



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

April 22, 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: R. E GINNA NUCLEAR POWER PLANT– ISSUANCE OF RELIEF
REQUEST ISI-18 REGARDING FIFTH 10-YEAR INSERVICE INSPECTION
PROGRAM INTERVAL (EPID L-2018-LLR-0104)

Dear Mr. Hanson:

By letter dated August 1, 2018, as supplemented by letter dated December 4, 2018 (Agencywide Documents Access and Management System Accession Nos. ML18213A274 and ML18338A235, respectively), Exelon Generation Company, LLC (the licensee) requested relief from the requirements of the American Society of Mechanical Engineers Boiler & Pressure Vessel Code (ASME Code), Section XI, Table IWB-2500-1, for Category B-A and B-D examinations for the R. E. Ginna Nuclear Power Plant (Ginna) reactor pressure vessel welds and nozzle welds.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), the licensee requested to use the proposed alternative to extend the fifth inservice inspection interval at Ginna for Category B-A and B-D examinations from 10 years to 20 years (from January 1, 2010, to December 31, 2029), 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 proposed alternative provides an acceptable 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)(1). Therefore, the NRC staff authorizes the use of Relief Request ISI-18 at Ginna for the extended fifth inservice inspection interval for ASME Category B-A and B-D items until December 31, 2029.

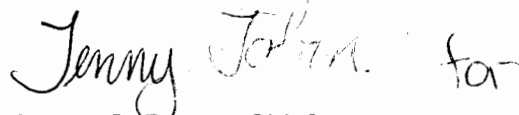
All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in the subject request for relief remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

B. Hanson

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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,

A handwritten signature in cursive script that reads "James G. Danna" followed by a small "for" written to the right.

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



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NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST ISI-18 REGARDING

FIFTH 10-YEAR INSERVICE INSPECTION PROGRAM INTERVAL

EXELON GENERATION COMPANY, LLC

R. E. GINNA NUCLEAR POWER PLANT

DOCKET NO. 50-244

1.0 INTRODUCTION

By letter dated August 1, 2018, as supplemented by letter dated December 4, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML18213A274 and ML18338A235, respectively), Exelon Generation Company, LLC (Exelon or the licensee) requested relief from the requirements of the American Society of Mechanical Engineers Boiler & Pressure Vessel Code (ASME Code), Section XI, Table IWB-2500-1 for Category B-A and B-D examinations for the R. E. Ginna Nuclear Power Plant (Ginna) reactor pressure vessel (RPV) welds and nozzle welds.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), the licensee requested to use the proposed alternative to extend the fifth inservice inspection (ISI) interval at Ginna for Category B-A and B-D examinations from 10 years to 20 years (from January 1, 2010, to December 31, 2029) on the basis that the alternative provides an acceptable level of quality and safety.

2.0 REGULATORY EVALUATION

Adherence to Section XI of the ASME Code is mandated by 10 CFR 50.55a(g)(4), which states, in part, that ASME Code Class 1, 2, and 3 components will meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in Section XI of the ASME Code.

Section 50.55a(z) of 10 CFR states 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. The licensee must demonstrate that: (1) the proposed alternatives 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 U.S. Nuclear Regulatory Commission (NRC) staff finds that regulatory authority exists for the licensee to request the use of an alternative, and the NRC to authorize the proposed alternative.

3.0 TECHNICAL EVALUATION

3.1 Background

The NRC staff's review of this proposed alternative assesses the consistency of the licensee's proposal with WCAP-16168-NP-A, Revision 3, "Risk-Informed Extension of the Reactor Vessel In-Service Inspection Interval," dated October 2011 (ADAMS Accession No. ML11306A084) (hereafter WCAP-A). WCAP-A provides a basis for the acceptability of the proposed inspection intervals for Category B-A and B-D components at U.S. pressurized water reactors (PWRs) designed by Westinghouse, Combustion Engineering, and Babcock and Wilcox, through the use of risk-informed analyses and probabilistic fracture mechanics for a pilot plant of each design. WCAP-A also contains the NRC staff's safety evaluation (SE) of the Westinghouse proposal. The SE finds the proposal acceptable for use based on consistency with the principles contained in Regulatory Guide (RG) 1.174, Revision 1, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis." However, the SE imposes a condition that requires licensees to provide plant-specific information in six areas to demonstrate the applicability of WCAP-A to the licensee's plant. The plant-specific information required by the condition is:

- (1) Licensees must provide the 95th percentile total through-wall cracking frequency ($TWCF_{TOTAL}$) and its supporting material properties at the end of the proposed 20-year ISI interval. The 95th percentile $TWCF_{TOTAL}$ must be calculated using the methodology in NUREG-1874, "Recommended Screening Limits for Pressurized Thermal Shock (PTS)" (ADAMS Accession No. ML070860156), which is frequently referred as "the NRC PTS Risk Study." The RT_{MAX-X} and the shift in the Charpy transition temperature produced by irradiation defined at the 30 ft-lb energy level, ΔT_{30} , must be calculated using the latest revision of RG 1.99, "Radiation Embrittlement of Reactor Vessel Materials," or other NRC-approved methodology.
- (2) Licensees must report whether the frequency of the limiting design-basis transients during prior plant operation are less than the frequency of the design-basis transients identified in the PWR Owners Group (PWROG) fatigue analysis as significant contributors to fatigue crack growth.
- (3) Licensees must report the results of prior ISI of RPV welds and the proposed schedule for the next 20-year ISI interval. Each licensee shall identify the years in which future inspections will be performed, and the dates provided must be within plus or minus one refueling cycle of the dates identified in the implementation plan provided to the NRC in PWROG letter OG-10-238, dated July 12, 2010 (ADAMS Accession No. ML11153A033).
- (4) Licensees with Babcock and Wilcox plants must (a) verify that the fatigue crack growth of 12 heatup/cooldown transients per year that was used in the PWROG fatigue analysis bounds the fatigue crack growth for all of its design-basis transients, and (b) identify the design-bases transients that contribute to significant fatigue crack growth.

- (5) Licensees with RPVs having forgings that are susceptible to underclad cracking and with RT_{MAX-FO} values exceeding 240 degrees Fahrenheit (°F) must submit a plant-specific evaluation because the analyses performed in WCAP-A are not applicable.
- (6) Licensees seeking second or additional interval extensions shall provide the information and analyses requested in Section (e) of 10 CFR 50.61a.

3.2 ASME Code Component Affected

The affected components are the subject plant RPV welds and full penetration nozzle welds. The following examination categories and item numbers from IWB-2500 and Table IWB-2500-1 of the ASME Code, Section XI, are listed in Relief Request ISI-18:

<u>Exam Category</u>	<u>Item Number</u>	<u>Description</u>
B-A	B1.11	Circumferential Shell Welds
B-A	B1.30	Shell-to-Flange Weld
B-A	B1.40	Head-to-Flange Weld
B-D	B3.90	Nozzle-to-Vessel Welds
B-D	B3.100	Nozzle Inner Radius Section

3.3 Applicable Code Edition and Addenda

For the fifth 10-year ISI interval at Ginna, the Code of record for the inspection of ASME Code Class 1, 2, and 3 components is the 2004 Edition of the ASME Code, Section XI.

3.4 Applicable Code Requirements

ASME Code, Section XI, paragraph IWB-2412, "Inspection Program B," requires volumetric examination of essentially 100 percent of the total number of RPV pressure-retaining welds identified in Table IWB-2500-1 once each 10-year interval.

3.5 Licensee's Proposed Alternative

In Relief Request ISI-18, the licensee proposed to perform ASME Code Category B-A and B-D examination items for Ginna in the sixth ISI interval before December 31, 2029, instead of in the fifth ISI interval before December 31, 2019. The NRC staff noted that this is equivalent to extending the fifth ISI interval for the ASME Code Category B-A and B-D examination items from 10 years to 20 years, as permitted by WCAP-A. The licensee stated that although for Ginna the proposed year 2029 to perform the ASME Code-required examination of subject items is not consistent with the schedule proposed in PWROG letter OG-10-238, the impact on the industry inspection plan is minor.

3.6 Licensee's Basis for Alternative

The licensee stated that the alternative is based on a negligible change in risk, satisfying the risk criteria specified in RG 1.174. The licensee further states that the methodology used to conduct this analysis is based on the study defined in WCAP-A. This study focuses on risk assessments of materials within the beltline region of the RPV wall. Appendix A of WCAP-A identifies the parameters to be compared between an applicant's plant and the appropriate pilot plant. These items include:

- Dominant PTS Transients in the NRC PTS Risk Study,
- TWCF,
- Frequency and Severity of Design Basis Transients, and
- Cladding Layers (single/multiple).

Table 1 of Relief Request ISI-18 provides the above parameters for Ginna and the Westinghouse pilot plant. Based on this information, the licensee concludes that the parameters for Ginna are bounded by the results of the Westinghouse pilot plant, and Ginna is qualified for the ISI interval extension.

For the most important parameter, TWCF, the licensee's calculated value is $3.26E-11$ events per year for Ginna, as compared to WCAP-A TWCF of $1.76E-08$ events per year for the Westinghouse pilot plant. The details of the TWCF calculation are presented in Table 3 of Relief Request ISI-18.

Table 2 of Relief Request ISI-18 contains inspection results for Ginna showing that RPV examinations have been performed with satisfactory results.

3.7 Duration of Alternative

The licensee stated that the request is applicable to the Ginna ISI program for the fifth and sixth 10-year ISI intervals. The NRC staff noted that this is equivalent to a request extending the fifth ISI interval for Ginna from 10 years to 20 years until December 31, 2029, for ASME Categories B-A and B-D items listed in Section 3.2 of this SE.

4.0 NRC STAFF EVALUATION

Since WCAP-A methodology has already been accepted by the NRC staff, the current evaluation focused on the manner in which the licensee addresses the four critical parameters in Table A-1 of WCAP-A, Appendix A, and the six plant-specific information items specified in the NRC SE enclosed in WCAP-A (listed in Section 3.1 of this SE).

The NRC staff reviewed the licensee's evaluation of the four critical parameters in Section 5 of Relief Request ISI-18. Regarding the pressurized thermal shock (PTS) transients, the licensee identified the NRC letter report, "Generalization of Plant-Specific Pressurized Thermal Shock (PTS) Risk Results to Additional Plants" (ADAMS Accession No. ML042880482), as its plant-specific basis. This is acceptable because the SE in WCAP-A concludes that, based on this letter report, the PTS transient characteristics are generally applicable for plants from the same reactor vendor. Regarding the cladding layers, the licensee reports "single layer" for Ginna. This is also acceptable because it is consistent with the Westinghouse pilot plant.

The remaining two critical parameters are among the six plant-specific information items discussed below.

4.1 Plant-Specific Information Item (1)

Plant-specific information item 1 addresses TWCFs. Table 3 of the relief request pertains to this item. As contained in the guidance provided in Appendix A in WCAP-A, Table 3 of the relief request contains a summary of the input parameters for all Ginna RPV materials and the resulting TWCFs for the controlling materials. The licensee proposed that the negligible change

in risk contained in Table 3 demonstrates that Ginna is bounded by WCAP-A and is, therefore, acceptable. Specifically, Table 3 of Relief Request ISI-18 provides input chemistry data, unirradiated nil-ductility transition reference temperature (RT_{NDT}), neutron fluence values for all RPV materials, and output shift and TWCF for controlling RPV materials of the unit.

The NRC staff compared Table 3 information with that in the license renewal application (LRA) for Ginna because these LRA values were accepted in NUREG-1786, "Safety Evaluation Report Related to the License Renewal of R.E. Ginna Nuclear Power Plant," May 2004 (ADAMS Accession No. ML041400502), and are considered as the current licensing basis values for 52 effective full power years. The NRC staff found that the fluence values in Table 3 are 15 percent higher than the LRA values, and the chemistry factor for the lower shell forging is 49 percent higher than the LRA value. The NRC staff further found that these updated values in Relief Request ISI-18 are based on WCAP-17036-NP, Revision 0, "Analysis of Capsule N from the R. E. Ginna Reactor Vessel Radiation Surveillance Program," dated May 2009 (ADAMS Accession No. ML091550271). The NRC staff review for WCAP-17036-NP, dated March 4, 2010 (ADAMS Accession No. ML100610677), accepts the report for future use in updating the pressure temperature limits report for Ginna. Therefore, all fluence values and the chemistry factors in Table 3 are acceptable for the current application.

The part of Table 3 titled "Outputs" shows that the calculated total TWCF is $3.26E-11$ events per year for Ginna. The TWCF value was obtained by the licensee using WCAP-A methodology with inputs from the part of Table 3 titled "Inputs." Table 3 used RG 1.99, Revision 2, Position 1.1 (without surveillance data) or Position 2.1 (with surveillance data), to calculate RT_{MAX} ($\Delta T_{30} + \text{unirradiated } RT_{NDT} + 460 \text{ }^\circ\text{F}$) for 53 effective full power years for all RPV beltline materials for Ginna. Using Table 3 input values, the NRC staff has verified the licensee's calculated ΔT_{30} values, RT_{MAX} values, and the resulting TWCF for Ginna. The NRC staff determined that the TWCF can support Relief Request ISI-18 because it is several orders of magnitude lower than the value of $1.76E-08$ for the Westinghouse pilot plant in WCAP-A. Hence, the NRC staff concludes that the licensee has addressed plant-specific information item (1) satisfactorily, and the embrittlement of the Ginna RPV is within the envelope used in the Westinghouse pilot plant analysis and determined by the NRC to be acceptable in its review of WCAP-A.

4.2 Plant-Specific Information Item (2)

The NRC staff then reviewed plant-specific information item (2) regarding the frequency of the limiting design-basis transients. Table 1 states that the heatup/cool-down cycles per year for Ginna are bounded by the heatup/cool-down cycles (7 per year) for the Westinghouse pilot plant. The NRC staff examined the heatup/cool-down design cycles for 40 years of operation in Table 5.1-4 of the Ginna Final Safety Analysis Report. Further, NUREG-1786 indicated that both the linear projection considering the first 30 years of plant operation and the weighted average, considering that the future plant is better operated, would show that the number of transients is not expected to exceed the number of design cycles for 60 years of plant operation. Hence, the NRC staff determines that the number of design cycles listed in Ginna Final Safety Analysis Report Table 5.1-4 for these transients is conservative. Based on the above, the NRC staff found that both frequencies (heatup and cool-down) are below the bounding value of 7 per year for the Westinghouse pilot plant, and the staff concludes that the licensee has addressed plant-specific information item (2) satisfactorily.

4.3 Plant-Specific Information Item (3)

The NRC staff reviewed plant-specific information item (3) regarding the results of prior ISI of RPV welds and the proposed schedule for the extended ISI interval. Table 2 in the submittal contains additional information pertaining to previous RPV inspections and the schedule for the future inspection. Specifically, Table 2 indicated that four 10-year ISIs have been performed for Ginna. No indications were identified in the RPV beltline region during the last ISI. Therefore, the NRC staff determined that the licensee has addressed the first part of plant-specific information item (3) satisfactorily.

The licensee proposed to conduct the next RPV inspection in 2029. This date represents a slight deviation from the RPV inspection proposed in PWROG letter OG-10-238. The proposed change in the inspection date for Ginna would increase the number of inspections in 2029 from five to six and decrease the number of inspections in 2031 from one to zero, making insignificant impact on industrywide inspections in 2029. The impact on the industrywide inspections in 2031 is also minimal because the Ginna inspection data of 2029 is still very useful to the industry in 2031, due to the short time difference of 2 years. Therefore, the NRC staff determines that the deviation has an insignificant impact on the implementation plan in the PWROG letter, and the licensee has addressed the second part of plant-specific information item (3) satisfactorily.

4.4 Plant-Specific Information Items (4) and (5)

The licensee did not address plant-specific information items (4) and (5). The NRC staff examined the specifics in each of these two plant-specific information items and confirmed that these information requirements are not applicable to Ginna.

4.5 Plant-Specific Information Item (6)

Plant-specific information item (6) requests that licensees seeking second or additional interval extensions provide the information and analyses requested in Section (e) of 10 CFR 50.61a. This is the second time that Exelon submitted a relief request of this nature to extend an ISI interval from 10 years to 20 years. The NRC SE dated July 31, 2009 (ADAMS Accession No. ML092080229), approved the first relief request from Ginna to extend the fourth ISI interval to 2019. For a second-time application of this type of relief request to extend the fifth ISI interval to 2029, plant-specific information item (6) requests the licensee provide the information and analyses requested in Section (e) of 10 CFR 50.61a.

Regarding implementation of the first relief request based on WCAP-A at Ginna, the licensee's December 4, 2018, supplement confirmed that Ginna has completed 100 percent of the affected Category B-A and B-D welds as required by ASME Code, IWB-2412, "Inspection Program B," for the fourth ISI interval. The supplement confirmed that the licensee has not yet performed any such examinations for the current fifth ISI interval. This is appropriate.

Further, since the relief request stated that no indications were identified in the RPV beltline during the last ISI, only a certain part of Section (e) applies (i.e., the ultrasonic results must be obtained using procedures, equipment, and personnel that have been qualified under the ASME Code, Section XI, Supplements 4 and 6. The December 4, 2018, supplement confirmed that examination of the affected Category B-A and B-D welds during the extended fourth ISI interval was performed in accordance with the then ASME Code, Section XI, 1995 Edition with 1996 Addenda, Supplements 4 and 6, as modified by 10 CFR 50.55a(b)(2)(xiv, xv, and xvi).

Therefore, the NRC staff determined that the licensee has addressed plant-specific information item (6) satisfactorily.

4.6 Clarification on Duration of Alternative

The licensee stated that the request is applicable to the Ginna ISI program for the fifth and sixth 10-year ISI intervals. The NRC staff clarifies that after the fifth ISI interval is approved to be extended from 10 years to 20 years for the subject welds, the duration of alternative would be 20 years, with the later half of the duration of alternative overlapping with the existing sixth 10-year ISI interval. Therefore, the licensee's stated duration of alternative is acceptable.

4.7 Summary

The NRC staff has reviewed the licensee's submittal and determined that it has satisfied all plant-specific information items specified in the SE for WCAP-16168-NP-A, Revision 3. For the most important one, $TWCF_{95-TOTAL}$, the NRC staff performed independent calculations to verify the input data and output results in Table 3 of the submittal. The difference between the licensee's and the staff's calculated $TWCF_{95-TOTAL}$ is insignificant. With the above information, the NRC staff determined that the proposed alternative is based on WCAP-A methodology, and the $TWCF_{95-TOTAL}$ values in Table 3 of the submittal are bounded by the corresponding pilot plant parameter in WCAP-A. Consequently, the licensee has demonstrated that the proposed alternative meets the guidance provided by RG 1.174, Revision 1, for risk-informed decisions and, therefore, will provide an acceptable level of quality and safety.

5.0 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 NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1). Therefore, the NRC staff authorizes the use of Relief Request ISI-18 at Ginna for the extended fifth ISI interval for ASME Category B-A and B-D items until December 31, 2029.

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

Principal Contributor: S. Sheng

Date: April 22, 2019

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ADAMS Accession No.: ML19100A004

*by memorandum

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