



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

April 16, 2019

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: LIMERICK GENERATING STATION, UNITS 1 AND 2 – ISSUANCE OF RELIEF REQUEST I4R-18 ASSOCIATED WITH INACCESSIBLE SUPPORTS FOR THE FOURTH 10-YEAR INSERVICE INSPECTION INTERVAL PIPING (EPID L-2018-LLR-089)

Dear Mr. Hanson:

By letter dated June 11, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18165A002) as supplemented by letter dated January 4, 2019 (ADAMS Accession No. ML19004A374), Exelon Generation Company, LLC (Exelon, the licensee) requested an alternative to the requirements of the American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel Code (Code), Section XI, for visual examinations of emergency service water and residual heat removal service water pump supports at the Limerick Generating Station (Limerick), Units 1 and 2.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(2), Exelon requested authorization to use the proposed 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 determined that the proposed alternative I4R-18 provides reasonable assurance of the structural integrity of the emergency service water and residual heat removal service water pump upper and lower seismic supports, and that complying with the specified ASME Code requirement would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2), and therefore, authorizes the use of proposed alternative I4R-18 at the Limerick, Units 1 and 2, for the fourth 10-year inservice inspection interval, which commenced on February 1, 2017, and is scheduled to end on January 31, 2027.

B. Hanson

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

If you have any questions, please contact the Limerick Project Manager, V. Sreenivas, at 301-415-2597 or V.Sreenivas@nrc.gov.

Sincerely,

A handwritten signature in black ink, appearing to be "JD", followed by the word "for" written in a cursive style.

James G. Danna, 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: Listserv



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELIEF REQUEST I4R-18 ASSOCIATED WITH INACCESSIBLE SUPPORTS FOR THE
FOURTH 10-YEAR INSERVICE INSPECTION INTERVAL
EXELON GENERATION
LIMERICK GENERATING STATION, UNITS 1 AND 2
DOCKET NOS. 50-352 AND 50-353

1.0 INTRODUCTION

By letter dated June 11, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18165A002) as supplemented by letter dated January 4, 2019 (ADAMS Accession No. ML19004A374), Exelon Generation Company, LLC (Exelon, the licensee), requested an alternative to the requirements of the American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel Code (Code), Section XI, for visual examinations of emergency service water (ESW) and residual heat removal service water (RHRSW) pump supports at Limerick Generating Station (Limerick), Units 1 and 2.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(2), Exelon proposes to perform a best effort VT-3 visual examination of the upper seismic support each time the ESW or RHRSW pump is disassembled and removed for maintenance, in lieu of the 100 percent VT-3 examination of the ESW and RHRSW pump supports. The licensee requested authorization to use the proposed 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 REQUIREMENTS

The regulations in 10 CFR 50.55a(g)(4) require that ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in 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 conditions listed therein.

The regulations in 10 CFR 50.55a(z) state, in part, that alternatives to the requirements of 10 CFR 50.55a(g) may be used, when authorized by the U.S. Nuclear Regulatory Commission (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

Based on the above, and subject to the following technical evaluation, the NRC staff concludes that regulatory authority to authorize an alternative to the ASME Code requirement, as requested by the licensee exists. Accordingly, the NRC staff has reviewed and evaluated the licensee's request pursuant to 10 CFR 50.55a(z)(2).

3.0 TECHNICAL EVALUATION

3.1 Licensee's Relief Request

ASME Code Components Affected (As stated)

Code Class 3

Examination Category: F-A

Item Number: F1.40, Supports Other Than Pipe Supports

Component Numbers:

ESW Pump	Upper Support	Lower Support
A	OA-P548-SRUP	OA-P548-SRLO
B	OB-P548-SRUP	OB-P548-SRLO
C	OC-P548-SRUP	OC-P548-SRLO
D	OD-P548-SRUP	OD-P548-SRLO

RHRSW Pump	Upper Support	Lower Support
A	OA- P506-SRUP	OA- P506-SRLO
B	OB- P506-SRUP	OB- P506-SRLO
C	OC- P506-SRUP	OC- P506-SRLO
D	OD- P506-SRUP	OD- P506-SRLO

Applicable Code Requirements (As stated)

The Code of Record for Limerick's fourth inservice inspection interval, which began February 1, 2017, is the ASME Code, Section XI, 2007 Edition with the 2008 Addenda.

ASME Code, Section XI, IWF-2500, Table IWF-2500-1, Code Category F-A, Item Number F1.40, Supports Other Than Pipe Supports, requires a VT-3 examination of 100 percent of the Class 3 component supports, as modified by Note 3. Note 3 states that "for multiple components other than piping, within a system of similar design, function, and service, the supports of only one of the multiple components are required to be examined."

A VT-3 examination is conducted to determine the general mechanical and structural condition of components and their supports in accordance with IWA-2213. The VT-3 procedure shall be demonstrated capable of resolving characters as specified in Table IWA-2211-1. Remote visual examinations may be utilized, provided the procedure is demonstrated capable of resolving characters in accordance with Table IWA-2211-1.

Reason for Request (As stated)

Pursuant to 10 CFR 50.55a(z)(2), relief is requested from the ASME Code-required 100 percent VT-3 examination of the ESW and RHRSW pump supports, on the basis that compliance with these specified ASME Code requirements is a hardship, without a compensating increase in the level of quality and safety. Limerick, Units 1 and 2, have common ESW and RHRSW systems. The ESW system provides cooling water flow to essential equipment during a loss-of-offsite power or loss-of-coolant accident, as described in the Limerick, Units 1 and 2, Updated Final Safety Analysis Report (UFSAR), Section 9.2.2, "Emergency Service Water System." The RHRSW system provides a reliable source of cooling water for all operating modes of the residual heat removal (RHR) system, including heat removal under post-accident conditions. It also provides water to flood the reactor core or to spray the primary containment after an accident, if necessary, as described in the UFSAR, Section 9.2.3, "RHR Service Water System."

There are two carbon steel seismic restraints (i.e., the upper support and lower support) around the column of each ESW and RHRSW pump. These restraints limit the movement of the pump columns during a seismic event. At the nominal spray pond water level (elevation 251'), the upper seismic restraint is partially covered by raw water (i.e., spray pond inventory), and the lower seismic restraint is fully submerged. The design of the spray pond pump structure does not allow the inspection of the seismic restraints to be performed unless the pumps are removed from the pump pit.

In the last 7 years, six of the eight (three ESW and three RHRSW) pumps have been replaced. With the old pump removed, a VT-3 examination of the upper and lower supports was attempted. Due to poor water clarity, a remote inspection was attempted at approximately 6" from the support; however, the ASME Code-required visual prerequisites could not be obtained. Additionally, there was scaling on the seismic restraint that could not be removed for the inspection. Due to the poor water clarity and the buildup of scale on the supports, a qualified VT-3 examination could not be performed.

Although a qualified VT-3 examination could not be performed, the inspection did assess the condition of the seismic supports to the best of our ability. The attempted examination found no evidence of structural deformation, missing, detached, or loosened items.

Sluice gates can be closed to isolate an ESW/RHRSW wet well from the spray pond, and the ESW/RHRSW pump wet well could potentially be drained. However, when the three sluice gates of an ESW/RHRSW pump wet well are closed, one loop of ESW and one loop of RHRSW are isolated from the spray pond. This alignment would place Limerick, Units 1 and 2, in a 72-hour shutdown action (Technical Specification (TS) 3.7.1.1, Action a.3, for the RHRSW system, and TS 3.7.1.2, Action a.3, for the ESW system).

Limerick, Units 1 and 2, have never used the sluice gates to drain an ESW/RHRSW pump wet well. Based on review of the ESW and RHRSW system out-of-service durations associated with previously completed pump replacement activities, physical work for motor and pump removal, and reinstallation and post-maintenance testing, requires a minimum of 67 hours. Therefore, the additional activities associated with draining and refilling the pump wet well, scaffold installation/removal, and restraint cleaning/inspection could not be performed within a 72-hour limiting condition for operation, which would result in a dual unit shutdown due to inoperability of one loop of ESW and RHRSW for greater than 72 hours.

To perform a qualified VT-3 examination of the ESW and RHRSW pump seismic restraints, a modification to the spray pond pumphouse structure would be necessary to isolate each pump compartment by possibly adding sluice gates for each individual RHRSW and ESW pump. Currently, each compartment contains two ESW pumps and two RHRSW pumps (i.e., one loop of each system). Without such modifications, the actions required to perform a qualified VT-3 examination of the ESW and RHRSW seismic restraints cannot be performed within the 72-hour limiting condition for operation, and therefore, a dual unit outage is required to comply with the ASME Code. Accordingly, performing this inspection is a hardship, without a compensating increase in the level of quality or safety.

Proposed Alternative and Basis for Use (As stated)

As an alternative to performing a qualified VT-3 examination of the ESW and RHRSW seismic restraints, Limerick, Units 1 and 2, will perform a best effort visual examination of the upper seismic restraint each time an ESW or RHRSW pump is disassembled and removed for maintenance. This examination will be performed remotely to look for evidence of structural deformation and missing, detached, or loosened support items. The upper seismic restraint is located in the most limiting environment, since it is exposed to continuous wet and dry cycles due to normal variations in spray pond water level.

Additionally, from a review of the design calculation, there is a minimum safety factor of 25 based on the operating basis earthquake (OBE) allowable stresses; this margin is available for any material loss due to corrosion. With this available margin, a best-effort visual examination is sufficient to identify degradation that would affect the ability of the ESW and RHRSW seismic restraints to perform their function, and therefore, provides an acceptable alternative to the ASME Code-required VT-3 examination

3.2 NRC STAFF EVALUATION

The NRC staff has evaluated the proposed alternative I4R-18 pursuant to 10 CFR 50.55a(z)(2). The NRC staff focused on whether compliance with the specified requirements of 10 CFR 50.55a(g), or portions thereof, would result in hardship or unusual difficulty, and if there is a compensating increase in the level of quality and safety despite the hardship. The NRC staff also evaluated the licensee's proposed alternative to determine whether it would provide reasonable assurance of structural integrity of the ESW and RHRSW pump supports.

The NRC staff determined that it would result in hardship if the IWF-2500, Table IWF-2500-1 requirement for VT-3 examination of the upper and lower seismic supports of an ESW and RHRSW pump is imposed upon the licensee. This hardship is due to the existing design and configurations of the Limerick, Units 1 and 2, common ESW and RHRSW systems, which would make draining and refilling the pump wet well to allow scaffold installation/removal and restraint cleaning/examination result in a dual unit shutdown, due to inoperability of one loop of ESW and RHRSW for greater than 72 hours. Without modifications to the spray pond pumphouse structure to isolate each pump compartment by possibly adding sluice gates for each individual RHRSW and ESW pump, the actions required to perform a qualified VT-3 examination of the ESW and RHRSW seismic restraints cannot be performed within the 72-hour limiting condition for operation, and therefore, a dual unit outage would be required to comply with the ASME Code, Section XI.

In evaluating whether the licensee's proposed alternative would provide reasonable assurance of structural integrity of the ESW and RHRSW pump supports, the staff examined the design of

the supports, materials of construction, past operating/maintenance experience, and the proposed future inspection program for the supports in question.

The NRC staff's evaluation of the normal operating and seismic loads provided by the licensee in the January 4, 2019, supplement showed that under normal operation, there is a slight clearance between the pump and the seismic restraint, and therefore, no loads are seen by the restraint. For seismic loading, the maximum loading is considered to be the shear force resulting from the design-basis earthquake. The maximum stresses in the anchor bolts from the seismic event are calculated to be 801 pounds per square inch (psi) for the ESW pumps and 863 psi for the RHRSW pumps. Seismic calculations for the restraints were deemed unnecessary because the design is rigid enough that their participation in the dynamic model is insignificant. The maximum loads expected to be experienced by the restraints is actually hypothesized to be from inadvertently allowing the pump to rest on the supports during handling for maintenance to remove/reinstall the pumps. The maximum stresses in the anchor bolts from the handling event are calculated to be 10,477 psi for the ESW pumps and 13,548 psi for the RHRSW pumps.

The NRC staff evaluated the materials of construction of the restraints provided by the licensee. The January 4, 2019, supplement identified that the seismic restraints are fabricated from American Society for Testing and Materials (ASTM) A-516 Gr. 70 material and the anchor bolting is ASTM A-193 Gr. B7 bolting material. The allowable stress for the anchor bolts is 25,000 psi. Therefore, the NRC staff finds that the structural integrity of the restraints is reasonably assured for both the seismic and handling event loads because the loads on the anchor bolts are well below the allowable stresses, and the design of the support is such that the restraint thickness and cross-sectional area at all critical locations exceed the total anchor bolt area.

The NRC staff evaluated the past operating and maintenance experience with these supports and the proposed future inspection program. The licensee stated that six of the eight pumps identified in the proposed alternative were replaced in the last 7 years. Best effort examinations were performed on the supports associated with these pumps. The January 4, 2019, supplement stated that there has been no operating or maintenance experience indicative of possible restraint degradation. The proposed alternative would continue to perform a best effort examination of the upper restraint of each pump removed for maintenance rather than limit the examination to one ESW and one RHRSW pump, as allowed by the ASME Code, Section XI. This examination will be performed remotely to look for evidence of structural deformation and missing, detached, or loosened support items. The upper restraint would logically be expected to experience degradation before the lower support, based on its environment being exposed to continuous wet and dry cycles due to normal variations in spray pond water level. The NRC staff finds that, based on the operating experience with the ESW and RHRSW pump seismic restraints and the licensee's proposed future inspections of the restraints during maintenance of the pumps, structural integrity of the ESW and RHRSW pump seismic restraints is reasonably assured.

In its application, the licensee requested relief for the current fourth 10-year ISI interval and the remainder of plant life for Limerick, Units 1 and 2. The NRC staff finds that the operating experience from the future inspection program proposed in Relief Request 14R-18 may indicate a need to perform additional examinations different from those authorized for the fourth 10-year ISI interval. There may be future technological advances that make it possible to perform the examination of the pump supports remotely, which may eliminate the hardship addressed in Relief Request 14R-18. Further, there may be Code changes that may either tighten or relax

the requirements for the examination of the upper and lower supports for the ESW or RHRSW pumps or changes in future editions of the ASME Code, Section XI.

Based on the above evaluation, the NRC staff finds that the licensee's proposed alternative I4R-18 is only acceptable for the fourth 10-year inservice inspection of Limerick, Units 1 and 2, scheduled to end on January 31, 2027.

4.0 CONCLUSION

As set forth above, the NRC staff determines that the licensee's proposed alternative I4R-18 provides reasonable assurance of the structural integrity of the ESW and RHRSW pump upper and lower seismic supports, and that complying with the specified ASME Code requirement would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(z)(2), and therefore, authorizes the use of proposed alternative I4R-18 at Limerick, Units 1 and 2, for the fourth 10-year inservice inspection interval, which commenced on February 1, 2017, and is scheduled to end on January 31, 2027.

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

Principal Contributor: Keith Hoffman

Date: April 16, 2019

SUBJECT: LIMERICK GENERATING STATION, UNITS 1 AND 2 – ISSUANCE OF RELIEF REQUEST I4R-18 ASSOCIATED WITH INACCESSIBLE SUPPORTS FOR THE FOURTH 10-YEAR INSERVICE INSPECTION INTERVAL PIPING (EPID L-2018-LLR-089) DATED APRIL 16, 2019

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**by memorandum

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