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

October 17, 2012

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

SUBJECT: JAMES A. FITZPATRICK NUCLEAR POWER PLANT - ISSUANCE OF RELIEF FROM THE REQUIREMENTS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS BOILER AND PRESSURE VESSEL CODE (TAC NO. ME7243)

Dear Sir or Madam:

By letter dated October 3, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML112770093), Entergy Nuclear Operations, Inc. (Entergy, the licensee) requested changes to the inspection program for the fourth 10-year inservice inspection (ISI) interval for James A. FitzPatrick Nuclear Power Plant (JAF). The proposed changes described in Relief Request RR-8 would revise the inspection requirements for certain reactor pressure vessel (RPV) nozzle-to-shell welds and nozzle inner radius sections from those based on the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI to an alternative based on ASME Code Case N-702, "Alternative Requirements for Boiling Water Reactor (BWR) Nozzle Inner Radius and Nozzle-to-Shell Welds."

The NRC staff has reviewed the licensee's proposed alternative, including its evaluation of the five plant specific criteria specified in the December 19, 2007, Safety Evaluation for the BWRVIP-108 report, which provides the technical bases for the use of ASME Code Case N-702, to examine RPV nozzle-to-vessel welds and nozzle inner radius sections at JAF. Based on the evaluation in the attached safety evaluation, the NRC staff determined that the licensee's proposed alternative provides an acceptable level of quality and safety and is appropriate for application to all JAF RPV nozzles specified in relief request RR-8. This request for alternative does not include recirculation inlet nozzles, feedwater nozzles, and control rod drive return nozzles.

Based on its evaluation, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements, set forth in 10 CFR 50.55a(a)(3)(i), that the use of 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 (a) (3) (i), and the NRC staff authorizes the use of licensee's proposed alternative for inspection of the RPV nozzles, as listed in relief request RR-8, for the remainder of the fourth 10-year ISI interval, which extended from March 1, 2007 to December 31, 2016 at JAF.

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, Mohan Thadani, at (301) 415-1476.

Sincerely,

George Wilson, 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. 8

ENTERGY NUCLEAR OPERATIONS, INC.

JAMES A. FITZPATRICK NUCLEAR POWER PLANT

DOCKET NOS. 50-333

1.0 INTRODUCTION

By letter dated October 3, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML112770093), Entergy Nuclear Operations, Inc. (Entergy, the licensee) requested changes to the inspection program for the fourth 10-year inservice inspection (ISI) interval for James A. FitzPatrick Nuclear Power Plant (JAF).

The proposed changes described in Relief Request RR-8 would revise the inspection requirements for certain reactor pressure vessel (RPV) nozzle-to-shell welds and nozzle inner radius sections from those based on the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI to an alternative based on ASME Code Case N-702, "Alternative Requirements for Boiling Water Reactor (BWR) Nozzle Inner Radius and Nozzle-to-Shell Welds."

2.0 REGULATORY EVALUATION

Inservice inspection 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 indications of degradation so that the 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 U.S. Nuclear Regulatory Commission (NRC) pursuant to 10 CFR 50.55a(g)(6)(i). It states in 10 CFR 50.55a(a)(3) that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if: (i) the proposed alternatives would provide an acceptable level of quality and safety or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the pre-service 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

regulation requires that inservice examination of components and system pressure tests conducted during the first ten-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(b) twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The applicable Code of record for the fourth 10-year ISI interval at JAF is the 2001 Edition of the ASME Code, Section XI, with 2003 Addenda. The fourth 10-year ISI interval at JAF began on March 1, 2007 and is scheduled to end on December 31, 2016.

The 2001 Edition with the 2003 Addenda of the ASME Code, Section XI, Table IWB-2500-1, Examination Category B-D requires a volumetric examination of 100% of all full penetration RPV nozzles-to-shell welds (Item No. B3.90) and nozzle inner radius sections (Item No. B3.100) once each 10-year ISI interval. However, for Boiling Water Reactors (BWRs), ASME Code Case N-702 provides an alternative which reduces the required examination percentage for RPV nozzle-to-shell welds and nozzle inner radius sections from 100% to a minimum of 25% of the nozzles for each nozzle type during each 10-year ISI interval. ASME Code Case N-702 also specifically excludes BWR feedwater nozzles and control rod drive return line nozzles from the provisions of the Code Case N-702. By letter dated November 25, 2002 (ADAMS Accession No. ML023330203), and supplemented by letters dated July 25, 2006 and September 13, 2007 the Boiling Water Reactor Vessel and Internals Project (BWRVIP) submitted Electric Power Research Institute Technical Report 1016123, "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" (the BWRVIP-108 report). The BWRVIP-108 report contains the technical basis supporting the use of ASME Code Case N-702. By letter dated December 19, 2007 (ADAMS Accession No. ML073600374), the NRC issued its safety evaluation (SE) regarding the BWRVIP-108 report. The staff's December 19, 2007 safety evaluation specified plant-specific requirements which must be satisfied by licensees who submit requests for alternatives to use ASME Code Case N-702 on a plant specific basis.

3.0 TECHNICAL EVALUATION

3.1 Requirements for Plant-Specific Implementation of ASME Code Case N-702

The NRC staff's December 19, 2007 safety evaluation for the BWRVIP-108 report identified five plant-specific criteria which must be met for licensees proposing to use the ASME Code Case N-702 alternative on a plant-specific basis. The licensee's request for relief RR-8 must demonstrate that the relevant JAF RPV nozzle-to-shell welds and nozzle inner radius sections meet these plant-specific criteria so that the proposed alternative can be approved for JAF.

In Section 5.0 of the NRC staff's safety evaluation for the BWRVIP-108 report, the NRC staff states that the licensees can demonstrate the plant-specific applicability of the BWRVIP-108 report to their units in their requests for alternatives by meeting the criteria as follows:

(1) the maximum RPV heatup/cooldown rate is limited to less than 115 °F/hour;

For recirculation inlet nozzles only

(2) $(pr/t)/C_{RPV} < 1.15$

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

(3) $[p(r_o^2 + r_i^2)/ (r_o^2 - r_i^2)]/C_{NOZZLE} < 1.15$

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) $(pr/t)/C_{RPV} < 1.15$

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

(5) $[p(r_o^2 + r_i^2)/ (r_o^2 - r_i^2)]/C_{NOZZLE} < 1.15$

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

This plant-specific information is required by the NRC staff to ensure that the probabilistic fracture mechanics (PFM) analysis documented in the BWRVIP-108 report is bounding for the specified JAF RPV nozzles. Note that the four nozzle-specific criteria above apply only to the recirculation system inlet and outlet nozzles. Section 5.0 of the SE for BWRVIP-108 states that only the recirculation inlet and outlet nozzle criteria need to be evaluated because the BWRVIP-108 PFM analysis demonstrated that the conditional probabilities of failure, P(F|E)s, for the other RPV nozzles covered in ASME Code Case N-702 are an order of magnitude lower.

3.2 Licensee Evaluation

ASME Code Components and Requirements for which Alternative is Requested

The licensee's request for alternative applies to the 2001 Edition with the 2003 Addenda of the ASME Code, Section XI, Table IWB-2500-1, Examination Category B-D, "Full Penetration Welded Nozzles in Vessels – Inspection Program B." Examination B-D requires a volumetric

examination of 100% of all full penetration RPV nozzles-to-shell welds (Item No. B3.90) and nozzle inner radius sections (Item No. B3.100) each 10-year ISI interval.

For ultrasonic examinations of the affected components, the licensee will continue to implement the performance demonstration initiative (PDI) requirements of the ASME Code, Section XI, Appendix VIII, "Performance Demonstration for Ultrasonic Examination Systems," as required by 10 CFR 50.55a(b)(2)(xv) and ASME CC N-702.

Licensee's Proposed Alternative

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee requested an alternative to the ASME Code, Section XI requirements for performing the required volumetric examinations on 100% of the RPV nozzle-to-shell welds and nozzle inner radius sections identified below. As an alternative, the incorporation of ASME Code Case N-702 would require examination of a minimum of 25% of the nozzle-to-shell welds and nozzle inner radius sections, including at least one nozzle from each system and nominal pipe size as shown in the table below.

ASME Code Class	Examination Category	Item Numbers	Component Description	Total Number of Components	Minimum Number to be Examined
1	B-D	B3.90 & B3.100	Recirculation Outlet Nozzles (N1)	2	1
1	B-D	B3.90 & B3.100	Main Steam Nozzles (N3)	4	1
1	B-D	B3.90 & B3.100	Core Spray Nozzles (N5)	2	1
1	B-D	B3.90 & B3.100	Jet Pump Instrumentation Nozzles (N8)	2	1
1	B-D	B3.90 & B3.100	Closure Head Instrumentation Nozzles (CH Inst.)	2	1
1	B-D	B3.90 & B3.100	Closure Head Vent Nozzles (CH Vent)	1	1

The licensee noted that the feedwater nozzles and control rod drive return nozzle are outside the scope of ASME Code Case N-702 and are therefore excluded from this request for alternative. The licensee also noted that the recirculation inlet nozzles are excluded from the proposed alternative because these nozzles did not meet the third criterion specified in Section 5.0 of the staff's safety evaluation for the BWRVIP-108 report for plant-specific application of ASME Code Case N-702.

The licensee noted that ASME Code Case N-702 stipulates that the VT-1 examination method may be used in lieu of the volumetric examination method for the nozzle inner radius sections. The licensee stated that JAF has adopted ASME Code Case N-648-1, with the provisions stipulated in Regulatory Guide 1.147, "Inservice Inspection Code

Case Acceptability, ASME Section XI, Division 1," Revision 16, October 2010, for the fourth 10-year ISI interval at JAF. ASME Code Case N-648-1 allows for the use of the VT-1 examination method for the nozzle inner radius sections.

Licensee's Basis for Alternative

The licensee stated that the BWRVIP-108 report provides the basis for the use of ASME Code Case N-702. The licensee noted that the PFM analysis in BWRVIP-108 found that failure probabilities at the RPV nozzle-to-shell weld and nozzle inner radius section due to a Low Temperature Overpressure event are very low (i.e., less than 1×10^{-6} for 40 years) with or without inservice inspection. Accordingly, the report concludes that inspection of 25% of each nozzle type is technically justified.

The licensee identified that the BWRVIP-108 report was approved by the NRC in a safety evaluation dated December 19, 2007. Section 5.0 of the safety evaluation indicates that each licensee, who plans to request an alternative to the ASME Code, Section XI requirements for inservice examinations of the RPV nozzle-to-shell welds and nozzle inner radius sections, may reference the BWRIP-108 report as the technical basis for the use of ASME Code Case N-702 as an alternative. In Section 5.0 of the NRC staff's safety evaluation, the NRC staff further states that each licensee must demonstrate the plant-specific applicability of the BWRVIP-108 report to its unit, when requesting approval of an alternative, by demonstrating that the five plant-specific criteria (as discussed above) are met.

The licensee evaluated the five criteria for plant-specific applicability of BWRVIP-108, and determined that the nozzles identified in the table above are acceptable for plant-specific application of ASME Code Case N-702. Based on its evaluation of the third criterion from Section 5.0 of the NRC staff's safety evaluation, the licensee determined that the recirculation inlet nozzles (N2) do not meet this criterion and are therefore excluded from the proposed alternative.

Period of application

The licensee specified that the proposed alternative will be used for the remainder of the fourth 10-year ISI interval which extended from March 1, 2007 to December 31, 2016 at JAF.

3.3 Staff Evaluation

The NRC staff's safety evaluation, dated December 19, 2007, for the BWRVIP-108 report specified five plant-specific criteria that licensees must meet to demonstrate that the BWRVIP-108 report results apply to their plants. The five criteria are related to the crack driving force for the PFM analyses for the recirculation inlet and outlet nozzles. The December 19, 2007 safety evaluation indicates that the nozzle material fracture toughness-related reference temperature (RT_{NDT}) used in the PFM analyses were based on data from the entire fleet of BWR RPVs. Therefore, the BWRVIP-108 report PFM analyses are bounding with respect to fracture resistance, and only the driving force of the underlying PFM analyses needs to be evaluated. The December 19, 2007 safety evaluation also states that, with the exception of the RPV heatup/cooldown rate, the plant-specific criteria are related only to the recirculation inlet and outlet nozzles because the conditional probabilities of failure, P(F|E)s, for the other Examination

Category B-D nozzles within the allowable scope of ASME Code Case N-702 are an order of magnitude lower. The plant-specific heatup/cooldown rate that the staff established in Criterion 1 pertains to the rate of temperature change under the plant's normal operating condition, which is limiting. Events that involve heatup/cooldown rate excursions exceeding 115 °F/hour are considered as transients. As stated in the December 19, 2007, safety evaluation, the PFM analysis results for a very severe low temperature overpressure transient are not limiting, largely because the event frequency for that transient is $1x10^{-3}$ event per reactor operating year, as opposed to 1.0 event per operating year for the normal operating conditions.

The licensee's submittal included plant-specific data for the JAF RPV and its evaluation of the five driving force factors against the criteria established in the December 19, 2007, safety evaluation. For the four nozzle-specific criteria, the staff performed confirmatory calculations to verify the licensee's result. A summary of the staff's results regarding whether licensee had satisfied these five criteria is provided below:

Criterion (1) The maximum RPV heat-up/cool-down rate shall be limited to less than 115 °F per hour:

> The licensee stated that, in accordance with JAF Technical Specification 3.4.9, reactor coolant system (RCS) heat-up/cool-down rates are limited to ≤100°F per hour when averaged over any one hour period. Therefore, based on the above specifications for the JAF RCS heat-up/cool-down rates, the staff concluded that the licensee has satisfied Criterion (1) from the staff safety evaluation for BWRVIP-108.

Recirculation inlet nozzles

Criterion (2) $(pr/t)/C_{RPV} < 1.15$, where p = normal RV operating pressure, r = RV inner radius, t=RV wall thickness, and C_{RPV} = 19332 psi (as specified in the staff's SE for BWRVIP-108):

> The NRC staff confirmed the licensee's calculated value for $(pr/t)/C_{RPV}$ of 0.87. Therefore, the NRC staff concluded that the licensee has satisfied Criterion (2) of the NRC staff's safety evaluation for BWRVIP-108.

Criterion (3) $[p(r_o^2 + r_i^2)/ (r_o^2 - r_i^2)]/C_{NOZZLE} < 1.15$, where p = normal RV operating pressure, r_o = recirculation inlet nozzle outer radius, r_i = nozzle inner radius, and C_{NOZZLE} = 1637 psi (as specified in the NRC staff's safety evaluation for BWRVIP-108):

> The NRC staff confirmed the licensee's calculated value for $[p(r_o^2 + r_i^2)/ (r_o^2 - r_i^2)]/C_{NOZZLE}$ of 1.303. The NRC staff agreed that the JAF RPV inlet nozzles do not meet Criterion (3) from the NRC staff's safety evaluation for BWRVIP-108.

Recirculation outlet nozzles

Criterion (4) $(pr/t)/C_{RPV} < 1.15$, where p = normal RV operating pressure, r = RV inner radius, t = RV wall thickness, and C_{RPV} = 16171 psi (as specified in the staff's SE for BWRVIP-108):

The NRC staff confirmed the licensee's calculated value for $(pr/t)/C_{RPV}$ of 1.04. Therefore, the staff concluded that the licensee has satisfied Criterion (4) from the staff's safety evaluation for BWRVIP-108.

Criterion (5) $[p(r_o^2 + r_i^2)/ (r_o^2 - r_i^2)]/C_{NOZZLE} < 1.15$, where p = normal RV operating pressure, r_o = recirculation outlet nozzle outer radius, r_i = nozzle inner radius, and C_{NOZZLE} = 1977 psi (as specified in the NRC staff's SE for BWRVIP-108):

The NRC staff confirmed the licensee's calculated value for $[p(r_o^2 + r_i^2)/ (r_o^2 - r_i^2)]/C_{NOZZLE}$ of 1.08. Therefore, the NRC staff concluded that the licensee has satisfied Criterion (5) from the NRC staff's safety evaluation for BWRVIP-108.

It should be noted that the recirculation inlet nozzles are outside the scope of the licensee's request for alternative because they failed to meet the Criterion (3), as shown above. Further, the RPV feedwater nozzles and control rod drive return line nozzles are outside the scope of ASME Code Case N-702 and are, accordingly, outside the scope of the licensee's request for alternative.

The NRC staff noted that ASME Code Case N-702 and ASME Code Case N-648-1 state that the VT-1 visual examination method may be used in lieu of the ASME Code, Section XI-required volumetric examination method for the nozzle inner radius sections. The licensee's submittal states that the VT-1 visual examination method will be used in lieu of the volumetric examination method for the nozzle inner radius sections, as provided for in ASME Code Case N-648-1. The staff noted that the performance of VT-1 visual examinations in lieu of volumetric examinations for the nozzle inner radius sections, as provided for in ASME CC N-648-1, is permitted by RG 1.147, Revision 16, with the following condition:

> In place of a UT examination, licensees may perform a visual examination with enhanced magnification that has a resolution sensitivity to detect a 1-mil width wire or crack, utilizing the allowable flaw length criteria of Table IWB-3512-1 with limiting assumptions on the flaw aspect ratio. The provisions of Table IWB-2500-1, Examination Category B-D, continue to apply except that, in place of examination volumes, the surfaces to be examined are the external surfaces shown in the figures applicable to table IWB-2500-1 (the external surface is from point M to point N in the figure).

The licensee's submittal states that JAF will abide by these provisions. Therefore, the staff concludes that the use of the VT-1 visual examination method in lieu of the volumetric examination method by the licensee for examinations of the nozzle inner radius sections is acceptable.

The NRC staff also noted that, consistent with the provisions of ASME Code Case N-702, the licensee stated that, for ultrasonic examinations of the affected components, it will continue to implement the PDI requirements of the ASME Code, Section XI, Appendix VIII, "Performance Demonstration for Ultrasonic Examination Systems."

Based on its review of the licensee's evaluation of the five plant-specific criteria, as discussed above, the NRC staff determined that the reduced inspection sample requirements specified ASME Code Case N-702 may be applied to all the proposed JAF RPV nozzles identified in relief request RR-8, which excludes the recirculation inlet nozzles from alternative examination. Therefore, the NRC staff concludes that the licensee's proposed alternative, for all JAF RPV nozzles included in RR-8 (see Section 3.2 of this SE), provides an acceptable level of quality and safety.

4.0 CONCLUSION

The NRC staff has reviewed the licensee's proposed alternative, including its evaluation of the five plant specific criteria specified in the December 19, 2007, safety evaluation for the BWRVIP-108 report, which provides the technical bases for the use of ASME Code Case N-702, to examine RPV nozzle-to-vessel welds and nozzle inner radius sections at JAF. Based on the evaluation in Section 3.3 of this safety evaluation, the NRC staff concludes that the licensee's proposed alternative provides an acceptable level of quality and safety and is appropriate for application to all JAF RPV nozzles specified in relief request RR-8. This approval for an alternative does not include recirculation inlet nozzles, feedwater nozzles, and control rod drive return nozzles.

Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(i), and the NRC staff authorizes the use of licensee's proposed alternative for inspection of the RPV nozzles, as listed in relief request RR-8, for the remainder of the fourth 10-year ISI interval which extended from March 1, 2007 to December 31, 2016 at JAF.

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: C. Sydnor

Date: October 17, 2012

If you have any questions, please contact the Fitzpatrick Project Manager, Mohan Thadani, at (301) 415-1476.

Sincerely,

/ra/
George Wilson, Chief
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-333

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OFFICE	LPL1-1/PM	LPL1-1/LA	Tech Staff	LPL1-1/BC
NAME	MThadani	KGoldstein	JPoehler*	GWilson
DATE	10/15/12	10/09/12	08/30/12	10/17/12

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