April 29, 2004

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

SUBJECT: QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2 - AUTHORIZATION FOR PROPOSED ALTERNATIVE REACTOR PRESSURE VESSEL CIRCUMFERENTIAL SHELL WELD EXAMINATIONS (TAC NOS. MB8985 AND MB8986)

Dear Mr. Crane:

By letter dated May 16, 2003, Exelon Generation Company, LLC (the licensee) submitted relief request I4R-10 requesting permanent relief from certain American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI requirements related to examination of reactor pressure vessel circumferential shell welds at Quad Cities Nuclear Power Station (QCNPS), Units 1 and 2. By letter dated July 7, 2003, the licensee submitted supplemental information in response to the staff's request for additional information.

The staff has reviewed your request and supplemental information and, based on the information provided, concludes that the proposed alternative will provide an acceptable level of quality and safety. Therefore, the proposed alternative under relief request I4R-10 is authorized pursuant to Section 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR), for the remaining term of the operating licenses for QCNPS, Units 1 and 2.

Our safety evaluation is enclosed.

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 w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

ALTERNATIVES FOR EXAMINATION OF REACTOR PRESSURE VESSEL

CIRCUMFERENTIAL SHELL WELDS

QUAD CITIES NUCLEAR POWER STATIONS UNITS 1 AND 2

EXELON GENERATION COMPANY

DOCKET NOS. 50-254 AND 50-265

## 1.0 INTRODUCTION

By letter dated May 16, 2003, (ML031480518) as supplemented by letter dated July 7, 2003, (ML031970483) Exelon Generation Company, LLC (the licensee), submitted Relief Request 14R-10 requesting permanent relief from American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, requirements related to examination of Reactor Pressure Vessel (RPV) circumferential shell welds at Quad Cities Nuclear Power Stations (QCNPS) Units 1 and 2.

The relief request would authorize the use of a proposed alternative to the RPV circumferential shell welds examination requirements of ASME Code, Section XI, for the remaining portion of the operating licenses for QCNPS, Units 1 and 2.

## 2.0 REGULATORY EVALUATION

### 2.1 Applicable Requirements

Inservice inspection of the ASME 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). 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 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

Enclosure

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 ISI Code of Record for the fourth 10-year ISI interval of Quad Cities Nuclear Power Stations, Units 1 and 2, is the 1995 Edition through 1996 Addenda of ASME Section XI.

## 2.2 BWRVIP-05 Report

By letter dated September 28, 1995, as supplemented by letters dated June 24 and October 29, 1996, and May 16, June 4, June 13, and December 18, 1997, and January 13, 1998, the Boiling Water Reactor Vessel and Internals Project (BWRVIP), submitted the proprietary report BWRVIP-05. As modified, the BWRVIP report proposed to reduce the scope of inspection of BWR RPV welds from essentially 100 percent of all RPV shell welds to examination of essentially 100 percent of the axial (i.e., longitudinal) welds and essentially zero percent of the circumferential RPV shell welds, except at the intersection of the axial and circumferential weld, thereby including 2-3 percent of the circumferential welds. In addition, the report includes proposals to provide alternatives to ASME Code requirements for successive and additional examinations of circumferential welds, provided in paragraph IWB-2420(b) of Section XI of the ASME Code.

On July 28, 1998, the NRC staff issued an safety evaluation report (SER) on the BWRVIP-05 report. This evaluation concluded that the failure frequency of RPV circumferential welds in BWRs was sufficiently low to justify elimination of ISI of these welds. In addition, the evaluation concluded that the BWRVIP proposals on successive and additional examinations of circumferential welds were acceptable. The evaluation indicated that examination of the circumferential welds shall be performed if axial weld examinations reveal an active, mechanistic mode of degradation.

In the BWRVIP-05 report, the BWRVIP concluded that the conditional probabilities of failure for BWR RPV circumferential welds are orders of magnitude lower than that of the longitudinal welds. As a part of its review of the report, the NRC conducted an independent risk-informed, probabilistic fracture mechanics assessment of the results presented in the BWRVIP-05 report. The staff’s assessment conservatively calculated the conditional probability of failure from RPV axial and circumferential welds during the (current) initial 40-year license period and at conditions approximating an 80-year vessel lifetime for a BWR nuclear plant, as indicated respectively in Tables 2.6-4 and 2.6-5 of the staff’s July 28, 1998 SER. The failure frequency for a reactor pressure vessel is calculated as the product of the frequency for the critical (limiting) transient event and the conditional probability of failure for the weld.

The staff determined the conditional probability of failure for longitudinal and circumferential welds in BWR vessels fabricated by Chicago Bridge and Iron (CB&I), Combustion Engineering (CE), and Babcock and Wilcox (B&W). The analysis identified a cold over-pressure event that occurred in a foreign reactor as the limiting event for BWR RPVs, with the pressure and temperature from this event used in the probabilistic fracture mechanics calculations. The staff estimated that the probability for the occurrence of the limiting over-pressurization transient was $1 \times 10^{-3}$ per reactor year. For each of the vessel fabricators, Table 2.6-4 of the staff’s SER identifies the conditional failure probabilities for the plant-specific conditions with the highest projected reference temperature (for that fabricator) after the initial 40-year license period.

2.3 Generic Letter 98-05

On November 10, 1998, the NRC issued Generic Letter (GL) 98-05 (ML031110082) which stated that BWR licensees may request permanent (i.e., for the remaining term of operation under the existing, initial, license) relief from the ISI requirements of 10 CFR 50.55a(g) for the volumetric examination of circumferential reactor pressure vessel welds (ASME Code Section XI, Table IWB-2500-I, Examination Category B-A, Item No. B1.11, "Circumferential Shell Welds"), upon demonstrating that:

(1) At the expiration of the license, the circumferential welds will continue to satisfy the limiting conditional failure probability for circumferential welds in the NRC staff's July 28, 1998 safety evaluation, and

(2) Licensees have implemented operator training and established procedures that limit the frequency of cold over-pressure events to the amount specified in the NRC staff's July 28, 1998 safety evaluation.

Licensees would still need to perform the required inspections of "essentially 100 percent" of all axial welds.

3.0 TECHNICAL EVALUATION

3.1 Code Requirement for which Relief is Requested

The licensee requested relief from the following requirements of ASME Code, Section XI, 1995 Edition through 1996 Addenda:

Subarticle IWB-2500, Table IWB 2500-1, Examination Category B-A, Item No. B1.11.
Subarticle IWB-2420, Successive Inspections.
Subarticle IWB-2430, Additional Examinations.

3.1.1 Component(s) for which Relief is Requested

The requested relief from the Table IWB 2500-1 requirements applies to:

ISI Class 1, Code Category B-A, "Pressure Retaining Welds in Reactor Vessel," item B1.11, "Circumferential Shell Welds"

3.2 Licensee's Proposed Alternative to the ASME Code

In accordance with 10 CFR 50.55a(a)(3)(i), and consistent with information contained in NRC Generic Letter 98-05, the licensee considers the following alternate provisions for the subject weld examinations:

The failure frequency for RPV shell circumferential welds is sufficiently low to justify their elimination from the ISI requirement of ASME Code Section XI, Table IWB-2500-1, Examination

Category B-A, Item No. B1.11. The ISI and augmented examination requirements of 10 CFR 50.55a(g) for ASME Code Section XI, Table IWB-2500-1, Examination Category B-A, Item No. B1.12, RPV shell longitudinal welds (i.e., also known as vertical or axial welds) shall be performed, and shall include inspection of the circumferential welds only at the intersection of these welds with the longitudinal welds, or approximately 2 to 3 percent of the RPV shell circumferential welds. The procedures for these examinations shall be qualified such that flaws relevant to the RPV integrity can be reliably detected and sized, and the personnel implementing these procedures shall be qualified in the use of these procedures.

Successive Examination of Flaws

For ASME Code Section XI, Table IWB-2500-1, Examination Category B-A, Item No. B1.11, RPV shell circumferential welds (i.e., at intersections with longitudinal welds), successive examinations per Subarticle IWB-2420 are not required for non-threatening flaws (original vessel material or fabrication flaws such as inclusions which exhibit negligible or no growth during the life of the vessel), provided that the following conditions are met:

1. The flaw is characterized as subsurface in accordance with BWRVIP-05.
2. The non-destructive examination technique and evaluation that detected and characterized the flaw as originating from material manufacture or vessel fabrication is documented in a flaw evaluation report; and
3. The vessel containing the flaw is acceptable for continued service in accordance with Subarticle IWB-3600, "Analytical Evaluation of Flaws," and the flaw is demonstrated acceptable for the intended service life of the vessel.

For ASME Code Section XI, Table IWB-2500-1, Examination Category B-A, Item No. B1.12, RPV shell longitudinal welds, all flaws shall be reinspected at successive intervals consistent with ASME Code and regulatory requirements.

Additional Examinations of Flaws

For ASME Section XI, Table IWB-2500-1, Examination Category B-A, Item No. B1.11, RPV shell circumferential welds (i.e., at intersections with longitudinal welds), additional requirements per Subarticle IWB-2430, "Additional Examinations," are not required for flaws provided the following conditions are met:

1. If the flaw is characterized as subsurface in accordance with BWRVIP-05, then no additional examinations are required;
2. If the flaw is not characterized as subsurface in accordance with BWRVIP-05, then an engineering evaluation shall be performed, addressing the following as a minimum:
   - a determination of the root cause of the flaw,
   - an evaluation of any potential failure mechanisms,
   - an evaluation of service conditions which could cause subsequent failure, and
   - an evaluation per Subarticle IWB-3600 demonstrating that the vessel is acceptable for continued service; and
3. If the flaw meets the criteria of Subarticle IWB-3600 for the intended service life of the vessel, then additional examinations may be limited to those welds subject to the root cause conditions and failure mechanisms, up to the number of examinations required by paragraph (a) of Subarticle IWB-2430. If the engineering evaluation determines that

there are no additional welds subject to the same root cause conditions or no failure mechanism exists, then no additional examinations are required.

For ASME Code Section XI, Table IWB-2500-1, Examination Category B-A, Item No. B1.12, RPV shell longitudinal welds, additional examination for flaws shall be in accordance with Subarticle IWB-2430. All flaws in RPV shell longitudinal welds shall require additional weld examinations consistent with ASME Code and regulatory requirements. Examinations of the RPV shell circumferential welds shall be performed if RPV longitudinal welds reveal an active, mechanistic mode of degradation.

3.3 Licensee's Bases for Alternative

BWRVIP-05 provides the technical basis to justify relief from the examination requirements of RPV shell circumferential welds. The results of the NRC's evaluation of BWRVIP-05 are documented in final safety evaluation report on BWRVIP-05. NRC Generic Letter 98-05 permits BWR licensees to request permanent (i.e., for the remaining term of operation under the existing, initial, license) relief from the ISI requirements of 10 CFR 50.55a(g) for the volumetric examination of RPV shell circumferential welds (i.e., ASME Code Section XI, Table IWB-2500-1, Examination Category B-A, Item No. B1.11). This relief can be granted by demonstrating that:

1. At the expiration of their license, the circumferential welds will continue to satisfy the limiting conditional failure probability for circumferential welds in the staff's July 30, 1998, safety evaluation, and

2. Licensees have implemented operator training and established procedures that limit the frequency of cold over-pressure events to the amount specified in the staff's July 30, 1998, safety evaluation.

Generic Letter 98-05 also states that licensees will still need to perform the required inspections of "essentially 100 percent" of all axial welds.

Generic Letter 98-05, Criterion 1

Demonstrate that at the expiration of their license, the circumferential welds will continue to satisfy the limiting conditional failure probability for circumferential welds in the NRC's July 28, 1998 safety evaluation.

Licensee's Response to Generic Letter 98-05 Criterion 1:

The NRC evaluation of BWRVIP-05 utilized the FAVOR code to perform a Probabilistic Fracture Mechanics Analysis (PFMA) to estimate the RPV shell weld failure probabilities. Three key assumptions of the PFMA are: (1) the neutron fluence used was the estimated end of life mean fluence, (2) the chemistry values are mean values based on vessel types, and (3) the potential for beyond-design-basis events is considered.

The table shown on page 8 of this SER provides a comparison of the limiting RPV circumferential weld parameters for each QCNPS unit to those found in Table 2.6-4 of the NRC final safety evaluation of BWRVIP-05 for a Babcock and Wilcox vessel. The chemistry composition and chemistry factor for Unit 1 are less than or equal to the limits of the NRC analysis. While the nickel content for Unit 2 is higher than the value utilized in the NRC analysis, the Unit 2 copper content and the chemistry factor are considerably lower than the values utilized in the NRC analysis. Additionally, the unirradiated reference temperatures for both QCNPS units are lower than the NRC limits. The combination of unirradiated reference temperature and embrittlement shift yields adjusted reference temperatures considerably lower than the NRC mean analysis values.

The end of life i.e., 32 Effective Full Power Year (EFPY) inside diameter fluences for QCNPS Units 1 and 2 are considerably lower than the NRC estimated 32 EFPY fluence. As a result, the shifts in reference temperature for both units are lower than the 32 EFPY shift from the NRC analysis.

Therefore, for each unit, the RPV shell weld embrittlement due to fluence is calculated to be less than the NRC's limiting case, and each unit's RPV shell circumferential weld failure probabilities are bounded by the conditional failure probability, P(FIE), in the NRC's limiting plant specific analysis (32 EFPY) through the projected end of license. For these reasons, the QCNPS Units 1 and 2 RPVs are bounded by the final safety evaluation report on BWRVIP-05.

<u>Generic Letter 98-05, Criterion 2</u>

Demonstrate that licensees have implemented operator training and established procedures that limit the frequency of cold over-pressure events to the amount specified in the NRC's July 28, 1998, safety evaluation.

Licensee's Response to Generic Letter 98-05 Criterion 2:

The licensee has procedures in place for QCNPS, Units 1 and 2, that guide operators in controlling and monitoring reactor pressure during all phases of operation, including cold shutdown. Use of these procedures minimizes the potential for low temperature over-pressurization (LTOP) events, and is reinforced through operator training. A primary system leakage test is performed prior to each restart after a refueling outage. The associated station test procedure has sufficient guidance to minimize the likelihood of an LTOP event, and requires a pre-job briefing prior to test commencement with all involved personnel. During pressure testing, measures are taken to limit the potential for system perturbations that could lead to pressure transients. These measures include both administrative and/or hardware controls, such as limiting testing or work activities, or installing jumpers to defeat system actuations that are not required operable. RPV temperature and pressure are required to be monitored and controlled to within the Technical Specifications pressure and temperature (P/T) limits curve during all portions of the testing. The normal and contingency methods to enact pressure control are specified in the test procedure.

A designated test coordinator is responsible for the coordination of the test (i.e., from initiation to conclusion) and maintains cognizance of test status. A controlled rate of pressure increase is administratively limited in the test procedure to no greater than 50 pounds per square inch per minute. If the rate of pressurization exceeds this limit, a contingency sequence portion of the testing procedures provides directions to reduce the rate of pressure increase by depressurizing through the reactor water cleanup system and/or securing control rod drive (CRD) pumps. Other pressure control contingencies are specified in the test procedure including: pressure control via the automatic depressurization system and/or main steam line drain lines.

Other than the CRD system, the other high pressure coolant sources that could inadvertently initiate and result in an LTOP event are the condensate/feedwater, the safe shutdown makeup pump (SSMP), reactor core isolation cooling (RCIC), and high pressure coolant injection (HPCI) systems.

During a normal RPV fill sequence prior to pressure testing, the condensate system is used to fill the reactor. This evolution is carefully controlled per the test procedure to minimize the potential for an LTOP. The feedwater pump motors are prevented from starting by the reactor water level high feedwater pump trip signal, which is present due to the high reactor water levels required during pressure testing. The SSMP is a manually operated system that has no automatic initiation signals. Initiation of the SSMP is strictly governed by station procedures. During pressure testing, the reactor is in cold shutdown, and as a result, there is no steam available to drive the turbine driven RCIC or HPCI pumps. In addition, the HPCI and RCIC steam supply and pump discharge valves are closed and their associated motor operator breakers are open in accordance with the test procedures.

The standby liquid control (SLC) system is also a high pressure water source to the RPV. Similar to the SSMP, there are no automatic initiation signals associated with this system. Operation of the SLC system is strictly governed by station emergency operating procedures, and requires an operator to manually start the system from the main control room via a keylock switch manipulation.

The low pressure coolant sources include the Emergency Core Cooling Systems (ECCS) (i.e., Core Spray and Residual Heat Removal) and the Condensate System. Operation of the ECCS systems is also governed by station emergency operating procedures. Although certain automatic initiation signals are required to be operable during pressure testing, an ECCS actuation would occur only when reactor conditions warranted RPV injection (for example, during a low water level condition). In addition, the shutoff head of the ECCS pumps is relatively low and the injection valves are interlocked closed at pressures greater than approximately 300 psig. For these reasons, an LTOP event that would exceed the P/T curve limits due to an inadvertent ECCS injection is considered unlikely. As mentioned above, the condensate system is normally used for RPV fill and is carefully governed by the test procedure.

During cold shutdown when the reactor head is tensioned, an LTOP event is prevented by the normal unit shutdown procedure, which requires the operator to place the RPV head vent valves in an open position when reactor coolant temperatures are below 190 °F.

In addition to the procedural barriers, licensed operators are provided specific training on the P/T curves and requirements of the Technical Specifications. Simulator sessions are conducted which include plant heat-up and cool-down. Additionally, in response to industry operating experience, the operating training program is routinely evaluated and revised, as necessary, to reduce the possibility of events such as an LTOP.

QCNPS RPV Shell Weld Information
Bounding Circumferential Weld

| **Parameter Description** | **QCNPS Unit 1 RPV Circumferential Weld Information at 32 EFPY (Weld Wire Heat/Flux Lot # 406L44/8688)** | **QCNPS Unit 2 RPV Circumferential Weld Information at 32 EFPY (Weld Wire Heat/Flux Lot # S3986/3870) Linde 124** | **NRC's Limiting Plant-Specific Analysis for B&W Circumferential Welds at 32 EFPY** |
|---|---|---|---|
| End of Life Inside Diameter Fluence, ($10^{19}$ n/cm$^{2}$) | 0.024 | 0.024 | 0.095 |
| Initial $RT_{NDT}$, °F | -5 | -32 | 20 |
| Chemistry Factor, °F | 183 | 68 | 196.7 |
| Cu% | 0.27 | 0.05 | 0.31 |
| Ni% | 0.59 | 0.96 | 0.59 |
| $\Delta RT_{NDT}$, °F | 35 | 13 | 79.8 |
| Mean $RT_{NDT}$, °F ($RT_{NDT(u)} + \Delta RT_{NDT}$) | 30 | -19 | 99.8 |

3.4 <u>Staff Evaluation</u>

As described previously, Generic Letter 98-05 provides two criteria that BWR licensees requesting relief from ISI requirements of 10 CFR 50.55a(g) for the volumetric examination of circumferential RPV welds (ASME Code, Section XI, Table IWB-2500-1, Examination Category B-A, Item No. B1.11, Circumferential Shell Welds) must satisfy. These criteria are intended to demonstrate that the conditions at the applicant's plant are bounded by those in the safety evaluation. The licensee will still need to perform the required inspections of "essentially 100 percent" of all axial welds.

3.4.1 Circumferential Weld Conditional Failure Probability

The staff's SER for the BWRVIP-05 report evaluated the conditional failure probability of circumferential welds for the limiting plant-specific case of BWR RPVs manufactured by different vendors, including B&W, using the highest mean irradiated $RT_{NDT}$ to determine the limiting case. Since the QCNPS RPV was fabricated by B&W, the licensee compared the mean irradiated $RT_{NDT}$ for QCNPS to that for the limiting B&W case described in Table 2.6-4 of the staff's SER for the BWRVIP-05 report. As indicated in the licensee's evaluation, the mean $RT_{NDT}$ for QCNPS is lower than that for the limiting B&W case; therefore, the licensee concluded that the conditional failure probability for the QCNPS circumferential welds is bounded by the conditional failure probabilities in the staff's SER for the BWRVIP-05 report through the end of the current license period.

The licensee has used an NRC approved methodology to estimate the end of life peak fluence value at the inside surface of the pressure vessel. The resulting value of $2.4 \times 10^{17}$ n/cm$^2$ is smaller than the limiting value of $3.5 \times 10^{17}$ n/cm$^2$ used in the staff's July 28, 1998, letter. The licensee has given additional information on July 7, 2003, indicating that the methodology of calculating the fluence estimates was provided by General Electric Nuclear Energy (GENE) licensing topical report NEDC-32983 P, which was approved by the NRC, and adheres to the guidance of Regulatory Guide 1.190. The staff has determined that the fluence value of $2.4 \times 10^{17}$ n/cm$^2$ at the inside surface of the vessel is acceptable because: (1) the methodology followed the guidance in Regulatory Guide 1.190, (2) the assumed load factor is conservative, and (3) the calculated fluence values are smaller than the corresponding values in the staff's 1998 evaluation.

The staff's SER for the BWRVIP-05 report provides a limiting conditional failure probability of $8.17 \times 10^{-5}$ per-reactor-year for a limiting plant-specific mean $RT_{NDT}$ of 99.8 °F for B&W-fabricated RPVs. Comparing the information in the NRC Reactor Vessel Integrity Database with that submitted in the proposed relief request, the staff confirmed that the mean $RT_{NDT}$ of the circumferential welds at QCNPS is projected to be 38.8 °F for QCNPS Unit 1, and -19 °F for QCNPS Unit 2 at the end of the current license. In this evaluation, the chemistry factor, $\Delta RT_{NDT}$, and mean $RT_{NDT}$ were calculated consistent with the guidelines of Regulatory Guide 1.99, Revision 2. The calculated value of mean $RT_{NDT}$ for the circumferential welds at QCNPS is significantly lower than that for the limiting plant-specific case for B&W-fabricated RPVs, indicating that the conditional failure probability of the QCNPS circumferential welds is much less than $8.17 \times 10^{-5}$ per-reactor-year.

3.4.2 Minimizing the Possibility of Low Temperature Overpressurization

The licensee established operator procedures to control vessel pressure at low coolant temperatures. These procedures are reinforced through periodic operator training. Reactor conditions which may result in cold overpressurization are: primary system leakage test, normal vessel fill sequence, and cold shutdown with tensioned head.

Primary System Leakage Test: Prior to the commencement of the test, the personnel involved are briefed on the procedure. During the test, potential overpressurization paths are avoided by administrative and/or hardware controls. Pressure vessel pressure and temperature (PT) limits are monitored and controlled to be within the pressure temperature curve limits. A test coordinator is designated who maintains cognizance of the test status. The test procedures specify a variety of depressurization paths in case the plant approaches the PT limits.

Normal Vessel Fill Sequence: The condensate system is used to fill the reactor. To minimize the potential of overpressurization, the feedwater pumps are prevented from starting during reactor testing when the reactor water level is high. The safe shutdown makeup pump can only be started manually, and does not have an automatic initiation signal. The reactor core isolation cooling and the high pressure coolant injection systems are steam driven and cannot be operated during a cold shut down. Finally, the standby liquid control system is also a high pressure delivery system, but it does not have an automatic initiation signal.

Cold Shutdown with Tensioned Head: With the head tensioned and the coolant temperature at or lower than 190 °F, plant operating procedures require that the reactor vessel head vent valves be in the open position to prevent pressurization.

In summary, the probability of cold overpressurization is minimized by a combination of operator training, procedures and hardware modifications. The measures instituted by the licensee at Quad Cities are reasonable and appropriate for the task, i.e., prevent cold overpressurization. The staff finds that this program is responsive to Generic Letter 98-05, and finds the proposed measures acceptable.

## 4.0 CONCLUSION

The NRC staff has reviewed the licensee's submittal and finds that the licensee has acceptably demonstrated that the appropriate criteria in Generic Letter 98-05 and the staff's evaluation of the BWRVIP-05 report have been satisfied regarding permanent relief (i.e., for the remaining portion of the operating license) from ISI requirements of ASME Code, Section XI, Table IWB-2500-1, Examination Category B-A, Item No. B1.11, for the volumetric examination of RPV circumferential welds.

The staff concludes that the licensee's permanent relief request from the examination requirements of circumferential shell welds for the remaining portion of the operating licenses for QCNPS, Units 1 and 2, is acceptable and is consistent with the information contained in NRC Generic Letter 98-05. The staff has also determined that the alternative program provides an acceptable level of quality and safety. Therefore the relief request is authorized pursuant to 10CFR 50.55a(a)(3)(i).

All other requirements of the ASME Code, Section XI for which relief has not been specifically requested remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

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