



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

February 2, 2018

Mr. Daniel G. Stoddard
Senior Vice President and Chief Nuclear Officer
Innsbrook Technical Center
5000 Dominion Blvd.
Glen Allen, VA 23060

SUBJECT: NORTH ANNA POWER STATION, UNITS 1 AND 2 – PROPOSED INSERVICE
INSPECTION ALTERNATIVES N1-I4-NDE-010 AND N2-I4-NDE-005 (CAC
NOS. MF9534 AND MF9535; EPID L-2017-LLR-0029)

Dear Mr. Stoddard:

By letter dated March 27, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17090A429), as supplemented by letters dated June 5, 2017 (ADAMS Accession No. ML17160A263), and August 24, 2017 (ADAMS Accession No. ML17241A045), Virginia Electric and Power Company (the licensee) requested relief from the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, regarding the inspection program for the fourth 10-year inspection intervals for North Anna Power Station (NAPS), Units 1 and 2.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z), the licensee proposed alternatives N1-I4-NDE-010 and N2-I4-NDE-005 to revise the inspection program requirements for ASME Code, Section XI, Category B-F, "Pressure Retaining Dissimilar Metal Welds in Vessel Nozzle," to extend the examination intervals for the subject welds from 10 years to 20 years, based on Topical Report WCAP-17236-NP-A, "Risk-Informed Extension of the Reactor Vessel Nozzle Inservice Inspection [ISI] Interval" (ADAMS Accession No. ML12215A043).

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the licensee has adequately addressed all of the regulatory requirements of 10 CFR 50.55a(z)(1), and further, that the proposed alternatives will provide an acceptable level of quality and safety. Therefore, the NRC authorizes the licensee's proposed alternatives to extend the fourth ISI intervals from 10 years to 20 years for the inspection of ASME Code, Section XI, Category B-F pressure retaining dissimilar metal welds in reactor pressure vessel nozzles for NAPS, Units 1 and 2.

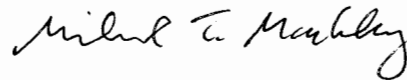
All other ASME Code requirements for which alternatives or relief were not specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

D. Stoddard

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If you have any questions, please contact the Project Manager, Randy Hall, at 301-415-4032 or via e-mail at Randy.Hall@nrc.gov.

Sincerely,

A handwritten signature in black ink that reads "Michael T. Markley". The signature is written in a cursive style with a large, looped "M" and "y".

Michael T. Markley, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-338 and 50-339

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv



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

REQUEST FOR ALTERNATIVE NOS. N1-I4-NDE-010 AND N2-I4-NDE-005

REACTOR PRESSURE VESSEL NOZZLE WELD EXAMINATIONS

FOURTH TEN-YEAR INSERVICE INSPECTION INTERVALS

VIRGINIA ELECTRIC AND POWER COMPANY

NORTH ANNA POWER STATION, UNITS 1 AND 2

DOCKET NOS. 50-338 AND 50-339

1.0 INTRODUCTION

By letter dated March 27, 2017 (ADAMS Accession No. ML17090A429), as supplemented by letters dated June 5, 2017 (ADAMS Accession No. ML17160A263), and August 24, 2017 (ADAMS Accession No. ML17241A045), Virginia Electric and Power Company (the licensee or Dominion) requested relief from the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, regarding the inspection program for the fourth 10-year inspection intervals for North Anna Power Station (NAPS), Units 1 and 2.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z), the licensee proposed alternatives N1-I4-NDE-010 and N2-I4-NDE-005 to revise the inspection program requirements for ASME Code, Section XI, Category B-F, "Pressure Retaining Dissimilar Metal Welds in Vessel Nozzle," to extend the examination intervals for the subject welds from 10 years to 20 years, based on Topical Report (TR) WCAP-17236-NP-A, "Risk-Informed Extension of the Reactor Vessel Nozzle Inservice Inspection Interval" (ADAMS Accession No. ML12215A043). The suffix "-A" indicates that the topical report has been approved by the U.S. Nuclear Regulatory Commission (NRC).

2.0 REGULATORY EVALUATION

Inservice inspection (ISI) of ASME Code Class 1, 2, and 3 components is performed in accordance with Section XI of the ASME Code and applicable addenda as a way to detect anomalies and degradation indications so that structural integrity of these components can be maintained. This is required by 10 CFR 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). Paragraph 10 CFR 50.55a(z) 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 (as delegated). A proposed alternative must be submitted and authorized prior to implementation. The licensee must demonstrate that: (1) the proposed alternative would provide an acceptable level of quality and safety; or (2) compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The ASME Code, Section XI, requires volumetric examination of Category B-F dissimilar metal welds in reactor pressure vessel (RPV) nozzles and Category B-J welds in piping, once every 10-year interval. However, TR WCAP-17236-NP-A (the TR) proposes an alternative which extends the inspection interval of ASME Code, Section XI, Category B-F and B-J welds that do not contain Alloy 82/182 material from 10 years to 20 years. The TR is based on a risk-informed methodology that relies on probabilistic fracture mechanics (PFM) results to support the ISI interval extension. The NRC staff's safety evaluation (SE) for the TR is enclosed in WCAP-17236-NP-A, and that SE specifies the conditions and limitations that must be addressed by licensees in any requests for alternative that reference the TR.

The ASME Code of record for both NAPS, Units 1 and 2 for the fourth 10-year ISI intervals is the 2004 Edition of the ASME Code, Section XI with no Addenda.

3.0 CONDITIONS AND LIMITATIONS TO BE ADDRESSED TO SUPPORT THE REQUEST

The SE enclosed in the TR specified conditions and limitations that must be addressed by licensees proposing to use the TR methodology to justify extension of the ISI interval from 10 years to 20 for the ASME Code, Section XI, Category B-F and Category B-J RPV nozzle welds that do not contain Alloy 82/182 material. These conditions and limitations from the SE are listed as follows:

PFM Evaluation Related Conditions

1. Licensees must confirm that at most one surface breaking flaw is present based on past ISI results. If multiple surface breaking flaws have been detected in past inspections, then the resulting change in failure frequency shall be multiplied by the number of surface flaws. If the total flaw size from this method exceeds the dimension assumed in the TR, a weld-specific PFM analysis should be performed to develop a weld-specific change-in-frequency value.
2. Licensees must identify the years in which future inspections will be performed. The dates provided must be within plus or minus one refueling cycle of the dates identified in the implementation plan referenced in the most recent revision of TR WCAP-16168-NP-A, "Risk-Informed Extension of the Reactor Vessel In-Service Inspection Interval" (ADAMS Accession No. ML11306A084).

Risk-Informed Evaluation Related Conditions

3. Licensees using the Pressurized Water Reactor Owners Group's (PWROG's) change-in-failure-frequency analysis results in Tables 3-3 through 3-6 of the TR must select the 40 or 60 year change-in-failure-frequency results, clarify the relationship between the selected lifetime and the values used in the existing risk-informed ISI (RI-ISI) program, and justify the selected lifetime values.

4. Licensees must submit plant-specific change-in-risk results in the requests for alternative as described in the TR. A change in risk between the ASME requirements and the extended ISI interval must always be provided. If the licensee has a RI-ISI program, the change in RI-ISI risk results including the extended intervals should be provided. If any change in risk exceeds the applicable risk guidelines in the TR, the licensee should identify and justify the deviation.
5. Licensees must identify specifically which of the change-in-risk equations and methods in the TR were used. Any deviations from the selected equations and/or methods must be identified and justified.
6. The use of the changes to the inspection effectiveness or the probability of detection to reflect changes in risk caused by extending the inspection interval may not include the use of the change in failure frequencies in Tables 3-3 through 3-6. Each licensee that uses this method must identify and justify all parameter values used.
7. Licensees should address probabilistic risk assessment (PRA) quality in their requests for alternative. Licensees relying on a NRC staff approved RI-ISI program to demonstrate PRA quality should provide this statement in their submittal and provide any updated information appropriate for the application since the RI-ISI application. Licensees without a NRC staff-approved RI-ISI program must describe the technical adequacy of their PRA in the requests for alternative.

Risk-Informed Evaluation Related Limitation

8. The NRC staff does not endorse the change-in-risk calculations for pilot plants Beaver Valley, Unit 1 (BV-1) and Three Mile Island, Unit 1 (TMI-1) in the TR or the use of any quantitative results from any tables besides Tables 3-3 through 3-6 of the TR. Licensees (including BV-1 and TMI-1) may not reference the examples to justify any evaluation or calculation.

A licensee must provide plant-specific information adequately addressing the above conditions and limitations in order for the NRC staff to determine that the conclusions in the TR apply to the licensee's request for alternative.

4.0 TECHNICAL EVALUATION

4.1 Licensee Evaluation

The licensee's proposed alternatives and evaluation for NAPS, Units 1 and 2 are briefly summarized below. They are described in greater detail in Attachments 1 and 2 of Dominion's March 27, 2017 submittal.

Component(s) for which Alternative is Requested (ASME Code Class 1)

RPV Nozzles.

Examination Category

Category B-F, "Pressure Retaining Dissimilar Metal Welds in Vessel Nozzles."

Examination Item Number

B5.10, "NPS 4 (DN 100) or Larger Nozzle-to-Safe End Butt Welds" (referred to as "subject welds" henceforth).

ASME Code Requirement for which Alternative is Requested

ASME Code, Section XI, 2004 Edition with no Addenda, IWB-2412, Inspection Program B, requires volumetric examination of the subject welds identified in Table IWB-2500-1 once each 10-year interval. The NAPS, Unit 1 and Unit 2 fourth 10-year ISI intervals are scheduled to end on April 30, 2019, and December 13, 2020, respectively. The applicable Code for the fifth 10-year ISI interval for each unit will be selected in accordance with the requirements of 10 CFR 50.55a.

Licensee's Proposed Alternative to the ASME Code

Pursuant to 10 CFR 50.55a(z)(1), an alternative is requested from performing the required examinations on the subject welds before the end of the fourth ISI intervals at NAPS, Units 1 and 2. The licensee's alternatives proposed to perform the ASME Code required subject weld examinations in the fifth ISI intervals for each unit; for NAPS, Unit 1, in the fall of 2028, before the end of the interval on April 30, 2029, and for NAPS, Unit 2, in the fall of 2029, before the end of the interval on December 13, 2030.

Licensee's Bases for Alternative

The alternatives are requested on the basis that the proposed new examination interval would result in a negligible change in risk using the risk criteria specified in Regulatory Guide (RG) 1.174. The methodology used to determine the change in risk from the proposed new interval is based on the TR. The TR methodology focuses on risk assessments of Examination Category B-F and B-J RPV nozzle-to-piping welds and piping welds. The evaluation for NAPS, Units 1 and 2 was performed following the four regulatory evaluation steps defined in Section 2 of the TR. The evaluation addresses the conditions and limitations as defined by the SE for the TR and is compared to the change-in-risk criteria defined in RG 1.174 and ASME Code Case N-716, "Alternative Piping Classification and Examination Requirements." A RI-ISI program, based in part on this ASME Code Case, for NAPS, Units 1 and 2, was approved by the NRC on January 21, 2011 (ADAMS Accession No. ML110050003).

Details of the licensee's evaluations regarding the four steps mentioned above, using plant-specific information and generic information in the TR, are contained in Dominion's March 27, 2017 submittal. The change-in-risk evaluation results are summarized in Table 1 and the effects of the RPV nozzle-to-piping weld ISI interval extensions on each unit's RI-ISI program are summarized in Table 2 of Attachments 1 and 2 for NAPS, Units 1 and 2, respectively. The licensee states that all relevant change-in-risk results in Tables 1 and 2 meet the criteria of RG 1.174 and, therefore, support the requests.

Period of application

The requests for alternative are applicable to the NAPS, Units 1 and 2 ISI program for the fourth 10-year inspection intervals. The required examinations will be performed before the end of the fifth 10-year ISI intervals, as specified.

4.2 NRC Staff Evaluation

As stated in Section 3.0 of this SE, there are eight conditions/limitations that must be addressed by licensees proposing to use the TR methodology to justify extension of the ISI interval from 10 years to 20 years for the ASME Code, Section XI, Category B-F, and B-J RPV nozzle welds that do not contain Alloy 82/182 material. Addressing these conditions/limitations is required by the SE for the TR for any future request for alternative by a licensee to demonstrate plant-specific applicability of the TR, so that the TR methodology and conclusion (i.e., extension of the ISI interval from 10 years to 20 years) can be applied to the subject welds of the plant.

Regarding the first condition, the licensee confirmed that the latest examinations for the NAPS, Units 1 and 2 RPV nozzle-to-piping welds indicated no recordable indications. Therefore, the NRC staff confirmed that NAPS, Units 1 and 2 meet the implementation requirements of having no more than one inside diameter surface flaw in each RPV nozzle-to-piping weld.

The second condition requires licensees to identify the years in which future inspections will be performed. The dates must be within plus or minus one refueling cycle of the dates identified in the implementation plan referenced in the most recent revision of TR WCAP-16168-NP-A. The requests for alternative state that Dominion will perform the ASME Code required examinations for the subject welds for NAPS, Unit 1 in the fall of 2028, before the end of the proposed ISI interval extension on April 30, 2029, and for Unit 2, in the fall of 2029, before the end of the proposed ISI interval extension on December 13, 2030. The licensee further states that the latest implementation plan in PWROG Letter OG-10-238, does not reflect implementation of the extended ISI interval for NAPS, Units 1 and 2. The NRC staff verified this information and determined that the proposed dates for the ASME Code-required examinations for the subject welds for NAPS, Units 1 and 2 meet Condition 2 because Dominion is the first licensee to apply the TR in support of the requests for alternative, and, therefore, the dates that the NAPS unit inspection data will be available for the subject welds will have no impact on the continued gathering of similar inspection data for the subject welds from the rest of the industry.

The third condition requires licensees using Tables 3-3 through 3-6 of the TR to select the 40- or 60-year change-in-failure-frequency results, clarify the relationship between the selected lifetime and the values used in the RI-ISI, and justify the selected lifetime values. The licensee selected the 60-year change-in-failure frequencies without leak detection from Table 3-5 for the change-in-risk evaluations (Step 3). The licensee selected the maximum change-in-failure-frequency with leak detection values for the RI-ISI evaluation (Step 4), which corresponded to the 40-year and 60-year small loss-of-coolant accident change-in-failure frequency values for the outlet and inlet nozzles, respectively. The NRC staff found that the licensee's bounding approach met the third condition.

The fourth condition requires the licensee to submit: (1) the plant-specific change in risk between the ASME requirements and the extended ISI interval, and (2) the change in RI-ISI risk results including the extended intervals. The licensee provided total change in core damage frequency (Δ CDF) and change in large early release frequency (Δ LERF) values for the plant-specific change-in-risk evaluation, which indicated that the change met the RG 1.174 acceptance criteria for an acceptably small change in risk (Δ CDF < 1E-6 and Δ LERF < 1E-7). The licensee also provided change in RI-ISI risk results. The results provided indicated that the system changes (Δ CDF < 1E-7 and Δ LERF < 1E-8) and the total changes (Δ CDF < 1E-6 and Δ LERF < 1E-7) met the acceptance criteria for their RI-ISI program.

The fifth condition requires that licensees identify specifically which of the change-in-risk equations and methods in the TR were used. For the change-in-risk evaluations (Step 3), the licensee provided the calculation table which indicated that the calculations were performed in accordance with the methodology described in Section 3.2.4 and Table 3-9 of the TR. For the RI-ISI evaluation (Step 4), the licensee described its RI-ISI program as the "NAPS ASME CC N-716" RI-ISI program. Since the licensee's evaluation used Table 3-5 change-in-failure-frequency results, it is clear that the licensee's method is the second method of the Electric Power Research Institute EPRI/Code Case N-716 methodology, i.e., bounding without any credit for increase in probability of detection. Therefore, the fifth condition is satisfied.

The sixth condition is specific to licensees that choose to use the changes to the initiating event or the probability of detection to reflect changes in risk caused by extending the inspection interval. The licensee did not use an approach which would require consideration of the sixth condition.

The seventh condition requires licensees to address PRA quality in their requests for alternative. The NRC staff approved Dominion's RI-ISI program for NAPS on January 21, 2011. By letter dated June 5, 2017, the licensee provided supplemental information regarding the technical adequacy of the PRA model. The licensee indicated that the NAPS-R07 PRA model underwent a full scope peer review in 2013. The licensee identified those supporting requirements that were assessed not to meet capability Category II of the ASME PRA Standard and identified all of the finding level Facts and Observations (F&Os). Subsequently, the licensee developed the NAPS-R07e PRA model, which was an interim model revision used to support the development of the proposed ISI alternatives.

The NRC staff issued a request for additional information (RAI) to determine whether the seventh condition was met. The staff requested that the licensee clarify whether its intent was to rely on the approved RI-ISI program, or to describe the technical adequacy of the PRA model used in the requests for alternative to demonstrate PRA quality, and to provide additional supporting information as applicable to the approach taken. In its August 24, 2017, response to the RAI, Dominion clarified that it did not rely on the approved RI-ISI program to demonstrate PRA quality, because the PRA model has been revised and peer reviewed since approval of the RI-ISI program. Additionally, the licensee further clarified the specific resolution of each finding that had the potential to impact this application, described the updates that had been made to the PRA model since the time of the peer review, and indicated which updates were considered to be upgrades. The upgrades were indicated as not having an impact on this application. The staff reviewed this additional information and found the PRA quality to be acceptable for use in Dominion's requests for alternative.

The last item from the TR SE is a limitation prohibiting licensees from referencing the BV-1 and TMI-1 examples to justify any evaluation or calculation. The licensee did not reference the TR examples and, therefore, did not challenge this limitation.

Based on the above evaluation, the NRC staff determined that the licensee has met all conditions in the SE for the TR, and, therefore, has demonstrated that the assumptions and methodology of the TR are applicable to NAPS, Units 1 and 2. Consequently, the SE conclusion regarding extending the ISI interval from 10 years to 20 years for examination of Category B-F or B-J RPV nozzle welds that do not contain Alloy 82/182 applies to NAPS, Units 1 and 2.

5.0 CONCLUSION

The NRC staff has reviewed proposed alternatives N1-I4-NDE-010 and N2-I4-NDE-005 against the eight conditions and limitations specified in the May 23, 2012, SE for the WCAP-17236-NP-A report, which provides the technical bases for extending the ISI interval for ASME Code, Section XI, Category B-F pressure retaining dissimilar metal welds in RPV nozzles from 10 years to 20 years. Based on the evaluation in Section 4.2 of this SE, the NRC staff determined that the licensee's proposed alternatives have demonstrated that the assumptions, methodology, and conclusions of the TR are applicable to NAPS, Units 1 and 2. Therefore, the TR conclusion that the ISI extension from 10 years to 20 years for the subject welds provides an acceptable level of quality and safety applies to NAPS, Units 1 and 2.

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 authorizes the licensee's proposed alternatives to extend the fourth ISI intervals from 10 years to 20 years for the examination of ASME Code, Section XI, Category B-F pressure retaining dissimilar metal welds in RPV nozzles for NAPS, Units 1 and 2. This authorization effectively allows completion of the examination of the subject welds in accordance with the ASME Code of Record for the fourth 10-year ISI intervals to be deferred until the end of the fifth 10-year ISI intervals for each unit.

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: S. Lyons, NRR
S. Sheng, NRR

SUBJECT: NORTH ANNA POWER STATION, UNITS 1 AND 2 – PROPOSED INSERVICE INSPECTION ALTERNATIVES N1-I4-NDE-010 AND N2-I4-NDE-005 (CAC NOS. MF9534 AND MF9535; EPID L-2017-LLR-0029) DATED FEBRUARY 2, 2018

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