



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

January 13, 2020

Site Vice President
Entergy Operations, Inc.
Waterford Steam Electric Station, Unit 3
17265 River Road
Killona, LA 70057-3093

SUBJECT: WATERFORD STEAM ELECTRIC STATION, UNIT 3 – APPROVAL OF RELIEF
REQUEST WF3-RR-19-2, RELIEF FROM THE REQUIREMENTS OF ASME
CODE SECTION XI REGARDING ALTERNATE REPAIR OF DEGRADED
DRAIN LINE OF CHEMICAL AND VOLUME CONTROL SYSTEM
(EPID L-2019-LLR-0066)

Dear Sir or Madam:

By letter dated July 18, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19199A708), as supplemented by letter dated July 22, 2019 (ADAMS Accession No. ML19203A365), Entergy Operations, Inc. (Entergy or the licensee) requested relief from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Article IWA-4000, "Repair/Replacement Activities," at Waterford Steam Electric Station, Unit 3 (Waterford 3). Specifically, the licensee requested an alternative to the requirements in Article IWA-4000 based on ASME Code, Section XI, Code Case N-666-1, "Weld Overlay of Class 1, 2, and 3 Socket Welded Connections, Section XI, Division 1."

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(z)(2), Entergy submitted Relief Request WF3-RR-19-2 proposing an alternate repair of the degraded drain line, 2CH1-30, of the chemical and volume control system on the basis that complying with the repair/replacement activities of the ASME Code, Section XI would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

On July 24, 2019 (ADAMS Accession No. ML19205A540), the U. S. Nuclear Regulatory Commission (NRC) verbally authorized the use of Relief Request WF3-RR-19-2 for Waterford 3 until the end of Refueling Outage 23, which is scheduled for fall 2020. The NRC staff determined that the proposed alternative is technically justified and provides reasonable assurance of structural integrity of the affected piping. This safety evaluation documents the technical basis for the NRC's verbal authorization.

As set forth in the enclosed safety evaluation, the NRC staff concludes that the proposed alternative provides reasonable assurance of structural integrity of the subject drain piping. The NRC staff finds that complying with the requirements of the ASME Code, Section XI would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the NRC authorizes

the use of Relief Request WF3-RR-19-2 at Waterford 3 until the end of Refueling Outage 23, which is scheduled for fall 2020.

All other ASME Code, Section XI, requirements for which relief was not specifically requested and authorized herein by the NRC staff remain applicable, including the third-party review by the Authorized Nuclear Inservice Inspector.

If you have any questions, please contact me at 301-415-1390 or via e-mail at April.Pulvirenti@nrc.gov.

Sincerely,

/RA/

April L. Pulvirenti, Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-382

Enclosure:
Safety Evaluation

cc: Listserv

SUBJECT: WATERFORD STEAM ELECTRIC STATION, UNIT 3 – APPROVAL OF RELIEF
REQUEST WF3-RR-19-2, RELIEF FROM THE REQUIREMENTS OF ASME
CODE SECTION XI REGARDING ALTERNATE REPAIR OF DEGRADED
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(EPID L-2019-LLR-0066) DATED JANUARY 13, 2020

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***by e-mail dated**

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DATE	1/13/2020	1/13/2020	

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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 WF3-RR-19-2

ALTERNATE REPAIR OF DEGRADED DRAIN LINE OF

CHEMICAL AND VOLUME CONTROL SYSTEM

ENTERGY OPERATIONS, INC.

WATERFORD STEAM ELECTRIC STATION, UNIT 3

DOCKET NO. 50-382

1.0 INTRODUCTION

By letter dated July 18, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19199A708), as supplemented by letter dated July 22, 2019 (ADAMS Accession No. ML19203A365), Entergy Operations, Inc. (Entergy or the licensee) requested relief from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Article IWA-4000, "Repair/Replacement Activities," at Waterford Steam Electric Station, Unit 3 (Waterford 3).

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(z)(2), Entergy submitted Relief Request WF3-RR-19-2 proposing an alternate repair of the degraded drain line, 2CH1-30, of the chemical and volume control system on the basis that complying with the repair/replacement activities of the ASME Code, Section XI would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

On July 31, 2019 (ADAMS Accession No. ML19221B674), the U. S. Nuclear Regulatory Commission (NRC) verbally authorized the use of Relief Request WF3-RR-19-2 for Waterford 3 until the end of Refueling Outage 23, which is scheduled for fall 2020. The NRC staff determined that the proposed alternative is technically justified and provides reasonable assurance of structural integrity of the affected piping. This safety evaluation documents the technical basis for the NRC's verbal authorization.

2.0 REGULATORY EVALUATION

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

The regulations in 10 CFR 50.55a(z), "Alternatives to codes and standards requirements," state, in part, 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) "Acceptable level of quality and safety." The proposed alternative would provide an acceptable level of quality and safety; or

(2) "Hardship without a compensating increase in quality and safety." 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.

Based on the above, and subject to the following technical evaluation, the NRC staff finds that regulatory authority exists for the licensee to request the use of an alternative and the NRC to grant relief and the use of the proposed alternative.

3.0 TECHNICAL EVALUATION

3.1 ASME Code Components Affected

The affected component is the ASME Code Class 2 pipe, 2CH1-30, which connects the volume control tank outlet header drain to the equipment drain tank sump of the chemical and volume control system.

The inservice inspection interval is the fourth interval beginning on December 1, 2017, and ending on November 30, 2027.

3.2 Applicable Code Edition and Addenda

The code of record for the fourth inservice inspection interval is the ASME Code, Section XI, 2007 Edition through 2008 Addenda. The original construction code is the ASME Code, Section III, Subsection NC, 1971 Edition through 1972 Winter Addenda. The construction code for the repair is the ASME Code, Section III, Subsection NC, 1992 Edition, No Addenda.

3.3 Applicable Code Requirement

The ASME Code, Section XI includes the following applicable requirements:

Paragraph IWA-4411 states: "Welding, brazing, fabrication, and installation shall be performed in accordance with the Owner's Requirements and, except as modified below, in accordance with the Construction Code of the item."

Subparagraph IWA-4411(a) states in part: "Later editions and addenda of the Construction Code, or a later different Construction Code, either in its entirety or portions thereof, and Code Cases may be used, provided the substitution is as listed in subparagraph IWA-4221(c)."

The licensee requested an alternative to the requirements in Article IWA-4000 specified above, based on ASME Code, Section XI, Code Case N-666-1, "Weld Overlay of Class 1, 2, and 3 Socket Welded Connections, Section XI, Division 1," which is approved for generic use in NRC Regulatory Guide (RG) 1.147, Revision 18 (ADAMS Accession No. ML16321A336), but modified to omit the following provisions:

Paragraph 1(d) of the Code Case states in part: "...the Owner shall verify that the pipe base material adjacent to the socket weld requiring overlay meets the required minimum wall thickness."

Paragraph 3(a) of Code Case N-666-1 states in part: "...The completed weld overlay shall meet the dimensional requirements of Figure 1 [of the Code Case].... When the fatigue crack is located in the base metal adjacent to the toe of the socket weld, the minimum throat dimensions shall be measured from the location of the crack farthest from the weld toe."

Figure 1 of Code Case N-666-1 provides weld overlay design details for toe cracks and requires that the angle of the weld overlay along the axis of the pipe shall not exceed 45 degrees.

Paragraph 4(d) of Code Case N-666-1 states in part: "The weld sequence shall be from the fitting to the pipe for the overlay of toe cracks.... The completed weld overlay shall meet the dimensional requirements of Figure 1."

RG 1.147, Revision 18, imposes the following condition on Code Case N-666-1:

"A surface examination (magnetic particle or liquid penetrant) must be performed after installation of the weld overlay on Class 1 and 2 piping socket welds. Fabrication defects, if detected, must be dispositioned using the surface examination acceptance criteria of the Construction Code identified in the Repair/Replacement Plan."

The licensee proposed to meet this condition as part of its proposed alternative.

3.4 Reason for Request

On July 2, 2019, the licensee discovered a leaking flaw in line 2CH1-30 of the chemical and volume control system while performing surveillances per Technical Specification 3.4.5.2 for unidentified reactor coolant system leakage. The licensee stated that the leak was in a short section of straight pipe in between a socket-welded tee and a socket-welded elbow in a 1-inch nominal pipe size drain line connection. The licensee further stated that due to the proximity of the socket-welded elbow, there is not enough length of straight pipe to overlay the socket weld toe crack in accordance with the dimensional requirements of Figure 1 in Code Case N-666-1. The distance between the toes of the socket-welded elbow and socket-welded tee is 1/8 inch or less.

The licensee indicated that the leak is due to a vibration-induced flaw through the straight section of the pipe at the toe of the socket-welded tee. The licensee stated that the flaw initiation and growth were most likely caused by the low cycle/high stress (vibration) fatigue.

The licensee indicated that a repair of the subject pipe in accordance with the ASME Code, Section XI, Article IWA-4000 cannot be performed without changing the operation of the plant to Mode 5 (cold shutdown), should such a repair become necessary. As an alternative to Article IWA-4000, the licensee proposed to perform a weld overlay repair of the subject pipe based on Code Case N-666-1, modified as discussed in Section 3.3 of this safety evaluation, which does not require a plant shutdown.

3.5 Proposed Alternative

The licensee proposed to use Code Case N-666-1, as modified per Section 3.3 above, to repair the subject pipe. In lieu of provisions in paragraphs 1(d), 3(a), and 4(d) of Code Case N-666-1, the licensee proposed to install the weld overlay across both socket welded joints, the pipe, and on the outer surfaces of the socket weld fittings as shown in the Detail 3 drawing of the relief request.

3.6 Basis for Use

The licensee stated that it could not satisfy Code Case N-666-1, paragraph 1(d), because it could not examine the pipe wall thickness at the degraded location due to the proximity of the adjacent socket weld.

According to the licensee, the proposed weld overlay cannot meet the dimensional requirements of paragraph 3(a) and Figure 1 of Code Case N-666-1. This is because the distance between the two socket welds does not permit the weld overlay to be installed on the pipe while meeting the 45-degree slope (maximum) requirement between the pipe and weld overlay contour as indicated in Figure 1 of the Code Case. However, the licensee stated that the proposed weld overlay will maintain the required wall thickness and throat dimensions as specified in paragraph 3(a) of Code Case N-666-1 and will satisfy the wall thickness requirements per the ASME Code Section III Construction Code. The licensee stated that the throat dimension of the proposed design, measured from the leak seal weld surface, is greater than 0.138 inches, which is 77 percent of the nominal pipe wall thickness of 0.179 inch, and will therefore meet the Code Case's design throat dimension.

As an alternative to Code Case N-666-1, paragraph 4(d), the licensee proposed to deposit weld beads in individual layers until the V-groove cavity is filled and flush with the shoulders of the fittings as shown in the Detail 3 drawing of the relief request. The licensee will apply a minimum of two structural layers around the entire circumference of the filled V-groove cavity and fittings. The licensee stated that the weld sequence will be from fitting to fitting. The throat dimensions of this design take no structural credit for the seal weld layers.

The licensee evaluated the structural stability of the circumferentially-oriented through-wall flaw using the criteria described in ASME Code Case N-513-3, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping Section XI, Division 1." The licensee calculated the allowable through-wall flaw in the circumferential direction for the affected piping to be 1.7 inches (41 percent of pipe circumference), which is bounding for the actual through-wall flaw that was determined to be 1.162 inches in length when characterized by the radiography. Based on Code Case N-513-3, the licensee determined that the leaking pipe will be structurally stable until repairs are complete.

In addition, the licensee used the hoop and axial stress limits of the Construction Code, 1971 Edition/Winter 1972 Addenda of the ASME Code, Section III to determine the minimum

required wall thickness of the weld overlay. This evaluation is based on operating loads and conservatively exclude the thickness provided by the 1-inch nominal pipe size, Schedule 80 socket-welded pipe that contains the through-wall crack. The licensee's evaluation shows that the minimum required wall thickness for the weld overlay is 0.021 inches. The licensee stated that the proposed throat dimension of the repair weld is 0.138 inches at the location of the toe crack. This shows that the proposed weld overlay has an additional 0.117 inches of thickness margin as compared to the minimum required weld overlay wall thickness.

3.7 Duration of Proposed Alternative

The licensee requested that the proposed alternative is applicable until repair is performed during Refueling Outage 23, which is scheduled during the fall of 2020.

3.8 NRC Staff Evaluation

The NRC staff determined whether the proposed alternative will provide reasonable assurance that structural integrity of the repaired pipe will be maintained until the next refueling outage in fall 2020 and whether hardship justification is appropriate.

Structural Integrity

The NRC staff evaluated the licensee's requested alternative with the understanding that it is based on the use of staff-accepted provisions from Code Case N-666-1; implementation of the condition on Code Case N-666-1 specified by the NRC in RG 1.147; and the omissions from Code Case N-666-1 identified in Section 3.3 above. Hence, the NRC staff concludes that provisions of the licensee's alternative other than the omissions identified in Section 3.3 have been found to be acceptable. Therefore, the NRC staff's evaluation focused on the requested omissions from Code Case N-666-1 to determine whether they would affect the acceptability of the repair.

Regarding the omission of paragraph 1(d) of Code Case N-666-1, based on the configuration of the socket connections, the NRC staff finds that it is difficult to accurately measure the pipe wall thickness at the flaw location because of the obstruction from the adjacent socket welds. The NRC staff noted that the licensee proposed to install the weld overlay across both socket welded joints, the pipe, and on the outer surfaces of the socket weld fittings to meet the minimum required wall thickness. The NRC staff finds the omission of the paragraph 1(d) requirements acceptable because the final overlaid configuration will have sufficient thickness such that the pipe wall thickness adjacent to the socket weld becomes immaterial.

Regarding Code Case N-666-1, paragraph 3(a), the NRC staff determined that the proposed weld overlay cannot meet the dimensional requirements of Figure 1 of the Code Case and cannot measure the throat dimension from the crack to the weld toe because of the existing socket connection. However, the NRC staff noted that the designed throat dimension of the proposed weld overlay, measured from the leaking seal weld surface, is greater than 0.138 inches whereas the minimum required wall thickness for the weld overlay is 0.021 inches. The NRC staff determined that the designed weld overlay thickness has a margin of 0.117 inches as compared to the minimum required weld overlay thickness of 0.021 inches. The NRC staff noted that the proposed weld overlay meets the wall thickness requirements per the Construction Code. The NRC staff finds that the omission of the requirements in paragraph 3(a) acceptable because the proposed weld overlay thickness exceeds the required weld overlay thickness with sufficient margin.

Code Case N-666-1, paragraph 4(d) requires that the weld overlay be from the fitting to the pipe for overlay of toe cracks and that the completed weld overlay comply with Figure 1 of the Code Case. Based on the licensee's drawing of the weld overlay configuration, the NRC staff determined that the licensee cannot deposit weld metal in a sequence to meet the requirement of paragraph 4(d). The NRC staff finds that although not meeting the requirement of paragraph 4(d), the licensee will deposit a seal weld and follow with weld layers to achieve sufficient overlay thickness. The NRC staff finds that the proposed weld overlay will be installed according to the contour of the existing weld configuration with sufficient thickness to provide structural integrity of the pipe. Therefore, the NRC staff finds that the omission of the paragraph 4(d) requirements acceptable.

The NRC staff finds acceptable that the licensee calculated an allowable flaw length of 1.70 inches, which bounds the actual through-wall flaw at 1.162 inches in length. Should the flaw exceed the allowable flaw length of 1.70 inches, the licensee would need to take corrective actions.

Based on the evaluation above, the NRC staff finds that structural integrity of the repaired pipe will be maintained until the next refueling outage.

Hardship Justification

The NRC staff finds that to perform a repair/replacement in accordance with the ASME Code, Section XI, the licensee needs to shut down the plant to Mode 5, which may cause unintended transients and unnecessary loadings on piping. The NRC staff finds that the proposed weld overlay repair will provide reasonable assurance of structural integrity of the subject piping. Therefore, the NRC staff finds that complying with the requirements of the ASME Code, Section XI would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

4.0 CONCLUSION

Based on the above, the NRC staff determines that the proposed alternative provides reasonable assurance of structural integrity of the subject drain piping. The NRC staff finds that complying with the requirements of the ASME Code, Section XI would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the NRC authorizes the use of Relief Request WF3-RR-19-2 at Waterford Steam Electric Station Unit 3 until the end of Refueling Outage 23, which is scheduled for fall 2020.

All other ASME Code, Section XI, requirements for which relief was not specifically requested and authorized herein by the NRC staff remain applicable, including the third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: John Tsao, NRR

Date: January 13, 2020