Exelon Nuclear
200 Exelon Way
Kennett Square, PA 19348

www.exeloncorp.com

Exelon. Nuclear

10 CFR 50.55a

RS-12-032
RA-12-021
TMI-12-018

February 13, 2012

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

Braidwood Station, Units 1 and 2
Facility Operating License Nos. NPF-72 and NPF-77
NRC Docket Nos. STN 50-456 and STN 50-457

Byron Station, Units 1 and 2
Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. STN 50-454 and STN 50-455

Clinton Power Station, Unit 1
Facility Operating License No. NPF-62
NRC Docket No. 50-461

Dresden Nuclear Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-19 and DPR-25
NRC Docket Nos. 50-237 and 50-249

LaSalle County Station, Units 1 and 2
Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Limerick Generating Station, Units 1 and 2
Facility Operating License Nos. NPF-39 and NPF-85
NRC Docket Nos. 50-352 and 50-353

Oyster Creek Nuclear Generating Station
Renewed Facility Operating License No. DPR-16
NRC Docket No. 50-219

Peach Bottom Atomic Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-44 and DPR-56
NRC Docket Nos. 50-277 and 50-278

Quad Cities Nuclear Power Station, Units 1 and 2
Renewed Facility Operating License Nos. DPR-29 and DPR-30
NRC Docket Nos. 50-254 and 50-265

Three Mile Island Nuclear Generating Station, Unit 1
Renewed Facility Operating License No. DPR-50
NRC Docket No. 50-289

Subject: Response to Request for Additional Information - Proposed Alternative to Utilize Code Case N-789, "Alternative Requirements for Pad Reinforcement of Class 2 and 3 Moderate Energy Carbon Steel Piping for Raw Water Service, Section XI, Division 1"

References:

1) Letter from M. D. Jesse (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "Proposed Alternative to Utilize Code Case N-789, 'Alternative Requirements for Pad Reinforcement of Class 2 and 3 Moderate Energy Carbon Steel Piping for Raw Water Service, Section XI, Division 1,' " dated October 7, 2011

2) E-mail from J. Wiebe (U.S. Nuclear Regulatory Commission) to T. R. Loomis (Exelon Generation Company, LLC), "Exelon Fleet - Non-acceptance with Opportunity to Supplement (Modified) RE: Proposed Alternative to Utilize Code Case N-789 (TAC Nos. ME7303 - ME7319)," dated November 1, 2011

3) Letter from M. D. Jesse (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "Response to Request for Additional Information-Proposed Alternative to Utilize Code Case N-789, 'Alternative Requirements for Pad Reinforcement of Class 2 and 3 Moderate Energy Carbon Steel Piping for Raw Water Service, Section XI, Division 1,' " dated November 10, 2011

4) Letter from J. Wiebe (U.S. Nuclear Regulatory Commission) to M. Pacilio (Exelon Generation Company, LLC), "Braidwood Station, Units 1 and 2; Byron Station, Unit Nos. 1 and 2; Clinton Power Station, Unit No. 1; Dresden Nuclear Power Station, Units 2 and 3; LaSalle County Station, Units 1 and 2; Limerick Generating Station, Units 1 and 2; Oyster Creek Nuclear Generating Station; Peach Bottom Atomic Power Station, Units 2 and 3; Quad Cities Nuclear Power Station, Units 1 and 2; and Three Mile Island Nuclear Station, Unit 1 - Request for Additional Information RE: Proposed Alternative to Use American Society of Mechanical Engineers Boiler and Pressure Vessel Code Case N-789 (TAC Nos. ME7303 through ME7319)," dated January 19, 2012

In the Reference 1 letter, Exelon Generation Company, LLC (Exelon) submitted in accordance with 10 CFR 50.55a(a)(3)(i), a proposed alternative to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to use Code Case N-789 for Class 2 and 3 moderate-energy raw water piping system repairs resulting from degradation mechanisms such as erosion, corrosion, cavitation, or pitting. In the Reference 2 letter, the U.S. Nuclear Regulatory Commission requested additional information. Attachment 3 was the Exelon response.

In the Reference 4 letter, the U.S. Nuclear Regulatory Commission requested additional information. Attached is our response. We note that as an additional change to the Attachment 2 relief request, this relief request has been expanded to include the fifth interval for the Dresden Nuclear Power Station, Units 2 and 3, and the Quad Cities Nuclear Power Station, Units 1 and 2.

There are no regulatory commitments contained in this letter.

If you have any questions, please contact Tom Loomis (610) 765-5510.

Respectfully,

Michael D. Jesse
Director - Licensing and Regulatory Affairs
Exelon Generation Company, LLC

Attachments: 1) Response to Request for Additional Information
2) Revised Proposed Alternative to Utilize Code Case N-789

cc: Regional Administrator - NRC Region I
Regional Administrator - NRC Region III
NRC Senior Resident Inspector - Braidwood Station
NRC Senior Resident Inspector - Byron Station
NRC Senior Resident Inspector - Clinton Power Station
NRC Senior Resident Inspector - Dresden Nuclear Power Station
NRC Senior Resident Inspector - LaSalle County Station
NRC Senior Resident Inspector - Limerick Generating Station
NRC Senior Resident Inspector - Oyster Creek Nuclear Generating Station
NRC Senior Resident Inspector - Peach Bottom Atomic Power Station
NRC Senior Resident Inspector - Quad Cities Nuclear Power Station
NRC Senior Resident Inspector - Three Mile Island Nuclear Generating Station, Unit 1
NRC Project Manager - Braidwood and Byron Stations
NRC Project Manager - Clinton Power Station
NRC Project Manager - Dresden Nuclear Power Station
NRC Project Manager - LaSalle County Station
NRC Project Manager - Limerick Generating Station
NRC Project Manager - Oyster Creek Nuclear Generating Station
NRC Project Manager - Peach Bottom Atomic Power Station
NRC Project Manager - Quad Cities Nuclear Power Station
NRC Project Manager - Three Mile Island Nuclear Generating Station, Unit 1

Attachment 1
Response to Request for Additional Information

Question:

"1. Paragraphs 1(e) and 8(d) of N-789 state that reinforcing pads, including those installed during a refueling outage, shall not remain in service beyond the end of the next refueling outage.

   a. Confirm that both the pressure pad and structural pad as discussed in Section 3 of N-789 are part of the reinforcing pads.

   b. Confirm that both the pressure and structural pads will not remain in service beyond the end of the next refueling outage.

   c. If the repair is performed in mid-cycle (e.g., one month before the scheduled refueling outage), discuss when is the 'next refueling outage'.

   d. There are piping systems that are required to be functional and thus cannot be repaired during refueling outages. The repair of these pipes can only be performed when the plant (the unit) is operating. The maximum service life to the next refueling outage would not be applicable or appropriate for these piping systems. Provide the service life of the reinforcing pads for these piping systems.

   e. Section 2 of the proposed alternative lists the end date of the 10-year inservice inspection (ISI) interval for each unit. Confirm that the end date of the 10-year ISI interval is reached during the mid-cycle because the duration of the proposed alternative is requested to be limited to the end of 10-year ISI interval."

Response:

a. Both pressure pads and structural pads are considered reinforcing pads.

b. Neither the pressure pad nor the structural pad may remain in service beyond the end of the next refueling outage after they are installed, unless specific regulatory relief is obtained.

c. Each reinforcing pad must be removed no later than the end of the next refueling outage after it is installed, unless specific regulatory relief is obtained. For the example given, if the repair is performed in mid-cycle (e.g., one month before the scheduled refueling outage), the reinforcing pad would be removed no later than the upcoming refueling outage (e.g., in one month) unless specific regulatory relief is obtained.

d. Each reinforcing pad must be removed before the end of the next scheduled refueling outage after it is installed, unless specific regulatory relief is obtained. In the case cited, the reinforcing pad would need to be removed prior to the conclusion of the next scheduled refueling outage after it was installed.

   A similar situation exists with common cooling lines that require a dual-unit outage to remove from service. In this case, specific regulatory approval would need to be obtained in order to defer removal of a pad beyond the next upcoming refueling outage of either unit.

e. The end date of the ten-year inservice inspection interval will not necessarily coincide with scheduled refueling outages for each unit. Installation of reinforcing pads in accordance with this relief request cannot take place after the end of the ten-year inservice inspection interval for the unit. Any reinforcing pads installed before the end of the ten-year inservice inspection interval will be removed during the next refueling outage, even if that refueling outage occurs after the end of the ten-year interval. Section 6.0 ("Duration of the Proposed Alternative") of the relief request (Attachment 2) will be revised to reflect this condition.

Question:

"2. Section 3.1(1) of N-789 states that ...[t]he pressure pads are designed to retain... full structural integrity... assuming a corrosion rate of either two times the actual measurement corrosion rate in that location or four times the estimated maximum corrosion rate for the system...."

a. Discuss how the actual measurement corrosion rate will be derived (e.g., what is the period of time between two measurements taken? Would the measured corrosion rate be based on the average of several measurements or only one measurement).

b. Discuss whether the maximum (worst) corrosion rate determined from both approaches in N-789 (i.e., the greater of the two times the actual measurement corrosion rate or four times the estimated maximum corrosion rate) will be used in the pressure pads design. If not, provide justification why the worst corrosion rate is not used in the reinforcing pad design.

c. Discuss how the corrosion rate is used to design the reinforcing pad (e.g., how the thickness and size of the pad and weld size are designed based on the corrosion rate?).

d. Discuss what the acceptance criteria are for the 'full structural integrity' of piping (provide reference specific ASME Code paragraphs that define the full structural integrity)."

Response:

a. To measure the corrosion rate at a specific location requires mapping the corroded area (using ultrasonic equipment) a minimum of two times with a distinct time interval between each mapping. Specific time intervals are not defined, as they depend on the rate and extent of corrosion; but they would need to be sufficient to measure discernible changes in thickness. Measured point corrosion rates would equal the change in thickness at various points within the mapped area divided by the time interval, revealing a predictable change in configuration of the area over time. This rate of change in configuration would be applied (two-fold for pressure pads) in the design to establish the minimum size of the reinforcing pad.

b. If the actual rate of corrosion is measured at a specific location, then that is what should be applied for predicting further degradation at that location. However, the Code Case imposes a conservative factor of safety of two, requiring that value to be doubled when designing and installing a pressure pad.

   If a repair must be performed without sufficient time to determine the actual rate of corrosion, then a pressure pad design must apply the worst-case corrosion rate observed for the system, plus apply an even more conservative safety factor of four. In this situation, a plant will likely elect instead to design and install a structural pad, which need only protect the actual (and not four times) area predicted to corrode, since its design enables in-service monitoring of the degradation to ensure that further corrosion does not reduce the structural integrity of the pad.

c. As discussed in (a) above, establishing the corrosion rate defines the changes in configuration of a degraded area over time. Using these defined rates of degradation, one can predict areas of wall thickness that could be less than the minimum thickness required by design by the time of the next refueling outage. The design of reinforcing pads considers such areas the same as if they were holes drilled or cut in the pipe. The reinforcing pad is then designed as a closure for that size hole, using design methodology of the applicable Construction Code (e.g., as a reinforced opening).

d. Although the term is used frequently in both ASME Sections III and XI, "structural integrity" is not defined by ASME; however, its meaning is self-evident [1]. In the context of Code Case N-789, paragraphs 3.1(a)(1) and (2), "full structural integrity" means the piping maintains full capability to withstand structural (mechanical) loading for which it is designed without need for additional support or reinforcement. Small areas of corrosion can, and do, result in thinning and leakage without impacting the ability of the piping to maintain its structural capabilities. These situations are candidates for pressure pads, which provide no added structural support or reinforcement - only pressure retention.

Question:

"3. The design requirements in Section 3.2 and examination requirements in Section 6 of N-789 stipulate the use of the Construction Code or ASME Code, Section III.

   a. Clarify the edition and addenda of the ASME Code, Section III that will be used if it is used in lieu of the Construction Code.

   b. N-789 also stipulates the use of various IWA paragraphs of the ASME Code, Section XI. Confirm that the edition and addenda of the ASME Code, Section XI, will be based on the Code of Record for the specific 10-year ISI interval at each nuclear unit covered under the proposed alternative."

Response:

a. Reconciliation and use of editions and addenda of Section III will be in accordance with ASME Section XI, IWA-4220. Only editions and addenda of Section III that have been accepted by 10 CFR 50.55a may be used.

b. The Code of Record for the specific ten-year inservice inspection interval at each nuclear unit covered under the proposed alternative will be used when applying the various IWA paragraphs unless specific regulatory relief is approved.

---

[1] The Section XI definition of "*inservice inspection*" in IWA-9000 does provide distinction between structural and pressure-retaining integrity.

Question:

"4. Section 4 of N-789 discusses requirements for installing the reinforcing pad on water-backed piping. Discuss whether N-789 permits a reinforcing pad be installed on a leaking area of the pipe. If yes, discuss how welding will be conducted on a leaking pipe to minimize fabrication defects (e.g., porosity and hydrogen cracking) in the weld."

Response:

Yes, Code Case N-789 does permit reinforcing pads to be installed on a leaking area of the pipe; however, the Code Case does not permit welding on wet surfaces. Therefore, a gasket or other sealing material will be applied to prevent moisture from encroaching upon the weld area; refer to paragraph 3.2(l) of the Code Case. These pads can be applied to pressurized systems by clamping the pad with gasket against the pipe, and then removing residual moisture by heating prior to welding.

Question:

"5. Section 8 of N-789 stipulates inservice monitoring requirements for the structural pad, but not the pressure pad. In Section 5 of the Proposed Alternative, the licensee stated that for the pressure pads, inservice monitoring will not be required because the design of pressure pads conservatively assumes two times the actual measured corrosion rate or four times if using an estimated rate.

a. Justify that either two times the actual measured corrosion rate or four times the estimated maximum corrosion rate for the system is adequate to ensure conservatism that the pressure pad will not leak or lose structural integrity prior to its removal.

b. Even if a conservative corrosion rate is used in the pad design, justify why the pressure pad does not need ISIs."

Response:

a. The ASME Code Committee has determined that a factor of safety of two (or four) for pressure pads is very conservative, and ensures excess design margin until the following refueling outage. This is based on several factors, including the fact that pressure pads serve no structural purpose and are only installed for temporary leak prevention. Further, the Code Case is restricted to raw water systems where the primary source of corrosion is microbiological or under-deposit in nature. These types of corrosion are not expected to accelerate during one refueling cycle by a factor of two for measured rates, or by a factor of four times the worst rate in the system. Also, the consequences of potential leakage at a pressure pad are considered small, since it would most likely begin as pin hole leakage at an attachment weld placed on structurally sound base metal.

b. The degradation beneath a pressure pad and its attachment welds cannot be monitored, although such areas can be monitored in structural pads. This is because the configuration of pressure pad attachment welds is not conducive to ultrasonic examination or thickness measurement of the material beneath the attachment weld. Rates of raw water corrosion do not increase rapidly during a single refueling cycle; and with the conservatism built into the design and resultant increased size of the pad there is low likelihood that the corrosion will expand to the structurally-sound attachment weld over that period of time. This is the reason that the Code Case does not require inspection of pressure pads.

However, based on the concerns identified, Section 5 ("Proposed Alternative and the Basis for Use") of the relief request (Attachment 2) has been revised to require inspection of the pressure pad as follows:

> Areas containing pressure pads shall be visually observed at least once per month to monitor for evidence of leakage. If the areas containing pressure pads are not accessible for direct observation, then monitoring will be accomplished by visual assessment of surrounding areas or ground surface areas above pressure pads on buried piping, or monitoring of leakage collection systems, if available.

<u>Question:</u>

"6. Discuss whether the proposed alternative will be applied to buried piping. If yes, discuss how the required examinations will be performed if the pipes are buried after the reinforcing pad is installed."

<u>Response:</u>

When used on buried piping, the area of structural reinforcing pads will need to be accessible for the examinations required by the Code Case, which could necessitate installation of removable barriers at the repair location in lieu of backfilling the pipe at that location. For pressure pads, please refer to Response 5(b) above.

Attachment 2
Revised Proposed Alternative to Utilize Code Case N-789

1. ASME Code Component(s) Affected:

All ASME Class 2 and 3 moderate energy carbon steel raw water piping systems. Raw water is defined as water such as from a river, lake, or well or brackish/salt water - used in plant equipment, area coolers, and heat exchangers. In many plants it is referred to as "Service Water." This Code Case applies to Class 2 and 3 moderate energy (i.e., less than or equal to 200°F (93°C) and less than or equal to 275 psig (1.9 MPa) maximum operating conditions) carbon steel raw water piping.

2. Applicable Code Edition and Addenda:

PLANT	INTERVAL	EDITION	START	END
Braidwood Station, Units 1 and 2	Third	2001 Edition, through 2003 Addenda	July 29, 2008 October 17, 2008	July 28, 2018 October 16, 2018
Byron Station, Units 1 and 2	Third	2001 Edition, through 2003 Addenda	January 16, 2006	July 15, 2016
Clinton Power Station	Third	2004 Edition	July 1, 2010	June 30, 2020
Dresden Nuclear Power Station, Units 2 and 3	Fourth	1995 Edition, through 1996 Addenda	January 20, 2003	January 19, 2013
Dresden Nuclear Power Station, Units 2 and 3	Fifth	2007 Edition, 2008 Addenda	January 20, 2013	January 19, 2023
LaSalle County Stations, Units 1 and 2	Third	2001 Edition, through 2003 Addenda	October 1, 2007	September 30, 2017
Limerick Generating Station, Units 1 and 2	Third	2001 Edition, through 2003 Addenda	February 1, 2007	January 31, 2017
Oyster Creek Nuclear Generating Station	Fourth	1995 Edition, through 1996 Addenda	October 15, 2002	October 14, 2012
Oyster Creek Nuclear Generating Station	Fifth	2007 Edition, 2008 Addenda	October 15, 2012	October 14, 2022
Peach Bottom Atomic Power Station, Units 2 and 3	Fourth	2001 Edition, through 2003 Addenda	November 5, 2008	November 4, 2018
Quad Cities Nuclear Power Station, Units 1 and 2	Fourth	1995 Edition, through 1996 Addenda	March 10, 2003	April 1, 2013
Quad Cities Nuclear Power Station, Units 1 and 2	Fifth	2007 Edition, 2008 Addenda	April 2, 2013	April 1, 2023

PLANT	INTERVAL	EDITION	START	END
Three Mile Island Nuclear Station, Unit 1	Fourth	2004 Edition	April 20, 2011	April 19, 2022

3. Applicable Code Requirement:

ASME Code, Section XI, IWA-4400 of the 1995 Edition through 1996 Addenda, 2001 Edition through 2003 Addenda, 2004 Edition, and 2007 Edition though 2008 Addenda provides requirements for welding, brazing, metal removal, and installation of repair/replacement activities.

4. Reason for Request:

In accordance with 10 CFR 50.55a(a)(3)(i), Exelon Generation Company, LLC (Exelon) is requesting a proposed alternative from the requirement for replacement or internal weld repair of wall thinning conditions resulting from degradation in Class 2 and 3 moderate energy carbon steel raw water piping systems in accordance with IWA-4000. Such degradation may be the result of mechanisms such as erosion, corrosion, cavitation, and pitting - but excluded are conditions involving flow-accelerated corrosion (FAC), corrosion-assisted cracking, or any other form of cracking. IWA-4000 requires repair or replacement in accordance with the Owner's Requirements and the original or later Construction Code. Other alternative repair or evaluation methods are not always practicable because of wall thinness and/or moisture issues.

The primary reason for this request is to permit installation of a technically sound temporary repair to provide adequate time for evaluation, design, material procurement, planning and scheduling of appropriate permanent repair or replacement of the defective piping, considering the impact on system availability, maintenance rule applicability, and availability of replacement materials.

5. Proposed Alternative and Basis for Use:

In accordance with 10 CFR 50.55a(a)(3)(i), Exelon proposes to implement the requirements of ASME Code Case N-789 ("Alternative Requirements for Pad Reinforcement of Class 2 and 3 Moderate-Energy Carbon Steel Piping for Raw Water Service, Section XI, Division 1") as a temporary repair of degradation in Class 2 and 3 moderate energy raw water piping systems resulting from mechanisms such as erosion, corrosion, cavitation, or pitting, but excluding conditions involving flow-accelerated corrosion (FAC), corrosion-assisted cracking, or any other form of cracking. These types of defects are typically identified by small leaks in the piping system or by pre-emptive non-code required examinations performed to monitor the degradation mechanisms.

Code Case N-789, which is included as part of this relief request, is attached.

The alternative repair technique described in Code Case N-789 involves the application of a metal reinforcing pad welded to the exterior of the piping system, which reinforces the weakened area and restores pressure integrity. This repair technique will be utilized when it is determined that this temporary repair method is suitable for the particular defect or degradation being resolved.

The Code Case requires that the cause of the degradation be determined, and that the extent and rate of degradation in the piping be evaluated to ensure that there are no other unacceptable locations within the surrounding area that could affect the integrity of the repaired piping. The area of evaluation will be dependent on the degradation mechanism present. A baseline thickness examination will be performed for a completed structural pad, attachment welds, and surrounding area, followed by monthly thickness monitoring for the first three months, with subsequent frequency based on the results of this monitoring, but at a minimum of quarterly. Areas containing pressure pads shall be visually observed at least once per month to monitor for evidence of leakage. If the areas containing pressure pads are not accessible for direct observation, then monitoring will be accomplished by visual assessment of surrounding areas or ground surface areas above pressure pads on buried piping, or monitoring of leakage collection systems, if available.

The repair will be considered to have a maximum service life of the time until the next refueling outage, when a permanent repair or replacement must be performed. Additional requirements for design of reinforcement pads, installation, examination, pressure testing, and inservice monitoring are provided in Code Case N-789.

Based on the above justification, the use of Code Case N-789 as a proposed alternative to the requirements of ASME Section XI will provide an acceptable level of quality and safety.

All other ASME Section XI requirements for which relief was not specifically requested and authorized by the NRC staff will remain applicable including third party review by the Authorized Nuclear Inservice Inspector.

Code Case N-789 was approved by the ASME Board on Nuclear Codes and Standards on June 25, 2011; however, it has not been incorporated into NRC Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI Division 1," and thus, is not available for application at nuclear power plants without specific NRC approval. Therefore, Exelon requests use of this alternative repair technique described in the Code Case via this relief request.

6. Duration of Proposed Alternative:

The proposed alternative is for use of the Code Case for the remainder of each plant's ten- (10) year inspection interval as specified in Section 2.

Any reinforcing pads installed before the end of the ten-year inservice inspection interval will be removed during the next refueling outage, even if that refueling outage occurs after the end of the ten-year interval.

7. Precedents:

A similar repair relief request (RR-3-43) was approved for Indian Point Nuclear Generating Unit No. 3 on February 22, 2008.