Exelon Generation®

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10 CFR 50.55a

RS-16-136
RA-16-059
TMI-16-064

June 14, 2016

U.S. Nuclear Regulatory Commission
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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

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

Calvert Cliffs Nuclear Power Plant, Units 1 and 2
Renewed Facility Operating License Nos. DPR-53 and DPR-69
NRC Docket Nos. 50-317 and 50-318

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
Renewed Facility Operating License Nos. NPF-39 and NPF-85
NRC Docket Nos. 50-352 and 50-353

Nine Mile Point Nuclear Station, Units 1 and 2
Renewed Facility Operating License Nos. DPR-63 and NPF-69
NRC Docket Nos. 50-220 and 50-410

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

R.E. Ginna Nuclear Power Plant
Renewed Facility Operating License No. DPR-18
NRC Docket No. 50-244

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

Subject: Proposed Alternative to Utilize Code Case N-513-4, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping Section XI, Division 1"

References:
1) Letter from D. Gudger (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "Proposed Alternative to Utilize Code Case N-513-4, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping Section XI, Division 1"," dated January 28, 2016

2) Email from B. Purnell (U.S. Nuclear Regulatory Commission) to T. Loomis (Exelon Generation Company, LLC), "Exelon Generation Company, LLC - Fleet Relief Request to use Code Case N-513-4 (CAC Nos. MF7301 - MF7322)," dated May 20, 2016

In the Reference 1 letter, Exelon Generation Company, LLC (Exelon) requested 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," on the basis that compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Specifically, Exelon requested to apply the evaluation methods of ASME Code Case N-513-4, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping Section XI, Division 1," to Class 2 and 3 moderate energy piping including elbows, bent pipe, reducers, expanders, and branch tees.

Peach Bottom Atomic Power Station and Quad Cities Nuclear Power Station have an approved relief request (ADAMS Accession Number ML15043A496) to utilize Code Case N-513-3 at a higher operating pressure than allowed by the Code Case. This relief request to utilize Code Case N-513-4 does not supersede or negate the need for the previous approval contained in ML15043A496. This relief request to utilize Code Case N-513-4 will only be applied to systems/components that meet the applicability conditions in Code Case N-513-4.

In the Reference 2 email, the U.S. Nuclear Regulatory Commission requested additional information. Attachment 1 is our response to this request for additional information. Attachment 1 contains an analysis prepared by Structural Integrity Associates, Inc. which provides an alternate leakage limit than proposed in the Reference 2 email. This analysis also contains suggested revisions to the relief request. Attachment 2 is Revision 1 to the proposed alternative which contains the revised relief request. The attachments identified in Attachment 2 were supplied in the Reference 1 letter.

There are no commitments contained in this submittal.

Respectfully,

James Barstow
Director - Licensing and Regulatory Affairs
Exelon Generation Company, LLC

Attachments: 1) Response to Request for Additional Information
2) Proposed Alternative to Utilize Code Case N-513-4, Revision 1

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 Station, Unit 1
NRC Senior Resident Inspector - Calvert Cliffs Nuclear Power Plant
NRC Senior Resident Inspector - Nine Mile Point Nuclear Station
NRC Senior Resident Inspector - R.E. Ginna Nuclear Power Plant
NRC Project Manager - Braidwood Station
NRC Project Manager - Byron Station
NRC Project Manager - Clinton Power Station
NRC Project Manager - Dresden Nuclear Power Station
NRC Project Manager - LaSalle County Station

cc (continued):

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 Station, Unit 1
NRC Project Manager - Calvert Cliffs Nuclear Power Plant
NRC Project Manager - Nine Mile Point Nuclear Station
NRC Project Manager - R.E. Ginna Nuclear Power Plant

Attachment 1

Response to Request for Additional Information

Structural Integrity Associates, Inc.®

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Centennial, CO 80112
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Fax: 303-792-2158
www.structint.com
ehouston@structint.com

June 9, 2016
Report No. 1600599.401.R0
Quality Program: ☐ Nuclear ☒ Commercial

Gene Navratil
Exelon Power
300 Exelon Way
Kennett Square, PA 19348

Subject: Exelon Fleet N-513-4 RAI Support

Dear Gene:

Exelon has received a Request for Additional Information (RAI) on the proposed alternative to use Code Case N-513-4 for the fleet (ML16029A003). Structural Integrity Associates (SI) has been contracted to help support a response to the RAI and provide suggested wording for a revision of ML16029A003. Attachment 1 of this letter contains the results of this effort.

Prepared by:

Eric J. Houston, P.E.
Senior Consultant

6/9/2016
Date

Verified by:

Robert O. McGill, P.E.
Senior Associate

6/9/2016
Date

Approved by:

Eric J. Houston
Senior Consultant

6/9/2016
Date

RAI-1

Code Case N-513-4 provides criteria which would allow the licensee to accept flaws, including through-wall flaws, in moderate energy Class 2 or 3 piping including elbows, bent pipe, reducers, expanders, and branch tees, without performing a repair or replacement activity for a limited time, not to exceed the next schedule refueling outage. Paragraph 1(f) states:

> The provisions of this Case demonstrate the integrity of the item and not the consequences of leakage. It is the responsibility of the Owner to consider effects of leakage in demonstrating system operability and performing plant flooding analyses.

The proposed alternative does not specify a maximum leakage rate for which the alternative may be used. Through operating experience and information provided in other relief requests, the NRC staff has identified cases where leak rates increased from drops per minute to gallons per minute (gpm) before the next refueling schedule. Based on this, the staff requires additional information regarding the management of leakage and the possibility of large leak rates which can erode defense-in-depth and lead to adverse consequences. The NRC has approved similar alternatives which were limited to a maximum leakage rate of 5 gpm (e.g., see ADAMS Accession No. ML15070A428).

Revise the proposed alternative to include a maximum leakage rate for which Code Case N-513-4 will be used. Explain how the proposed maximum leakage rate is adequate to ensure defense-in-depth is maintained and that adverse consequences are minimized.

Response:

Per the NRC's request in the RAI, the relief request was revised to include leakage limits. The process of determining the allowable leakage rate is specified based on a safety factor applied to the critical leakage rate. The critical leakage rate is determined as the lowest leakage rate that can be tolerated and may be based on the allowable loss of inventory or the maximum leakage that can be tolerated relative to room flooding, among others. The safety factor is selected as four (4) based on Code Case N-705. Paragraph 2.2(e) of Code Case N-705 requires a safety factor of two (2) on flaw size when estimating the flaw size from the leakage rate. This corresponds to a safety factor of four (4) on leakage for nonplanar flaws. Although the use of a safety factor for determination of an unknown flaw is considered conservative when the actual flaw size is known, this approach is deemed acceptable based upon the precedent of Code Case N-705. Note that the alternative in the revised relief request does not propose to use any portion of Code Case N-705 and that citation of N-705 is intended only to provide a technical basis for the safety factor of four (4) on leakage.

To further support Exelon's revised request, several previously-approved relief requests that used the methods of N-513-4 for in-scope (i.e., moderate energy) piping components were reviewed. A comparison of the structural allowable through-wall flaw

sizes and the observed flaw sizes from four previous NRC-approved submittals are summarized in Table 1.

Table 1. Summary of NRC-Approved Allowed Leakage Rates Based on Use of Code Case N-513-4

Plant, Submittal Date (ADAMS Accession No.)	Allowable Flaw Size	Observed Flaw Size	Observed Leakage Rate (gpm)	Calculated Margin
Pilgrim, September 30, 2014 (ML14240A603)	8 inches x 10 inches	3/8 inch diameter	60 drops per minute	> 700 (1) Based on allowable and observed flaw areas
Peach Bottom 2 & 3, December 18, 2014 (ML14335A551)	Not explicitly given (2)	0.6 inch diameter	10 drops per minute (3 milliliters (ml) per minute, 0.0008 gpm)	> 6,000 (3) Based on leakage
Fort Calhoun, November 19, 2014 (ML14316A167)	4 inches x 10 inches	Pinhole less than 3/8 inch diameter (4)	1100 ml/hour	> 350 (5) Based on allowable and observed flaw areas
Arkansas Nuclear One, Unit 2, March 16, 2015 (ML15070A428)	2.7 inches x 5.8 inches	pinhole	32 drops per hour	> 360 (6) Based on leakage

Notes:

1. Calculated as the ratio of flaw areas, $(8)(10) / [\pi(0.188)^2]$.
2. Allowable flaw size is not given in the proposed alternative. The observed flaw size is very conservatively characterized based on the low leakage rate.
3. The margin based on leakage rate is the action level leakage rate of 5 gpm divided by the observed leakage rate of 0.0008 gpm. The allowable stress intensity factor, K_{Ic}, divided by the calculated stress intensity factor, K_I, is the implied margin of 1.8. This does not include the additional margin term included in the calculation of K_I required by Code Case N-513-4. Therefore, the margin term of 1.8 is a lower bound margin.
4. The inspection report contained in the submittal shows inspection locations at a radius of 3/16 inch from the leak. Thus, the diameter of the leak is less than 3/8 inch.
5. Calculated as the ratio of flaw areas, $(4)(10) / [\pi(0.188)^2]$.
6. Calculated as a bounding value of 1,800/5; refer to discussion below.

In the four examples summarized in Table 1, it is evident that significant changes in the observed leakage rates will not challenge the structural stability of the piping components because the allowable flaw sizes are all significantly larger than the observed flaw sizes. In addition, calculated safety factors are shown in Table 1 for the four previous NRC-approved submittals, which range from more than 350 to greater than 6,000. Note that the Peach Bottom submittal (ML14335A551) contains both the high and low margin term, demonstrating that there is little correlation between the leakage rate and the allowable flaw size. The margin terms based on leakage significantly exceed the safety factor of four (4) used in the revised Exelon relief

request. Furthermore, daily monitoring, which is required by Code Case N-513-4 for leaking flaws, is intended to confirm that the analysis conditions used in the evaluation remain valid. Any significant change in the leakage rate is reason to question that the analysis conditions remain valid, and would require re-inspection per paragraph 2(f) of the Code Case. Any re-inspection must be performed in accordance with paragraph 2(a) of the Code Case.

In the previous alternative referenced in the RAI (ADAMS Accession No. ML15070A428), which is the March 16, 2015 submittal for Arkansas Nuclear One, Unit 2 (ANO-2) shown in Table 1, a pinhole leak was discovered with a measured leakage of 32 drops per hour. The observed flaw size was stated as, "too small to measure." The loss of water inventory was characterized as, "essentially imperceptible" and that "no significant leak rate increase is expected to occur." The structural allowable flaw size was determined to be 2.7 inches by 5.8 inches. For a through-wall flaw with a diameter of 2.5 inches (which is smaller than the allowable hole size), the leakage rate is shown to exceed 1,800 gpm using the Bernoulli equation with the following inputs:

- Design pressure, p_1 = 150 psig
- Water density, ρ = 62.4 lbm/ft^3
- Irreversible loss coefficient, K_L = 0.5

$$p_1 = (1 + K_L)\frac{\rho V_2^2}{2g_c}$$ (Basic form of the Bernoulli equation)

The limiting leakage rate of 5 gpm represented an upper bound value on potential leakage. The calculated safety factor on the allowable flaw size is greater than 360 (i.e., > 1,800/5). However, the 5 gpm leakage limit is a practical limit that is governed by the capacity of the nearby floor drain or the inventory loss rather than a safety-factor based argument between the 5 gpm limit and the required flow rate. Therefore, the ANO-2 submittal did not use safety factors to derive the 5 gpm limit.

An approved alternative dated March 19, 2015 for Peach Bottom and Quad Cities (ADAMS Accession No. ML15043A496) to apply Code Case N-513-3 to systems above 275 psig also limits leakage to 5 gpm. However, this previous request for alternative was for higher pressure systems, which require additional defense-in-depth to avoid adverse consequences. An arbitrary leakage limit for the current Exelon request for alternative to moderate energy systems is overly restrictive without a compensatory increase in safety.

In summary, Exelon will apply ASME Code Case N-513-4 for the evaluation of Class 2 and 3 components that are within the scope of the Code Case. Code Case N-513-4 utilizes technical evaluation approaches that are based on principals that are accepted in other Code documents already acceptable to the NRC. The application of this code case, in concert with safety factors on leakage limits, will maintain acceptable structural and leakage integrity while minimizing plant risk and personnel exposure by minimizing

the number of plant transients that could be incurred if degradation is required to be repaired based on ASME Section XI acceptance criteria only.

1. **ASME Code Component(s) Affected:**

   All American Society of Mechanical Engineers (ASME), Section XI, Class 2 and 3 components that meet the operational and configuration limitations of Code Case N-513-4, paragraphs 1(a), 1(b), 1(c), and 1(d).

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
	Fourth	2007 Edition, through 2008 Addenda	July 16, 2016	July 15, 2025
Calvert Cliffs Nuclear Power Plant, Units 1 and 2	Fourth	2004 Edition	October 10, 2009	June 30, 2019
Clinton Power Station, Unit 1	Third	2004 Edition	July 1, 2010	June 30, 2020
Dresden Nuclear Power Station, Units 2 and 3	Fifth	2007 Edition, through 2008 Addenda	January 20, 2013	January 19, 2023
R. E. Ginna Nuclear Power Plant	Fifth	2004 Edition	January 1, 2010	December 31, 2019
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
	Fourth	2007 Edition, through 2008 Addenda	February 1, 2017	January 31, 2027
Nine Mile Point Nuclear Station, Unit 1	Fourth	2004 Edition	August 23, 2009	August 22, 2019
Nine Mile Point Nuclear Station, Unit 2	Third	2004 Edition	April 5, 2008	April 4, 2018
Oyster Creek Nuclear Generating Station	Fifth	2007 Edition, through 2008 Addenda	January 15, 2013	January 14, 2023
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	Fifth	2007 Edition, through 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, IWC-3120 and IWC-3130 require that flaws exceeding the defined acceptance criteria be corrected by repair/replacement activities or evaluated and accepted by analytical evaluation. ASME Code, Section XI, IWD-3120(b) requires that components exceeding the acceptance standards of IWD-3400 be subject to supplemental examination, or to a repair/replacement activity.

4. Reason for Request:

In accordance with 10 CFR 50.55a(z)(2), Exelon Generation Company, LLC (Exelon) is requesting a proposed alternative from the requirement to perform repair/replacement activities for degraded Class 2 and 3 piping whose maximum operating temperature does not exceed 200°F and whose maximum operating pressure does not exceed 275 psig[1]. Moderately degraded piping could require a plant shutdown within the required action statement timeframes to repair observed degradation. Plant shutdown activities result in additional dose and plant risk that would be inappropriate when a degraded condition is demonstrated to retain adequate margin to complete the component's function. The use of an acceptable alternative analysis method in lieu of immediate action for a degraded condition will allow Exelon to perform additional extent of condition examinations on the affected systems while allowing time for safe and orderly long term repair actions if necessary. Actions to remove degraded piping from service could have a detrimental overall risk impact by requiring a plant shutdown, thus requiring use of a system that is in standby during normal operation. Accordingly, compliance with the current code requirements results in a hardship without a compensating increase in the level of quality and safety.

ASME Code Case N-513-3 does not allow evaluation of flaws located away from attaching circumferential piping welds that are in elbows, bent pipe, reducers, expanders, and branch tees. ASME Code Case N-513-3 also does not allow evaluation of flaws located in heat exchanger external tubing or piping. ASME Code Case N-513-4 provides guidance for evaluation of flaws in these locations.

5. Proposed Alternative and Basis for Use:

Exelon is requesting approval to apply the evaluation methods of ASME Code Case N-513-4, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping Section XI, Division 1," to Class 2 and 3 components that meet the operational and configuration limitations of Code Case N-513-4, paragraphs 1(a), 1(b), 1(c), and 1(d) in

[1] Peach Bottom Atomic Power Station and Quad Cities Nuclear Power Station have an approved relief request (ADAMS Accession Number ML15043A496) to utilize Code Case N-513-3 at a higher operating pressure than allowed by the Code Case. This relief request to utilize Code Case N-513-4 does not supersede or negate the need for the previous approval contained in ML15043A496.

order to avoid accruing additional personnel radiation exposure and increased plant risk associated with a plant shutdown to comply with the cited Code requirements.

The NRC issued Generic Letter 90-05 (Reference 1), "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping (Generic Letter 90-05)," to address the acceptability of limited degradation in moderate energy piping. The generic letter defines conditions that would be acceptable to utilize temporary non-code repairs with NRC approval. The ASME recognized that relatively small flaws could remain in service without risk to the structural integrity of a piping system and developed Code Case N-513. NRC approval of Code Case N-513 versions in Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," allows acceptance of partial through-wall or through-wall leaks for an operating cycle provided all conditions of the Code Case and NRC conditions are met. The Code Case also requires the Owner to demonstrate system operability due to leakage.

The ASME recognized that the limitations in Code Case N-513-3 were preventing needed use in piping components such as elbows, bent pipe, reducers, expanders, and branch tees and external tubing or piping attached to heat exchangers. Code Case N-513-4 was approved by the ASME to expand use on these locations and to revise several other areas of the Code Case. Attachment 2 provides a marked-up N-513-3 version of the Code Case to highlight the changes compared to the NRC approved N-513-3 version. Attachment 3 provides the ASME approved Code Case N-513-4. The following provides a high level overview of the Code Case N-513-4 changes:

1. Revised the maximum allowed time of use from no longer than 26 months to the next scheduled refueling outage.
2. Added applicability to piping elbows, bent pipe, reducers, expanders, and branch tees where the flaw is located more than $(R_o t)^{1/2}$ from the centerline of the attaching circumferential piping weld.
3. Expanded use to external tubing or piping attached to heat exchangers.
4. Revised to limit the use to liquid systems.
5. Revised to clarify treatment of Service Level load combinations.
6. Revised to address treatment of flaws in austenitic pipe flux welds.
7. Revised to require minimum wall thickness acceptance criteria to consider longitudinal stress in addition to hoop stress.
8. Other minor editorial changes to improve the clarity of the Code Case.

Detailed discussion of significant changes in Code Case N-513-4 when compared to NRC approved Code Case N-513-3 is provided in Attachment 4.

The design basis is considered for each leak and evaluated using the Exelon Operability Evaluation process. The evaluation process must consider requirements or commitments established for the system, continued degradation and potential consequences, operating experience, and engineering judgment. As required by the Code Case, the evaluation process considers but is not limited to system make-up capacity, containment integrity with the leak not isolated, effects on adjacent equipment, and the potential for room flooding.

Leakage rate is not typically a good indicator of overall structural stability in moderate energy systems, where the allowable through-wall flaw sizes are often on the order of inches (ML14240A603, ML14316A167, ML15070A428). The periodic inspection interval

defined using paragraph 2(e) of Code Case N-513-4 provides evidence that a leaking flaw continues to meet the flaw acceptance criteria and that the flaw growth rate is such that the flaw will not grow to an unacceptable size.

The effects of leakage may impact the operability determination or the plant flooding analyses specified in paragraph 1(f). For a leaking flaw, the allowable leakage rate will be determined by dividing the critical leakage rate by a safety factor of four (4). The critical leakage rate is determined as the lowest leakage rate that can be tolerated and may be based on the allowable loss of inventory or the maximum leakage that can be tolerated relative to room flooding, among others. The safety factor of four (4) on leakage is based upon Code Case N-705, which is accepted without condition in Regulatory Guide 1.147, Revision 17. Paragraph 2.2(e) of N-705 requires a safety factor of two (2) on flaw size when estimating the flaw size from the leakage rate. This corresponds to a safety factor of four (4) on leakage for nonplanar flaws. Although the use of a safety factor for determination of an unknown flaw is considered conservative when the actual flaw size is known, this approach is deemed acceptable based upon the precedent of Code Case N-705. Note that the alternative herein does not propose to use any portion of Code Case N-705 and that citation of N-705 is intended only to provide technical basis for the safety factor on leakage.

During the temporary acceptance period, leaking flaws will be monitored daily as required by paragraph 2(f) of Code Case N-513-4 to confirm the analysis conditions used in the evaluation remain valid. Significant change in the leakage rate is reason to question that the analysis conditions remain valid, and would require re-inspection per paragraph 2(f) of the Code Case. Any re-inspection must be performed in accordance with paragraph 2(a) of the Code Case.

The leakage limit provides quantitative measurable limits which ensure the operability of the system and early identification of issues that could erode defense-in-depth and lead to adverse consequences.

In summary, Exelon will apply ASME Code Case N-513-4 to evaluation of Class 2 and 3 components that are within the scope of the Code Case. Code Case N-513-4 utilizes technical evaluation approaches that are based on principals that are accepted in other Code documents already acceptable to the NRC. The application of this code case, in concert with safety factors on leakage limits, will maintain acceptable structural and leakage integrity while minimizing plant risk and personnel exposure by minimizing the number of plant transients that could be incurred if degradation is required to be repaired based on ASME Section XI acceptance criteria only.

6. Duration of Proposed Alternative:

The proposed alternative is for use of Code Case N-513-4 for Class 2 and Class 3 components within the scope of the Code Case. A Section XI compliant repair/replacement will be completed prior to exceeding the next refueling outage or allowable flaw size, whichever comes first. This relief request will be applied for the duration of the inservice inspection interval defined in Section 2 of this relief request or such time as the NRC approves Code Case N-513-4 in Regulatory Guide 1.147 or other document. If a flaw is evaluated near the end of the interval for one of the plants in Section 2 and the next refueling outage is in the subsequent interval the flaw may remain in service under this relief request until the next refueling outage.

7. Precedent:

None

8. References:

1. NRC Generic Letter 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping (Generic Letter 90-05)"
2. ASME Boiler and Pressure Vessel Code, Code Case N-705, "Evaluation Criteria for Temporary Acceptance of Degradation in Moderate Energy Class 2 or 3 Vessels and Tanks Section XI, Division 1," October 12, 2006.
3. NRC Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 17, August 2014.

Attachment 2

Proposed Alternative to Utilize Code Case N-513-4, Revision 1

Attachment 2

10 CFR 50.55a RELIEF REQUEST:
Request to Use Code Case N-513-4 in
Accordance with 10 CFR 50.55a(z)(2), Revision 1
(Page 1 of 5)

1. ASME Code Component(s) Affected:

All American Society of Mechanical Engineers (ASME), Section XI, Class 2 and 3 components that meet the operational and configuration limitations of Code Case N-513-4, paragraphs 1(a), 1(b), 1(c), and 1(d).

2. Applicable Code Edition and Addenda:

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	Fourth	2007 Edition, through 2008 Addenda	July 16, 2016	July 15, 2025
Calvert Cliffs Nuclear Power Plant, Units 1 and 2	Fourth	2004 Edition	October 10, 2009	June 30, 2019
Clinton Power Station, Unit 1	Third	2004 Edition	July 1, 2010	June 30, 2020
Dresden Nuclear Power Station, Units 2 and 3	Fifth	2007 Edition, through 2008 Addenda	January 20, 2013	January 19, 2023
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	Fourth	2007 Edition, through 2008 Addenda	February 1, 2017	January 31, 2027
Nine Mile Point Nuclear Station, Unit 1	Fourth	2004 Edition	August 23, 2009	August 22, 2019
Nine Mile Point Nuclear Station, Unit 2	Third	2004 Edition	April 5, 2008	April 4, 2018
Oyster Creek Nuclear Generating Station	Fifth	2007 Edition, through 2008 Addenda	January 15, 2013	January 14, 2023
Peach Bottom Atomic Power Station, Units 2 and 3	Fourth	2001 Edition, through 2003 Addenda	November 5, 2008	November 4, 2018

PLANT	INTERVAL	EDITION	START	END
Quad Cities Nuclear Power Station, Units 1 and 2	Fifth	2007 Edition, through 2008 Addenda	April 2, 2013	April 1, 2023
Three Mile Island Nuclear Station, Unit 1	Fourth	2004 Edition	April 20, 2011	April 19, 2022

3. Applicable Code Requirement:

ASME Code, Section XI, IWC-3120 and IWC-3130 require that flaws exceeding the defined acceptance criteria be corrected by repair/replacement activities or evaluated and accepted by analytical evaluation. ASME Code, Section XI, IWD-3120(b) requires that components exceeding the acceptance standards of IWD-3400 be subject to supplemental examination, or to a repair/replacement activity.

4. Reason for Request:

In accordance with 10 CFR 50.55a(z)(2), Exelon Generation Company, LLC (Exelon) is requesting a proposed alternative from the requirement to perform repair/replacement activities for degraded Class 2 and 3 piping whose maximum operating temperature does not exceed 200°F and whose maximum operating pressure does not exceed 275 psig[1]. Moderately degraded piping could require a plant shutdown within the required action statement timeframes to repair observed degradation. Plant shutdown activities result in additional dose and plant risk that would be inappropriate when a degraded condition is demonstrated to retain adequate margin to complete the component's function. The use of an acceptable alternative analysis method in lieu of immediate action for a degraded condition will allow Exelon to perform additional extent of condition examinations on the affected systems while allowing time for safe and orderly long term repair actions if necessary. Actions to remove degraded piping from service could have a detrimental overall risk impact by requiring a plant shutdown, thus requiring use of a system that is in standby during normal operation. Accordingly, compliance with the current code requirements results in a hardship without a compensating increase in the level of quality and safety.

ASME Code Case N-513-3 does not allow evaluation of flaws located away from attaching circumferential piping welds that are in elbows, bent pipe, reducers, expanders, and branch tees. ASME Code Case N-513-3 also does not allow evaluation of flaws located in heat exchanger external tubing or piping. ASME Code Case N-513-4 provides guidance for evaluation of flaws in these locations.

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[1] Peach Bottom Atomic Power Station and Quad Cities Nuclear Power Station have an approved relief request (ADAMS Accession Number ML15043A496) to utilize Code Case N-513-3 at a higher operating pressure than allowed by the Code Case. This relief request to utilize Code Case N-513-4 does not supersede or negate the need for the previous approval contained in ML15043A496.

5. Proposed Alternative and Basis for Use:

Exelon is requesting approval to apply the evaluation methods of ASME Code Case N-513-4, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping Section XI, Division 1," to Class 2 and 3 components that meet the operational and configuration limitations of Code Case N-513-4, paragraphs 1(a), 1(b), 1(c), and 1(d) in order to avoid accruing additional personnel radiation exposure and increased plant risk associated with a plant shutdown to comply with the cited Code requirements.

The NRC issued Generic Letter 90-05 (Reference 1), "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping (Generic Letter 90-05)," to address the acceptability of limited degradation in moderate energy piping. The generic letter defines conditions that would be acceptable to utilize temporary non-code repairs with NRC approval. The ASME recognized that relatively small flaws could remain in service without risk to the structural integrity of a piping system and developed Code Case N-513. NRC approval of Code Case N-513 versions in Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," allows acceptance of partial through-wall or through-wall leaks for an operating cycle provided all conditions of the Code Case and NRC conditions are met. The Code Case also requires the Owner to demonstrate system operability due to leakage.

The ASME recognized that the limitations in Code Case N-513-3 were preventing needed use in piping components such as elbows, bent pipe, reducers, expanders, and branch tees and external tubing or piping attached to heat exchangers. Code Case N-513-4 was approved by the ASME to expand use on these locations and to revise several other areas of the Code Case. Attachment 2 provides a marked-up N-513-3 version of the Code Case to highlight the changes compared to the NRC approved N-513-3 version. Attachment 3 provides the ASME approved Code Case N-513-4. The following provides a high level overview of the Code Case N-513-4 changes:

1. Revised the maximum allowed time of use from no longer than 26 months to the next scheduled refueling outage.
2. Added applicability to piping elbows, bent pipe, reducers, expanders, and branch tees where the flaw is located more than $(R_o t)^{1/2}$ from the centerline of the attaching circumferential piping weld.
3. Expanded use to external tubing or piping attached to heat exchangers.
4. Revised to limit the use to liquid systems.
5. Revised to clarify treatment of Service Level load combinations.
6. Revised to address treatment of flaws in austenitic pipe flux welds.
7. Revised to require minimum wall thickness acceptance criteria to consider longitudinal stress in addition to hoop stress.
8. Other minor editorial changes to improve the clarity of the Code Case.

Detailed discussion of significant changes in Code Case N-513-4 when compared to NRC approved Code Case N-513-3 is provided in Attachment 4.

The design basis is considered for each leak and evaluated using the Exelon Operability Evaluation process. The evaluation process must consider requirements or commitments established for the system, continued degradation and potential consequences, operating experience, and engineering judgment. As required by the Code Case, the evaluation process considers but is not limited to system make-up capacity, containment integrity with the leak not isolated, effects on adjacent equipment, and the potential for room flooding.

Leakage rate is not typically a good indicator of overall structural stability in moderate energy systems, where the allowable through-wall flaw sizes are often on the order of inches (ML14240A603, ML14316A167, ML15070A428). The periodic inspection interval defined using paragraph 2(e) of Code Case N-513-4 provides evidence that a leaking flaw continues to meet the flaw acceptance criteria and that the flaw growth rate is such that the flaw will not grow to an unacceptable size.

The effects of leakage may impact the operability determination or the plant flooding analyses specified in paragraph 1(f). For a leaking flaw, the allowable leakage rate will be determined by dividing the critical leakage rate by a safety factor of four (4). The critical leakage rate is determined as the lowest leakage rate that can be tolerated and may be based on the allowable loss of inventory or the maximum leakage that can be tolerated relative to room flooding, among others. The safety factor of four (4) on leakage is based upon Code Case N-705, which is accepted without condition in Regulatory Guide 1.147, Revision 17. Paragraph 2.2(e) of N-705 requires a safety factor of two (2) on flaw size when estimating the flaw size from the leakage rate. This corresponds to a safety factor of four (4) on leakage for nonplanar flaws. Although the use of a safety factor for determination of an unknown flaw is considered conservative when the actual flaw size is known, this approach is deemed acceptable based upon the precedent of Code Case N-705. Note that the alternative herein does not propose to use any portion of Code Case N-705 and that citation of N-705 is intended only to provide technical basis for the safety factor on leakage.

During the temporary acceptance period, leaking flaws will be monitored daily as required by paragraph 2(f) of Code Case N-513-4 to confirm the analysis conditions used in the evaluation remain valid. Significant change in the leakage rate is reason to question that the analysis conditions remain valid, and would require re-inspection per paragraph 2(f) of the Code Case. Any re-inspection must be performed in accordance with paragraph 2(a) of the Code Case.

The leakage limit provides quantitative measurable limits which ensure the operability of the system and early identification of issues that could erode defense-in-depth and lead to adverse consequences.

In summary, Exelon will apply ASME Code Case N-513-4 to evaluation of Class 2 and 3 components that are within the scope of the Code Case. Code Case N-513-4 utilizes technical evaluation approaches that are based on principals that are accepted in other

Code documents already acceptable to the NRC. The application of this code case, in concert with safety factors on leakage limits, will maintain acceptable structural and leakage integrity while minimizing plant risk and personnel exposure by minimizing the number of plant transients that could be incurred if degradation is required to be repaired based on ASME Section XI acceptance criteria only.

6. Duration of Proposed Alternative:

The proposed alternative is for use of Code Case N-513-4 for Class 2 and Class 3 components within the scope of the Code Case. A Section XI compliant repair/replacement will be completed prior to exceeding the next refueling outage or allowable flaw size, whichever comes first. This relief request will be applied for the duration of the inservice inspection interval defined in Section 2 of this relief request or such time as the NRC approves Code Case N-513-4 in Regulatory Guide 1.147 or other document. If a flaw is evaluated near the end of the interval for one of the plants in Section 2 and the next refueling outage is in the subsequent interval the flaw may remain in service under this relief request until the next refueling outage.

7. Precedent:

None

8. References:

1. NRC Generic Letter 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping (Generic Letter 90-05)"
2. ASME Boiler and Pressure Vessel Code, Code Case N-705, "Evaluation Criteria for Temporary Acceptance of Degradation in Moderate Energy Class 2 or 3 Vessels and Tanks Section XI, Division 1," October 12, 2006.
3. NRC Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 17, August 2014.