in the revised 10 CFR 50.55a(b)(2)(xv)(C)(1), in lieu of the requirements contained in Section XI, 1995 Edition, 1996 Addenda, Appendix VIII, Supplement 4, Subparagraph 3.2(a) and 3.2(b) of the Code.

## 2.0 BACKGROUND

### 2.1 Component Description

RPV longitudinal and circumferential shell welds and RPV head welds in Examination Category B-A, Item Nos. B1.10, B1.11, B1.12, B1.20, B1.21, B1.22, B1.50, and B1.51 of ASME Code, Section XI.

### 2.2 Examination

Ultrasonic Testing (UT) in accordance with ASME Code, Section XI, Appendix VIII, Supplement 4.

### 2.3 Code Requirement for which Relief is Requested

Section 50.55a(g)(6)(ii)(C) of Title 10 of the *Code of Federal Regulations* imposes implementation of Appendix VIII to the 1995 Edition with the 1996 Addenda of Section XI of the ASME Code. The imposed implementation schedule for Supplement 4 to Appendix VIII is November 22, 2000. 1995 Edition, 1996 Addenda of ASME Code, Section XI, Appendix VIII, Supplement 4, Subparagraph 3.2(c), requires that the UT performance demonstration results be plotted on a two-dimensional plot with the measured depth plotted along the ordinate axis and the true depth plotted along the abscissa axis. For qualification, the plot must satisfy the following statistical parameters: (1) the slope of the linear regression line is not less than 0.7, (2) the mean deviation of flaw depth is less than 0.25 inches, and (3) the correlation coefficient is not less than 0.70.

### 2.4 Licensee's Proposed Alternative to ASME Code

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee proposed to use the RMS values of 10 CFR 50.55a(b)(2)(xv)(C)(1), which modifies the depth and length sizing criterion of Subparagraph 3.2(a) and 3.2(b), in lieu of the statistical parameters of ASME Code, Section XI, Appendix VIII, Supplement 4, Subparagraph 3.2(c). These examinations will be performed during the third inspection intervals at Quad Cities.

## 2.5 Licensee's Basis for Relief

The licensee's submittal provided the following as the basis for relief:

On September 22, 1999, the NRC published a final rule in the Federal Register (64 FR 51378) to amend 10 CFR 50.55a(b)(2), to incorporate by reference the 1995 Edition and addenda through the 1996 Addenda, of Section XI of ASME Code. The change included the provisions of Subparagraph 3.2(a), 3.2(b) and 3.2(c) of Section XI of the ASME Code, 1995 Edition with the 1996 Addenda, Appendix VIII, Supplement 4.

Additionally, the September 22, 1999, Federal Register amended 10 CFR 50.55a(b)(2)(xv)(C)(1). The amended 10 CFR 50.55a(b)(2)(xv)(C)(1) requires a depth sizing acceptance criterion of 0.15 inch RMS to be used in lieu of the requirements of Subparagraph 3.2(a) and 3.2(b) of Section XI of the ASME Code, Appendix VIII, Supplement 4.

On March 26, 2001, the NRC published a correction to the September 22, 1999, final rule in the Federal Register (66 FR 16390). The NRC identified that an error had occurred in the published wording of 10 CFR 50.55a(b)(2)(xv)(C)(1). The corrected 10 CFR 50.55a(b)(2)(xv)(C)(1) requires a depth sizing acceptance criterion of 0.15 inch RMS to be used in lieu of the requirements of Subparagraph 3.2(a) and a length sizing requirement of 0.75 inch RMS to be used in lieu of the requirements 3.2(b) of Section XI of the ASME Code, Appendix VIII, Supplement 4.

## 3.0 EVALUATION

The U.S. nuclear utilities created the Performance Demonstration Initiative (PDI) to implement performance demonstration requirements contained in Appendix VIII of Section XI of the ASME Code. To this end, PDI has developed a performance demonstration program for qualifying UT equipment, procedures, and personnel. During the development of the performance demonstration for Supplement 4, the PDI determined that the Code criteria for flaw sizing was unworkable.

In relief request CR-36, the licensee proposed to eliminate the use of the requirement in Supplement 4, Subparagraph 3.2(c), which imposes three statistical parameters for depth sizing. The first parameter, 3.2(c)(1), pertains to the slope of a linear regression line. The linear regression line is the difference between actual versus true value plotted along a through-wall thickness. For Supplement 4 performance demonstrations, a linear regression line of the data is not applicable because the performance demonstrations are performed on test specimens with flaws located in the inner 15 percent through-wall. The differences between actual versus true value produce a tight grouping of results which resemble a shotgun pattern. The slope of a regression line from such data is extremely sensitive to small variations, thus making the parameter of Subparagraph 3.2(c)(1) a poor and inappropriate acceptance criterion. The second parameter, 3.2(c)(2), pertains to the mean deviation of flaw depth. The value used in the code is too lax with respect to evaluating flaw depths within the inner 15 percent of wall thickness. The third parameter, 3.2(c)(3), pertains to a correlation coefficient. The value of the correlation coefficient in Subparagraph 3.2(c)(3) is inappropriate for this application since it is based on the linear regression from Subparagraph 3.2(c)(1). Therefore, the licensee proposed



to use the more appropriate acceptance criteria of 0.15-inch RMS (depth) and 0.75-inch RMS (length) from 10 CFR 50.55a(b)(2)(xv)(C)(1), which modifies Subparagraph 3.2(a) and 3.2(b).

PDI was aware of the inappropriateness of Subparagraph 3.2(c) early in the development of their program. They brought the issue before the appropriate ASME committee which formalized Code Case N-622, eliminating the use of Supplement 4, Subparagraph 3.2(c). The NRC staff representatives participated in the discussions and consensus process of the code case. Based on the above, the NRC staff finds that the use of Subparagraph 3.2(c) requirements in this context is inappropriate and that the proposed alternative to use the RMS values of 10 CFR 50.55a(b)(2)(xv)(C)(1), namely 0.15-inch RMS (depth) and 0.75-inch RMS (length), which modifies the criteria of Appendix VIII, Supplement 4, Subparagraph 3.2(a) and 3.2(b), in lieu of Subparagraph 3.2(c), will provide an acceptable level of quality and safety.

#### 4.0 CONCLUSION

Based on the discussion above, the staff has concluded that the proposed alternative in relief request CR-36 will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the proposed alternative for the third 10-year inservice inspection interval at Quad Cities.

Principal Contributor: M. Chawla

Date: December 6, 2001