



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

December 6, 2016

Site Vice President
Entergy Nuclear Operations, Inc.
James A. FitzPatrick Nuclear Power Plant
P.O. Box 110
Lycoming, NY 13093

SUBJECT: JAMES A. FITZPATRICK NUCLEAR POWER PLANT - RELIEF FROM THE REQUIREMENTS OF THE ASME CODE CASE N-702 AND BWRVIP-241 FOR PLANT NOZZLE-TO-VESSEL WELDS AND NOZZLE INNER RADII (CAC NO. MF8301)

Dear Sir or Madam:

By application dated August 24, 2016, Entergy Nuclear Operations, Inc. (Entergy, the licensee) submitted a request to the Nuclear Regulatory Commission (NRC) requesting alternative examination requirements for the American Society of Mechanical Engineers (ASME) Code Case N-702 and Boiling Water Reactor Vessel Inspection Program (BWRVIP)-241 regarding the Inservice Inspection (ISI) Program for the fourth 10-year inspection interval for James A. Fitzpatrick Nuclear Power Plant (Fitzpatrick).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), Entergy requested to use the proposed alternative on the basis that the alternative provides an acceptable level of quality and safety.

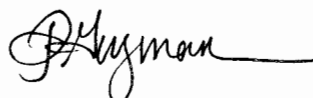
The staff has reviewed the submittal regarding Entergy's evaluation of the first three of the five plant-specific criteria specified in the Safety Evaluation (SE) for the BWRVIP-241 report, dated April 19, 2013. The BWRVIP-241 report provides technical bases for use of ASME Code Case N-702 to examine reactor pressure vessel (RPV) N2 recirculation inlet nozzle-to-vessel welds and nozzle inner radii at Fitzpatrick. Based on the evaluation in Section 4.2 of this SE, the NRC staff determined that Entergy's proposed alternative provides an acceptable level of quality and safety and applies to the requested Fitzpatrick N2 recirculation inlet nozzles. The similar approval for other RPV nozzles is documented in the SE for Relief Request No. 08, dated October 17, 2012.

Accordingly, the NRC staff concludes that Entergy has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1) and is in compliance with the requirements of the ASME Code. Therefore, the NRC authorizes Entergy's proposed alternative for inspection of nozzle-to-vessel shell welds and nozzle inner radii sections of RPV N2 recirculation inlet nozzles for the Fitzpatrick's remaining fourth 10-year ISI interval.

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.

If you have any questions, please contact the Fitzpatrick Project Manager, Diane Render, Ph.D., at (301) 415-3629.

Sincerely,

A handwritten signature in black ink, appearing to read "R. Guzman", with a long horizontal flourish extending to the right.

Richard Guzman, Acting Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-333

Enclosure:
As stated

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST NO. 18

ENERGY NUCLEAR FITZPATRICK, LLC
AND ENERGY NUCLEAR OPERATIONS, INC.

DOCKET NO. 50-333

JAMES A. FITZPATRICK NUCLEAR POWER PLANT

1.0 INTRODUCTION

By application dated August 24, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16238A004), Entergy Nuclear Operations, Inc. (Entergy, the licensee) submitted a request to the Nuclear Regulatory Commission (NRC) requesting alternative examination requirements for the American Society of Mechanical Engineers (ASME) Code Case N-702 and Boiling Water Reactor Vessel Inspection Program (BWRVIP)-241 regarding the Inservice Inspection (ISI) Program for the fourth 10-year inspection interval for James A. Fitzpatrick Nuclear Power Plant (Fitzpatrick).

2.0 REGULATORY REQUIREMENTS

Inservice Inspection of the 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 anomaly and degradation indications so that structural integrity of these components can be maintained. This is required by Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). 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 applicant or 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.

Enclosure

For all reactor pressure vessel (RPV) nozzle-to-vessel shell welds and nozzle inner radii, Section XI of the ASME Code requires inspection of 100 percent of the nozzles during each 10-year ISI interval. However, ASME Code Case N-702 proposes an alternative which reduces the inspection of RPV nozzle-to-vessel shell welds and nozzle inner radius areas from 100 percent to 25 percent of the nozzles for each nozzle type during each 10-year interval. The NRC has approved the BWRVIP-108 report, "BWRVIP-108: BWR Vessel and Internals Project, Technical Basis for the Reduction of Inspection Requirements for the Boiling Water Reactor Nozzle-to-Vessel Shell Welds and Nozzle Inner Radii" and the BWRVIP-241 report, "BWRVIP-241: BWR Vessel and Internals Project, Probabilistic Fracture Mechanics [PFM] Evaluation for the Boiling Water Reactor Nozzle-to-Vessel Shell Welds and Nozzle Blend Radii," which contain the technical basis supporting ASME Code Case N-702. The BWRVIP-241 report contains additional PFM results supporting revision of the evaluation criteria in the BWRVIP-108 report. Hence, the conditions and limitations specified in the safety evaluation (SE) for the BWRVIP-241 report, dated April 19, 2013 (ADAMS Accession No. ML13071A240), supersede those in the SE for the BWRVIP-108 report, dated December 19, 2007 (ADAMS Accession No. ML073600374).

The ASME Code of record for FitzPatrick for the fourth 120-month interval ISI program is the 2001 Edition of the ASME Code, Section XI, through the 2003 Addenda.

3.0 LICENSEE'S PROPOSED ALTERNATIVE

The SE for the BWRVIP-241 report specified plant-specific requirements which must be met for applicants proposing to use this alternative of ASME Code Case N-702. These plant-specific requirements are reproduced from the SE for the BWRVIP-241 report, which are the following:

- (1) The maximum RPV heatup/cool-down rate is limited to less than 115 °F/hour;

For recirculation inlet nozzles

- (2) $(pr/t)/C_{RPV} \leq 1.15$

p = RPV normal operating pressure (psi),
 r = RPV inner radius (inch),
 t = RPV wall thickness (inch), and
 $C_{RPV} = 19332$;

- (3) $[p(r_o^2 + r_i^2) / (r_o^2 - r_i^2)] / C_{NOZZLE} \leq 1.47$

p = RPV normal operating pressure (psi),
 r_o = nozzle outer radius (inch),
 r_i = nozzle inner radius (inch), and
 $C_{NOZZLE} = 1637$;

For recirculation outlet nozzles

(4) $(pr/t)/C_{RPV} \leq 1.15$

p = RPV normal operating pressure (psi),
r = RPV inner radius (inch),
t = RPV wall thickness (inch), and
 $C_{RPV} = 16171$; and

(5) $[p(r_o^2 + r_i^2) / (r_o^2 - r_i^2)]/C_{NOZZLE} \leq 1.59$

p = RPV normal operating pressure (psi),
 r_o = nozzle outer radius (inch),
 r_i = nozzle inner radius (inch), and
 $C_{NOZZLE} = 1977$.

The NRC staff requires that the above five criteria using plant-specific information must be met in order to ensure that the PFM analysis documented in the BWRVIP-241 report applies to the RPV of the applicant's plant.

4.0 TECHNICAL EVALUATION

4.1 Licensee Evaluation

Component for Requested Alternative (ASME Code Class 1): N2, Reactor Recirculation Inlet Nozzles

Examination Category: B-D, "Full Penetration Welded Nozzles in Vessels"

Examination Item Number: B3.90, "Nozzle-to-Vessel Welds" and B3.100, "Nozzle Inside Radius Section"

ASME Code Requirement for Requested Alternative

ASME Section XI, 2001 Edition with the 2003 Addenda, Table IWB-2500-1, Examination Category B-D, Inspection Program B requires a volumetric examination of all nozzles with full penetration welds to the vessel shell (or head) and integrally cast nozzles each 10-year interval. Additionally, for ultrasonic test examinations, Appendix VIII, "Performed Demonstration for Ultrasonic Examination Systems" in ASME Section XI, is implemented; as required and modified by 10 CFR 50.55a(b)(2)(xv).

Proposed Alternative to the ASME Code

Pursuant to 10 CFR 50.55a(z)(1), an alternative is requested from performing the required examinations on 100 percent of the N2 recirculation inlet nozzles. This alternative, incorporation of Code Case N-702, would require examination of a minimum of 25 percent of the nozzle-to-vessel welds and nozzle inner radius sections via inspection of three N2

recirculation inlet nozzle assemblies. Five of the N2 recirculation inlet nozzle assemblies or 50 percent have been inspected during the current interval, with no recordable indications identified.

The NRC SE, dated October 17, 2012 (ADAMS Accession No. ML12279A248), approved the utilization of ASME Code Case N-702 for the fourth 10-year ISI interval for FitzPatrick. The N2 recirculation inlet nozzles were excluded from the alternative because they did not meet the third criterion specified in Section 5.0 of the staff's SE for the BWRVIP-108 report. On April 19, 2013, the NRC approved the use of BWRVIP-241, which documents additional PFM analyses to support the revised five evaluation criteria in the BWRVIP SE. Therefore, FitzPatrick is requesting NRC approval to apply ASME Code Case N-702 based on BWRVIP-241 to the N2 recirculation inlet nozzles for the remainder of the fourth 10-year ISI interval (ending February 3, 2017).

Bases for Requested Alternative (as stated)

The applicability of the criteria in Section 5.0 of the NRC SE regarding BWRVIP-241 to the recirculation inlet nozzles at FitzPatrick is demonstrated as shown below:

(1) Max RPV Heatup / Cooldown Rate

First criterion - the maximum RPV heatup/cooldown rate is limited to $< 115^{\circ}\text{F/hr}$. In accordance with Technical Specification 3.4.9, RCS Pressure and Temperature Limits, the maximum RPV heatup/cooldown rate is limited to $\leq 100^{\circ}\text{F}$ when averaged over any one hour period. FitzPatrick meets this criterion.

(2) Recirculation Inlet (N2) Nozzles

Second criterion - Equation: $(pr/t)/C_{i\text{-RPV}} < 1.15$
 $[(1040)(110.375)/6.875]/19332 = 0.864 < 1.15$
FitzPatrick's result is 0.864, which meets the requirement of this criterion.

(3) Recirculation Inlet (N2) Nozzles

Third criterion - Equation: $[p(r_{o\text{N}2}^2 + r_{i\text{N}2}^2)/(r_{o\text{N}2}^2 - r_{i\text{N}2}^2)]/C_{i\text{-NOZZLE}} < 1.47$
 $[1040(10.22^2 + 6.19^2)/(10.22^2 - 6.19^2)]/1637 = 1.371 < 1.47$
FitzPatrick's result is 1.371, which meets the requirement of this criterion.

Criteria four and five relate solely to recirculation outlet (N1) nozzles that were granted as an alternative to utilize Code Case N-702 as part of Relief Request No. 08 (RR-08) on October 17, 2012.

The NRC SE Section Criteria are met for all nozzles listed in Attachment 1. Therefore, the basis for using Code Case N-702 is demonstrated for the FitzPatrick N2 Recirculation Inlet nozzles.

Period of application (as stated)

Upon approval by the NRC staff, this alternative will be utilized through the remainder of FitzPatrick's fourth inspection interval (March 1, 2007 – February 3, 2017) for the N2 Recirculation Inlet nozzle assemblies.

4.2 Staff Evaluation

Additional PFM results supporting revision of the five evaluation criteria in the SE for the BWRVIP-108 report is documented in the BWRVIP-241 report. The objective of the BWRVIP-241 report is limited, i.e., revision of the limitations and conditions specified in the SE for the BWRVIP-108 report; therefore, it is considered as a supplement to the BWRVIP-108 report, not a replacement. Nonetheless, the conditions and limitations specified in the SE for the BWRVIP-241 report supersede those in the SE for the BWRVIP-108 report. Applicants requesting relief from the inspection requirements on the subject RPV nozzles in Section XI of the ASME Code must demonstrate that the five plant-specific criteria are satisfied, so that BWRVIP-241 report results apply to their plants.

The SE on the BWRVIP-108, established that (1) the fracture toughness-related reference temperature (RT_{NDT}) used in the PFM analyses were based on data from the entire fleet of BWR RPVs, making the PFM analyses bounding with respect to fracture resistance and leaving the driving force of the underlying PFM analyses the only item to be evaluated, and (2) except for the RPV heatup/cooldown rate, the plant-specific criteria are for the recirculation inlet and outlet nozzles only because the probabilities of failure, $P(F|E)$ s, for other nozzles are an order of magnitude lower. Based on the above, the BWRVIP-241 report documents additional PFM analyses on the recirculation inlet and outlet nozzles having the highest driving force among the BWR fleet to demonstrate that the associated vessel failure probability for the normal operation is still consistent with the NRC safety goal, thus supporting the proposed revision of the five evaluation criteria. The SE for the BWRVIP-241 report accepted the proposed revision of the five evaluation criteria in the BWRVIP-108 report.

Entergy provided FitzPatrick's plant-specific RPV and N2 recirculation inlet nozzle data and an evaluation of the first three of the five driving force factors, or ratios, against the criteria established in the SE for BWRVIP-241. Entergy did not address the last two criteria regarding recirculation outlet nozzles because they were previously evaluated and approved in RR-08 for the same fourth ISI interval in an SE dated October 17, 2012. Relief Request No. 08 excluded N2 recirculation inlet nozzles because they failed to meet Criterion 3. Relief Request No. 18 is intended to re-address the applicability of ASME Code Case N-702 to N2 recirculation inlet nozzles by applying the new plant-specific criteria specified in the SE for BWRVIP-241. Therefore, the SE dated October 17, 2012, is still valid, and the current SE only supplements it by extending the application of ASME Code Case N-702 to N2 recirculation inlet nozzles.

The NRC staff examined Entergy's calculations and verified that the evaluation, using the plant-specific RPV and N2 recirculation inlet nozzle data, has demonstrated that Criteria 2 and 3 are satisfied. Although there is a minor revision of the N2 recirculation inlet nozzle dimensions (RR-18 versus RR-08), this revision is not significant and does not change the above NRC staff conclusion. As a result, the reduced inspection requirements in accordance with ASME Code

Case N-702 apply to N2 recirculation inlet nozzles, and the licensee's proposed alternative provides an acceptable level of quality and safety because the plant-specific results have met the revised criteria in BWRVIP-241, which is consistent with the NRC safety goal on PFM results. For other RPV nozzles approved for the same reduced inspection requirements, please see the SE dated October 17, 2012. FitzPatrick has already inspected 50 percent of the N2 recirculation inlet nozzle assemblies during the current fourth ISI interval; therefore, no additional inspection is required for the N2 recirculation inlet nozzle assembly to the end of this interval, per Code Case N-702 requirements.

5.0 CONCLUSION

The staff has reviewed the submittal regarding Entergy's evaluation of the first three of the five plant-specific criteria specified in the SE for the BWRVIP-241 report, dated April 19, 2013. The BWRVIP-241 report provides technical bases for use of ASME Code Case N-702 to examine RPV N2 recirculation inlet nozzle-to-vessel welds and nozzle inner radii at Fitzpatrick. Based on the evaluation in Section 4.2 of this SE, the NRC staff determined that Entergy's proposed alternative provides an acceptable level of quality and safety and applies to the requested Fitzpatrick N2 recirculation inlet nozzles. The similar approval for other RPV nozzles is documented in the SE for RR-08, dated October 17, 2012.

Accordingly, the NRC staff concludes that Entergy has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1) and is in compliance with the requirements of the ASME Code. Therefore, the NRC authorizes Entergy's proposed alternative for inspection of nozzle-to-vessel shell welds and nozzle inner radii sections of RPV N2 recirculation inlet nozzles for the Fitzpatrick's remaining fourth 10-year ISI interval.

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: Simon Sheng

Date: December 6, 2016

Accordingly, the NRC staff concludes that Entergy has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1) and is in compliance with the requirements of the ASME Code. Therefore, the NRC authorizes Entergy's proposed alternative for inspection of nozzle-to-vessel shell welds and nozzle inner radii sections of RPV N2 recirculation inlet nozzles for the Fitzpatrick's remaining fourth 10-year ISI interval.

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.

If you have any questions, please contact the Fitzpatrick Project Manager, Diane Render, Ph.D., at (301) 415-3629.

Sincerely,

/RA/

Richard Guzman, Acting Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-333

Enclosure:
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