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

June 2, 2020

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: R. E. GINNA NUCLEAR POWER PLANT – ISSUANCE OF RELIEF REQUESTED ASSOCIATED WITH ALTERNATIVE I6R-02 FOR THE SIXTH 10-YEAR INSERVICE INSPECTION INTERVAL (EPID L-2019-LLR-0071)[1]

Dear Mr. Hanson:

By letter dated June 27, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19178A013), Exelon Generation Company, LLC (the licensee) requested relief from the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel (ASME) Boiler and Pressure Vessel Code (Code) for the R. E. Ginna Nuclear Power Plant (Ginna). In Relief Request I6R-02, the licensee proposed to eliminate the volumetric examination of the reactor pressure vessel (RPV) threads in flange during the sixth inservice inspection (ISI) interval at Ginna.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), the licensee proposed an alternative, I6R-02, to eliminate the volumetric examination of the RPV threads in flange on the basis that the alternative provides an acceptable level of quality and safety.

The U.S. Nuclear Regulatory Commission (NRC) staff has determined that the licensee's proposed alternative provides an acceptable level of qualify and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all the regulatory requirements set forth in 10 CFR 50.55a(z)(1). Therefore, the NRC staff authorizes the use of the licensee's proposed alternative I6R-02 at Ginna for the duration of the sixth 10-year inservice inspection program interval, which began on January 1, 2020, and is scheduled to end on December 31, 2029.

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

[1] Relief Request I6R-02 was approved on March 13, 2020. However, to correct administrative errors, the transmittal letter and safety evaluation are being reissued herein; this document supersedes ADAMS Accession No. ML20056D559 in its entirety.
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If you have any questions, please contact the Ginna Project Manager, V. Sreenivas, at 301-415-2597 or V.Sreenivas@nrc.gov.

Sincerely,

James G. Danna

Digitally signed by James G. Danna
Date: 2020.06.02 18:09:48 -04'00'

James G. Danna, Chief
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-244

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 I6R-02 FOR THE

SIXTH 10-YEAR INSERVICE INSPECTION INTERVAL

EXELON GENERATION COMPANY, LLC

R. E. GINNA NUCLEAR POWER PLANT

DOCKET NO. 50-244[1]

1.0 INTRODUCTION

By letter dated June 27, 2019 (Agencywide Documents Access and Management System Accession No. ML19178A013), Exelon Generation Company, LLC (the licensee) requested relief from the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel (ASME) Boiler and Pressure Vessel Code (Code) for the R. E. Ginna Nuclear Power Plant (Ginna). In Relief Request I6R-02, the licensee proposed to eliminate the volumetric examination of the reactor pressure vessel (RPV) threads in flange during the sixth inservice inspection (ISI) interval at Ginna.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), the licensee proposed an alternative, I6R-02, to eliminate the volumetric examination of the RPV threads in flange on the basis that the alternative provides an acceptable level of quality and safety.

2.0 REGULATORY EVALUATION

The regulations in 10 CFR 50.55a(g)(4) state, in part, that ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in Section XI of the applicable editions and addenda of the ASME Code to the extent practical within the limitations of design, geometry, and materials of construction of the components. The threads in the RPV flange are categorized as ASME Code Class 1 components. Therefore, per 10 CFR 50.55a(g)(4), ISI of these threads must be performed in accordance with Section XI of the applicable edition and addenda of the ASME Code.

[1] Relief Request I6R-02 was approved on March 13, 2020. However, to correct administrative errors, the transmittal letter and safety evaluation are being reissued herein; this document supersedes ADAMS Accession No. ML20056D559 in its entirety.

The regulations in 10 CFR 50.55a(z) state that alternatives to the requirements of paragraphs (b) through (h) of 10 CFR 50.55a, or portions thereof, may be used when authorized by the Director, Office of Nuclear Reactor Regulation. A proposed alternative must be submitted and authorized prior to implementation. Paragraph 50.55a(z)(1) of 10 CFR states that alternatives to the requirements of paragraphs (b) through (h) may be used when authorized by the U.S. Nuclear Regulatory Commission (NRC) if the licensee demonstrates that "the proposed alternative would provide an acceptable level of quality and safety."

Based on the above, and subject to the following technical evaluation, the NRC staff finds that the licensee may propose an alternative, and the NRC staff has the regulatory authority to authorize the proposed alternative requested by the licensee.

3.0 TECHNICAL EVALUATION

3.1 Applicable Code Requirement and Components Affected

Proposed alternative I6R-02 applies to the RPV threads in flange, Examination Category B-G-1, Item No. B6.40, in Section XI of the ASME Code.

Examination Category	Item No.	Examination Method	Description	Code Class
B-G-1	B6.40	Volumetric	RPV Threads in Flange	1

For the sixth 10-year ISI interval at Ginna, the code of record for the inspection of ASME Code Class 1, 2, and 3 components is the 2013 Edition of the ASME Code, Section XI. The sixth ISI interval for Ginna began on January 1, 2020, and is scheduled to end on December 31, 2029.

The licensee has requested an alternative to the examination requirements in Examination Category B-G-1, Item No. B6.40, which is listed in Table IWB-2500-1, "Examination Categories," of the ASME Code, Section XI. This item requires volumetric examination every ISI interval of the threads in RPV flange stud holes, as indicated in Figure IWB-2500-12, "Closure Stud and Threads in Flange Stud Hole," of the ASME Code, Section XI.

3.2 Licensee's Proposed Alternative

The licensee proposed to eliminate the required volumetric examination of the threads in flange region during the sixth ISI interval. The NRC authorized a similar alternative for Ginna in the fifth ISI interval by letter dated June 26, 2017 (ADAMS Accession No. ML17170A013).

3.3 Licensee's Basis for Proposed Alternative

The licensee states that the technical basis for eliminating the RPV threads in flange volumetric examinations is provided in Electric Power Research Institute (EPRI) Report No. 3002007626 (ADAMS Accession No. ML16221A068, hereinafter referred to as the EPRI report). The EPRI report discussed the potential for various degradation mechanisms, including pitting, dealloying corrosion, creep, and others. Of all the potential mechanisms considered in the report, only mechanical/thermal fatigue was identified as relevant for the threads in flange.

To evaluate the impact of fatigue, EPRI performed a stress analysis and flaw tolerance evaluation. The stress analysis involved a finite element model with certain geometry assumptions. The applied loads included design pressure, bolt preload, and loads resulting

from 100 degrees Fahrenheit (°F)/h heatup/cooldown transient. For the flaw tolerance evaluation, EPRI calculated an allowable flaw size, assuming linear elastic fracture mechanics as the controlling failure mode. The finite element model used in the stress analysis was also used to calculate stress intensity factors for 360-degree semi-elliptical flaw centered on the bolt hole. For a number of assumed flaw depths, the maximum stress intensity factors were extracted from the model and used to calculate fatigue crack growth. EPRI found that the resulting fatigue crack growth was negligible and that a postulated flaw does not reach critical size for 80 years of operation. In addition to the flaw tolerance evaluation at operating conditions, the licensee performed an analysis for stud preload conditions. The preload analysis indicated that the maximum stress intensity factor for preload does not exceed the room temperature fracture toughness with a structural factor for engineering margin.

The licensee investigated whether the EPRI analysis was applicable to Ginna. As part of that investigation, the licensee calculated that the preload per stud at Ginna was 674 kips (a kip equals 1,000 pounds-force), whereas that of the EPRI analysis was 1,088 kips. The licensee also provided a table comparing EPRI analysis inputs to the actual values at Ginna (reproduced below). As a result of this investigation, the licensee concluded that Ginna was bounded by the EPRI analysis.

Comparison of Ginna Parameters to EPRI Analysis Inputs

Case	No. of Studs	Minimum No. of Studs	Stud Nominal Diameter [inches]	RPV Inside Diameter at Stud Hole [inches]	Flange Thickness at Stud Hole [inches]	Design Pressure [psig]	Preload Stress [psi]
Ginna	48	48	6	128.31	14.56	2500	26,202
EPRI Analysis	54	54	6	173	16	2500	42,338

The licensee referred to the results of a survey of U.S. nuclear plants contained in the EPRI report. The EPRI survey of 94 U.S. plants showed that, after 10,000+ threads in flange exams, no reportable indications have been found. The licensee indicated that the threads in flange exams have been adversely impacting outage activities without identifying service-induced degradation.

Finally, the licensee provided a detailed description of the maintenance activities and inspections that will be performed on the RPV threads in flange and studs each time the RPV head is removed during the sixth ISI interval. The license explicitly identified the plant-specific procedures controlling these activities. The procedures included instruction to visually inspect the studs and stud holes, perform cleaning activities if needed, and other various routine maintenance activities that occur every plant refueling outage. The licensee stated that these controlled maintenance activities provide assurance that any degradation would be detected and mitigated prior to returning the reactor to service.

3.4 NRC Staff Evaluation

The NRC staff has assessed the EPRI report and the safety evaluations issued in its June 26, 2017, letter. The staff finds that mechanical and thermal fatigue are the only potential degradation mechanisms for the threads in the RPV flange. The report documented stress and fatigue crack growth analyses for the flange region of the RPV. The EPRI analysis showed that, for the geometry and boundary conditions assumed, a 360-degree semielliptical flaw will not grow to a critical size throughout 80 years of plant life. The staff compared the relevant

parameters for Ginna, including flange geometry, stud geometry, and stud preload, to the assumptions of the analysis. The staff independently confirmed the 26 kilopound per square inch stud preload referenced in the licensee's submittal. There are several conservatisms in the EPRI analysis, including use of ASME Code, Section XI structural factors and a larger number of assumed fatigue cycles than expected in normal operation of the plant. As a result of this evaluation, the staff finds that the referenced EPRI analysis provides a conservative description of the design and operating conditions at Ginna.

The licensee referenced a 2016 survey in the EPRI report that showed that there have been no indications from threads in flange examinations at 94 U.S. nuclear plants. The staff finds that quality or safety will not be adversely impacted through granting of the proposed relief. Therefore, the proposed alternative, I6R-02, to eliminate the volumetric examination of the RPV threads in flange is acceptable, since these exams only occur once every 10 years under the ASME Code, Section XI requirement.

4.0 CONCLUSION

As set forth above, the NRC staff determines that the licensee has demonstrated that the proposed alternative provides an acceptable level of quality and safety. Accordingly, the staff concludes that the licensee has adequately addressed all the regulatory requirements set forth in 10 CFR 50.55a(z)(1). Therefore, the NRC staff authorizes the use of relief request I6R-02 at Ginna for the sixth ISI interval for ASME Examination Category B-G-1, Item No. B6.40.

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 Contributor: M. Benson

Date: June 2, 2020

SUBJECT: R. E. GINNA NUCLEAR POWER PLANT – ISSUANCE OF RELIEF REQUESTED ASSOCIATED WITH ALTERNATIVE I6R-02 FOR THE SIXTH 10-YEAR INSERVICE INSPECTION INTERVAL (EPID L-2019-LLR-0071) DATED JUNE 2, 2020

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