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

February 6, 2017

Mr. Bryan C. Hanson
President and Chief Nuclear Officer
Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: SAFETY EVALUATION OF RELIEF REQUESTS I4R-05, I4R-06, I4R-07, I4R-08, I4R-09, I4R-11, I4R-12, AND I4R-13, FOR THE FOURTH 10-YEAR INTERVAL OF THE INSERVICE INSPECTION PROGRAM FOR LIMERICK GENERATING STATION, UNITS 1 AND 2 (CAC NOS. MF7589 AND MF7590)

Dear Mr. Hanson:

By letter dated April 13, 2016, as supplemented by letters dated May 11, 2016; July 12, 2016; and September 19, 2016, Exelon Generation Company, LLC submitted Relief Requests I4R-01, I4R-02, I4R-05, I4R-06, I4R-07, I4R-08, I4R-09, I4R-10, I4R-11, I4R-12, and I4R-13, which proposed alternatives to certain requirements specified in the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) for the Limerick Generating Station (LGS), Units 1 and 2. The subject relief requests are for the fourth 10-year interval of the inservice inspection (ISI) program at LGS.

The purpose of this letter is to provide the results of the U.S. Nuclear Regulatory Commission (NRC) staff's review of Relief Requests I4R-05, I4R-06, I4R-07, I4R-08, I4R-09, I4R-11, I4R-12, and I4R-13, as documented in the enclosed safety evaluation (SE). Our SE concludes the following:

(1) With respect to Relief Requests I4R-05, I4R-06, I4R-07, I4R-08, I4R-09, and I4R-13, the proposed alternatives provide an acceptable level of quality and safety. Therefore, pursuant to Section 50.55a(z)(1) of Title 10 of the *Code of Federal Regulations* (10 CFR), the proposed alternatives are authorized for the fourth 10-year ISI interval at LGS, Units 1 and 2.

(2) With respect to Relief Requests I4R-11 and I4R-12, the proposed alternatives provide reasonable assurance of the structural integrity and leak tightness of the subject components. Furthermore, complying with the ASME Code requirements would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(z)(2), the proposed alternatives are authorized for the fourth 10-year ISI interval at LGS, Units 1 and 2.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

In a letter dated November 21, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16301A401), the NRC staff authorized Relief Requests I4R-02 and I4R-10. In a letter dated December 29, 2016 (ADAMS Accession No. ML16344A324), the NRC staff authorized Relief Request I4R-01.

If you have any questions concerning this matter, please contact the LGS Project Manager, Dr. V. Sreenivas, at (301) 415-2597, or V.Sreenivas@nrc.gov.

Sincerely,

Stephen S. Koenick, Acting Chief
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-352 and 50-353

Enclosure:
Safety Evaluation

cc w/enclosure: Distribution via Listserv

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUESTS I4R-05, I4R-06, I4R-07, I4R-08, I4R-09, I4R-11, I4R-12, AND I4R-13

FOR THE FOURTH 10-YEAR INTERVAL OF THE INSERVICE INSPECTION PROGRAM

EXELON GENERATION COMPANY, LLC

LIMERICK GENERATING STATION, UNITS 1 AND 2

DOCKET NOS. 50-352 AND 50-353

1.0 INTRODUCTION

By letter dated April 13, 2016, as supplemented by letters dated May 11, 2016; July 12, 2016; and September 19, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML16104A122, ML16132A441, ML16194A230, and ML16263A218, respectively), Exelon Generation Company, LLC (Exelon, the licensee) submitted Relief Requests I4R-01, I4R-02, I4R-05, I4R-06, I4R-07, I4R-08, I4R-09, I4R-10, I4R-11, I4R-12, and I4R-13, which proposed alternatives to certain requirements specified in the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) for the Limerick Generating Station (LGS), Units 1 and 2. The subject relief requests are for the fourth 10-year interval of the inservice inspection (ISI) program at LGS. The fourth 10-year ISI interval for LGS, Units 1 and 2, starts on February 1, 2017, and ends on January 31, 2027.

The purpose of this safety evaluation (SE) is to provide the results of the U.S. Nuclear Regulatory Commission's (NRC or the Commission) review of Relief Requests I4R-05, I4R-06, I4R-07, I4R-08, I4R-09, I4R-11, I4R-12, and I4R-13. In an SE dated November 21, 2016 (ADAMS Accession No. ML16301A401), the NRC staff documented its review of Relief Requests I4R-02 and I4R-10. The NRC staff's review for Relief Request I4R-01 was documented in an SE dated December 29, 2016 (ADAMS Accession No. ML16344A324).

2.0 REGULATORY EVALUATION

The ISI of ASME Code Class 1, 2, and 3 components is performed in accordance with the latest edition and addenda of ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," as required by Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g), except where specific relief has been granted by the NRC pursuant to 10 CFR 50.55a(g)(6)(i). Pursuant to 10 CFR 50.55a(z), alternatives to the requirements of paragraph (g) may be used when authorized by the NRC if (1) the proposed alternatives would provide 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.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and access 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 regulation requires that inservice examination of components and system pressure tests conducted during the first 10-year interval, and subsequent intervals, complies with the requirements of the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(a), 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed in 10 CFR 50.55a(b). The applicable code of record for the fourth 10-year ISI interval for LGS, Units 1 and 2, is ASME Code, Section XI, 2007 Edition through 2008 Addenda.

3.0 TECHNICAL EVALUATION

3.1 Relief Request I4R-05

3.1.1 Components for Which Relief is Requested

In its submittal dated April 13, 2016, the licensee proposed alternative requirements for pressure testing the drywell pressure instrumentation. The proposed alternative applies to drywell pressure instrumentation from penetrations X-22, X-30B, X-40E, and X-50A. The components affected are ASME Code Class 2 and 3, Examination Categories C-H and D-B, Item Nos. C7.10 and D2.10.

3.1.2 ASME Code Requirements

Paragraph IWC-2500 states that components shall be examined as specified in Table IWC-2500-1. Table IWC-2500-1, Examination Category C-H, Item No. C7.10, requires performance of a VT-2 visual examination during a system leakage test each inspection period. Additionally, paragraph IWD-2500 states that components shall be examined and pressure tested as specified in Table IWD-2500-1. Table IWD-2500-1, Examination Category D-B, Item No. D2.10, also requires the performance of a VT-2 visual examination during the system leakage test for each inspection period.

3.1.3 Licensee's Proposed Alternative

Pursuant to 10 CFR 50.55a(z)(1), the licensee has proposed an alternative on the basis that the alternative will provide an acceptable level of quality and safety.

The licensee stated that the normal drywell pressure is less than 1 pound per square inch gauge (psig) during normal operation and that the pressurizing medium used in the drywell and drywell instrumentation is nitrogen gas. The licensee further stated that performing a visual examination for nitrogen leakage with less than 1 psig pressure would yield inconclusive results.

The licensee stated that the LGS, Units 1 and 2, Technical Specifications (TSs) require channel checks every 12 hours to verify operability of the drywell pressure instrumentation by verifying proper pressure readings. Tubing leakage would cause an improper reading and would be corrected and retested. Exelon stated that these drywell pressure instrumentation components

and tubing are also included in the integrated leak rate test (ILRT) boundary and that the ILRT subjects the tubing to a pressure of 44 psig.

The licensee stated that the proposed alternative to perform channel checks to verify drywell pressure instrumentation operability every 12 hours in accordance with the LGS TSs and the use of the ILRT provides adequate assurance of structural integrity of the drywell pressure instrumentation tubing and components and provides an acceptable level of quality and safety. The license further stated that the drywell pressure instrumentation operability check will be performed per the LGS TSs, while the ILRTs will be performed in accordance with 10 CFR Part 50, Appendix J, Option B, independent of the ASME Code, Section XI, ISI program.

3.1.4 NRC Staff Evaluation of Relief Request I4R-05

The examination requirements for Examination Categories C-H and D-B require a visual examination (VT-2) of the pressure retaining boundary during a system leakage test in accordance with paragraphs IWC-5221 and IWD-5221, respectively. Both paragraphs state that the system leakage test shall be conducted at the system pressure obtained while the system, or portion of the system, is in service performing its normal operating function or at the system pressure developed during a test conducted to verify system operability (e.g., to demonstrate system safety function or satisfy TS surveillance requirements). The licensee's primary basis for use of the proposed alternative relied on the consideration that a leakage test performed at the normal operating pressure of the drywell and drywell instrumentation (i.e., less than 1 psig) would be inconclusive. Therefore, the NRC staff finds that performing channel checks of the pressure indicators to verify drywell pressure instrumentation operability every 12 hours provides sufficient opportunities to check for leakage.

The licensee's second basis for use of the proposed alternative relied on the consideration that during the ILRT, the instrument tubing for the drywell is subjected to a test pressure of 44 psig. The NRC staff noted that while ILRT will be performed on a less frequent basis than the required VT-2 examinations, it provides additional assurance of structural integrity during plant operations because of the higher test pressure.

Based on the above, the NRC staff finds that the licensee's proposed alternative described in Relief Request I4R-05 provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(z)(1), the proposed alternative is authorized for the fourth 10-year ISI interval at LGS, Units 1 and 2.

3.2 Relief Request I4R-06

3.2.1 Components for Which Relief is Requested

In its submittal dated April 13, 2016, the licensee proposed alternative requirements for pressure testing the suppression pool pressure and level instrumentation. The proposed alternative applies to containment atmosphere control tubing to suppression pool pressure and level instrumentation outboard of valve SV-57-101 for LGS, Unit 1, and valve SV-57-201 for LGS, Unit 2. The components affected are ASME Code Class 3, Examination Category D-B, Item No. D2.10.

3.2.2 ASME Code Requirements

ASME Code, Section XI, paragraph IWD-2500, states that components shall be examined and pressure tested as specified in Table IWD-2500-1. Table IWD-2500-1, Examination Category D-B, Item No. D2.10, requires the performance of VT-2 visual examination during the system leakage test for each inspection period.

3.2.3 Licensee's Proposed Alternative

Pursuant to 10 CFR 50.55a(z)(1), the licensee has proposed an alternative on the basis that the alternative will provide an acceptable level of quality and safety.

The licensee stated that during normal operation, the suppression pool pressure is less than 1 psig. The licensee also stated that the pressurizing medium used in the suppression pool and level instrumentation is nitrogen gas. The licensee further stated that performing a visual examination for nitrogen leakage in a system with less than 1 psig pressure would yield inconclusive results.

Exelon stated that LGS, Units 1 and 2, TSs require monitoring suppression pool pressure every 12 hours to verify proper pressure. The licensee also stated that TSs require channel checks every 24 hours to verify operability of the suppression pool level indicators. Tubing leakage would cause an improper reading and would be corrected and retested. Exelon further stated that the tubing and components are included in the ILRT boundary. The licensee stated that the instrument tubing is subjected to a pressure of 44 psig by the ILRT.

Exelon stated that the proposed alternative to use suppression pool instrumentation operability checks, in accordance with the TSs and use of the ILRT, provides adequate assurance of structural integrity of the instrumentation tubing and components and provides an acceptable level of quality and safety. The license further stated that the suppression pool instrumentation operability check will be performed per the LGS TSs, while the ILRTs will be performed in accordance with 10 CFR Part 50, Appendix J, Option B, independent of the ASME Code, Section XI, ISI program.

3.2.4 NRC Staff Evaluation of Relief Request I4R-06

The examination requirements for Examination Category D-B require a visual examination (VT-2) of the pressure retaining boundary during a system leakage test in accordance with paragraph IWD-5221. Paragraph IWD-5221 states that the system leakage test shall be conducted at the system pressure obtained while the system, or portion of the system, is in service performing its normal operating function or at the system pressure developed during a test conducted to verify system operability (e.g., to demonstrate system safety function or satisfy TS surveillance requirements). The licensee's primary basis for use of the proposed alternative relied on the consideration that a leakage test performed at the normal operating pressure of the suppression pool instrumentation (i.e., less than 1 psig) would be inconclusive. The NRC staff finds that performing suppression pool instrumentation operability checks, in accordance with the TSs, provides sufficient opportunities to check for leakage.

The licensee's second basis for use of the proposed alternative relied on the consideration that during the ILRT, the instrument tubing for the suppression pool is subjected to a test pressure of 44 psig. The NRC staff noted that while ILRT will be performed on a less frequent basis than the required VT-2 examinations, it provides additional assurance of structural integrity during plant operations because of the higher test pressure during ILRT.

Based on the above, the NRC staff finds that the licensee's proposed alternative, as described in Relief Request I4R-06, provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(z)(1), the proposed alternative is authorized for the fourth 10-year ISI interval at LGS, Units 1 and 2.

3.3 Relief Request I4R-07

3.3.1 Components for Which Relief is Requested

In its submittal dated April 13, 2016, the licensee requests NRC authorization to use an alternate inspection program for the hydrogen recombiner and combustion gas analyzer piping and sampling lines in lieu of ASME Code-required VT-2 examinations during the system leakage test for the noted components. Specifically, for LGS, Unit 1, Relief Request I4R-7 is for the following components:

- Post-loss-of-coolant accident (LOCA) recombiner piping HBB-128 and HBB-127 between and including "A" recombiner and valves HV-57-161 and HV-57-162.

- Post-LOCA recombiner piping HBB-126 and HBB-124 between and including "B" recombiner and valves HV-57-163 and HV-57-164.

- Hydrogen/oxygen sampling lines HCB-116 and HCB-117 between connections on the combustible gas analyzer package 10-S205, and valves SV-57-159, SV-57-141, SV-57-142 and SV-57-147B, SV-57-143, SV-57-144 and SV-57-146B, and SV-57-145 (HCB-117).

- Hydrogen/oxygen sampling lines HCB-116 and HCB-117 between connections on the combustible gas analyzer package 10-S206, and valves SV-57-184 and SV-57-146A, SV-57-186 and SV-57-147A, SV-57-195, SV-57-190 and SV-57-1090, and SV-57-185 (HCB-117).

For LGS, Unit 2, Relief Request I4R-7 is for the following hydrogen recombiner and cmbustion gas analyzer piping and components:

- Post-LOCA recombiner piping HBB-228 and HBB-227 between and including "A" recombiner and valves HV-57-261 and HV-57-262.

- Post-LOCA recombiner piping HBB-226 and HBB-224 between and including "B" recombiner and valves HV-57-263 and HV-57-264.

- Hydrogen/oxygen sampling lines HCB-216 and HCB-217 between connections on the combustible gas analyzer package 20-S205, and valves SV-57-259, SV-57-241, SV-57-242 and SV-57-247B, SV-57-243, SV-57-244 and SV-57-246B, and SV-57-245 (HCB-217).

- Hydrogen/oxygen sampling lines HCB-216 and HCB-217 between connections on the combustible gas analyzer package 20-S206, and valves SV-57-284 and SV-57-246A, SV-57-286 and SV-57-247A, SV-57-295, SV-57-290 and 57-2090, and SV-57-285 (HCB-217).

The components affected are ASME Code Class 2, Examination Category C-H, Item No. C7.10.

3.3.2 ASME Code Requirements

ASME Code, Section XI, paragraph IWC-2500, states that components shall be examined and pressure tested as specified in Table IWC-2500-1. Table IWC-2500-1, Examination Category C-H, Item No. C7.10. requires the performance of VT-2 visual examination during the system leakage test for each inspection period.

3.3.3 Licensee's Proposed Alternative

Pursuant to 10 CFR 50.55a(z)(1), the licensee has proposed an alternative on the basis that the alternative will provide an acceptable level of quality and safety.

The licensee stated that during normal operation, these piping components are either isolated or exposed to the containment pressure of less than 1 psig. The licensee also stated that the pressurizing medium used in the containment is essentially nitrogen gas. Exelon further stated that performing a visual examination for nitrogen leakage in a system with less than 1 psig pressure would yield inconclusive results.

The licensee stated that for LGS, Units 1 and 2, it performs system contaminated pipe inspections (CPIs) on post-LOCA recombiner piping during each refueling outage. Exelon also stated that during CPIs, the recombiner piping is pressurized to 44 psig. Exelon further stated that the CPI is associated with its leak reduction program, as outlined in LGS, Units 1 and 2, Updated Final Safety Analysis Report (UFSAR), Section 6.2.8. The licensee stated that the hydrogen/oxygen sampling lines for the combustible gas analyzer are constantly being used for sampling the containment; therefore, a tubing leak will cause improper readings that would be corrected and retested.

The licensee stated that the proposed alternative to use the CPIs will provide an acceptable level of quality and safety for the post-LOCA hydrogen recombiner and combustion gas analyzer piping and sampling lines.

3.3.4 NRC Staff Evaluation of Relief Request I4R-07

The examination requirements for Examination Category C-H, Item No. C7.10, require a visual examination (VT-2) of the pressure retaining boundary during a system leakage test in accordance with paragraph IWC-5221. Paragraph IWC-5221 states that the system leakage test shall be conducted at the system pressure obtained while the system, or portion of the system, is in service performing its normal operating function or at the system pressure developed during a test conducted to verify system operability (e.g., to demonstrate system safety function or satisfy TS surveillance requirements). The licensee's primary basis for use of the proposed alternative relied on the consideration that a leakage test performed at the normal

operating pressure of less than 1 psig would be inconclusive. Exelon's proposed alternative to use CPIs would be performed at the same frequency as the required examinations; however, these examinations will simulate the expected operating conditions during an accident (i.e., 44 psig). Furthermore, as described in LGS UFSAR, Section 6.2.8.3, the acceptance criteria for this test is zero leakage or leakage will be quantified. Since the CPIs will be performed on the same frequency as the required VT-2 examinations, the NRC staff finds that the proposed alternative will provides adequate assurance of structural integrity during plant operations because of the higher test pressure used during CPIs.

Based on the above, the NRC staff finds that the licensee's proposed alternative, as described in Relief Request I4R-07, provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(z)(1), the proposed alternative is authorized for the fourth 10-year ISI interval at LGS, Units 1 and 2.

3.4 Relief Request I4R-08

3.4.1 Components for Which Relief is Requested

In its submittal dated April 13, 2016, the licensee requests NRC authorization to use an alternate inspection program for the containment atmospheric control penetration piping in lieu of ASME Code-required VT-2 examinations during the system leakage test for the noted components.

For LGS, Unit 1, Relief Request I4R-08 pertains to the following components:

- Hydrogen/oxygen sample lines HCB-116, between and including containment penetrations X-28A and X-28B and valves SV-57-142, SV-57-143, SV-57-144, and SV-57-195.

- Drywell low flow nitrogen makeup line HCB-116, between and including containment penetration X-62 and valves HV-57-116 and SV-57-159.

- Hydrogen/oxygen sample line HCB-116, between and including containment penetration X-221A and valves SV-57-141 and SV-57-184.

- Nitrogen purge line HBB-125, between and including valves HV-57-109, HV-57-121, and HV-57-131.

- Drywell air purge line HBB-124, between and including valves HV-57-123 and HV-57-135.

- Suppression pool air purge line HBB-126, between and including valves HV-57-124 and HV-57-147.

- Drywell purge to standby gas treatment line HBB-127, between and including valves HV-57-114 and HV-57-115, and line HCB-117, between and including connection to line HBB-127 and valve SV-57-145.

- Suppression pool low flow nitrogen makeup line HCB-116, between and including containment penetration X-220A, valve SV-57-190, and connection to drywell low flow nitrogen makeup line HCB-116.

- Hydrogen/oxygen sample line HCB-116, between and including containment penetration X-221B and valves SV-57-186 and HV-55-126.

- Drywell purge exhaust bypass line HBB-127, between and including valves 57-1807 and HV-57-117.

- Suppression pool purge exhaust bypass line HBB-128, between and including valves 57-1810 and HV-57-118.

- Suppression pool purge air exhaust lines HBB-128 and HCB-117, between and including valves HV-57-104, HV-57-112, and SV-57-185.

For LGS, Unit 2, Relief Request I4R-08 pertains to the following components:

- Hydrogen/oxygen sample lines HCB-216, between and including containment penetrations X-28A and X-28B and valves SV-57-242, SV-57-243, SV-57-244, and SV-57-295.

- Drywell low flow nitrogen makeup line HCB-216, between and including containment penetration X-62 and valves HV-57-216 and SV-57-259.

- Hydrogen/oxygen sample line HCB-216, between and including containment penetration X-221A and valves SV-57-141 and SV-57-284.

- Nitrogen purge line HBB-225, between and including valves HV-57-209, HV-57-221, and HV-57-231.

- Drywell air purge line HBB-224, between and including valves HV-57-223 and HV-57-235.

- Suppression pool air purge line HBB-226, between and including valves HV-57-224 and HV-57-247.

- Drywell purge to standby gas treatment line HBB-227, between and including valves HV-57-214 and HV-57-215, and line HCB-217, between and including connection to line HBB-227 and valve SV-57-245.

- Suppression pool low flow nitrogen makeup line HCB-216, between and including containment penetration X-220A, valve SV-57-290, and connection to drywell low flow nitrogen makeup line HCB-216.

- Hydrogen/oxygen sample line HCB-216, between and including containment penetration X-221B and valve SV-57-286.

- Drywell purge exhaust bypass line HBB-227, between and including valves 57-2815 and HV-57-217.
- Suppression pool purge exhaust bypass line HBB-228, between and including valves 57-2818 and HV-57-218.

- Suppression pool purge air exhaust lines HBB-228 and HCB-117, between and including valves HV-57-204, HV-57-212, and SV-57-285.

The components affected are ASME Code Class 2, Examination Category C-H, Item No. C7.10.

3.4.2 ASME Code Requirements

ASME Code, Section XI, paragraph IWC-2500, states that components shall be examined and pressure tested as specified in Table IWC-2500-1. Table IWV-2500-1, Examination Category C-H, Item No. C7.10, requires the performance of VT-2 visual examination during the system leakage test for each inspection period.

3.4.3 Licensee's Proposed Alternative

Pursuant to 10 CFR 50.55a(z)(1), the licensee has proposed an alternative on the basis that the alternative will provide an acceptable level of quality and safety.

The licensee stated that during normal plant operation, this piping is either isolated or is maintained at less than 1 psig. The licensee also stated that the pressurizing fluid is essentially nitrogen gas. The licensee further stated that performing a visual examination for nitrogen leakage in a system with less than 1 psig pressure would yield inconclusive results.

Exelon stated that local leak rate testing (LLRT) is currently performed once per refueling outage at LGS, Units 1 and 2, per 10 CFR Part 50, Appendix J, Option B. The licensee stated that as a result of the LLRT, the reference piping is pressurized to 44 psig, a substantially higher pressure than is achieved during periodic system functional tests. The licensee further stated that the proposed alternative provides a means for quantifying the leakage, as well as the ability to detect through-valve leakage, which is not feasible to do by VT-2 visual examinations. The licensee stated that the proposed alternative will provide an acceptable level of quality and safety.

3.4.4 NRC Staff Evaluation of Relief Request I4R-08

The examination requirements for Examination Category C-H require a visual examination (VT-2) of the pressure retaining boundary during a system leakage test in accordance with paragraph IWC-5221. Paragraph IWC-5221 states that the system leakage test shall be conducted at the system pressure obtained while the system, or portion of the system, is in service performing its normal operating function or at the system pressure developed during a test conducted to verify system operability (e.g., to demonstrate system safety function or satisfy TS surveillance requirements).

The licensee's primary basis for use of the proposed alternative relied on the consideration that a leakage test performed at the normal operating pressure for these components (i.e., essentially 1 psig), would be inconclusive. Additionally, the licensee stated that during the LLTR, the referenced components are subjected to a test pressure of 44 psig, a substantially higher pressure. The NRC staff finds that performing the LLTRs every refueling outage provides adequate opportunity to check for leakage.

Based on the above, the NRC staff finds that the licensee's proposed alternative, as described in Relief Request I4R-08, provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(z)(1), the proposed alternative is authorized for the fourth 10-year ISI interval at LGS, Units 1 and 2.

3.5 Relief Request I4R-09

3.5.1 Components for Which Relief is Requested

In its submittal dated April 13, 2016, the licensee requests NRC authorization to use an alternate inspection program for the primary containment instrument gas (PCIG) pressure retaining components in lieu of ASME Code-required VT-2 examinations during system leakage testing.

For LGS, Unit 1, Relief Request I4R-09 pertains to the following components:

- Instrument gas lines HCC-135, between and including valves HV-059-151A, SV-059-150A, 059-1138, 059-1120A-1, 059-1120A-2, and 059-1120A-3.

- Instrument gas lines HCC-135, between and including valves HV-059-151B, SV-059-150B, 059-1119, 059-1120B-1, 059-1120B-2, and 059-1120B-3.

For LGS, Unit 2, Relief Request I4R-09 pertains to the following components:

- Instrument gas lines HCC-235, between and including valves HV-059-251A, SV-059-250A, 059-2138, 059-2120A-1, 059-2120A-2, and 059-2120A-3.

- Instrument gas lines HCC-235, between and including valves HV-059-251B, SV-059-250B, 059-2119, 059-2120B-1, 059-2120B-2, and 059-2120B-3.

The components affected are ASME Code Class 3, Examination Category D-B, Item No. D2.10.

3.5.2 ASME Code Requirements

ASME Code, Section XI, Paragraph IWD-2500 states that components shall be examined and pressure tested as specified in Table IWD-2500-1. Table IWD-2500-1, Examination Category D-B, Item No. D2.10, requires the performance of VT-2 visual examination during the system leakage test for each inspection period.

3.5.3 Licensee's Proposed Alternative

Pursuant to 10 CFR 50.55a(z)(1), the licensee has proposed an alternative on the basis that the alternative will provide an acceptable level of quality and safety.

The licensee stated that the PCIG is a pneumatic system, and an ASME Code-required VT-2 visual examination would require the ability to examine piping and pressure retaining components that are 20 to 30 feet above floor level and inaccessible due to being routed through many penetrations and close proximity to many obstructions, which restricts the ability to perform complete VT-2 visual examinations.

Exelon stated that during the third 10-year ISI interval, it performed system leakage test and VT-2 visual examination of the PCIG piping for LGS, Unit 2, which included approximately 500 feet of piping. The licensee stated that approximately 39 percent of the "A" loop, and 68 percent of the "B" loop piping was inaccessible for the inspection. The licensee also stated that no indications were observed during the VT-2 visual examinations. Exelon stated that a walkdown performed for LGS, Unit 1, confirmed that its PCIG has similar configuration.

Exelon stated that as an alternative to the examination requirements of ASME Code, Section XI, Table IWD-2500-1, the licensee will perform pressure decay testing once per inspection period. The licensee stated that the pressure decay testing will be performed by isolating and pressurizing the associated piping to the nominal operating pressure. The decay in pressure is monitored by calibrated pressure instrumentation, and unacceptable decay results are investigated to locate the leak. The licensee stated that the proposed decay test provides an equivalent level of quality and safety as ASME Code-required testing.

3.5.4 NRC Staff Evaluation of Relief Request I4R-09

The examination requirements for Examination Category D-B require a visual examination (VT-2) of the pressure retaining boundary during a system leakage test in accordance with paragraph IWD-5221. Paragraph IWD-5221 states that the system leakage test shall be conducted at the system pressure obtained while the system, or portion of the system, is in service performing its normal operating function or at the system pressure developed during a test conducted to verify system operability (e.g., to demonstrate system safety function or satisfy TS surveillance requirements). The NRC staff finds the licensee's proposed alternative would be performed at the same frequency. The system would be pressurized to the same nominal pressure as would be required if the testing was performed according to the ASME Code requirement and would provide an equivalent level of quality and safety.

Based on the above, the NRC staff finds that the licensee's proposed alternative, as described in Relief Request I4R-09, provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(z)(1), the proposed alternative is authorized for the fourth 10-year ISI interval at LGS, Units 1 and 2.

3.6 Relief Request I4R-11

3.6.1 Components for Which Relief is Requested

In its submittal dated April 13, 2016, the licensee requests NRC authorization to continue use of ASME Code Case N-789, "Alternative Requirements for Pad Reinforcement of Class 2 and 3 Moderate-Energy Carbon Steel Piping for Raw Water Service," with specified modifications, as an alternative to the requirements of ASME Code, Section XI, IWA-4400, during the fourth 10-year ISI interval. Specifically, Relief Request I4R-11 is for the temporary repair of ASME Code Class 2 and 3 moderate-energy carbon steel raw water piping systems. Moderate energy is defined as operating conditions that are less than or equal to 200 degrees Fahrenheit (°F) and less than or equal to 275 psig. Raw water is defined as water from a river, lake, or well or brackish/salt water, used in plant equipment, area coolers, and heat exchangers.

Licensees need to get prior NRC approval to use ASME Code Case N-789 because this Code Case is not endorsed by the current revision of Regulatory Guide (RG) 1.147, Revision 17, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1" (ADAMS Accession No. ML13339A689).

3.6.2 ASME Code Requirements

The 2007 Edition through 2008 Addenda of ASME Code, Section XI, Table IWA-4400, provides the requirements for welding, brazing, metal removal, and installation of repair/replacement activities. Specifically, welding, brazing, defect removal, metal removal by thermal methods, fabrication, and installation shall be performed in accordance with the owner's requirements and original or later editions of the Construction Code of the item being repaired/replaced.

3.6.3 Licensee's Proposed Alternative

Pursuant to 10 CFR 50.55a(z)(2), the licensee has proposed an alternative on the basis that compliance with the specified requirements would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety.

Exelon stated that in many instances, performing ASME Code repair/replacement activities can result in unnecessary plant shutdowns and transients and loss of safety system availability versus keeping the plant online and implementing the requested alternative. The licensee stated that the ability to be able to use Relief Request I4R-11 would permit the installation of technically sound temporary repairs and provide the necessary time for evaluation, design, material procurement, planning, and scheduling of appropriate permanent repair or replacement of defective piping, with consideration of the impact on systems availability and availability of replacement materials.

The licensee proposes to continue implementation of the requirements of ASME Code Case N-789 as a temporary repair of degradation in ASME Code Class 2 and 3 moderate-energy raw water piping systems. The licensee stated that the alternate repair would be applicable when the identified degradation mechanism is erosion, corrosion, cavitation, or pitting, and would specifically exclude use of this relief request when the degradation mechanism is identified as flow-accelerated corrosion, corrosion-assisted cracking, or any other form of cracking.

The licensee stated that the proposed alternative repair involves the application of a metal reinforcing pad welded to the exterior of the piping system, reinforcing the degraded area and restoring pressure integrity. The licensee further stated that this temporary repair would be used when it is determined that the repair method is applicable to the particular degradation mechanism(s).

The licensee stated that the implementation of this alternative requires that the cause of the degradation be determined, and the extent and rate of degradation be evaluated, to ensure that there are no other unacceptable locations that could affect the integrity of the repaired piping. The licensee also stated that a baseline wall thickness examination will be performed of the repair pad, attachment welds, and the surrounding area. The licensee further stated that the repaired area would be monitored for wall thickness on a monthly basis for 3 months, with

subsequent monitoring performed based on the prior results, but at a minimum, would continue on a quarterly basis. Additionally, the licensee stated that the repaired areas will be visually observed once per month for evidence of leakage. The licensee stated that in the event the repaired areas are not accessible for direct observation, the monitoring would be accomplished by visually assessing surrounding areas and monitoring of leakage collection systems where available.

Exelon stated that for the purposes of design of the repair pad, it would use the higher of 2 times the actual measured corrosion rate or 4 times the estimated maximum corrosion rate. The licensee stated that when the actual measured corrosion rate for the degraded location is unavailable, the estimated maximum corrosion rate for the system assumed in the design will be calculated based on the same degradation mechanism as the degraded location.

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

The licensee requested the proposed alternative for the duration of the LGS, Units 1 and 2, fourth 10-year ISI interval, which is scheduled to begin on February 1, 2017, and is scheduled to end on January 31, 2027. However, the licensee stated that when ASME Code Case N-789 is approved for use by the NRC and incorporated into the next revision to RG 1.147, the alternative will no longer be required, and ASME Code Case N-789, with any RG 1.147 conditions, will be utilized in lieu of this alternative.

3.6.4 NRC Staff Evaluation of Relief Request I4R-11

In its Relief Request I4R-11, Exelon has requested use of ASME Code Case N-789, with additional conditions as an alternative to the ASME Code requirements of IWA-4400, for replacement or repair of ASME Code Class 2 and 3 moderate-energy carbon steel raw water piping systems. On March 2, 2016, the NRC published in the *Federal Register* (81 FR 10780) a proposed rule which, in part, would incorporate by reference into the NRC regulations the latest revision of RG 1.147, Revision 18 (Draft RG DG-1296) (ADAMS Accession No. ML15027A202). As part of the proposed rule, the NRC staff proposed to endorse Code Case N-789 with two conditions. However, use of Code Case N-789 by nuclear power plants as an alternative to the mandatory requirements of ASME Code provisions requires specific NRC approval until the final rule is issued and Code Case N-789 is incorporated in RG 1.147. In its review of Relief Request I4R-11, the NRC staff considered the requirements of Code Case N-789, as well as the licensee's additional conditions described in Relief Request I4R-11.

The NRC staff reviewed the licensee's proposed alternative described in Relief Request I4R-11 using the regulatory requirements described in Section 2.0 of this SE. The staff evaluated the proposed alternative to ensure that compliance with the specified requirements would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety.

Section 1 of Code Case N-789 requires the reinforcing pad be applied in accordance with a repair replacement plan satisfying the requirements of ASME Code, Section XI, IWA-4150. The

design, materials, and installation requirements of the Construction Code and IWA-4000, except as stated in the Code Case, must be satisfied. The Code Case includes the following limitations: (1) the repair cannot be applied if the minimum required thickness of reinforcing pad necessary to satisfy the requirements of Section 3 of the Code Case is greater than the nominal thickness for the size and schedule of the piping; (2) additional reinforcement or repair on top of an existing reinforcing pad is not permitted; (3) reinforcing pads, including those installed during a refueling outage, shall not remain in service beyond the end of the next refueling outage; and (4) the repair is only applicable to piping not required to be ultrasonically examined for ISI. The NRC staff determined that the proposed general requirements and limitations are appropriate for the affected piping systems.

Prior to installing the reinforcing pad, Section 2 of Code Case N-789 requires that the material beneath the surface to which the reinforcing pad is to be applied will be ultrasonically examined to establish the existing wall thickness, and the extent and configuration of the degradation to be corrected, by the application of the reinforcing pad. Additionally, the cause and rate of degradation will be determined. If the degradation is caused by flow-accelerated corrosion (FAC), corrosion-assisted cracking, or any other form of cracking, this Code Case shall not apply. Section 2 also requires an evaluation to determine the extent and rate of degradation in the subject piping to ensure that there are no other unacceptable locations within the surrounding area that could affect the integrity of the repaired piping. Furthermore, Section 2 also requires that the effects of the repair on the piping and any remaining degradation shall be evaluated in accordance with IWA-4311. The NRC staff determined that the proposed initial evaluation requirements are acceptable because the initial evaluation will ensure that the repair method will not be used on piping with degradation mechanisms that are not suitable for temporary repairs using reinforcement pads (FAC and cracking), and the extent of degradation, will be accurately determined.

Section 3 of Code Case N-789 describes the two types of reinforcing pads, pressure pads and structural pads, and specifies the conditions and requirements for their use. Specifically, pressure pads are designed to retain pressure but do not structurally reinforce the repaired piping, while structural pads are designed to retain pressure and provide structural reinforcement for piping that is predicted not to retain full-structural integrity until the next refueling outage.

Paragraph 3.1(a)(1) of the Code Case states that pressure pads may be used only if the piping is predicted to retain full-structural integrity until the next refueling outage, assuming a corrosion rate of either two times the actual measured corrosion rate in that location or four times the estimated maximum corrosion rate for the system. In its March 2, 2016, *Federal Register* notice, the NRC proposed a condition to require use of the higher of the two values since the corrosion rate specified in paragraph 3.1(a)(1) may not address certain scenarios. The licensee's Relief Request I4R-11 states that it will use the higher of the two values for the design of the pressure pad. Additionally, Exelon stated that if the actual corrosion rate in the degraded location is not available, then the estimated maximum corrosion rate for the system assumed in the design will be calculated based on the same degradation mechanism as the degraded location.

The NRC staff noted that the licensee's proposed alternative is similar to the staff's proposed condition in Draft RG DG-1296. The staff determined that the conditions under which the licensee will use pressure pads are acceptable since the licensee will use the more conservative corrosion rate.

Paragraph 3.2(a) of Code Case N-789 states that reinforcing pads will be designed in accordance with the applicable requirements of the Construction Code or Section III of the ASME Code. Paragraph 3.2(i) of Code Case N-789 also states that if flexibility analysis was required by the original Construction Code, the effect of the reinforcing pad shall be reconciled with the original analysis. Paragraph 3.2(i) of Code Case N-789 further states that, "for rectangular-shaped reinforcing pads on piping designed to NC-2650, ND-3650 and aligned parallel or perpendicular to the axis..." The NRC staff notes that the reference to "NC-2650," is incorrect (it is not in use), and it should be NC-3650. The staff determined that it is clear from the context that the intended references are for NC-3650 and ND-3650, as they provide ASME Code requirements for Class 2 and 3 piping designs, respectively. Based on the NRC staff's review of the proposed alternative, the staff determined that the proposed design requirements for reinforcing pads are acceptable.

The description of the two types of pads in Code Case N-789, along with the licensee's statement that it will use the more conservative corrosion rate for the design of pressure pads, is adequate to ensure that the appropriate pad type and Code Case requirements are used for pipe repairs, given the conditions of the pipe. Additionally, the pads will be designed in accordance with applicable requirements of the Construction Code or Section III of the ASME Code.

The Code Case requires structural pads to be examined using ultrasonic or direct thickness measurement upon completion of the repair to record the thickness of the plate; the thickness at the attachment welds, including the underlying base metal; and to the extent examinable in a 3-inch wide band surrounding the repair as a baseline for subsequent monitoring of the repair. The licensee is required to monitor the structural pad monthly for the first quarter, and the subsequent frequency will be based on the results of the monitoring activities, but at least quarterly. However, Code Case N-789 does not require inservice monitoring of pressure pads by visual observation for evidence of leakage. In its March 2, 2016, *Federal Register* notice, the NRC staff proposed a condition to require monthly visual examination of installed pressure pads for evidence of leakage since degradation of the pipe could unexpectedly expand beyond the area covered by the pressure pad. In its Relief Request I4R-11, Exelon stated that areas containing pressure pads will be visually examined at least once per month to monitor for evidence of leakage, and if the areas with a pressure pads are not accessible for direct observation, the licensee will observe surrounding areas or ground surface areas above pressure pads on buried piping, or monitor leakage collection systems, if available. The NRC staff noted that the licensee's proposed alternative includes requirements to Code Case N-789, similar to those that the staff has proposed in Draft RG DG-1296.

Based on its review of Relief Request I4R-11, the NRC staff finds that the licensee's proposed alternative will provide reasonable assurance of the structural integrity and leak tightness of repaired ASME Code Class 2 and 3 moderate-energy carbon steel raw water piping systems because (1) the scope of the applicability of the alternate repair is clearly defined; (2) reinforcing pads will be designed in accordance with the Construction Code, Section III of the ASME Code, and (3) the application of the alternate repair using Code Case N-789, as modified by the licensee's proposal in Relief Request I4R-11, matches the staff's expectations proposed in Draft RG DG-1296. In addition, the staff also finds that making permanent ASME Code Class 2 and 3 compliant repairs of piping systems may require the system to be removed from service and the

plant to shut down, and performing the required ASME Code repairs during normal operation may challenge the TS completion time requirements and place the plant at higher safety risk than warranted. Therefore, the NRC staff determined that compliance with the specified ASME Code repair requirements would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety.

In summary, with respect to Relief Request I4R-11, the proposed alternative provides reasonable assurance of the structural integrity and leak tightness of the subject components. Furthermore, complying with the Code requirements would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(z)(2), the proposed alternative is authorized for the fourth 10-year ISI interval at LGS, Units 1 and 2.

3.7 Relief Request I4R-12

3.7.1 Components for Which Relief is Requested

In its submittal dated April 13, 2016, the licensee requests NRC authorization to continue use of ASME Code Case N-786, "Alternative Requirements for Sleeve Reinforcement of Class 2 and 3 Moderate-Energy Carbon Steel Piping," for repair of degradation in ASME Code Class 2 and 3 moderate-energy carbon steel piping systems resulting from mechanisms such as localized erosion, corrosion, cavitation, or pitting, but excluding conditions that involve any form of cracking. Exelon requested to use Code Case N-786 as an alternative to the requirements of ASME Code, Section XI, IWA-4400, during the fourth 10-year ISI interval. Moderate energy is defined as operating conditions that are less than or equal to 200 °F, and less than or equal to 275 psig.

NRC approval is required to use ASME Code Case N-786 because this Code Case is not endorsed by the current revision of RG 1.147, Revision 17.

3.7.2 ASME Code Requirements

The 2007 Edition through 2008 Addenda of ASME Code, Section XI, Table IWA-4400, provides the requirements for welding, brazing, metal removal, and installation of repair/replacement activities. Specifically, welding, brazing, defect removal, metal removal by thermal methods, fabrication, and installation shall be performed in accordance with the owner's requirements and original or later editions of the Construction Code of the item being repaired/replaced.

3.7.3 Licensee's Proposed Alternative

Pursuant to 10 CFR 50.55a(z)(2), the licensee has proposed an alternative on the basis that compliance with the specified requirements would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety.

Exelon stated that in many instances, performing ASME Code repair/replacement activities can result in unnecessary plant shutdowns and transients and loss of safety system availability versus keeping the plant online and implementing the requested alternative. The licensee stated that the ability to use Relief Request I4R-12 would permit the installation of technically

sound temporary repairs and provide the necessary time for evaluation, design, material procurement, planning, and scheduling of appropriate permanent repairs or replacement of defective piping, with consideration of the impact on systems availability and availability of replacement materials. Additionally, this relief request would also permit the installation of long-term sound repairs for locally degraded portions of a piping system.

The licensee proposes to continue implementation of the requirements of ASME Code Case N-786 as an alternative to the requirements of the ASME Code to repair degradation in ASME Code Class 2 and 3 moderate-energy carbon steel piping systems. The licensee stated that the alternate repair would be used to repair degradation resulting from mechanisms such as localized erosion, corrosion, cavitation, or pitting, and would specifically exclude use of this relief request when the degradation mechanism involves any form of cracking. The licensee stated that these types of degradation are typically identified by small leaks in the piping system or by preemptive examinations performed to monitor for degradation.

The licensee stated that the proposed alternative repair involves the application of Type A and Type B full encirclement sleeve halves welded together, with full penetration longitudinal seam welds to reinforce the structural integrity in the degraded area. Exelon also stated that for Type B reinforcing sleeves, the ends are also welded to the subject piping in order to restore pressure integrity. The licensee further stated that this repair would be used when it is determined that the repair method is suitable to the particular degradation or defect being repaired without flaw removal. Exelon stated that use of this repair will be limited to pipe and fittings, and consequently, the following condition will apply to LGS's application of ASME Code Case N-786:

> Reinforcing sleeves may not be applied to pumps, valves, expansion joints, vessels, heat exchangers, tubing, or flanges, and may not be applied over flanged joints, socket welded or threaded joints, or branch connection welds.

The licensee stated that the implementation of this alternative requires that the cause of the degradation be determined, and the extent and rate of degradation be evaluated, to ensure that there are no other unacceptable locations that could affect the integrity of the repaired piping. The licensee also stated that the surrounding areas showing signs of degradation shall be identified and included in the plan for thickness monitoring for full-structural reinforcing sleeves. The licensee further stated that the area of evaluation will be dependent on the degradation mechanism present, but shall extend at least 0.75 $(R \times T_{nom})^{1/2}$ beyond the edge of any sleeve attachment weld (where R is equal to the outer radius of the piping and T_{nom} is equal to the nominal wall thickness of the piping). Exelon stated that if the cause of the degradation is not known, the maximum permitted life for service life of any reinforcing sleeve shall be the time remaining to the next refueling outage. Additionally, the repaired areas shall be visually observed once per month for evidence of leakage. The licensee stated that in the event the repaired areas are not accessible for direct observation, the monitoring would be accomplished by visually assessing surrounding areas and monitoring of leakage collection systems where available. Exelon stated that the following condition shall apply to the application of ASME Code Case N-786:

> The initial degradation rate selected for design of all sleeves shall be equal to or greater than two (2) times the maximum rate observed at the location for the

> repair. If the degradation rate for that location is unknown, four (4) times the estimated maximum degradation rate for that or a similar system at the same plant site for the same degradation mechanism shall be applied. If both the degradation rate for that location and the cause of the degradation are not conclusively determined, four (4) times the maximum degradation rate observed for all degradation mechanisms for that or a similar system at the same plant site shall be applied.

The licensee stated that Type B reinforcing sleeves may be applied to leaking systems by installing a gasket or sealant between the sleeve and the pipe, as permitted by Code Case N-786, and then clamping the reinforcing sleeve halves to the piping prior to welding. Exelon stated that residual moisture is then removed by heating prior to welding. The licensee further stated that when welding of any type of sleeve occurs on a wet surface, the maximum permitted life of the sleeve shall be the time until the next refueling outage.

The licensee stated that because ASME Code Case N-786 requires that partial-structural Type B reinforcing sleeves are designed to accommodate the predicted maximum degradation and to be removed during the next outage, the Code Case did not have a requirement for monitoring of these sleeves. Exelon stated that because of the NRC staff's concerns previously discussed in its SE, dated May 10, 2012 (ADAMS Accession No. ML12121A637), granting approval for Exelon to use Code Case N-789, the following condition shall also apply to the application of ASME Code Case N-786 at LGS:

> Type A reinforcing sleeves and partial-structural Type B reinforcing sleeves shall be visually observed at least once per month to monitor for evidence of leakage. If the areas containing these sleeves are not accessible for direct observation, then monitoring will be accomplished by visual assessment of surrounding areas or ground surface areas above such sleeves on buried piping, or monitoring of leakage collection systems, if available.

The licensee stated that when used on buried piping, the area of the full-structural Type B reinforcing sleeves shall be visually accessible for the required examinations. Exelon also stated that when access is required, this could result in the installation of removable barriers at the repair location in place of backfilling the pipe at the location of the repair. Exelon further stated that the ability to use Relief Request I4R-12, rather than scheduling contingency plans for piping replacement, provides the opportunity to schedule more corrosion inspections and improves overall plant safety.

The licensee requested the proposed alternative for the duration of LGS, Units 1 and 2, fourth 10-year ISI interval, which is scheduled to begin on February 1, 2017, and is scheduled to end on January 31, 2027. However, the licensee stated that when ASME Code Case N-786 is approved for use by the NRC and incorporated into the next revision to RG 1.147, the alternative will no longer be required, and ASME Code Case N-786, with any RG 1.147 conditions, will be utilized in lieu of this alternative.

3.7.4 NRC Staff Evaluation of Relief Request I4R-12

In its Relief Request I4R-12, Exelon has requested use of ASME Code Case N-786, with additional conditions, as an alternative to the ASME Code requirements of IWA-4400, for replacement or repair of ASME Code Class 2 and 3 moderate-energy carbon steel piping systems. On March 2, 2016, the NRC published in the *Federal Register* (81 FR 10780) a proposed rule which, in part, would incorporate by reference into the NRC regulations the latest revision of RG 1.147, Revision 18 (Draft RG DG-1296). As part of the proposed rule, the NRC staff proposed to endorse Code Case N-786. However, use of Code Case N-786 by nuclear power plants as an alternative to the mandatory requirements of ASME Code provisions requires specific NRC approval until the final rule is issued, and Code Case N-786 is incorporated in RG 1.147, Revision 18. In its review of Relief Request I4R-12, the NRC staff considered the requirements of Code Case N-786 and the additional conditions, as described by the licensee in its submittal of Relief Request I4R-12.

The NRC staff reviewed the licensee's proposed alternative described in Relief Request I4R-12 using the regulatory requirements described in Section 2.0 of this SE. The staff evaluated the proposed alternative to ensure that compliance with the specified requirements would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety.

Section 1 of Code Case N-786 requires that the installation of reinforcing sleeves be in accordance with a repair replacement plan satisfying the requirements of the ASME Code, Section XI, IWA-4150. Additionally, the design, materials, and installation requirements of the Construction Code and IWA-4000, except as stated in the Code Case, must be satisfied. The Code Case includes the following limitations: (1) the repair cannot be applied if the minimum required thickness of reinforcing sleeve necessary to satisfy the requirements of Section 3 of the Code Case is greater than 1.4 times the nominal thickness for the size and schedule of the piping; (2) additional reinforcement or repair, on top of an existing reinforcing sleeve, is not permitted; and (3) the repair is only applicable to piping not required to be ultrasonically examined for ISI. Additionally, Relief Request I4R-12 limits use of this Code Case to piping and specifically excludes pumps, valves, expansion joints, vessels, heat exchanges, tubing, or flanges, and may not be applied over flanged joints, socket welded or threaded joints, or branch connection welds. The NRC staff determined that the proposed general requirements and additional limitations by the licensee are appropriate for the affected piping systems.

Prior to installing the reinforcing sleeves, Section 2 of Code Case N-786 requires that the material beneath the surface to which the reinforcing sleeve is to be applied be ultrasonically examined to establish the existing wall thickness, and the extent and configuration of the degradation to be reinforced, by the application of the reinforcing sleeve. Additionally, the adjacent area shall be examined to verify that the repair will encompass the entire unacceptable area, and the adjacent base metal has sufficient thickness to accommodate the attachment welds for the sleeve. Furthermore, the cause and rate of degradation will be determined. Code Case N-786, Section 2, also requires an evaluation to determine the extent and rate of degradation in the subject piping to ensure that there are no other unacceptable locations within the surrounding area that could affect the integrity of the repaired areas. Code Case N-786, Section 2, also requires that the effects of the repair on the piping and any remaining degradation shall be evaluated in accordance with IWA-4311. The NRC staff determined that the proposed initial evaluation requirements are acceptable because the evaluation will ensure

that the repair method will not be used on piping with insufficient wall thickness, and the extent of degradation, will be accurately determined.

Section 3.1 of Code Case N-786 describes the types of reinforcing sleeves and specifies the conditions and requirements for their use. Specifically, Type A reinforcing sleeves (Code Case N-786, Figure 1) shall have a maximum service life of the time until the next refueling outage and may be for structural reinforcement of thinned areas, which are not expected to penetrate the existing wall thickness and cause leakage. Type B reinforcing sleeves (Code Case N-786, Figure 2) may be used for pressure and partial or full-structural reinforcement of degraded areas that have penetrated or are expected to penetrate the wall thickness of the existing pipe. Full-structural reinforcing sleeves are designed to accommodate pressure, plus the axial and circumferential design load at the location, without taking credit for the degraded portion of the existing pipe. Partial structural reinforcing sleeves are designed to accommodate design loads at the segment being repaired and take partial credit for the degraded segment after projecting further degradation over the life of the repair. Partial structural reinforcing sleeves shall have a maximum service life of the time until the next refueling outage.

Section 3.2 of Code Case N-786 provides the general design requirements and states that reinforcing sleeves shall be designed in accordance with the requirements of the ASME Code, Section III, Articles NC-3100 and ND-3100, or Articles NC-3600 and NC-ND-3600, and Appendix II. Additionally, paragraph 3.2(k) of Code Case N-786 states that the predicted maximum degradation of the carrier base metal and reinforcing sleeve over the design life of the reinforcement shall be based on in-situ inspection and established data for similar base metals. The licensee's alternative includes additional requirements, which state that the initial degradation rate selected for design of all sleeves shall be equal to or greater than two (2) times the maximum rate observed at the location of the repair. If the degradation rate for that location is unknown, four (4) times the estimated maximum degradation rate for that, or a similar system at the same plant site for the same degradation mechanism, shall be applied. If both the degradation rate for that location and the cause of the degradation are not conclusively determined, four (4) times the maximum degradation rate observed for all degradation mechanisms for that or a similar system at the same plant site shall be applied.

Based on the NRC staff's review of the proposed alternative, the staff determined that the proposed design requirements for reinforcing sleeves are acceptable. The reinforcing sleeves will be designed in accordance with applicable requirements of the Construction Code or Section III of the ASME Code. Additionally, the licensee stated that it will use the more conservative corrosion rate for the design of the sleeves. The NRC staff finds that the licensee's approach provides assurance that the appropriate sleeve types are used for pipe repairs for the given condition of the pipe. The NRC staff finds the above acceptable because applying a safety factor of either 2 or 4 will provide a sufficiently conservative potential rate of degradation to ensure that the sleeves will perform their intended function until the next scheduled outage, at which time the sleeve is either removed and the degraded pipe is permanently repaired (Type A and Type B partial structural), or receives a thickness monitoring inspection (Type B full structural).

The licensee's alternative states that Type B reinforcing sleeves may be applied to leaking systems by installing a gasket or sealant between the sleeve and the pipe, as permitted by the Code Case, and then clamping the reinforcing sleeve halves to the piping prior to welding.

Residual moisture is then removed by heating prior to welding. Because welding on a wet surface can impact weld quality, the NRC staff finds that the above modification ensures that steps will be taken to remove moisture from the weld area, and is, therefore, acceptable.

Code Case N-786 includes requirements for inservice examination of Type B full-structural sleeves. The Code Case requires that monitoring activities be performed during the first two refueling outages after installation, and at least every fourth refueling outage thereafter.

The licensee stated that a baseline thickness examination will be performed for completed full-structural Type B reinforcing sleeves, partial penetration attachment welds, and surrounding areas, followed by similar thickness monitoring inspections performed at a minimum of every refueling outage for the life of the repair. The licensee will also perform more frequent examinations based on the maximum degradation rates observed during these inspections, if necessary, to ensure that the required design thicknesses will not be infringed upon before each subsequently scheduled thickness monitoring examination. The NRC staff finds this modification acceptable because the examination frequency by the licensee will be more conservative than what is required by Code Case N-786 and provides a higher level of assurance that the minimum required design thickness is maintained and that unanticipated increases in degradation rates will be identified so that corrective action can be taken.

Code Case N-786 does not include inservice examinations for partial structural Type B or Type A reinforcing sleeves. The licensee's alternative includes a modification to the Code Case, which requires that Type A reinforcing sleeves and partial-structural Type B reinforcing sleeves shall be visually observed at least once per month to monitor for evidence of leakage. For partial structural Type B or Type A reinforcing sleeves that are inaccessible for direct observation, the licensee will perform visual assessment of surrounding areas or ground surface areas above such sleeves on buried piping, or monitoring of leakage collection systems, if available. The NRC staff notes that while it is unlikely that partial structural Type B or Type A reinforcing sleeves installed in accordance with Code Case N-786 would leak within the prescribed one outage cycle service life, the NRC staff finds it prudent to perform occasional direct visual examinations or visual assessment, as described by the licensee, to verify that no leakage has occurred. Therefore, the NRC staff finds this modification acceptable because it provides additional assurance of leak tightness and structural integrity for the partial structural Type B or Type A reinforcing sleeves during the time they are in service.

Based on its review of Relief Request I4R-12, the NRC staff finds that the licensee's proposed alternative will provide reasonable assurance of the structural integrity and leak tightness of repaired ASME Code Class 2 and 3 moderate-energy carbon steel piping systems because (1) the scope of the applicability of the alternate repair is clearly defined; (2) reinforcing sleeves will be designed in accordance with the Construction Code, Section III of the ASME Code; and (3) the application of the alternate repair using Code Case N-786, as modified by the licensee's proposal in Relief Request I4R-12, matches the staff's expectations proposed in DG-1296. In addition, the staff also finds that making permanent ASME Code Class 2 and 3 compliant repairs of piping systems may require the systems to be removed from service and the plant to shut down. Additionally, performing the required ASME Code repairs during normal operation may challenge the TS completion time requirements and place the plant at higher safety risk than warranted. Therefore, the NRC staff determined that compliance with the specified ASME Code

repair requirements would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety.

In summary, with respect to Relief Request I4R-12, the proposed alternative provides reasonable assurance of the structural integrity and leak tightness of the subject components. Furthermore, complying with the Code requirements would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(z)(2), the proposed alternative is authorized for the fourth 10-year ISI interval at LGS, Units 1 and 2.

3.8 Relief Request I4R-13

3.8.1 Components for Which Relief is Requested

In its submittal dated April 13, 2016, the licensee requests NRC authorization to use an alternate inspection program for the ASME Code Class 2 piping associated with the high pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) exhaust vacuum breaker piping.

For LGS, Unit 1, Relief Request I4R-13 pertains to the following components:

- HPCI exhaust vacuum breaker piping lines HBB-144, between and including valves HV-1F095, 1091, 1F092, 1026, 1F094, and 1F091.

- RCIC exhaust vacuum breaker piping lines HBB-145, between and including valves HV-1F084, 1076, 1F085, 1F081, 1F083, and 1018.

For LGS, Unit 2, Relief Request I4R-13 pertains to the following components:

- HPCI exhaust vacuum breaker piping lines HBB-244, between and including valves HV-2F095, 2091, 2F092, 2026, 2F094, and 2F091.

- RCIC exhaust vacuum breaker piping lines HBB-245, between and including valves HV-2F084, 2076, 2F085, 2F081, 2F083, and 2018.

The components affected are ASME Code Class 2, Examination Category C-H, Item No. C7.10.

3.8.2 ASME Code Requirements

ASME Code, Section XI, paragraph IWC-2500, states that components shall be examined and pressure tested as specified in Table IWC-2500-1. Table IWV-2500-1, Examination Category C-H, Item No. C7.10, requires the performance of VT-2 visual examination during the system leakage test for each inspection period.

3.8.3 Licensee's Proposed Alternative

Pursuant to 10 CFR 50.55a(z)(1), the licensee has proposed an alternative on the basis that the alternative will provide an acceptable level of quality and safety.

The licensee stated that during normal plant operation, this piping is either isolated or is maintained at less than 1 psig. The licensee also stated that the pressurizing fluid is essentially nitrogen gas. The licensee further stated that performing a visual examination for nitrogen gas leakage in a system with less than 1 psig pressure would yield inconclusive results.

Exelon stated that LLRT is currently performed on LGS, Units 1 and 2, once per refueling outage, per 10 CFR Part 50, Appendix J, Option B. The licensee stated that as a result of the LLRT, the reference piping is pressurized to 44 psig, which is a substantially higher pressure than is achieved during periodic system functional tests. The licensee further stated that the proposed alternative provides a means for quantifying the leakage, as well as the ability to detect through valve leakage, which is not feasible to do by VT-2 visual examinations. The licensee stated that the proposed alternative will provide an acceptable level of quality and safety.

3.8.4 NRC Staff Evaluation of Relief Request I4R-13

The examination requirements for Examination Category C-H require a visual examination (VT-2) of the pressure retaining boundary during a system leakage test in accordance with paragraph IWC-5221. Paragraph IWC-5221 states that the system leakage test shall be conducted at the system pressure obtained while the system, or portion of the system, is in service performing its normal operating function or at the system pressure developed during a test conducted to verify system operability (e.g., to demonstrate system safety function or satisfy TS surveillance requirements).

The licensee's primary basis for use of the proposed alternative relies on the consideration that a leakage test performed at the normal operating for these components (i.e., essentially 1 psig), would be inconclusive. Additionally, the licensee stated that during the LLRT, the referenced components are subjected to a test pressure of 44 psig, a substantially higher pressure. The NRC staff finds that performing the LLRTs every refueling outage provides adequate opportunity to check for leakage.

Based on the above, the NRC staff finds that the licensee's proposed alternative, as described by the licensee's Relief Request I4R-13, provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(z)(1), the proposed alternative is authorized for the fourth 10-year ISI interval at LGS, Units 1 and 2.

4.0 CONCLUSION

In summary, based on the evaluation in Sections 3.1 through 3.8 of this SE, the NRC staff concludes the following:

(1) With respect to Relief Requests I4R-05, I4R-06, I4R-07, I4R-08, I4R-09, and I4R-13, the proposed alternatives provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(z)(1), the proposed alternatives are authorized for the fourth 10-year ISI interval at LGS, Units 1 and 2.

(2) With respect to Relief Requests I4R-11 and I4R-12, the proposed alternatives provide reasonable assurance of the structural integrity and leak tightness of the subject components. Furthermore, complying with the Code requirements would result in

hardship or unusual difficulty, without a compensating increase in the level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(z)(2), the proposed alternatives are authorized for the fourth 10-year ISI interval at LGS, Units 1 and 2.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributors: R. Kalikian
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Date: February 6, 2017

If you have any questions concerning this matter, please contact the LGS Project Manager, Dr. V. Sreenivas, at (301) 415-2597, or V.Sreenivas@nrc.gov.

Sincerely,

/RA/

Stephen S. Koenick, Acting Chief
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-352 and 50-353

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