UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 6, 2016

Mr. Bryan C. Hanson
Senior Vice President
Exelon Generation Company, LLC
President and Chief Nuclear Officer
Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: BRAIDWOOD STATION, UNITS 1 AND 2; BYRON STATION, UNIT NOS. 1 AND 2; CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 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; NINE MILE POINT NUCLEAR 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; R. E. GINNA NUCLEAR POWER PLANT; AND THREE MILE ISLAND NUCLEAR STATION, UNIT 1 – PROPOSED ALTERNATIVE TO USE ASME CODE CASE N-513-4 (CAC NOS. MF7301–MF7322)

Dear Mr. Hanson:

By application dated January 28, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16029A003), as supplemented by letter dated June 14, 2016 (ADAMS Accession No. ML16167A015), Exelon Generation Company, LLC (the licensee) submitted a request in accordance with paragraph 50.55a(z)(2) of Title 10 of the *Code of Federal Regulations* (10 CFR) for a proposed alternative to the requirements of Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) for Braidwood Station, Units 1 and 2; Byron Station, Unit Nos. 1 and 2; Calvert Cliffs Nuclear Power Plant, Units 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; Nine Mile Point Nuclear 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; R. E. Ginna Nuclear Power Plant; and Three Mile Island Nuclear Station, Unit 1. The proposed alternative would allow the licensee to use 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," for the evaluation and temporary acceptance of flaws in moderate energy Class 2 and 3 piping in lieu of specified ASME Code requirements.

Specifically, pursuant to 10 CFR 50.55a(z)(2), the licensee requested to use the alternative on the basis that complying with the specified requirement would result in hardship or unusual

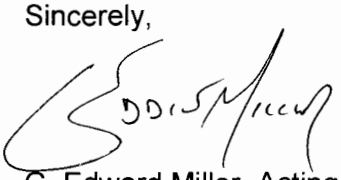
difficulty without a compensating increase in the level of quality and safety. The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2).

Therefore, the NRC staff authorizes the use of the proposed alternative described in the licensee's application, as supplemented, for the remainder of each plant's current 10-year inservice inspection (ISI) interval, as specified in the application, or until such time as the NRC approves Code Case N-513-4 for general use through revision of NRC Regulatory Guide (RG) 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," or other document. The NRC staff also authorizes the use of the proposed alternative described in the licensee's application, as supplemented, for Limerick Generating Station, Units 1 and 2, for the duration of its fourth ISI interval (i.e., February 1, 2017, through January 31, 2027), or until such time as the NRC approves Code Case N-513-4 for general use through revision of NRC RG 1.147 or other document. If the proposed alternative is applied to a flaw near the end of the authorized 10-year ISI interval, and the next refueling outage is in the subsequent interval, the licensee is authorized to continue to apply the proposed alternative to the flaw until the next refueling outage.

All other requirements of the ASME Code, Section XI, for which relief has not been specifically requested and authorized by NRC staff remain applicable, including a third party review by the Authorized Nuclear Inservice Inspector. The NRC staff notes that approval of this alternative does not imply NRC approval of ASME Code Case N-513-4 for generic use.

If you have any questions, please contact Blake Purnell at 301-415-1380 or by e-mail at Blake.Purnell@nrc.gov.

Sincerely,



G. Edward Miller, Acting Chief
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. STN 50-456, STN 50-457,
STN 50-454, STN 50-455,
50-317, 50-318, 50-461,
50-237, 50-249, 50-373,
50-374, 50-352, 50-353,
50-220, 50-410, 50-219,
50-277, 50-278, 50-254,
50-265, 50-244, and 50-289

Enclosure:
Safety Evaluation

cc w/enclosure: Distribution via Listserv

Letter to Bryan C. Hanson from G. Edward Miller, dated: September 6, 2016

SUBJECT: BRAIDWOOD STATION, UNITS 1 AND 2; BYRON STATION, UNIT NOS. 1 AND 2; CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 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; NINE MILE POINT NUCLEAR 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; R. E. GINNA NUCLEAR POWER PLANT; AND THREE MILE ISLAND NUCLEAR STATION, UNIT 1 – PROPOSED ALTERNATIVE TO USE ASME CODE CASE N-513-4 (CAC NOS. MF7301 – MF7322)

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

PROPOSED ALTERNATIVE TO USE ASME CODE CASE N-513-4

BRAIDWOOD STATION, UNITS 1 AND 2;

BYRON STATION, UNIT NOS. 1 AND 2;

CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 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;

NINE MILE POINT NUCLEAR 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;

R.E. GINNA NUCLEAR POWER PLANT; AND

THREE MILE ISLAND NUCLEAR STATION, UNIT 1

EXELON GENERATION COMPANY, LLC

DOCKET NOS. STN 50-456, STN 50-457, STN 50-454, STN 50-455, 50-317, 50-318, 50-461, 50-237, 50-249, 50-373, 50-374, 50-352, 50-353, 50-220, 50-410, 50-219, 50-277, 50-278, 50-254, 50-265, 50-244, AND 50-289

1.0 INTRODUCTION

By application dated January 28, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16029A003), as supplemented by letter dated June 14, 2016 (ADAMS Accession No. ML16167A015), Exelon Generation Company, LLC (Exelon, the

Enclosure

licensee) submitted a request in accordance with Paragraph 50.55a(z)(2) of Title 10 of the *Code of Federal Regulations* (10 CFR) for a proposed alternative to the requirements of Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) for Braidwood Station, Units 1 and 2; Byron Station, Unit Nos. 1 and 2; Calvert Cliffs Nuclear Power Plant, Units 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; Nine Mile Point Nuclear 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; R. E. Ginna Nuclear Power Plant; and Three Mile Island Nuclear Station, Unit 1. The proposed alternative would allow the licensee to use 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," for the evaluation and temporary acceptance of flaws in moderate energy Class 2 and 3 piping in lieu of specified ASME Code requirements.

Specifically, pursuant to 10 CFR 50.55a(z)(2), the licensee requested to use the alternative on the basis that complying with the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

2.0 REGULATORY EVALUATION

The U.S. Nuclear Regulatory Commission (NRC) staff considered the following regulatory requirements and guidance in its evaluation.

The regulations in 10 CFR 50.55a(g)(4) state, in part, that ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and assess provisions and the preservice examination requirements, set forth in Section XI of the ASME Code to the extent practical within the limitations of design, geometry, and materials of construction of the components. The licensee's application, as supplemented, proposes an alternative to the requirements in IWC-3120, IWC-3130, IWD-3120(b), and IWD-3400 of the ASME Code, Section XI, insofar as they relate to the evaluation, repair, and replacement of ASME Code Class 2 and 3 moderate energy piping systems with flaws.

The regulations in 10 CFR 50.55a(z) state, in part, that alternatives to the ASME Code requirements may be authorized by the NRC if the licensee demonstrates that: (1) the proposed alternative provides an acceptable level of quality and safety, or (2) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

ASME Code Case N-513-3 (i.e., Revision 3 to Code Case N-513) is approved for generic use by licensees in NRC Regulatory Guide (RG) 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 17 (ADAMS Accession No. ML13339A689), with one condition. This RG is incorporated into NRC regulations by reference in 10 CFR 50.55a. Code Case N-513 provides criteria, which allows licensees to temporarily accept flaws, including through-wall flaws, in moderate energy Class 2 or 3 piping

without performing repair or replacement activities. Code Case N-513-4 contains several revisions including expanding the applicability of the code case beyond straight pipe to include elbows, bent pipe, reducers, expanders, and branch tees. Code Case N-513-4 has not been approved by the NRC for generic use by licensees.

3.0 TECHNICAL EVALUATION

3.1 Licensee's Relief Request

3.1.1 ASME Code Components Affected

The affected components are ASME Code Class 2 and 3 moderate energy piping systems, as specified in Section 1, "Scope," of Code Case N-513-4, whose maximum operating temperature does not exceed 200 degrees Fahrenheit (°F) and whose operating pressure does not exceed 275 pounds per square inch gauge (psig).

3.1.2 Applicable Code Edition and Addenda

The licensee provided the applicable ASME Code editions and Addenda for each plant as shown in the table below. In addition, the table shows the applicable inservice inspection (ISI) 10-year interval, including the start and end dates.

PLANT	ISI INTERVAL	ASME CODE EDITION	START	END
Braidwood Station, Unit 1	3rd	2001 Edition/ 2003 Addenda	7/29/2008	7/28/2018
Braidwood Station, Unit 2	3rd	2001 Edition/ 2003 Addenda	10/17/2008	10/16/2018
Byron Station, Unit Nos. 1 and 2	4th	2007 Edition/ 2008 Addenda	7/16/2016	7/15/2025
Calvert Cliffs Nuclear Power Plant, Units 1 and 2	4th	2004 Edition	10/10/2009	6/30/2019
Clinton Power Station, Unit No. 1	3rd	2004 Edition	7/1/2010	6/30/2020
Dresden Nuclear Power Station, Units 2 and 3	5th	2007 Edition/ 2008 Addenda	1/20/2013	1/19/2023
R. E. Ginna Nuclear Power Plant	5th	2004 Edition	1/1/2010	12/31/2019
LaSalle County Station, Units 1 and 2	3rd	2001 Edition/ 2003 Addenda	10/1/2007	9/30/2017
Limerick Generating Station, Units 1 and 2	3rd	2001 Edition/ 2003 Addenda	2/1/2007	1/31/2017
	4th	2007 Edition/ 2008 Addenda	2/1/2017	1/31/2027

PLANT	ISI INTERVAL	ASME CODE EDITION	START	END
Nine Mile Point Nuclear Station, Unit 1	4th	2004 Edition	8/23/2009	8/22/2019
Nine Mile Point Nuclear Station, Unit 2	3rd	2004 Edition	4/5/2008	4/4/2018
Oyster Creek Nuclear Generating Station	5th	2007 Edition/ 2008 Addenda	1/15/2013	1/14/2023
Peach Bottom Atomic Power Station, Units 2 and 3	4th	2001 Edition/ 2003 Addenda	11/5/2008	11/4/2018
Quad Cities Nuclear Power Station, Units 1 and 2	5th	2007 Edition/ 2008 Addenda	4/2/2013	4/1/2023
Three Mile Island Nuclear Station, Unit 1	4th	2004 Edition	4/20/2011	4/19/2022

The licensee also identified the third 10-year ISI interval for Byron Station, Unit Nos. 1 and 2. However, this relief request is not applicable to this interval since it ended on July 15, 2016.

3.1.3 Applicable Code Requirement

For ASME Code Class 2 components, subarticles IWC-3120 and IWC-3130 of ASME Code, Section XI, require that flaws exceeding specified acceptance criteria be corrected by repair or replacement or determined to be acceptable by analytical evaluation. For ASME Code Class 3 components, Paragraph IWD-3120(b) of ASME Code, Section XI, requires that components exceeding the acceptance standards of IWD-3400 be subject to supplemental examination or to a repair or replacement activity.

3.1.4 Reason for Request

The licensee stated that ASME Code Case N-513-3 contains limitations regarding the evaluation of flaws in certain locations of moderate energy piping components. Many of these limitations have been addressed in Code Case N-513-4. Moderately degraded piping could require a plant shutdown within the required action statement timeframes to repair observed degradation. The licensee stated that 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.

3.1.5 Licensee's Proposed Alternative and Basis for Use

The licensees proposed alternative is to use ASME Code Case N-513-4 for the evaluation and temporary acceptance of flaws in moderate energy Class 2 and 3 piping in lieu of specified ASME Code requirements. In addition, the licensee's proposed alternative includes the determination of an allowable leakage rate by dividing the critical leakage rate by a safety factor of four.

The licensee stated that limitations in Code Case N-513-3, related to its use on piping components such as elbows, bent pipe, reducers, expanders, and branch tees and external tubing or piping attached to heat exchangers, have been addressed in Code Case N-513-4. The application states that the major differences between the NRC-approved Code Case N-513-3 and Code Case N-513-4 are as follows:

1. Revised the maximum allowable time of use from no longer than 26 months to the next refueling outage.

2. Added applicability to piping elbows, bent pipe, reducers, expanders, and branch tees where the flaw is located more than $(R_o t)^{1/2}$ [where R_o is the outside pipe radius and t is the evaluation wall thickness] 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.

Attachment 4 to the application contained "Technical Basis for Proposed Fourth Revision to ASME Code Case N-513," from the *Proceedings of the ASME 2014 Pressure Vessels & Piping Conference*, July 20–24, 2014, Anaheim, California.

The licensee contends that the proposed allowable leakage rate 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.

The licensee's June 14, 2016, letter further stated:

> Code Case N-513-4 utilizes technical evaluation approaches that are based on principles 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.

3.1.6 Hardship Justification

The application states:

> 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.

3.1.7 Duration of Proposed Alternative

The licensee requested use of the proposed alternative for the remainder of the current ISI intervals for each unit, as stated in Section 3.1.2 above, or until such time as the NRC approves Code Case N-513-4 in RG 1.147 or other document. For Limerick Generating Station, Units 1 and 2, the current third 10-year ISI interval ends on January 31, 2017; thus, the licensee also requested the proposed alternative for the duration of the fourth 10-year ISI interval for these units. The licensee stated that when using its proposed alternative, a Section XI compliant repair or replacement will be completed prior to exceeding the next refueling outage or allowable flaw size, whichever comes first. The licensee stated that if a flaw is evaluated near the end of an ISI interval, and the next refueling outage is in the subsequent interval, the flaw may remain in service until the next refueling outage.

3.2 NRC Staff's Evaluation

The NRC staff evaluated the adequacy of the proposed alternative in maintaining the structural integrity of piping components identified in Code Case N-513-4. Code Case N-513-3, which is conditionally approved for use in RG 1.147, provides alternative evaluation criteria for temporary acceptance of flaws, including through-wall flaws, in moderate energy Class 2 and 3 piping. However, Code Case N-513-3 contains limitations that the licensee considers overly restrictive and could result in an unnecessary plant shutdown. Code Case N-513-3 is limited to straight pipe with provisions for flaws that extend for a short distance, at the pipe to fitting weld, into the fitting. Evaluation criteria for flaws in elbows, bent pipe, reducers, expanders, branch tees and heat exchangers are not included within the scope of Code Case N-513-3. Code Case N-513-4 addresses these additional situations. Given that Code Case N-513-3 is conditionally approved for use in RG 1.147, Revision 17, which is incorporated by reference into 10 CFR 50.55a, the staff focused its review on the differences between Code Case N-513-3 and N-513-4.

The NRC staff's review of the proposed alternative included the following significant changes in Code Case N-513-4: (1) revised temporary acceptance period; (2) added flaw evaluation criteria for elbows, bent pipe, reducers/expanders and branch tees; (3) expanded applicability to heat exchanger tubing or piping; (4) limited use to liquid systems; (5) clarified treatment of service load combinations; (6) revised treatment of flaws in austenitic pipe flux welds; (7) revised minimum wall thickness acceptance criteria to consider longitudinal stress in addition to hoop stress; and (8) revised leakage monitoring requirements. The staff also evaluated the licensee's proposed limitation on the leakage rate and its hardship justification.

3.2.1 Temporary Acceptance Period

Code Case N-513-3 specifies a temporary acceptance period of a maximum of 26 months. Code Case N-513-3 is accepted for use in RG 1.147, Revision 17, with the condition that: "The repair or replacement activity temporarily deferred under the provisions of this Code Case shall be performed during the next scheduled outage." Code Case N-513-4 includes wording that limits the use of the code case to the next refueling outage. The NRC staff finds that this limitation in Code Case N-513-4 is acceptable since it is consistent with the NRC condition on Code Case N-513-3.

3.2.2 Flaw Evaluation Criteria for Elbows, Bent Pipe, Reducers/Expanders and Branch Tees

Evaluation and acceptance criteria have been added to Code Case N-513-4 for flaws in elbows, bent pipe, reducers, expanders and branch tees using a simplified approach based on the Second International Piping Integrity Research Group (IPIRG-2) program reported in NUREG/CR-6444, "Fracture Behavior of Circumferentially Surface-Cracked Elbows," published December 1996.

The flaw evaluation methodology approach in Code Case N-513-4 for piping components is conducted as if in straight pipe by scaling hoop and axial stresses using ASME piping design code stress indices and stress intensification factors to account for the stress variations caused by the geometric differences. As stated in Attachment 4 to the application, equations used in the code case are consistent with the piping design by rule approach in ASME Code, Section III, NC/ND-3600. Attachment 4 states that NUREG/CR-6444 shows this approach is conservative for calculating stresses used in flaw evaluations in piping elbows and bent pipe. The code case also applies this methodology to reducers, expanders and branch tees.

The NRC staff finds that the flaw evaluation and acceptance criteria in Code Case N-513-4 for elbows, bent pipe, reducers, expanders and branch tees is acceptable because the flaw evaluation methods in the code case are consistent with ASME Code, Section XI, and the ASME Code, Section III, design by rule approach. In addition, the staff compared the failure moments predicted using the code case approach to calculating stresses to the measured failure moments from the elbow tests for through-wall circumferential flaws in the IPIRG-2 program. This comparison demonstrated that the code case approach is conservative.

3.2.3 Flaw Evaluation in Heat Exchanger Tubing or Piping

Code Case N-513-4 has been revised to include heat exchanger external tubing or piping provided that the flaw is characterized in accordance with Section 2(a) of the code case and leakage is monitored. Section 2(a) requires that the flaw geometry be characterized by volumetric inspection or physical measurement. The NRC staff considers the heat exchanger external tubing or piping to be equivalent to straight or bent piping. Thus, the staff determined that the flaw evaluation criteria in Code Case N-513-4 for straight or bent piping, as appropriate, can be applied to heat exchanger external tubing or piping. The staff determined the methods for evaluating flaws in straight pipe are acceptable since they are currently allowed in Code Case N-513-3. For bent pipe, the acceptability is described in Section 3.2.2 above. Therefore, the NRC staff finds inclusion of heat exchanger external tubing or piping in the code case to be acceptable because only heat exchanger tubing flaws that are accessible for characterization and leakage monitoring may be evaluated in accordance with the code case and the code case provides acceptable methods for the evaluation flaws.

3.2.4 Limit Use to Liquid Systems

Use of Code Case N-513-4 is specifically limited to liquid systems. The NRC staff finds this change acceptable since Code Case N-513 is not intended to apply to air or other compressible fluid systems.

3.2.5 Treatment of Service Load Combinations

Code Case N-513-4 was revised to clarify that all service load combinations must be considered in flaw evaluations to determine the most limiting condition. The NRC staff finds this change acceptable since it was previously implied, but not explicitly stated, in Code Case N-513-3

3.2.6 Treatment of Flaws in Austenitic Pipe Flux Welds

Paragraph 3.1(b) of Code Case N-513-4 was revised to include a reference to ASME Code Section XI, Appendix C, C-6320, to address flaws in austenitic stainless steel pipe flux welds. Flaws in stainless steel pipe flux welds require the use of elastic plastic fracture mechanics criteria in lieu of limit load criteria. Equation 1 of the code case was also revised to be consistent with ASME Code Section XI, Appendix C, C-6320, so the equation can be used for flaws in austenitic stainless steel pipe flux welds. The NRC staff finds this acceptable because the modification to the code case now includes appropriate methods for the evaluation of austenitic stainless steel pipe flux welds in accordance with ASME Code, Section XI.

3.2.7 Minimum Wall thickness Acceptance Criteria to Consider Longitudinal Stress

Although it is unlikely that a longitudinal stress based minimum wall thickness would be limiting when compared to a hoop stress based minimum wall thickness, Code Case N-513-4 includes revisions that require consideration of longitudinal stress in the calculation of minimum wall thickness. Previous versions of the code case only required the use of hoop stress. The NRC

staff finds this acceptable because it will ensure that the more limiting of the longitudinal or hoop stress is used.

3.2.8 Leakage Monitoring for Through-Wall Flaws

Code Case N-513-3 requires through-wall leakage to be "observed by daily walkdowns" to confirm the analysis conditions used in the evaluation remain valid. Code Case N-513-4 modifies this requirement to require that leakage be "monitored daily," which will allow other techniques (e.g., leakage detection systems) besides visual observation by walkdown to be used. The NRC staff finds this change acceptable because the code case continues to require through-wall leaks to be monitored daily and other monitoring methods should have no adverse impact.

3.2.9 Leakage Rate

Paragraph 1(d) of Code Case N-513-3 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 demonstrate system operability considering effects of leakage.

Code Case N-513-4 modified the last sentence, now located in paragraph 1(f), to state: "It is the responsibility of the Owner to consider effects of leakage in demonstrating system operability and performing plant flooding analyses."

The NRC staff notes that the original proposed alternative did not specify a maximum leakage rate. Through operating experience and information provided in other relief requests, the staff has identified cases where leak rates increased significantly before the next refueling outage. In an email dated May 20, 2016 (ADAMS Accession No. ML16144A006), the staff requested 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.

In its June 14, 2016, letter, the licensee revised its proposed alternative to include a limitation on leakage in response to the NRC staff's request for additional information. This letter states:

> 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 licensee contends that applying a safety factor of four to the critical leakage rate 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.

Code Cases N-513-3 and N-513-4 do not contain leakage limits for components with through-wall flaws. The NRC staff finds that the licensee's approach of applying a safety factor of four to the critical leakage rate is acceptable because it will provide sufficient time for corrective measures to be taken before significant increases in leakage erode defense-in-depth or lead to adverse consequences.

3.2.10 Hardship Justification

The NRC staff finds that performing a plant shutdown to repair the subject piping would cycle the unit and increase the potential of an unnecessary transient, resulting in undue hardship. Additionally, performing certain ASME Code repairs during normal operation may challenge a Technical Specification Completion Time and place the plant at higher safety risk than warranted. Therefore, the staff determined that compliance with the specified ASME Code repair requirements would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety.

3.3 Summary

The NRC staff finds that the proposed alternative will provide reasonable assurance of the structural integrity because: (1) Code Case N-513-4 addresses the NRC condition in RG 1.147 for Revision 3 of the code case; (2) flaw evaluations in component types added to Revision 4 of the code case are based on acceptable methodologies; and (3) the method for determining the allowable leakage rate is adequate to provide early identification of a significant increase in leakage. In addition, complying with the specified ASME Code, Section XI, requirements would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety

4.0 CONCLUSION

As set forth above, the NRC staff determined that the proposed alternative provides reasonable assurance of structural integrity of the subject components and that complying with IWC-3120, IWC-3130, IWD-3120(b), and IWD-3400 of the ASME Code, Section XI, would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2).

Therefore, the NRC staff authorizes the use of the proposed alternative described in the licensee's application, as supplemented, for the remainder of each plant's current 10-year ISI interval, as specified in the application (Section 3.1.2 of this safety evaluation), or until such time as the NRC approves Code Case N-513-4 for general use through revision of NRC RG 1.147 or other document. The staff also authorizes the use of the proposed alternative described in the

licensee's application, as supplemented, for Limerick Generating Station, Units 1 and 2, for the duration of its fourth ISI interval (i.e., February 1, 2017, through January 31, 2027), or until such time as the NRC approves Code Case N-513-4 for general use through revision of NRC RG 1.147 or other document. If the proposed alternative is applied to a flaw near the end of the authorized 10-year ISI interval, and the next refueling outage is in the subsequent interval, the licensee is authorized to continue to apply the proposed alternative to the flaw until the next refueling outage.

All other requirements of the ASME Code, Section XI, for which relief has not been specifically requested and authorized by NRC staff remain applicable, including a third party review by the Authorized Nuclear Inservice Inspector. The NRC staff notes that approval of this alternative does not imply NRC approval of ASME Code Case N-513-4 for generic use.

Principal Contributor: Robert Davis

Date: September 6, 2016

difficulty without a compensating increase in the level of quality and safety. The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2).

Therefore, the NRC staff authorizes the use of the proposed alternative described in the licensee's application, as supplemented, for the remainder of each plant's current 10-year inservice inspection (ISI) interval, as specified in the application, or until such time as the NRC approves Code Case N-513-4 for general use through revision of NRC Regulatory Guide (RG) 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," or other document. The NRC staff also authorizes the use of the proposed alternative described in the licensee's application, as supplemented, for Limerick Generating Station, Units 1 and 2, for the duration of its fourth ISI interval (i.e., February 1, 2017, through January 31, 2027), or until such time as the NRC approves Code Case N-513-4 for general use through revision of NRC RG 1.147 or other document. If the proposed alternative is applied to a flaw near the end of the authorized 10-year ISI interval, and the next refueling outage is in the subsequent interval, the licensee is authorized to continue to apply the proposed alternative to the flaw until the next refueling outage.

All other requirements of the ASME Code, Section XI, for which relief has not been specifically requested and authorized by NRC staff remain applicable, including a third party review by the Authorized Nuclear Inservice Inspector. The NRC staff notes that approval of this alternative does not imply NRC approval of ASME Code Case N-513-4 for generic use.

If you have any questions, please contact Blake Purnell at 301-415-1380 or by e-mail at Blake.Purnell@nrc.gov.

Sincerely,

/RA/
G. Edward Miller, Acting Chief
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. STN 50-456, STN 50-457,
STN 50-454, STN 50-455,
50-317, 50-318, 50-461,
50-237, 50-249, 50-373,
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50-265, 50-244, and 50-289

Enclosure:
Safety Evaluation

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