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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION OF THE THIRD TEN YEAR INTERVAL INSERVICE INSPECTION PROGRAM PLAN REQUESTS FOR RELIEF NOS. CR-16 AND CR-17 COMMONWEALTH EDISON COMPANY QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2 DOCKET NOS. 50-254 AND 50-265

1.0 INTRODUCTION

The Technical Specifications for Quad Cities Nuclear Power Station, Units 1 and 2, state that the inservice inspection (ISI) of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Class 1, 2, and 3 components shall be performed in accordance with Section XI of the ASME Code and applicable Addenda as required by 10 CFR 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(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 difficulties 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 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 applicable edition of Section XI of the ASME Code for the Quad Cities Nuclear Power Station, Units 1 and 2, third 10-year ISI interval is the 1989 Edition. 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

Pursuant to 10 CFR 50.55a(g)(5), if the licensee determines that conformance with an examination requirement of Section XI of the ASME Code is not practical for its facility, information shall be submitted to the Commission in support of that determination and a request made for relief from the ASME Code requirement. After evaluation of the determination, pursuant to 10 CFR 50.55a(g)(6)(i), the Commission may grant relief and may impose alternative requirements that are determined to be authorized by law, will not endanger life, property, or the common defense and security, and are otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed. In a letter dated September 25, 1995, Commonwealth Edison Company (ComEd) submitted to the NRC its Third Ten-Year Interval Inservice Inspection Program Plan Requests for Relief Nos. CR-16 and CR-17 for Quad Cities Nuclear Power Station, Units 1 and 2. Additional information to support the Requests for Relief was provided by ComEd in its letters dated October 3, 1995, and January 9, 1996.

2.0 EVALUATION AND CONCLUSIONS

The staff, with technical assistance from its contractor, the Idaho National Engineering Laboratory (INEL), has evaluated the information provided by the licensee in support of its Third Ten-Year Interval Inservice Inspection Program Plan Requests for Relief Nos. CR-16 and CR-17 for Quad Cities Nuclear Power Station, Units 1 and 2.

Based on the information submitted, the staff adopts the contractor's conclusions and recommendations presented in the Technical Letter Report attached. The staff concludes that for Request for Relief CR-16 the Code requirement for the removal of control rod drive (CRD) bolting when leakage is detected will result in a burden without a compensating increase in quality and safety, and that the licensee's: 1) alternative to perform a VT-1 visual examination when CRDs are disassembled for maintenance or exchange will verify the bolting integrity; and 2) commitment to follow the General Electric Service Information Letter 483, Revision 2, and *CRD Operation and Maintenance Guidelines "CRD Housing Flange Leakage"* dated August 30, 1970, will provide reasonable assurance of operational readiness of the CRDs. Therefore, the licensee's proposed alternative contained in Request for Relief No. CR 16 is authorized pursuant to 10 CFR 50.55a(a)(3)(ii).

For Request for Relief CR-17, the licensee's alternative, to remove the bolt nearest the source of leakage in a leaking connection for visual examination and evaluation, will yield the information necessary to assess the general condition of all bolts, providing an acceptable level of quality and safety. Therefore, the licensee's proposed alternative to the Code requirement contained in Request for Relief No. CR-17 is authorized pursuant to 10 CFR 50.55a(a)(3)(i).

Attachment: Technical Letter Report

Principle Contributor: W. Reckley

Dated:

TECHNICAL LETTER REPORT
ON THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL
REQUESTS FOR RELIEF CR-16 AND CR-17
FOR
QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2
COMMONWEALTH EDISON
DOCKET NUMBERS: 50-254 AND 50-265

1. INTRODUCTION

By letter dated September 25, 1995, Commonwealth Edison (ComEd) submitted Requests for Relief CR-16 and CR-17 for Quad Cities Nuclear Power Station, Units 1 and 2. In a letter dated October 3, 1995, the licensee provided supplemental information in support of the requests for relief. In addition, by letter dated January 9, 1996, the licensee provided further information to support Request for Relief CR-16. The Idaho National Engineering Laboratory (INEL) staff has evaluated the subject requests for relief in the following section.

2.0 EVALUATION

The Code of record for the Quad Cities Nuclear Power Station third 10-year inservice inspection (ISI) interval, which began February 18, 1993, for Unit 1 and March 10, 1993, for Unit 2, is the 1989 Edition of the *American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI*. The information provided by the licensee in support of the requests for relief from Code requirements has been evaluated and the bases for disposition are documented below.

A. Request for Relief CR-16, IWA-5250(a)(2), Corrective Action Resulting from Leakage at Control Rod Drive Bolted Connections

Code Requirement: IWA-5250(a)(2) requires that the source of leakage detected during a system pressure test shall be located

ATTACHMENT

and evaluated by the Owner for corrective action. When the leakage is detected at a bolted connection, the bolting shall be removed, VT-3 visually examined for corrosion, and evaluated in accordance with IWA-3100.

Licensee's Code Relief Request: The licensee requested relief from the ASME Section XI requirements for removal and VT-3 visual examination of control rod drive (CRD) bolting when leakage is detected at these bolted connections.

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

"Control Rod Drive (CRD) housing leakage has been primarily observed at Quad Cities Station when the primary system was pressurized prior to reaching normal operating temperature range during system pressure testing.

"During every refueling outage since the units went on line in 1973, there have been scheduled drive exchanges. At the end of fuel cycle 13, 172 drives in Unit 1 and 163 drives in Unit 2 had been exchanged. There are a total of 177 drives in each Quad Cities unit. Current maintenance practice requires that bolts removed from the exchange drives be subject to a VT-1 examination, with supplemental surface examination when warranted. These examinations have not revealed significant degradation caused by inservice corrosion. However, a number of CRD bolts were rejected during the course of these examinations because of linear indications found in the head-to-shank transition region. Metallurgical analyses of some of these rejected bolts from other ComEd BWR units revealed shallow and innocuous defects caused by the manufacturing process at maximum depth of 0.036 inch with no sign of crack initiation or propagation. Quad Cities Station will continue to examine these bolts during scheduled drive exchanges using VT-1 and supplemental surface examination when necessary. This sampling of CRD bolts will identify degradation trends that may occur.

"There are eight (8) bolts in each drive. In the unlikely event that a bolt might fail due to manufacturing defects, a drive would not separate from its housing. In accordance with an analysis performed by General Electric Co. for Commonwealth Edison Co. (ComEd) in 1991 (EBO-91-448, dated August 22, 1991) as few as three (3) uniformly distributed and unflawed bolts can support all imposed loads and maintain the applicable ASME Code stress limits.

Alternatively, the applicable ASME Code stress limits can be maintained with eight (8) bolts having defects that are 0.157 inch deep and extend 360° around each bolt shank circumference.

"Relief is requested from the requirements specified in IWA-5250(a)(2) of the 1989 ASME Section XI for the CRD bolts on the basis that examination of CRD bolts during scheduled drive exchanges will provide an acceptable level of quality that will identify potential degradation trends."

In a letter dated January 9, 1996, the licensee provided supplemental information on the maintenance and inspection of CRD's and associated bolting. In this letter the licensee stated that guidance is taken from the General Electric Services Information Letter (SIL) 483[1] and CRD Operation and Maintenance Guidelines[2] for performing maintenance on the CRD's and examination of associated bolting.

Licensee's Proposed Alternative Examination (as stated):

"As an alternative examination, Quad Cities Station will perform a VT-1 visual examination in accordance with Table IWB-2500-1, Examination Category B-G-2, Item B7.80 on the CRD bolting when the CRDs are disassembled for maintenance. Supplemental surface examination will be performed when deemed necessary. CRD bolts will not be removed for a VT-3 examination when leakage is detected at the CRD housing flange connection during the conduct of the system pressure tests in accordance with IWB-5000."

Evaluation: The 1989 Edition of the Code requires that the source of leakage detected during the conduct of a system pressure test be located and evaluated for corrective measures. When leakage occurs at a bolted connection, all bolting shall be removed, VT-3 visually examined for corrosion, and evaluated in accordance with IWA-3100. The licensee's inspection program associated with CRD

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1 General Electric Services Information Letter (SIL) 483, Revision 2, *CRD Cap Screw Crack Indications* dated August 7, 1992.

2 CRD Operation and Maintenance Guidelines by N. J. Biglieri, General Electric Co., Nuclear Energy Division, San Jose, CA. 8/30/70

bolting examinations and maintenance is based on guidance from General Electric Services Information Letter (SIL) 483 and CRD Operation and Maintenance Guidelines. SIL 483 recommends that the licensee visually inspect all CRD cap screws (bolts) for crack indications either during routine CRD maintenance or within the inspection intervals specified in ASME Section XI Code, whichever is more frequent. If there are any questionable bolts, a surface examination should be performed. When bolts are found to be defective, they should be replaced with a redesigned bolt.

The following is excerpted from the CRD Operation and Maintenance Guideline, "CRD Housing Flange Leakage":

"The fact that a flange joint leak exists on a newly installed CRD (either at initial CRD installation or subsequent reinstallation following maintenance) does not mean that an adequate flange joint seal has not been achieved. Experience to date indicates that flange joints may leak when they are initially tightened. However, if a decrease in leak rate is detectable in 8 hours of being subjected to pressures of 1000 psig or greater, the joint will eventually stop leaking. A decreasing leak rate will also eventually seal without being internally pressurized, providing the flange bolts remain properly torqued. Recognizing these condition, the following guide lines are established:

A) All drip type leakages which show a decreasing leak rate after being pressurized for an 8 hour period at pressures greater than 1,000 psig do not require any corrective maintenance action. They should, however, be observed at later periods whenever the opportunity exists.

B) Maintenance should be considered if a drip type leak at pressures of 1,000 psig or greater is constant or the leak rate shows an increasing rate over an 8 hour period.

C) Maintenance should be considered for any spray type leak from the flange joint."

The licensee is requesting relief from the requirement to remove the bolting at leaking CRD housing connections when leakage occurs. Considering that leakage is not uncommon for the CRD flange joint during the increase in pressure during startup, and

that the licensee is taking guidance from the referenced documents, it can be concluded that the VT-1 visual examinations performed during each refueling outage in conjunction with the exchange and/or maintenance of the CRD's will detect degradation, if occurring. Therefore, the INEL staff believes that requiring the licensee to remove bolting when leakage is detected during each startup pressure test would result in a burden without a compensating increase in safety.

Conclusions: Requiring the licensee to remove all bolts at a CRD joint when leakage is detected will result in a burden without a compensating increase in the level of quality and safety. The licensee's alternative, to perform a VT-1 visual examination when CRDs are disassembled for maintenance or exchange, and the licensee's commitment to follow the General Electric Service Information Letter 483, Revision 2, and *CRD Operation and Maintenance Guidelines "CRD Housing Flange Leakage"* dated August 30, 1970, will verify the bolting integrity, providing reasonable assurance of operational readiness. Therefore, it is recommended that the proposed alternative be authorized pursuant to 10 CFR 50.55a(a)(3)(ii).

B. Request for Relief CR-17, IWA-5250(a)(2), Corrective Action Resulting from Leakage at Bolted Connections

Code Requirement: IWA-5250(a)(2) requires that the source of leakage detected during a system pressure test shall be located and evaluated by the Owner for corrective action. When the leakage is at a bolted connection, the bolting shall be removed, VT-3 visually examined for corrosion, and evaluated in accordance with IWA-3100.

Licensee's Code Relief Request: The licensee requested relief from the ASME Section XI requirements for removal of bolting for VT-3 visual examination when leakage is detected for all Class 1, 2, and 3 pressure-retaining bolted connections.

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

"The current requirement to remove all bolting associated with a leaking bolted connection results in unnecessary radiation exposure without a commensurate increase in safety. Rules provided in later editions of the Code (i.e., 1992 Edition with 1993 Addenda) state, "If leakage occurs at a bolted connection on other than a gaseous system, one of the bolts shall be removed, VT-3 examined, and evaluated in accordance with IWA-3100. The bolt selected shall be the one closest to the source of leakage. When the removed bolt has evidence of degradation, all remaining bolting in the connection shall be removed, VT-3 examined, and evaluated in accordance with IWA-3100." Removal and inspection of the bolt closest to the source of leakage will provide adequate assessment of the condition of the bolting and overall integrity of the bolted connection.

"Relief is requested from the requirements specified in IWA-5250(a)(2) of the 1989 ASME Section XI for the removal of all bolts on the basis that the later Code requirements are a better approach with regard to bolting removal and inspection at leaking connections.

Licensee's Proposed Alternative Examination (as stated):

"As an alternative examination, Quad Cities Station will meet the requirements as specified in ASME Section XI, 1992 Edition with Addenda, Subsubarticle IWA-5250(a)(2) in it's entirety."

Evaluation: The Code requires that if leakage occurs at a bolted connection, all bolting shall be removed, VT-3 visually examined for corrosion, and evaluated in accordance with IWA-3100. As an alternative, the licensee proposes to remove and examine the bolt closest to the area of leakage. If degradation is noted on that bolt, the remainder of the bolting will be removed, VT-3 visually examined, and evaluated in accordance with IWA-3100.

Later Editions of Section XI require the removal of only the bolt closest to the source of leakage for evaluation. This is based on the belief that the bolt closest to the source of leakage should be representative of the worst case of potential degradation of all bolts in the connection. The INEL staff believes that the licensee's alternative, i.e., the removal of the bolt closest to the source of leakage for VT-3 visual examination and evaluation, will yield the information necessary to assess the general condition of all bolts and provide an acceptable level of quality and safety.

Conclusion: For corrective action at leaking bolted connections, the licensee's proposal to remove and examine the bolt nearest the source of leakage in lieu of removal of all bolts for visual examination and evaluation will yield the information necessary to assess the general condition of all bolts, providing an acceptable level of quality and safety. Therefore, it is recommended that the licensee's proposed alternative be authorized pursuant to 10 CFR 50.55a(a)(3)(i).

3.0 CONCLUSION

The INEL staff has evaluated Requests for Relief CR-16 and CR-17. For Request for Relief CR-16, is has been determined that the removal of CRD bolting when leakage is detected will result in a burden without a compensating increase in quality and safety. The licensee's alternative, to perform a VT-1 visual examination when CRDs are disassembled for maintenance or exchange, and the licensee's commitment to follow the General Electric Service Information Letter 483, Revision 2, and *CRD Operation and Maintenance Guidelines "CRD Housing Flange Leakage"* dated August 30, 1970, will verify the bolting integrity, providing reasonable assurance of operational readiness. Therefore, it is recommended that the licensee's proposed alternative, to perform a

VT-1 visual examination when the CRD is disassembled for exchange or maintenance, be authorized pursuant to 10 CFR 50.55a(a)(3)(ii). For Request for Relief CR-17, the licensee's alternative, to remove the bolt nearest the source of leakage in a leaking connection for visual examination and evaluation, will yield the information necessary to assess the general condition of all bolts, providing an acceptable level of quality and safety. Therefore, it is recommended that the licensee's proposed alternative to the Code requirement be authorized pursuant to 10 CFR 50.55a(a)(3)(i).