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10 CFR 50.55a

RS-18-125

October 11, 2018

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

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

Subject: Proposed Alternative Requirements for the Repair and Examination of Reactor Pressure Vessel Head Penetration Nozzles for the Fourth Inservice Inspection Interval in Accordance with 10 CFR 50.55a(z)(1)

References:

1) Letter from J. Zimmerman (U.S. Nuclear Regulatory Commission) to M. J. Pacilio, (Exelon Generation Company, LLC), "Braidwood Station, Units 1 and 2 and Byron Station, Unit Nos. 1 and 2 - Relief Requests I3R-09 and I3R-20 Regarding Alternative Requirements for Repair of Reactor Vessel Head Penetrations (TAC Nos. ME6071, ME6072, ME6073, and ME6074)," dated March 29, 2012 (ML120790647)

2) Letter from D. M. Gullott (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "Revision to the Third 10-Year Inservice Inspection Interval Requests for Relief for Alternative Requirements for the Repair of Reactor Vessel Head Penetrations," dated September 8, 2014 (ML14251A536)

3) Letter from D. M. Gullott (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "Response to Preliminary RAI Regarding Braidwood and Byron Stations Relief Request for Alternative Requirements for Repair of Reactor Vessel Head Penetrations," dated May 29, 2015 (ML15149A424)

4) Letter from J. C. Poole (U.S. Nuclear Regulatory Commission) to B. C. Hanson (Exelon Generation Company, LLC), "Byron Station, Units Nos. 1 and 2, and Braidwood Station, Units 1 and 2 – Relief from the Requirements of the ASME Code (CAC Nos. MF4809, MF4810, MF4811, and MF4812)," dated January 21, 2016 (ML16007A185)

In Reference 1, the U.S. Nuclear Regulatory Commission (NRC) provided their authorization to implement Relief Requests I3R-09 and I3R-20, Revision 1, as a repair method for degradation

identified in reactor pressure vessel head penetration nozzles for Braidwood Station, Units 1 and 2, and Byron Station, Units 1 and 2. By letters dated September 8, 2014, as supplemented by letter dated May 29, 2015 (References 2 and 3, respectively), Exelon Generation Company, LLC (EGC) submitted relief requests that were applicable to the third 10-Year Inservice Inspection (ISI) interval requesting inspection frequency relief for the reactor vessel head penetrations repair weld surface examinations (i.e., dye penetrant (PT)) for Braidwood Station, Units 1 and 2, and Byron Station, Units 1 and 2. In Reference 4, the NRC authorized the requests for the third ISI interval for Braidwood Station and Byron Station.

The attached relief request addresses potential repairs and inspections that would be performed during a refueling outage within the fourth ISI interval for Braidwood Station, Units 1 and 2. The fourth interval of the Braidwood Unit 1 ISI Program started on August 29, 2018 and will end on July 28, 2028. The fourth interval of the Braidwood Unit 2 ISI Program is scheduled to start on November 5, 2018 and will end on October 16, 2028.

EGC requests approval of the proposed relief requests by September 10, 2019, prior to the beginning of the Braidwood Station Unit 1 fall 2019 refueling outage (A1R21).

There are no regulatory commitments contained in this letter.

If you have any questions regarding this matter, please contact Ms. Lisa A. Simpson at (630) 657-2815.

Respectfully,

David M. Gullott
Director - Licensing
Exelon Generation Company, LLC

Attachment: 10 CFR 50.55a Relief Request I4R-10, Alternative Requirements for the Repair of Reactor Pressure Vessel Head Penetration Nozzles in Accordance with 10 CFR 50.55a(z)(1)

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Braidwood Station
Illinois Emergency Management Agency – Division of Nuclear Safety

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Request for Relief
Alternative Requirements for the Repair of Reactor Pressure Vessel Head Penetration Nozzles in Accordance with 10 CFR 50.55a(z)(1)

1.0 ASME CODE COMPONENT(S) AFFECTED

Component Numbers	Braidwood Station, Units 1 and 2, Reactor Vessels 1RC01R (Unit 1) and 2RC01R (Unit 2)
Description:	Alternative Requirements for the Repair of Reactor Pressure Vessel Head Penetration Nozzles (RPVHPNs) and J-groove Welds
Code Class:	Class 1
Examination Category:	ASME Code Case N-729-4
Code Item:	B4.20
Identification:	Braidwood Units 1 and 2, RPVHPN Numbers 1 through 78, (P-1 through P-78) Previous repairs (I3R-09): Unit 1, P-69[1]
Drawing Numbers:	Various

2.0 APPLICABLE CODE EDITION AND ADDENDA

Inservice Inspection (ISI) and Repair/Replacement Programs: American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, 2013 Edition (Reference 1, hereafter referred to as ASME Section XI). Examinations of the RPVHPNs are performed in accordance with 10 CFR 50.55a(g)(6)(ii)(D), which specifies the use of Code Case N-729-4, with conditions (Reference 2).

Code of Construction [Reactor Pressure Vessel (RPV)]: ASME Section III, 1971 Edition through Summer 1973 Addenda.

[1] This relief request includes ISI examination requirements for repairs previously completed in accordance with I3R-09 in the previous inspection interval.

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3.0 APPLICABLE CODE REQUIREMENT

ASME Code Case N-729-4 contains requirements for the inspection of RPVHPNs, with or without flaws, as conditioned by 10 CFR 50.55a(g)(6)(ii)(D). The specific Code requirements for which use of the proposed alternative is being requested are as follows:

Code of Federal Regulations (CFR) 10 CFR 50.55a(g)(6)(ii)(D)(1) requires (in part):

"Holders of operating licenses or combined licenses for pressurized-water reactors as of or after August 17, 2017 shall implement the requirements of ASME BPV Code Case N-729-4 instead of ASME BPV Code Case N-729-1, subject to the conditions specified in paragraphs (g)(6)(ii)(D)(2) through (4) of this section, by the first refueling outage starting after August 17, 2017."

ASME Code Case N-729-4, "Alternative Examination Requirements for PWR Reactor Vessel Upper Heads with Nozzles Having Pressure-Retaining Partial-Penetration Welds, Section XI, Division 1" (Reference 2), Figure 2, "Examination Volume for Nozzle Base Metal and Examination Area for Weld and Nozzle Base Metal," is applicable to the RPVHPNs.

ASME Code Case N-729-4, Paragraph -2410 specifies that the RPVHPNs shall be examined on a frequency in accordance with Table 1 of the Code Case (Reference 2, hereafter referred to as N-729-4). Since flaws attributed to Primary Water Stress Corrosion Cracking (PWSCC) have been identified at Braidwood Station Unit 1, the RPVHPNs are examined every fuel cycle per Table 1, Note (8), of ASME Code Case N-729-4 in accordance with Code Item B4.20. No flaws have been identified to date in the RPVHPNs at Braidwood Station Unit 2.

ASME Section XI

IWA-4000 of ASME Section XI contains requirements for the removal of defects from and welded repairs performed on ASME components. The specific Code requirements for which use of the proposed alternative is being requested are as follows:

ASME Section XI, IWA-4421 states:

Defects shall be removed or mitigated in accordance with the following requirements:

- *(a) Defect removal by mechanical processing shall be in accordance with IWA-4462.*
- *(b) Defect removal by thermal methods shall be in accordance with IWA-4461.*
- *(c) Defect removal or mitigation by welding or brazing shall be in accordance with IWA-4411.*
- *(d) Defect removal or mitigation by modification shall be in accordance with IWA-4340.*

Note that use of the "Mitigation of Defects by Modification" provisions of IWA-4340 is prohibited per 10 CFR 50.55a(b)(2)(xxv).

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For the removal or mitigation of defects by welding, ASME Section XI, IWA-4411 states, in part, the following:

> *Welding, brazing, fabrication, and installation shall be performed in accordance with the Owner's Requirements and … in accordance with the Construction Code of the item.*

The applicable requirements of the Construction Code required by IWA-4411 for the removal or mitigation of defects by welding from which relief is requested are as follows.

Base Material Defect Repairs:

For defects in base material, ASME Section III, NB-4131 requires that the defects are eliminated, repaired, and examined in accordance with the requirements of NB-2500. These requirements include the removal of defects via grinding or machining per NB-2538. Defect removal must be verified by a Magnetic Particle (MT) or Liquid Penetrant (PT) examination in accordance with NB-2545 or NB-2546, and if necessary to satisfy the design thickness requirement of NB-3000, repair welding in accordance with NB-2539.

ASME Section III, NB-2539.1 addresses removal of defects and requires defects to be removed or reduced to an acceptable size by suitable mechanical or thermal methods.

ASME Section III, NB-2539.4 provides the rules for examination of the base material repair welds and specifies they shall be examined by the MT or PT methods in accordance with NB-2545 or NB-2546. Additionally, if the depth of the repair cavity exceeds the lesser of 3/8-inch or 10% of the section thickness, the repair weld shall be examined by the radiographic method in accordance with NB-5110 using the acceptance standards of NB-5320.

Weld Metal Defect Repairs (This applies to the RPVHPN J-Groove weld.)

ASME Section III, NB-4450 addresses repair of weld metal defects.

ASME Section III, NB-4451 states that unacceptable defects in weld metal shall be eliminated and, when necessary, repaired in accordance with NB-4452 and NB-4453.

ASME Section III, NB-4452 addresses elimination of weld metal surface defects without subsequent welding and specifies defects are to be removed by grinding or machining.

ASME Section III, NB-4453.1 addresses removal of defects in welds by mechanical means or thermal gouging processes and requires the defect removal to be verified with MT or PT examinations in accordance with NB-5340 or NB-5350 and weld repairing the excavated cavity. In the case of partial penetration welds where the entire thickness of the weld is removed, only a visual examination is required to determine suitability for re-welding.

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As an alternative to the requirements above, repairs will be conducted in accordance with the appropriate edition/addenda of ASME Section III and the alternative requirements, based on WCAP-15987-P, Revision 2-P-A, "Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations," December 2003, (Reference 3, hereafter referred to as WCAP-15987-P).

4.0 REASON FOR THE REQUEST

Exelon Generation Company, LLC (EGC) will conduct examinations of the reactor Vessel Head Penetrations (RPVHPNs) in accordance with Code Case N-729-4, as amended by 10 CFR 50.55a and other NRC approved alternatives. Flaw indications that require repair may be found on the RPVHPN tube material and/or the J-groove attachment weld(s) on the underside of the reactor vessel head.

Relief is requested from the requirements of ASME Section XI, IWA-4411 to perform permanent repair of future defects that may be identified on the RPVHPNs and/or J-groove attachment weld(s) in accordance with the rules of the ASME Section III Construction Code as described in this relief request.

Specifically, relief is requested from the following:

- The requirements of ASME Section III, NB-4131, NB-2538, and NB-2539 to eliminate and repair defects in materials.

- The requirements of ASME Section III, NB-4450 to repair defects in weld metal.

5.0 PROPOSED ALTERNATIVE AND BASIS FOR USE

5.1 Proposed Alternative

EGC proposes to use the less intrusive embedded flaw process (Reference 3) for the repair of RPVHPN(s) as approved by the U.S. Nuclear Regulatory Commission (NRC) (Reference 4) as an alternative to the defect removal requirements of ASME Section XI and Section III.

5.1.1 The criteria for flaw evaluation established in 10 CFR 50.55a(g)(6)(ii)(D), which specifies the use of Code Case N-729-4, will be used in lieu of the "Flaw Evaluation Guidelines" specified by the NRC Safety Evaluation for WCAP-15987-P (Reference 5).

5.1.2 Consistent with the WCAP-15987-P methodology, the following repair requirements will be performed.

1. Inside Diameter (ID) RPVHPN Repair Methodology

   a. An unacceptable axial flaw will be first excavated (or partially excavated) to a maximum depth of 0.125 inches. Although this depth differs from that specified in WCAP-15987-P, the cavity depth is not a critical parameter in the implementation of a repair on the ID surface of the RPVHPN. The goal is to isolate the susceptible material from the primary water (PW) environment. The

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purpose of the excavation is to accommodate the application of at least two weld layers of Alloy 52 or 52M, which is resistant to Primary Water Stress Corrosion Cracking (PWSCC), to meet that requirement. The depth specified in WCAP-15987-P is a nominal dimension and the depth needed to accommodate three weld layers while still maintaining the tube ID dimension. Since two weld layers will be applied, less excavation is required and only 0.125 inches of excavation is necessary. The shallower excavated cavity for 2 weld layers would mean a slightly thinner weld, which would produce less residual stress.

The excavation will be performed using an Electrical Discharge Machining (EDM) process to minimize RPVHPN tube distortion. After the excavation is complete, either an ultrasonic test (UT) or surface examination will be performed to ensure that the entire flaw length is captured. Then a minimum of 2 layers of Alloy 52 or 52M weld material will be applied to fill the excavation. The expected chemistry of the weld surface is that of typical Alloy 52 or 52M weldment with no significant dilution. The finished weld will be conditioned to restore the inside diameter and then examined by UT and surface examination to ensure acceptability.

b. If required, an unacceptable ID circumferential flaw will be either repaired in accordance with existing code requirements or will be partially excavated to reduce the flaw to an acceptable size, examined by UT or surface examination, inlaid with Alloy 52 or 52M, and examined by UT and surface examination as described above.

2. Outside Diameter (OD) RPVHPN and J-groove Weld Repair Methodology

a. An unacceptable axial or circumferential flaw in a tube below a J-groove attachment weld will be sealed off with an Alloy 52 or 52M weldment. Excavation or partial excavation of such flaws is not necessary. The embedded flaw repair technique may be applied to OD axial or circumferential cracks below the J-groove weld because they are located away from the pressure boundary, and the proposed repair of sealing the crack with Alloy 690 weld material would isolate the crack from the environment as stated in Section 3.6.1 of the NRC Safety Evaluation for WCAP-15987-P.

b. Unacceptable radial flaws in the J-groove attachment weld will be sealed off with a 360 degree seal weld of Alloy 52 or 52M covering the entire weld. Excavation or partial excavation of such flaws is not necessary.

c. If EGC determines an excavation is desired (e.g., boat sample), then

- The excavation will be filled with Alloy 52 or 52M material.

- It is expected that a portion of the indication may remain after the boat sample excavation; however, a surface examination will be performed on the excavation to assess the pre-repair condition.

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- Depending on the extent and/or location of the excavation, the repair procedure requires the Alloy 52 or 52M weld material to extend at least one half inch outboard of the Alloy 82/182 to stainless steel clad interface.

d. Unacceptable axial flaws in the RPVHPN tube extending into the J-groove weld will be sealed with Alloy 52 or 52M as discussed in Item 5.1.2.2.a above. In addition, the entire J-groove weld will be sealed with Alloy 52 or 52M to embed the axial flaw. The seal weld will extend onto and encompass the portion of the flaw on the outside diameter of the RPVHPN tube.

e. For seal welds performed on the J-groove weld, the interface boundary between the J-groove weld and stainless steel cladding will be located to positively identify the weld clad interface to ensure that all of the Alloy 82/182 material of the J-groove weld is seal welded during the repair.

f. The seal weld that will be used to repair an OD flaw in the nozzles and the J-groove weld will conform to the following.

- Prior to the application of the Alloy 52 or 52M seal weld repair on the RPV clad surface, at least three beads (one layer) of ER309L stainless steel buffer will be installed 360° around the interface of the clad and the J-groove weld metal.

- The J-groove weld will be completely covered by at least three (3) layers of Alloy 52 or 52M deposited 360° around the nozzle and over the ER309L stainless steel buffer. Additionally, the seal weld will extend onto and encompass the outside diameter of the penetration tube Alloy-600 material by at least one half inch.

- The RPVHPN tube will have at least two layers of Alloy 52 or 52M deposited over the flaw on the RPVHPN tube, extending out at least one half inch beyond the flaw, or to the maximum extent allowed by the nozzle geometry (e.g., limited length of the RPVHPN tube).

g. Nondestructive examinations of the finished seal weld repair (i.e., Repair NDE) and during subsequent outages (i.e., ISI NDE) are summarized in the following table.

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Repair Location	Flaw Orientation	Repair Weld	Repair NDE Note 2	ISI NDE of the Repair Note 2
RPVHPN Nozzle/Tube ID	Axial or Circumferential	Seal	UT and Surface	UT or Surface
RPVHPN Nozzle/Tube OD above J-groove weld	Axial or Circumferential	Note 1	Note 1	Note 1
RPVHPN Nozzle/Tube OD below J-groove weld	Axial or Circumferential	Seal	UT or Surface	UT or Surface
J-groove weld	Axial	Seal	UT and Surface, Note 3	UT and Surface, Notes 3 and 4
J-groove weld	Circumferential	Seal	UT and Surface, Note 3	UT and Surface, Notes 3 and 4

Notes: 1) Repair method must be reviewed and approved separately by NRC.

2) Preservice and Inservice Inspection to be consistent with 10 CFR 50.55a(g)(6)(ii)(D), which requires implementation of Code Case N-729-4 with conditions; or NRC-approved alternatives to these specified conditions.

3) UT personnel and procedures qualified in accordance with 10 CFR 50.55a(g)(6)(ii)(D), which requires implementation of Code Case N-729-4 with conditions. Examine the accessible portion of the J-groove repaired region. The UT plus surface examination coverage equals to 100%.

4) Surface examination of the embedded flaw repair (EFR) shall be performed to ensure the repair satisfies ASME Section III, NB-5350 acceptance standards. The frequency of examination shall be as follows:
   a. Perform surface examination during the first and second refueling outage after installation or repair of the EFR.
   b. When the examination results in 4.a above verify acceptable results then re-inspection of the EFR will be continued at a frequency of every other refueling outage. If these examinations identify unacceptable results that require flaw removal, flaw reduction to acceptable dimensions or welded repair the requirements of 4.a above shall be applied during the next refueling outage.

5.1.3 J-Groove Weld ISI NDE Requirements

Note 4 permits a reinspection frequency of every other cycle when the surface examination results of the EFR are verified to be acceptable for two consecutive cycles after the original installation or repair of the EFR. Westinghouse Report LTR-PSDR-TAM-14-005, Revision 1 (Reference 6) provides the technical bases for reducing surface examination requirements for J-groove weld repairs. This technical justification includes

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a detailed review of PT examination history, review of potential causes of PT indications in EFRs, and the use of crack resistant alloys in the EFR. The EFR is a robust design that is resistant to PWSCC. EFR installation, examination, and operational history indicate that the EFR performs acceptably. Examination and removed sample history indicate that the flaws identified shortly after installation of EFR weld material were due to embedded weld discontinuities and not due to service induced degradation. With inspection of the EFR every other cycle of operation, the nozzles are adequately monitored for degradation by ultrasonic examination methods similar to the nozzles without EFR repairs.

EGC projects that the reduction of the PT examination of nozzles would result in a dose savings of approximately 0.4 to 0.7 REM per nozzle examination. The historical radiation dose associated with these examinations is presented in Reference 6, Table 2.

The proposed changes to the inservice examination requirements assure that the EFR repaired nozzles are adequately monitored through a combination of volumetric and surface examinations throughout the life of the installation at a frequency approved by the NRC, thus ensuring the EFR repaired nozzles will continue to perform their required function.

5.1.4 Reporting Requirements and Conditions on Use

EGC will notify the NRR Division of Materials and License Renewal or its successor of changes in indication(s) or findings of new indication(s) in the penetration nozzle or J-groove weld beneath a seal weld repair, or new linear indications in the seal weld repair, prior to commencing repair activities in subsequent outages.

5.2 Technical Basis for Proposed Alternative

As discussed in WCAP-15987-P, the embedded flaw repair technique is considered a permanent repair. As long as a PWSCC flaw remains isolated from the Primary Water (PW) environment, it cannot propagate. Since an Alloy 52 or 52M weldment is considered highly resistant to PWSCC, a new PWSCC flaw should not initiate and grow through the Alloy 52 or 52M seal weld to reconnect the PW environment with the embedded flaw. Structural integrity of the affected J-groove weld and/or nozzle will be maintained by the remaining unflawed portion of the weld and/or the RPVHPN. Alloy 690 and Alloy 52/52M are highly resistant to stress corrosion cracking, as demonstrated by multiple laboratory tests, as well as over twenty years of service experience in replacement steam generators.

The residual stresses produced by the embedded flaw technique have been measured and found to be relatively low because of the small seal weld thickness. This implies that no new flaws will initiate and grow in the area adjacent to the repair weld. There are no other known mechanisms for significant flaw propagation in the reactor vessel closure head and penetration tube region since cyclic loading is negligible, as described in WCAP-15987-P. Therefore, fatigue driven crack growth should not be a mechanism for further crack growth after the embedded flaw repair process is implemented.

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The thermal expansion properties of Alloy 52 or 52M weld metal are not specified in the ASME Code. In this case the properties of the equivalent base metal (Alloy 690) should be used. For Alloy 690, the thermal expansion coefficient at 600 degrees F is 8.2E-6 in/in/degree F as found in ASME Section II part D. The Alloy 600 base metal has a coefficient of thermal expansion of 7.8E-6 in/in/degree F, a difference of about 5 percent. The effect of this small difference in thermal expansion is that the weld metal will contract more than the base metal when it cools, thus producing a compressive stress on the Alloy 600 tube or J-groove weld. This beneficial effect has already been accounted for in the residual stress measurements reported in the technical basis for the embedded flaw repair, as noted in the WCAP-15987-P.

In Reference 7, ECG submitted WCAP-16401-P, Revision 1 (Reference 8) "Technical Basis for Repair Options for Reactor Vessel Head Penetration Nozzles and Attachment Welds: Byron and Braidwood Units 1 and 2," which provides the plant-specific analysis performed for Byron and Braidwood Stations using the same methodology as WCAP-15987-P. WCAP-16401-P, Revision 1, provides the means to evaluate a broad range of postulated repair scenarios to the reactor vessel head penetrations and J-groove welds relative to ASME Code requirements for allowable flaw size and service life. Based on WCAP-16401-P, Revision 1, a service life of at least twenty (20) years was determined for flaws in the RPVHPN nozzles and a service life of at least forty (40) years was determined for flaws in the J-groove attachment welds.

Embedded flaw repairs were previously performed on one Unit 1 RPVHPN. The following table summarizes the nozzle that was repaired, the repair outage, and the flaw location:

Unit	Penetration	Repair Outage	Flaw Location
1	69	A1R16 (spring 2012)	Attachment Weld

The last UT inspection was performed for Unit 1 in the fall 2016 refueling outage (A1R19), and the last PT inspection was performed for Unit 1 in the spring 2018 refueling outage (A1R20).

The initial evaluation in WCAP-16401, Revision 0, used conservative bounding inputs that resulted in a service life that did not challenge or limit the expected duration of flaw life due to anticipated replacement of the RPVHPN heads at Byron and Braidwood Stations. EGC subsequently elected to peen the RPVHPN heads as a PWSCC mitigating measure resulting in the existing EFRs remaining for the life of the plant, necessitating a reevaluation of the EFR service life for J-groove welds. The re-evaluation in WCAP-16401, Revision 1, included modifying the assumed flaw aspect ratio for the uphill nozzle location from 6 to 2 and modifying the pressure used in the analysis from a design pressure of 2500 psia to an operating pressure of 2250 psia. An aspect ratio of 2 bounds all uphill nozzle location J-groove weld geometries, as shown in WCAP-16401, Revision 1, Table 3-1 (i.e., Attachment 1 of Reference 7). The use of the operating pressure, in lieu of the design pressure, is acceptable because the use of the operating pressure is consistent with ASME Section XI, Appendix A.

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The methodologies used in the evaluations contained in WCAP-16401-P Revision 1 as included in Reference 7 Attachment 2 (Proprietary) and Attachment 3 (Non-Proprietary) are consistent with the requirements of Appendix A and Appendix K of Section XI. There are no differences in the fracture mechanics evaluations and methodologies (i.e., elastic-plastic fracture mechanics guidance - ASME Section XI Appendix K or fatigue crack growth - ASME Section XI Appendix A) between the ASME Section XI 2004 Edition and the 2013 Edition. Therefore, the WCAP-16401-P Revision 1 results and conclusions between 2004 Edition and the 2013 Edition would be the same.

The above proposed embedded flaw repair process is supported by applicable generic and plant specific technical bases and is therefore considered to be an alternative to Code requirements that provides an acceptable level of quality and safety, as required by 10 CFR 50.55a(z)(1).

6.0 DURATION OF THE PROPOSED ALTERNATIVE

The duration of the proposed alternative is for the Braidwood Station Unit 1 and 2 Fourth Inservice Inspection Interval.

The Fourth Inservice Inspection Interval for Braidwood Station Unit 1 started on August 29, 2018 and will end on July 28, 2028.

The Fourth Inservice Inspection Interval for Braidwood Station Unit 2 is scheduled to start on November 5, 2018 and will end on October 16, 2028.

7.0 PRECEDENTS

On January 21, 2016 (Reference 9), the NRC provided their authorization to implement relief requests during the remainder of the Third ISI Interval for Braidwood Station and Byron Station.

In a letter dated August 16, 2016 (Reference 10), EGC submitted I4R-10, Revision 0, for Byron Station requesting alternative requirements for the repair and examination of reactor vessel head penetrations for the Fourth ISI Interval. In a letter dated February 13, 2017 (Reference 7), EGC submitted Revision 2 of Byron Station Relief Request I4R-10 for the NRC's review and authorization. Enclosed with Reference 7 was WCAP-16401-P and associated documentation.

On March 6, 2017 (Reference 11), the NRC authorized Byron Station Relief Request I4R-10, Revision 2. The attached Braidwood Station Fourth ISI Interval Relief Request I4R-10 utilizes the same approach that was previously authorized under the March 6, 2017 Safety Evaluation for Byron Station Units 1 and 2.

8.0 REFERENCES

1) ASME Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 2013 Edition

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2) American Society of Mechanical Engineers Boiler and Pressure Vessel Case N-729-4, "Alternative Examination Requirements for PWR Reactor Vessel Upper Heads With Nozzles Having Pressure-Retaining Partial-Penetration Welds Section XI, Division 1," approved June 22, 2012

3) Westinghouse WCAP-15987-P, Revision 2-P-A, "Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations," December 2003

4) Letter from H. N. Berkow (U.S. Nuclear Regulatory Commission) to H. A. Sepp (Westinghouse Electric Company), "Acceptance for Referencing – Topical Report WCAP-15987-P, Revision 2, 'Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations,' (TAC No. MB8997)," dated July 3, 2003

5) Letter from R. J. Barrett (U.S. Nuclear Regulatory Commission) to A. Marion (Nuclear Energy Institute), "Flaw Evaluation Guidelines," dated April 11, 2003

6) Westinghouse Report LTR-PSDR-TAM-14-005, Revision 3, "Technical Basis for Optimization or Elimination of Liquid Penetrant Exams for the Embedded Flaw Repair," dated May 2015 (provided in EGC letter dated May 25, 2015 – ML15149A424)

7) Letter from D. M. Gullott (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "Supplemental Response to Request for Additional Information for Byron Station Relief Request I4R-10: Proposed Alternative Requirements for the Repair and Examination of Reactor Vessel Head Penetrations for the Fourth Inservice Inspection Interval," dated February 13, 2017 [including WCAP-16401-P and associated documentation] (ML17044A294)

8) Westinghouse WCAP-16401-P, Revision 1, "Technical Basis for Repair Options for Reactor Vessel Head Penetration Nozzles and Attachment Welds: Byron and Braidwood Units 1 and 2," January 2017

9) Letter from Justin C. Poole, (U.S. Nuclear Regulatory Commission) to Bryan C. Hanson (EGC), "Byron Station, Units Nos. 1 and 2, and Braidwood Station, Units 1 and 2 – Relief from the Requirements of the ASME Code," dated January 21, 2016 (ML16007A185)

10) Letter from D. M. Gullott (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "Relief Request for Alternative Requirements for the Repair and Examination of Reactor Vessel Head Penetrations for the Fourth Inservice Inspection Interval," dated August 16, 2016 (ML16229A250)

11) Letter from K. J. Green (U.S. Nuclear Regulatory Commission) to B. C. Hanson (Exelon Nuclear) (Exelon Generation Company, LLC), "Byron Station, Unit Nos. 1 and 2 – Request for Relief from the Requirements of the ASME Code (CAC Nos. MF8282 and MF8283)," dated March 6, 2017 (ML17062A428)