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

Quad Cities Nuclear Power Station Unit 1
Renewed Facility Operating License No. DPR-29
NRC Docket No. 50-254

References:

1. Letter from P. R. Simpson (Exelon Generation Company, LLC) to U. S. NRC, " Request to Extend the First Period of the Fourth 10-Year Inservice Inspection Interval for Twenty Reactor Pressure Vessel Welds," dated May 11, 2007

2. E-mail from M. Thorpe-Kavanaugh (U.S. NRC) to J. L. Schrage (Exelon Generation Company, LLC), "Request for Additional Information," dated May 16, 2007

Subject: Response to Request for Additional Information Regarding Relief Request I4R-16

In Reference 1, Exelon Generation Company, LLC (EGC) requested 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). This relief requested the extension of the first Inspection Period of the fourth Inservice Inspection (ISI) Interval for Quad Cities Nuclear Power Station (QCNPS) Unit 1, which began on March 10, 2003, for 20 Reactor Pressure Vessel (RPV) welds. In Reference 2, the NRC transmitted a Request for Additional Information to EGC concerning the requested relief.

The response to Reference 2 is presented in the Attachment to this letter. In addition, as a result of Reference 2, EGC has revised the requested Inspection Interval extension until either:

- The current inspection procedures are re-qualified by the Electric Power Research Institute (EPRI) through the Performance Demonstration Initiative (PDI) organization; or
- The ASME Section XI Code is revised to allow equivalence evaluation of cables and connectors as "essential variables" in accordance with ASME Section XI, Appendix VIII, Supplement 1; the NRC approves this ASME Section XI Code revision; and the NRC

approves the adoption of this later edition and addenda of the ASME Section XI Code for QCNPS Unit 1; or

- The completion of the 20th QCNPS Unit 1 refuel outage (Q1R20), currently scheduled to complete on May 30, 2009, to allow for the re-examination of the subject RPV welds using a PDI qualified procedure that uses a PDI qualified cable configuration;

whichever occurs first.

As stated in Reference 1, EGC requests verbal approval of this request by May 19, 2007, to enable start-up following Q1R19. If there are any questions or comments, please contact Mr. John L. Schrage at (630) 657-2821.

Respectfully,

Patrick R. Simpson
Manager - Licensing

Attachment:

Quad Cities Nuclear Power Station Unit 1, Response to Request for Additional Information Regarding Relief Request I4R-16

Attachment

Quad Cities Nuclear Power Station Unit 1

Response to Request for Additional Information Regarding Relief Request I4R-16

Attachment
Quad Cities Nuclear Power Station Unit 1
Response to Request for Additional Information Regarding Relief Request I4R-16

By letter dated May 11, 2007, Exelon Generation Company, LLC (EGC) requested 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). The relief request proposed to extend the first Inspection Period of the fourth Inservice Inspection (ISI) Interval for Quad Cities Nuclear Power Station (QCNPS) Unit 1, which began on March 10, 2003, for 20 Reactor Pressure Vessel (RPV) welds. The NRC has requested the following additional information to complete its review.

NRC Question 1

In Section 6.0, Duration of Proposed Alternative, of Relief Request 14R-16, the licensee requested the first inspection period for examination of the subject RPV welds for QCNPS Unit 1 be extended until one of the three options occurs. The staff has the following questions regarding those statements:

NRC Question 1.A

Describe how the current inspection procedures will be re-qualified and re-certified by PDI as described in the first provision.

EGC Response

Implementation of the first provision (i.e., re-qualification of the inspection procedure) would be conducted by the Electric Power Research Institute (EPRI), through the Performance Demonstration Initiative (PDI). This re-qualification would be performed in accordance with the requirements of ASME Section XI, Appendix VIII, "Performance Demonstration for Ultrasonic Examination Systems," Supplement 1, and the PDI Program, and in accordance with 10 CFR 50.55a. The re-qualification would be comprised of a demonstration of the procedure, in accordance with the PDI processes and procedures, using the current essential variables.

When the procedure satisfactorily passes the PDI demonstration process, it will be qualified in accordance with ASME Section XI, and a Performance Demonstration Qualification Summary (PDQS) will be prepared and published by EPRI, documenting the essential variables that were used during the performance demonstration.

NRC Question 1.B

Discuss whether the ultrasonic examination procedures that were used in the 2005 examination were previously qualified and certified by the PDI. If not, discuss how the 2005 ultrasonic examination procedures were qualified and by what standards.

EGC Response

In 1995, ultrasonic (UT) examination procedures used by ISwT (then Southwest Research Institute) for the inside surface examination of reactor vessel shell welds were qualified at the Electric Power Institute (EPRI) under the Performance Demonstration Initiative (PDI). This qualification included the type of cabling, cable length, and number

of connectors used in the actual demonstration, along with the active components, such as scanners, receivers, and search units.

In order to utilize these UT examination procedures for boiling water reactor (BWR) RPV welds, the vendor performed a system equivalency demonstration in 2001 between the essential variable cable configuration that was previously qualified by PDI and the cable configuration listed in the UT examination procedure for BWR RPVs. This equivalency demonstration used a "worst-case" BWR cable configuration that could be necessary if the data acquisition system was physically located outside of the reactor building. The equivalency demonstration was performed in accordance with ASME Section XI, Appendix VIII, "Performance Demonstration for Ultrasonic Examination Systems," Supplement 1, of ASME Section XI. The variable aspects of the procedure were held constant and the system center frequency and bandwidth were measured for both cable configurations and each type of probe specified in the procedures. The comparison identified that the center frequency and bandwidth of the total system were within the acceptance criteria contained in ASME Section XI, Appendix VIII.

The UT examination procedures that were used at QCNPS Unit 1 in 2005 to perform RPV weld examinations utilized a cable configuration that was bounded by the cable configuration that was used during the 2001 equivalency demonstration (i.e., as tabulated in the response to RAI questions 4 and 5 below). Based upon the successful equivalency demonstration in 2001 of the worst case cable configuration to the original PDI qualification, in conjunction with a less limiting cable configuration for the actual UT examination procedure, EGC has concluded that the 2005 UT examination procedures used for the QCNPS Unit 1 RPV welds provide results that are consistent with the procedures that were originally qualified by PDI in 1995. As such, these procedures provide confidence that the 2005 UT examinations of the QCNPS Unit 1 RPV welds have confirmed the structural integrity of the RPV welds.

NRC Question 1.C

The staff has concerns regarding the wording used in the second provision (i.e., the ASME Code Inquiry). The staff cannot use ASME Code Inquiry as a regulatory basis for its decisions. In addition, ASME Subcommittee's approval does not imply that the NRC would approve the inquiry. The regulatory authority resides with the NRC, not the ASME. The staff would find acceptable if requirements for the equivalency demonstration of cable and connectors are added to the latest ASME Code, Section XI and that the NRC approves the changes to the ASME Code through NRC's regulatory process. In addition, licensees who wish to use the provisions of an edition and addenda of the ASME code later than their ISI code of record must be approved by the NRC with a licensee request to use a later edition and addenda of the ASME Code (Regulatory Issue Summary 2004-16). Therefore, the licensee should consider removing this option as written from consideration or modifying the request to be consistent with the regulatory process outlined above.

EGC Response

Based upon concerns raised by the NRC, EGC has revised the requested Inspection Interval extension until either:

- The current inspection procedures are re-qualified by the Electric Power Research Institute (EPRI) through the Performance Demonstration Initiative (PDI) organization; or

- The ASME Section XI Code is revised to allow equivalence evaluation of cables and connectors as "essential variables" in accordance with ASME Section XI, Appendix VIII, Supplement 1; the NRC approves this ASME Section XI Code revision; and the NRC approves the adoption of this later edition and addenda of the ASME Section XI Code for QCNPS Unit 1; or

- The completion of the 20th QCNPS Unit 1 refuel outage (Q1R20), currently scheduled to complete on May 30, 2009, to allow for the re-examination of the subject RPV welds using a PDI qualified procedure that uses a PDI qualified cable configuration;

  whichever occurs first.

NRC Question 2

Provide the scheduled end date for QCNPS Unit 1 refueling outage 20.

EGC Response

The 20th QCNPS Unit 1 refuel outage (Q1R20) is currently scheduled to complete on May 30, 2009.

NRC Question 3

Describe the examination history of the subject welds including previous examination schedules and results.

EGC Response

EGC conducted UT examinations of the referenced RPV welds on QCNPS Unit 1 during the 14th refueling outage in 1996 and during the 18th refueling outage in 2005. The results of these inspections were submitted to the NRC in letters dated November 22, 1996, and July 18, 2005, respectively. These results for the 20 RPV welds that are cited in Relief Request I4R-16 are tabulated below. In summary, EGC confirmed that there were no rejectable indications during both the 1996 and 2005 examinations. In addition, the procedures and the UT examination tool that was used during the 2005 examination provided superior accessibility, which enabled EGC to examine welds that had previously been inaccessible.

QCNPS Unit 1 RPV Weld UT Examination Results		
Weld	**Q1R14**	**Q1R18**
1/REACTOR VESSEL/RPV-VSC1-197/WELD	Not accessible due to tooling	No rejectable indications
1/REACTOR VESSEL/RPV-VSC1-317/WELD	No rejectable indications	No rejectable indications
1/REACTOR VESSEL/RPV-VSC1-55/WELD	No rejectable indications	No rejectable indications
1/REACTOR VESSEL/RPV-VSC1-77/WELD	Not accessible due to tooling	No rejectable indications
1/REACTOR VESSEL/RPV-VSC2-141/WELD	No rejectable indications	No rejectable indications
1/REACTOR VESSEL/RPV-VSC2-22/WELD	No rejectable indications	No rejectable indications
1/REACTOR VESSEL/RPV-VSC2-261/WELD	No rejectable indications	No rejectable indications
1/REACTOR VESSEL/RPV-VSC2-323/WELD	No rejectable indications	No rejectable indications
1/REACTOR VESSEL/RPV-VSC3-197/WELD	No rejectable indications	No rejectable indications
1/REACTOR VESSEL/RPV-VSC3-317/WELD	No rejectable indications	No rejectable indications
1/REACTOR VESSEL/RPV-VSC3-77/WELD	No rejectable indications	No rejectable indications
1/REACTOR VESSEL/RPV-VSC4-219/WELD	No rejectable indications	No rejectable indications
1/REACTOR VESSEL/RPV-VSC4-261/WELD	No rejectable indications	No rejectable indications
1/REACTOR VESSEL/RPV-VSC4-339/WELD	No rejectable indications	No rejectable indications
1/REACTOR VESSEL/RPV-VSC4-99/WELD	No rejectable indications	No rejectable indications
1/REACTOR VESSEL/BMR-167-305/WELD	No rejectable indications	No rejectable indications
1/REACTOR VESSEL/BMR-138-270/WELD	No rejectable indications	No rejectable indications
1/REACTOR VESSEL/BMR-018-310/WELD	No rejectable indications	No rejectable indications
1/REACTOR VESSEL/BMR-017-318/WELD	No rejectable indications	No rejectable indications
1/REACTOR VESSEL/BMR-016-295/WELD	Not accessible due to tooling	No rejectable indications

NRC Question 4

On page 2, third paragraph, of Relief Request 14R-16, the licensee stated the "worst-case" configuration consisted of 1350 feet of RG-58 coaxial cable, plus 230 feet of RG-174 coaxial cable, plus 5 feet of "micro cable" and a total of 20 connectors. Describe the actual cable lengths that were qualified for the cable configuration by the PDI organization.

EGC Response

The table below provides the cable configuration that was originally qualified by PDI in 1995, the "worst case" cable configuration that was used in the 2001 and 2007 Equivalency Demonstrations, and the cable configuration that was used during the QCNPS Unit 1 2005 UT examination. The value for RG-174 cable that was used during the 1995 PDI qualification represents a clarification of the information that was originally provided by EGC in Relief Request I4R-16.

	Cable Length (feet)			
Cable Type/Connectors	**1995 PDI Qualification**	**2001 Equivalency Determination**	**2007 Equivalency Determination**	**2005 QCNPS Unit 1 UT Examination**
RG-58	1018	1350	1350	0
RG-174	40	230	230	230
Micro cable	0	5	5	5
Total Cable	1058	1585	1585	235
Connectors	13	20	20	6

NRC Question 5

On page 2, last paragraph, of Relief Request 14R-16, the licensee stated that the maximum length of cable that was used in 2005 is greater than that quantified for cable type RG-174. The licensee used 230 feet of cable in the 2005 examination. It seems that the licensee is using the same (not greater) length of cable. Clarify the statement regarding the cable length used in 2005.

EGC Response

The table that is provided above in response to RAI Question 4 provides the cable configuration that was originally utilized during the 2005 UT examinations, relative to the cable configuration that was originally qualified, and the cable configurations that were used during the subsequent Equivalency Demonstrations.

NRC Question 6

Discuss the impact of difference in the number of connectors on the examination results because the licensee used 6 connectors whereas the worst-case configuration had 20 connectors. Discuss the impact on examination results of difference in cable length and type of cables (i.e., RG-58 and RG-174) between the 2005 examination at QCNPS and PDI qualified procedures.

EGC Response

The originally qualified system that was demonstrated at PDI in 1995 used more total connectors than was used at QCNPS Unit 1 in 2005. By use of the Appendix VIII, Supplement I Equivalency Demonstration in 2001, the vendor successfully demonstrated that the combined variables of cables and connectors, using the same detection equipment, resulted in acceptable equivalency. The 2007 Equivalency Demonstration reconfirmed the 2001 Equivalency Demonstration results utilizing the worst-case scenario (i.e., 1350 feet of RG-58 cable, 230 feet of RG-174 cable, 5 feet of micro cable, and 20 connectors). The resulting frequency and bandwidth measurements during the 2007 Equivalency Demonstrations was within the 10% tolerance specified by ASME Section XI, Appendix VIII, Paragraph VIII-4110 (h). Based on testing by the inspection vendor, the impedance and capacitance values for the different number of connectors are equivalent. This testing indicates that the use of only six connectors at QCNPS Unit 1 during UT examinations, relative to the worst-case configuration, has no discernible effect on the detection capability of the system.

Similar to the number of connectors used during 2005, the alternate cable configuration that EGC utilized in 2005 had no discernible effect on the detection capability of the system, relative to the cable configuration that was qualified by PDI in 1995, and demonstrated as equivalent in 2001 and 2007. By use of the Appendix VIII, Supplement I Equivalency Demonstration in 2001, the vendor successfully demonstrated that the combined variables of cables and connectors, using the same detection equipment, resulted in acceptable equivalency. The 2007 Equivalency Demonstration reconfirmed the 2001 Equivalency Demonstration results utilizing the worst-case scenario (i.e., 1350 feet of RG-58 cable, 230 feet of RG-174 cable, 5 feet of micro cable,

and 20 connectors). The resulting frequency and bandwidth measurements during the 2007 Equivalency Demonstration was within the 10% tolerance specified by ASME Section XI, Appendix VIII, Paragraph VIII-4110 (h). Based on testing by the inspection vendor, the impedance and capacitance values for the different number of connectors are equivalent. This testing indicates that the use of the alternate cable configuration at QCNPS Unit 1, relative to the worst-case configuration, has no impact on the examination results.

NRC Question 7

In light of the staff's concern regarding the qualification of the ultrasonic examination, discuss the probability of flaw(s) in the subject RPV welds that may not be detected. Discuss the structural integrity of the subject RPV welds until May 2009, considering the crack growth of the undetected flaw(s).

EGC Response

EGC has concluded that the probability of flaws that may not have been detected due to a change in cabling configuration is negligible. This conclusion is based on the successful Equivalency Demonstrations of the UT examination procedures and equipment that were conducted in 2001 and 2007. These Equivalency Demonstrations were conducted in accordance with the requirements of ASME Section XI, Appendix VIII Supplement 1. The results of these Equivalency Demonstrations were within the allowable tolerance provided in the Code.

Although the change to the essential variables potentially calls into question the effectiveness and validity of the UT examinations of the subject welds, the UT procedure still had to satisfy the calibration process for detecting a reflector located on the RPV inside diameter. The ability to detect the calibration reflector indicates that the UT procedure is capable of finding flaws. There is reasonable assurance that any detrimental flaw, if present, would have been detected when the subject welds were examined during Q1R18 in 2005. The possibility of a flaw growing to a detrimental size during the two-year extension is small because of the slow crack growth rates in RPV material.

The UT examination technique that was used in 2005 to examine the QCNPS Unit 1 RPV welds exceeds the inspection requirements specified by BWR Vessel and Internals Project (BWRVIP)-05, "BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations." The use of BWRVIP-05 was endorsed by the NRC by letter and Safety Evaluation dated July 28, 1998.

BWRVIP-05, which was issued by EPRI in September 1995, concluded that the results of inservice inspections that had been performed up to that time, support the conclusion that vessel seam welds are free from unacceptable fabrication defects, and that no flaws had developed during operation. A review of operational issues, including loadings and irradiation, provided evidence of the inherent integrity of BWR reactor pressure vessels. This point was further supported in BWRVIP-05 by an evaluation of potential degradation mechanisms. This evaluation concluded that there were no known degradation mechanisms that challenge vessel weld integrity.

Based on the results of the UT examinations performed on QCNPS Unit 1 RPV welds in 2005, the original PDI qualification and subsequent Equivalency Demonstrations of the UT examination procedures, and the conclusions of BWRVIP-05, EGC has concluded that the structural integrity of the QCNPS Unit 1 RPV welds has been confirmed.