



Entergy Operations, Inc.  
1340 Echelon Parkway  
Jackson, MS 39213  
Tel 601-368-5573

Mandy K. Halter  
Director, Nuclear Licensing

10 CFR 50.55a

W3F1-2018-0060

October 19, 2018

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, DC 20555-0001

Subject: Request for NRC Alternative to ASME Code Case N-770-2, Successive Examinations, Relief Request W3-ISI-031

Waterford Steam Electric Station, Unit 3  
NRC Docket No. 50-382  
License No. NPF-38

- References:
1. Entergy Operations, Inc. (EOI) letter to U.S. Nuclear Regulatory Commission (NRC), "Waterford 3 Request for Alternative W3-ISI-023, ASME Code Case N-770-1 Successive Examinations," dated September 26, 2013 (ADAMS Accession Number ML13270A041).
  2. NRC letter to EOI, "Waterford Steam Electric Station, Unit 3 – Request for Alternative W3-ISI-023, Associated with Weld Examination Coverage Requirements Specified in ASME Code Case N-770-1 (TAC No. MF2815)," dated March 26, 2014 (ADAMS Accession Number ML14070A008).
  3. EOI letter to NRC, "Clarification to Waterford 3 Request for Alternative W3-ISI-023," dated September 18, 2018 (ADAMS Accession No. ML18255A362).

Pursuant to 10 CFR 50.55a, "Codes and Standards," paragraph (z)(2), Entergy Operations, Inc. (EOI) requests U.S. Nuclear Regulatory Commission (NRC) approval of the attached relief request associated with the Fourth Inservice Inspection (ISI) interval of the Waterford Steam Electric Station, Unit 3 (Waterford 3) ISI program.

By this submittal, EOI is requesting to use an alternative to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Case N-770-2, as conditioned by 10 CFR 50.55a(g)(6)(ii)(F), for the volumetric examination of dissimilar metal butt welds associated with the suction and discharge piping of the Reactor Coolant Pumps at Waterford 3.

By letter and Safety Evaluation (SE) dated March 26, 2014 (Reference 2), the NRC previously approved Waterford 3 Relief Request W3-ISI-023, pursuant to 10 CFR 50.55a(a)(3)(ii) on the basis that compliance with the requirements of Code Case N-770-1, as required by 10 CFR 50.55a(g)(6)(ii)(F), would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The required coverage could not be obtained due to interference or geometry, and obtaining additional coverage would have necessitated modification and/or replacement of the components.

This relief was granted until the scheduled refueling outage in the fall of 2018 [RF22], not to exceed 54 months at weld temperatures of 525 degrees Fahrenheit or greater between completion of subject weld volumetric examinations.

The Waterford 3 refueling outage schedule has since been revised and RF22 is now scheduled to commence in early 2019. Subsequent to approval of Relief Request W3-ISI-023, Code Case N-770-1 was replaced by N-770-2. This request is being submitted in order to receive schedule relief until the examinations can be performed during RF22.

The Enclosure and associated Attachments provide EOI's request for relief, including the basis for the proposed alternative. EOI requests that the proposed alternative be effective immediately upon approval by the NRC staff, with a duration extending until the start of RF22 in early 2019. Based on Waterford 3 operating history and the expected RF22 outage start date, this will not exceed 54 months at weld temperatures of 525 degrees Fahrenheit or greater between completion of subject weld volumetric examinations.

EOI requests approval of the proposed alternative by November 8, 2018.

This submittal contains a revision to a regulatory commitment that was made in Reference 1. This revision is provided in Attachment 2 of the Enclosure.

This submittal supersedes the Reference 3 letter.

If you have any questions or require additional information, please contact the Acting Regulatory Assurance Manager, John V. Signorelli, at (504) 739-6032.

Respectfully,



Mandy K. Halter

MKH/jls

Enclosure: 10 CFR 50.55a Request Number W3-ISI-031, Proposed Alternative in Accordance with 10 CFR 50.55a(z)(2) [with two Attachments]

cc: NRC Region IV Regional Administrator  
NRC Senior Resident Inspector – Waterford Steam Electric Station, Unit 3  
NRR Project Manager

**Enclosure to**

**W3F1-2018-0060**

**Entergy Operations, Inc.**

**10 CFR 50.55a Request Number W3-ISI-031**

**Proposed Alternative in Accordance with 10 CFR 50.55a(z)(2)**

**Hardship without Compensating Increase in Level of Quality and Safety**

**(6 pages)**

**Entergy Operations, Inc.**  
**10 CFR 50.55a Request Number W3-ISI-031**  
**Proposed Alternative in Accordance with 10 CFR 50.55a(z)(2)**

**Hardship without Compensating Increase in Level of Quality and Safety**

**1. PLANT/UNIT**

Waterford Steam Electric Station, Unit 3 (Waterford 3)

**2. INTERVAL**

4th Interval beginning December 1, 2017, and ending November 30, 2027.

**3. COMPONENTS AFFECTED**

**Components/Numbers:** Pressure retaining dissimilar metal butt welds containing nickel-based Alloy 82/182 materials.

Component ID	Component Description
07-002	30" Reactor Coolant Pump (RCP) 1A Inlet Elbow Carbon Steel (CS) to Safe-end (Cast Stainless Steel (CASS))
08-014	30" RCP 1A Outlet Safe-end (CASS) to Pipe (CS)
09-016	30" RCP 1B Inlet Elbow (CS) to Safe-end (CASS)
10-002	30" RCP 1B Outlet Safe-end (CASS) to Pipe (CS)
11-002	30" RCP 2A Inlet Elbow (CS) to Safe-end (CASS)
13-016	30" RCP 2B Inlet Elbow (CS) to Safe-end (CASS)
14-002	30" RCP 2B Outlet Safe-end (CASS) to Pipe (CS)

**Code Classes:** American Society of Mechanical Engineers (ASME) Code Class 1

**Examination Category:** ASME Boiler and Pressure Vessel (BPV) Code Case N-770-2, as conditioned by 10 CFR 50.55a(g)(6)(ii)(F)

**Inspection Item:** B

**Description:** Unmitigated Butt Weld at Cold Leg Operating Temperature

**4. CODE EDITION AND ADDENDA**

American Society of Mechanical Engineers (ASME) Section XI, 2007 Edition, 2008 Addenda.



## **5. REQUIREMENTS**

The regulations in 10 CFR 50.55a(g)(6)(ii)(F), "Augmented ISI requirements: Examination requirements for Class 1 piping and nozzle dissimilar-metal butt welds - (1) Implementation," state: "Holders of operating licenses or combined licenses for pressurized-water reactors as of or after August 17, 2017, shall implement the requirements of ASME BPV Code Case N-770-2 instead of ASME BPV Code Case N-770-1, subject to the conditions specified in paragraphs (g)(6)(ii)(F)(2) through (13) of this section, by the first refueling outage starting after August 17, 2017."

Code Case N-770-2 requires successive examination of all Inspection Item B welds, as defined in Table 1 of the Code Case, every second inspection period not to exceed seven years after the baseline examination is performed using Section XI, Appendix VIII requirements. Code Case N-770-2 has been incorporated into the Waterford 3 ISI Program.

The regulations in 10 CFR 50.55a(g)(6)(ii)(F)(4) Examination coverage, state "When implementing Paragraph -2500(a) of ASME BPV Code Case N-770-2, essentially 100 percent of the required volumetric examination coverage shall be obtained, including greater than 90 percent of the volumetric examination coverage for circumferential flaws. Licensees are prohibited from using Paragraphs -2500(c) and -2500(d) of ASME BPV Code Case N-770-2 to meet examination requirements."

ASME BPV Code Case N-460 allows a reduction in coverage due to interference or geometry as long as the overall coverage is greater than 90 percent. Code Case N-460 has been unconditionally accepted by the NRC in Regulatory Guide 1.147, Revision 18.

## **6. REASON FOR REQUEST**

As documented in the NRC Safety Evaluation (SE) dated March 26, 2014 (Reference 2), relief was previously granted to Waterford 3 as Relief Request W3-ISI-023 pursuant to 10 CFR 50.55a(a)(3)(ii), on the basis that compliance with the requirements of Code Case N-770-1, as required by 10 CFR 50.55a(g)(6)(ii)(F), would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The required coverage could not be obtained due to interference or geometry, and obtaining additional coverage would have necessitated modification and/or replacement of the components. This approval was until the scheduled refueling outage in the fall of 2018 [RF22], not to exceed 54 months at weld temperatures of 525 degrees Fahrenheit or greater, between completion of subject weld volumetric examinations. The authorization is invalid for a specific weld, if service-induced flaws are detected in the weld.

The Waterford 3 outage schedule has since been revised and RF22 is now scheduled to commence in early 2019. Subsequent to approval of Relief Request W3-ISI-023, Code Case N-770-1 was replaced by N-770-2. This request is being submitted in order to receive schedule relief until the examinations can be performed during RF22.

## 7. PROPOSED ALTERNATIVE AND BASIS

Entergy Operations, Inc. (EOI) proposes to obtain relief from the Code Case N-770-2 examination coverage requirements until the examinations can be performed during RF22 with the alternative coverage requirements being the results obtained during the examinations performed during RF19. The background and basis for this relief follows.

The credited baseline examination requirement of 10 CFR 50.55a(g)(6)(ii)(F) for the seven RCP inlet and outlet welds listed in Section 3 was performed in 2009 during RF16. These examinations were performed using ASME Code, Section XI, Appendix VIII requirements. The examinations performed for the baseline could not obtain essentially 100% coverage of the required examination volume due to the weld taper and the presence of the CASS safe-ends. Component specific details of each weld examination, including the percent of Code required coverage achieved, has been previously submitted (References 4, 5, and 6).

The current limitation to these welds is due to weld joint limitations and not surface conditioning. To obtain additional axial coverage of just the Primary Water Stress Corrosion Cracking (PWSCC) susceptible material, weld build-up of the dissimilar metal butt weld would be required, along with additional contouring and an ASME Code, Section III, required radiographic (RT) examination. However, even this would not address the cast stainless steel limitation.

The design configuration of the welds limits the volumetric examination to be performed primarily from the ferritic steel side of the welds. Due to the short length of the CASS safe-ends and the adjacent safe-end-to-pump welds and nozzle-to-safe end welds, there is not adequate surface from which to perform scanning from the safe-end side of the weld; therefore, the required 100% coverage cannot be obtained.

As documented in the NRC SE dated May 31, 2013, (Reference 7), the use of alternative W3-ISI-020 was approved. In the safety evaluation, the NRC determined that fulfilling the essentially 100% examination requirements for axial flaws is not possible using the technology and procedures that were available at the time. The NRC also concluded that complying with the specified requirement would require modification or replacement of the components which would constitute a hardship.

ASME Code Case N-770-1 required successive examination of all Inspection B welds to be performed using Section XI, Appendix VIII requirements and meeting the Code Case required examination volume of essentially 100%.

Letter W3F1-2013-0044 (Reference 1) was submitted to request NRC staff approval of alternative W3-ISI-023. This was submitted prior to the performance of the successive examinations of the subject welds (which were scheduled to be performed in 2014 during RF19) to allow for less than essentially 100 percent examination coverage.

As documented in the NRC SE dated March 26, 2014 (Reference 2), the use of alternative W3-ISI-023 was approved. This allowed EOI to ultrasonically examine the subject welds to the extent that had been obtained when the baseline examinations were performed in 2009 during RF16 in lieu of the Code Case N-770-1 examination coverage requirements. Entergy had stated that if the examination coverage obtained during the successive examinations was less than that obtained during the baseline examinations for the weld with the bounding examination coverage (i.e., weld 08-014), then additional relief would be sought.



Attachment 1 to this Enclosure contains Table 1, "Pressure Retaining Dissimilar Metal Butt Welds Containing Nickel-Based Alloy 82/182 Materials 2014 Examination Coverage." This table provides the examination coverage obtained during RF19. For all of the subject welds, the examination coverage obtained exceeded that of the weld with the bounding examination coverage. Note that Reference 1 stated that RCP outlet weld 14-002 was expected to meet the requirements of Code Case N 770-1 examination requirements contained in Code Case N 770 1-2500(b) when examined during RF19. As shown in the table, the N 770 1 volume coverage achieved for weld 14-002 during RF19 was 100%.

The examination of these welds performed in the credited baseline examinations used non-encoded Linear Phased Array (LPA) ultrasonic techniques. For the RF19 examinations, phased array ultrasonic techniques were used with encoding for data capture, allowing independent review away from the examination location. These techniques are qualified in accordance with ASME Section XI, Appendix VIII, Supplement 10 for dissimilar metal welds and 10 CFR 50.55a, and administered by the Performance Demonstration Initiative (PDI) Program.

Subsequent to the performance of the examinations, Code Case N-770-1 was replaced by Code Case N-770-2. The volume coverage requirements of N-770-2 for the Axial and Circumferential Scans that are noted in the table have not changed with the revision of the Code Case; therefore, the results are applicable to both revisions.

EOI previously provided information in letter W3F1-2012-0102 dated December 16, 2012 (Reference 6) and in letter 2CAN121201 dated December 4, 2012 (Reference 8) indicating that analyses had concluded a postulated initial flaw that is 16.7% through wall would grow to the ASME Code allowable flaw size of 75% through wall in approximately 54 months from the inspection. The largest undetected flaw that could exist due to the examination limitations is 10% through wall, providing a margin of 6.7%. Based on the results of the examinations performed in RF19, which obtained examination coverage equal to or better than the most limiting coverage obtained in the 2009 examinations, the crack growth analysis supports operation of Waterford 3 for 54 months at normal operating temperature from the RF19 (Spring 2014) exams.

The basis for the alternative W3-ISI-023 states that flaw growth in the subject welds would not exceed the ASME Code allowable flaw size during 54 months at operating temperatures of 525 degrees Fahrenheit or higher. Given the operating history since the Spring 2014 outage, 54 months at operating temperature would end January 31, 2019. The start date of the Spring 2019 refueling outage is before January 31, 2019, therefore, the alternative to inspection requirements will not exceed 54 operating months.

EOI will perform Code Case N-770-2 examinations at Waterford 3 prior to the conclusion of the Spring 2019 outage (RF22).

EOI continues to monitor technology changes and plans to use the best available PDI qualified techniques to examine the subject piping welds, as practical. The examination techniques utilized in the 2014 examinations are essentially unchanged, continue to be the best available technology. To improve upon these examination coverage percentages, modification and/or replacement of the component would be required.

## **8. DURATION**

EOI requests that the proposed alternative be effective immediately upon approval by the NRC staff, with duration to be until the examinations can be performed during the Spring 2019 outage (RF22).

## **9. PRECEDENT**

Relief from this requirement was previously granted as W3-ISI-023 during the third Waterford 3 120 month ISI Interval on the basis that the proposed alternative would provide a hardship without a compensating increase in the level of quality and safety. That approval was documented in the NRC SE dated March 26, 2014 (Reference 2).

## **10. REFERENCES**

1. W3F1-2013-0044, Waterford 3 Request for Alternative W3-ISI-023, ASME Code Case N 770-1 Successive Examinations, September 26, 2013 [NRC ADAMS Accession Number ML13270A041].
2. Waterford Steam Electric Station, Unit 3 - Request for Alternative W3 ISI 023, ASME Code Case N-770-1 Successive Examinations, Third 10-Year Inservice Inspection Interval (TAC No. MF2815), March 26, 2014 [NRC ADAMS Accession Number ML14070A008].
3. W3F1-2018-0044, Clarification to Waterford 3 Request for Alternative W3-ISI-023, September 12, 2018 [NRC ADAMS Accession Number ML18255A362].
4. W3F1-2012-0085, Waterford 3 Request for Alternative W3-ISI-020, ASME Code Case N 770-1 Baseline Examination Request for Alternative, October 16, 2012 [NRC ADAMS Accession Number ML12296A241].
5. W3F1-2012-0096, Waterford 3 Response to an NRC Request for Additional Information (RAI) associated with W3-ISI-020, Request for Alternative to ASME Code Case N-770-1 Baseline Examination (TAC No. ME9801), November 15, 2012 [NRC ADAMS Accession Number ML12324A170].
6. W3F1-2012-0102, Waterford 3 Supplemental Response to an NRC Request for Additional Information (RAI) Associated with W3-ISI-020, Request For Alternative to ASME Code Case N-770-1 Baseline Examination (TAC No. ME9801), December 16, 2012 [NRC ADAMS Accession Number ML12352A172].
7. Waterford Steam Electric Station, Unit 3 - Request for Alternative W3-ISI-020, ASME Code Case N-770-1 Baseline Examination (TAC No. ME9801), May 31, 2013 [NRC ADAMS Accession Number ML13128A129].
8. 2CAN121201, Revised Request for Alternative ANO2-ISI-007 Code Case N-770-1 Baseline Examination Arkansas Nuclear One, Unit 2, December 4, 2012 [NRC ADAMS Accession Number ML12340A449].

Attachment 1: Table 1, Pressure Retaining Dissimilar Metal Butt Welds Containing Nickel-Based Alloy 82/182 Materials

Attachment 2: Waterford Steam Electric Station, Unit 3 Regulatory Commitment



**Enclosure Attachment 1 to**

**W3F1-2018-0060**

**Table 1**

**Pressure Retaining Dissimilar Metal Butt Welds  
Containing Nickel-Based Alloy 82/182 Materials  
2014 Examination Coverage**

**(1 Page)**

**Table 1  
Pressure Retaining Dissimilar Metal Butt Welds Containing Nickel-Based Alloy 82/182 Materials  
2014 Examination Coverage**

Component ID	Component Description	N-770-1 Volume Coverage Axial Scan for Circumferential Flaws	N-770-1 Volume Coverage Circumferential Scan for Axial Flaws	N-770-1 Volume Coverage Total %	Volume Coverage of PWSCC Susceptible Material Axial Scan for Circumferential Flaws	Volume Coverage of PWSCC Susceptible Material PDQS Qualified Circumferential Scan for Axial Flaws
07-002	30" RCP 1A Inlet Elbow (CS) to Safe-end (CASS)	100.0%	90.6%	95.3%	100%	100%
08-014	30" RCP 1A Outlet Safe-end (CASS) to Pipe (CS)	100%	73.4%	86.7%	100%	100%
09-016	30" RCP 1B Inlet Elbow (CS) to Safe-end (CASS)	86.4%	86.4%	86.4%	100%	100%
10-002	30" RCP 1B Outlet Safe-end (CASS) to Pipe (CS)	100%	73.6%	94.3%	100%	100%
11-002	30" RCP 2A Inlet Elbow (CS) to Safe-end (CASS)	100%	93.6%	96.8%	100%	100%
13-016	30" RCP 2B Inlet Elbow (CS) to Safe-end (CASS)	100%	88.2%	94.1%	100%	100%
14-002	30" RCP 2B Outlet Safe-end (CASS) to Pipe (CS)	100%	100%	100%	100%	100%

Note: For weld profiles that have a tapered surface, the PDQS states that the procedure is not qualified to detect axial flaws on the far side (stainless steel side) of a single sided access. This would limit the qualified exams from the near side (carbon steel side) to the weld centerline including the PWSCC susceptible weld material scanned within this detectable region.

PDQS: Performance Demonstration Qualification Summary

PA-UT: Phased Array Ultrasonic Examination

**Enclosure Attachment 2 to**

**W3F1-2018-0060**

**Waterford Steam Electric Station, Unit 3**

**Regulatory Commitment**



**Waterford Steam Electric Station, Unit 3  
Regulatory Commitment**

This table identifies actions discussed in this letter for which Entergy commits to perform. Any other actions discussed in this submittal are described for the NRC's information and are not commitments.

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE (If Required)
	ONE- TIME ACTION	CONTINUING COMPLIANCE	
Perform N-770-2 examination of the 30" and 12" RCS nozzles within 54 operating months with cold leg temperatures at or above 525 degrees Fahrenheit following the Spring 2014 refueling outage.	<b>X</b>		Prior to conclusion of the Spring 2019 Waterford 3 Refueling Outage.