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CNRO-2016-00002

January 29, 2016

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

SUBJECT: Relief Request Number RR EN-15-1, Rev. 1 - Proposed Alternative to Use ASME Code Case N-789-1, "Alternative Requirements for Pad Reinforcement of Class 2 and 3 Moderate Energy Carbon Steel Piping for Raw Water Service, Section XI, Division 1"

Arkansas Nuclear One, Units 1 & 2
Docket Nos. 50-313 & 50-368
License Nos. DPR-51 & NPF-6

Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416
License No. NPF-29

James A. Fitzpatrick Nuclear Power Plant
Docket No. 50-333
License No. DPR-59

Indian Point Energy Center, Units 2 & 3
Docket Nos. 50-247 & 50-286
License Nos. DPR-26 & DPR-64

Palisades Nuclear Plant
Docket 50-255
License No. DPR-20

Pilgrim Nuclear Power Station
Docket No. 50-293
License No. DPR-35

River Bend Station, Unit 1
Docket No. 50-458
License No. NPF-47

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

Reference:
1. Entergy Letter to the NRC, Regarding Relief Request Number RR EN-15-1 - Proposed Alternative to Use ASME Code Case N-789-1, "Alternative Requirements for Pad Reinforcement of Class 2 and 3 Moderate-Energy Carbon Steel Piping for Raw Water Service, Section XI, Division 1", dated June 5, 2015
2. E-mail from Mr. Richard Guzman, NRC Project Manager, to Mr. Guy Davant, Entergy, "Request for Additional Information: Relief Request RR EN-15-1 Proposed Alternative to Use ASME Code Case N-789-1 to repair degraded piping for Arkansas Nuclear One et al," dated December 7, 2015

Dear Sir or Madam:

Pursuant to 10 CFR 50.55a(z)(2) and via Reference 1, Entergy Operations, Inc. and Entergy Nuclear Operations, Inc. (hereafter referred to collectively as "Entergy") submitted a relief request for NRC approval to use Code Case N-789-1 as an alternative to the ASME Boiler

and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," requirements on the basis that the current code requirements result in hardship and/or unusual difficulty. Specifically, this request is for application of ASME Code Case N-789-1 for Class 2 and Class 3 moderate energy piping system repairs resulting from degradation mechanisms such as localized erosion, corrosion, cavitation, and pitting at the Entergy nuclear plants listed above.

The NRC subsequently transmitted to Entergy, via Reference 2, a Request for Additional Information (RAI) and requested Entergy provide responses by January 29, 2016. Attachment 1 to this letter provides the specific responses to each RAI question. Entergy has also made the following changes to the subject relief request.

- Section 2 of the relief request has been revised to request NRC approval of the proposed alternative for the 4th ISI intervals at GGNS, RBS, and WF3 and the 5th interval at ANO-1 since the present intervals at these sites end within 1-1/2 years of the requested relief request approval date. ISI information regarding the 4th ISI interval at IPEC-2 was also revised because this interval ends prior to the requested relief request approval date. Finally, ISI information for the 5th interval at JAF has been deleted because of Entergy's decision to permanently cease power operations at JAF. [See Entergy letter JAFP-15-0133 to the NRC dated 11/18/15 (ML15322A273)].

- Section 5 of the relief request has been revised to address an NRC request for additional information (RAI-2).

- Section 6 of the relief request, which addresses duration of the proposed alternative, has been revised to be consistent with the changes made in Section 2.

As such, Entergy hereby submits Revision 1 to RR EN-15-1, which incorporates the described changes. Relief request RR EN-15-1, Rev. 1, which is provided in Attachment 2, supersedes the previously submitted Rev. 0 in its entirety. Changes are shown by revision bars in the right margins.

The information provided in the attachments demonstrates that the proposed request provides an acceptable level of quality and safety and that compliance with the specified requirements of ASME Section XI would result in a hardship and/or unusual difficulty without a compensating increase in the level of quality and safety.

This relief request is proposed for the 10-year Inservice Inspection (ISI) intervals for the facilities as identified in Section 2 of the attached relief request.

Since this relief request could be needed at any time to address an emergent condition, Entergy requests NRC approval as soon as possible or by June 5, 2016.

This letter contains no new commitments.

If you have any questions, please contact Mr. Guy Davant at (601) 368-5756.

Sincerely,

BSF/ghd/aye

Attachments: 1. Response to NRC RAI Regarding Relief Request RR-EN-15-1

2. Relief Request RR EN-15-1, Rev. 1

cc T. Mitchell (ECH)
J. Ventosa (WPO)
D. Jacobs (ECH)
M. Woodby (ECH)
J. Browning (ANO)
K. Mulligan (GGNS)
E. Olson (RBS)
M. Chisum (WF3)
B. Sullivan (JAF)
L. Coyle (IPEC)
J. Dent (PIL)
T. Vitale (PAL)
D. Mannai (WPO)
G. H. Davant (ECH)
All above w/o attachments

NRC Region I Administrator
NRC Region III Administrator
NRC Region IV Administrator
NRC Project Manager (ANO)
NRC Project Manager (GGNS)
NRC Project Manager (RBS)
NRC Project Manager (WF3)
NRC Project Manager (IPEC)
NRC Project Manager (JAF)
NRC Project Manager (PIL)
NRC Project Manager (PAL)
NRC Senior Resident Inspector (ANO)
NRC Senior Resident Inspector (GGNS)
NRC Senior Resident Inspector (RBS)
NRC Senior Resident Inspector (WF3)
NRC Senior Resident Inspector (IPEC)
NRC Senior Resident Inspector (JAF)
NRC Senior Resident Inspector (PIL)
NRC Senior Resident Inspector (PAL)

ATTACHMENT 1

CNRO-2016-00002

RESPONSE TO NRC RAI REGARDING
RELIEF REQUEST RR EN-15-1

RESPONSE TO NRC RAI REGARDING RELIEF REQUEST RR EN-15-1

By letter dated June 5, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML 15159A200), Entergy requested the Nuclear Regulatory Commission (NRC) to authorize relief from Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) for the specific repair/replacement activity identified in Relief Request RR EN-15-1. Relief Request RR EN-15-1 provides an alternative repair method for degraded moderate energy Class 2 and 3 piping using ASME Code Case N-789-1 at Arkansas Nuclear One, Units 1 & 2; Grand Gulf Nuclear Station, Unit 1; James A. Fitzpatrick Nuclear Power Plant; Indian Point Energy Center, Units 2 & 3; Palisades Nuclear Plant; Pilgrim Nuclear Power Station; River Bend Station, Unit 1; and Waterford 3 Steam Electric Station.

To complete its review, the NRC staff requests the following additional information.

1. Section 5, page 4, of the relief request states "Some piping systems are required to be functional and cannot be repaired during refueling outages. The repair of this piping can only be performed when the plant is operating. For this unique case, the reinforcing pad will have to be removed prior to, but no later than, the refueling outage unless specific regulatory relief is obtained." Confirm that the repair will be removed prior to the refueling outage that is scheduled at the end of the fuel cycle during which the repair is performed.

   Entergy Response:

   For piping systems which must remain functional during refueling outages, Entergy will remove Type A and partial-structural Type B reinforcing sleeves prior to the refueling outage that is scheduled at the end of the fuel cycle during which the repair is performed.

2. The licensee includes several restrictions and clarifications in its relief request regarding its use of Code Case N-789-1, such as the case described in question 1 above. However, it is not clear, in all cases, exactly which portions of the Code Case that the licensee will not comply with. (1) Provide a clear description of portions of the code case that will not be followed (2) Provide a clear description of the alternatives to the Code Case (3) Provide the basis for why the alternatives are acceptable.

   Entergy Response:

   As noted by the NRC, Section 5 of the relief request includes several "restrictions and clarifications" regarding use of Code Case N-789-1. To clarify which portions of the Code Case will not be followed, Entergy has revised this section to distinguish Code Case clarifications from Code Case alternatives. Code Case clarifications are provided to describe how Entergy will comply with certain Code Case requirements. Conversely, Code Case alternatives describe proposed alternatives to requirements of the Code Case.

   A. Code Case Clarifications

   Paragraphs 1, 3, 4, 5, and 6 from Revision 0 of the relief request have been included in the "Code Case Clarifications" section of Revision 1. Note that the last sentence of paragraph 1 has been revised so that it no longer allows use of corrosion rates from "a similar system at the plant site".

B. *Code Case Alternatives*

Paragraph 2 from Revision 0 of the relief request has been included in the "Code Case Alternatives" section of the revised relief request since it describes Entergy's proposed alternative to paragraph 3.2(i) of Code Case N-789-1. Paragraph 3.2(i) specifies requirements for evaluating the effect of reinforcing pads on the original analysis. However, paragraph 3.2(i) includes an incorrect reference to NC-2650 (ASME Section III) for Class 2 designs. The fact of this error is demonstrated by the following:

- *NC-2600 addresses quality system programs for material organizations for ASME Class 2 materials. It does not address design. Furthermore, NC-2650 does not exist as a paragraph in NC-2600.*

- *Paragraph 3.2(i) correctly refers to ND-3650 for design of Class 3 reinforcement pads. For Class 2 reinforcement pads, the correct reference is NC-3650, which specifies requirements for analyzing piping system designs, not NC-2650.*

- *The incorrect reference to NC-2650 is a publishing error. When originally approved by ASME under Record 10-1105, paragraph 3.2(i) of Code Case N-789 correctly referred to NC-3650 for Class 2 designs. However, when published, the Code Case included the incorrect reference to NC-2650. This error was corrected in Revision 2 of the Code Case (N-789-2) under ASME Record 13-2014. Upon request, Entergy can provide copies of the ASME Records discussed in this paragraph.*

In conclusion, the reference to NC-2650 in paragraph 3.2(i) is an incorrect reference. The correct code paragraph is NC-3650. Therefore, Entergy will apply NC-3650 instead of NC-2650 when addressing the flexibility analysis of paragraph 3.2(i) of the Code Case.

3. Verify that the proposed alternative in Relief Request RR EN-15-1 will only be implemented when the result of complying with IWA-4000 would result in an unscheduled plant shutdown or extended technical specification required actions which could challenge the technical specification completion time requirements.

Entergy Response:

Raw water piping systems, such as Service Water, may experience wall thinning due to internal degradation. When this occurs, Entergy's preference would be to perform a code repair in accordance with IWA-4000 of ASME Section XI. IWA-4000 repairs, such as pipe replacement and internal weld repair, are preferable because they are approved by the NRC in 10CFR50, permanent, and do not require a supplemental replacement during the next refueling outage. However, performance of IWA-4000 repairs is not always possible or may result in unnecessary plant risk for one or more of the following reasons:

- *Longer repair times may challenge the Technical Specification (TS) completion time or necessitate a plant shutdown because the repair cannot be performed within the TS completion time.*

- *Isolation of the affected piping to facilitate performance of an IWA-4000 repair may result in a plant configuration or condition which sufficiently increases the likelihood of an initiating event (e.g., plant scram, loss of power, turbine trip) or plant coping capability resulting in an unacceptable level of plant risk. Equipment out-of-service considerations (e.g., degree of available redundancy for performing the safety function served by out-of-service equipment, effects on key safety functions, duration of out-of-service condition, likelihood of an initiating event or accident that would require performance of the safety function, etc.) are evaluated in accordance with Entergy procedures.*

- *An IWA-4000 repair, such as pipe replacement or internal weld repair, may not be possible due to excessive leakage by a valve seat or inability to isolate the degraded piping.*

- *Replacement materials may not be available or additional time may be needed to develop plans for performing an IWA-4000 repair or replacement. The proposed alternative provides adequate time for evaluation, design, material procurement, planning, and scheduling of an appropriate permanent repair or replacement of the defective piping, considering the impact on system availability.*

In conclusion, Entergy would only perform the proposed alternative due to the existence of one or more of the conditions described above, or other unforeseen conditions that Entergy determines to be prudent to use the Code Case instead of performing a code repair.

ATTACHMENT 2

CNRO-2016-00002

RELIEF REQUEST RR EN-15-1, Rev. 1

RELIEF REQUEST RR EN-15-1 Rev. 1

1. ASME Code Component(s) Affected

This relief request applies to all ASME Class 2 and 3 moderate energy carbon steel raw water piping systems. Raw water is defined as water such as a river, lake, or well or brackish/salt water used in plant equipment, area coolers, and heat exchangers. In many plants, it is referred to as "Service Water." Moderate energy is defined as less than or equal to 200°F (93°C) and less than or equal to 275 psig (1.9 MPa) maximum operating conditions.

2. Applicable Code Edition and Addenda

The following table identifies the ASME Section XI Code of Record for performing Inservice Inspection (ISI) activities at each Entergy site.

Plant	ISI Interval	ASME Section XI Edition/Addenda	Interval Start	Interval End
Arkansas Nuclear One Unit 1 (ANO-1) (Note 1)	4 5	2001 Edition / 2003 Addenda 2007 Edition / 2008 Addenda (Note 3)	5/31/08 5/31/17	5/30/17 5/30/27
Arkansas Nuclear One Unit 2 (ANO-2)	4	2001 Edition / 2003 Addenda	3/26/10	3/25/20
Grand Gulf Nuclear Station (GGNS) (Note 1)	3 4	2001 Edition / 2003 Addenda 2007 Edition / 2008 Addenda (Note 3)	5/31/08 6/2/17	6/1/17 6/1/27
Indian Point Energy Center Unit 2 (IPEC-2) (Note 2)	5	2007 Edition / 2008 Addenda	6/1/16	5/31/26
Indian Point Energy Center Unit 3 (IPEC-3)	4	2001 Edition / 2003 Addenda	7/21/09	7/20/19
James A. FitzPatrick (JAF)	4	2001 Edition / 2003 Addenda	3/1/07	12/31/16
Palisades (PLP) (Note 2)	5	2007 Edition / 2008 Addenda	12/13/15	12/12/25
Pilgrim Nuclear Power Station (PNPS) (Note 2)	5	2007 Edition / 2008 Addenda	7/1/15	6/30/25
River Bend Station (RBS) (Note 1)	3 4	2001 Edition / 2003 Addenda 2007 Edition / 2008 Addenda (Note 3)	5/31/08 12/1/17	11/30/17 11/30/27
Waterford Unit 3 (WF3) (Note 1)	3 4	2001 Edition / 2003 Addenda 2007 Edition / 2008 Addenda (Note 3)	5/31/08 7/1/17	6/30/17 6/30/27

Notes:

1) The 3rd ISI intervals for GGNS, RBS, and WF3 and the 4th ISI interval for ANO-1 end within 1-1/2 years of the requested relief request approval date. Therefore, Entergy requests the NRC to approve this alternative for the 3rd and 4th GGNS, RBS, and WF3 intervals and the 4th and 5th ANO-1 intervals.

2) The 4th ISI intervals for IPEC-2, PLP, and PNPS end prior to the requested relief request approval date. Therefore, Entergy requests the NRC to approve this alternative for the 5th IPEC-2, PLP, and PNPS ISI intervals.

3) ANO-1, GGNS, RBS, and WF3 will update to the 2007 Edition/2008 Addenda except as otherwise required by the NRC in 10 CFR 50.55a(g)(4)(ii).

The table above identifies the ASME Section XI Code of Record for performing ISI activities at each Entergy nuclear plant. However, it should be noted that ASME Section XI repair/replacement activities at all Entergy nuclear plants are performed in accordance with a standardized Repair/Replacement Program that is based on a common Edition/Addenda of ASME Section XI which, at present, is the 2001 Edition/ 2003 Addenda. As Entergy nuclear sites update their ISI Programs in accordance with 10 CFR 50.55a(g)(4)(ii), Entergy will also update the Code bases of the Repair/ Replacement Program to a later Edition/Addenda of ASME Section XI. The planned update to the Repair/Replacement Program is scheduled for 2017 and no later than December 31, 2017. The Repair/Replacement Program update must comply with 10 CFR 50.55a and, where appropriate, in accordance with 10 CFR 50.55a(g)(4)(iv) and 10 CFR 50.55a(z). (Ref: PNPS PRR-26, dated November 26, 2014; ML14342B0001)

3. Applicable Code Requirements

The Editions/Addenda of ASME Section XI for which the alternative is requested are specified in Section 2, above. Subsection IWA-4000 of these Editions and Addenda provide requirements for welding, brazing, metal removal, and installation of repair/replacement activities.

4. Reason for Request

IWA-4000 requires replacement or internal weld repair of wall-thinning conditions resulting from degradation to be in accordance with the Owner's Requirements and the original or later Construction Code. However, the repair and replacement provisions of IWA-4000 cannot always be utilized when degradation or leakage is identified during plant operations. Other approved alternative repair or evaluation methods are not always practicable because of wall thinness and/or moisture issues. The proposed alternative will permit installation of a technically sound temporary repair to provide adequate time for evaluation, design, material procurement, planning, and scheduling of an appropriate permanent repair or replacement of the defective piping, considering the impact on system availability, maintenance rule applicability, and availability of replacement materials. Without this repair option, compliance with the specified requirements of IWA-4000 would result in hardship and/or unusual difficulty – including higher risks associated with plant shut-downs and extended technical specification actions – without a compensating increase in the level of quality and safety.

5. Proposed Alternative and Basis for Use

Pursuant to 10CFR50.55a(z)(2), Entergy proposes to implement the requirements of Code Case N-789-1 as a temporary repair of degradation in Class 2 and 3 moderate energy raw water piping systems resulting from mechanisms such as erosion, corrosion, cavitation, or pitting, but excluding conditions involving flow accelerated corrosion (FAC), corrosion-assisted cracking, or any other form of cracking. These types of defects are typically identified by small leaks in the piping system or by pre-emptive, non-code required examinations performed to monitor the degradation mechanisms. This repair technique involves welding a metal reinforcing pad – pressure pad or structural pad - to the exterior of the piping system to reinforce the degraded area and restore pressure integrity. This repair technique will be used when it is determined that the temporary repair method is suitable for the particular defect and type of degradation present. Code Case N-789-1 is included in the enclosure of this request.

The Code Case requires that the cause of the degradation be determined, and that the extent and rate of degradation in the piping be evaluated to ensure there are no other unacceptable locations within the surrounding area that could affect the integrity of the repaired piping. The area of evaluation is dependent on the degradation mechanism present.

Entergy implementation of Code Case N-789-1 will include the following clarifications and alternatives:

Code Case Clarifications

1) Regarding paragraph 3.1(a)(1) of the Code Case, Entergy designs of pressure pads will be based on a corrosion rate of 2 times the actual measured corrosion rate in that location. If a repair must be performed without sufficient time to determine the actual rate of corrosion at the repair location, then the pressure pad design will be based on a corrosion rate that is 4 times the estimated maximum (worst-case) corrosion rate for the same degradation mechanism in that system.

2) When gasket material is used in accordance with paragraph 3.2(l) of the Code Case (water-backed applications), Entergy will also require removal of any residual moisture by heating prior to welding.

3) Regarding paragraph 8(b) of the Code Case, Entergy will perform monitoring on a monthly basis during the first quarter as required by Code Case N-789-1. The subsequent monitoring frequency shall be based on corrosion rates calculated using reductions in thicknesses since the previous monitoring inspection, but at least quarterly.

4) Sections 1, 3, 5, and 6 of the Code Case specify that materials, design, installation, and examination of reinforcement pads shall be performed in accordance with the Construction Code or ASME Section III applicable to each Entergy site. As allowed by IWA-4200 and IWA-4411, later Editions and Addenda of the Construction Code or ASME Section III may be used provided any required reconciliations are performed. However, only Editions/Addenda of ASME Section III that have been approved by the NRC in 10 CFR 50.55a will be used.

5) Entergy performs repair/replacement activities in accordance with a fleet-wide, standardized Repair/Replacement Program based on the 2001 Edition/ 2003 Addenda of ASME Section XI. Therefore, this Edition/Addenda of ASME Section XI will be used by all plants whenever the Code Case refers to IWA-4000 until the code bases of the Repair/Replacement Program is updated as noted in Section 2 of this request.

Code Case Alternatives

1) Paragraph 3.2(i) of the Code Case includes an incorrect reference to NC-2650 for the flexibility analysis associated with Class 2 designs. The correct reference should be NC-3650. Entergy will comply with NC-3650.

Code Case N-789-1 includes requirements for incorporating actual or estimated corrosion rates in the design of all reinforcing pads. For pressure pads that cannot be directly measured for the on-going effects of corrosion, rates of twice the measured actual or four times the worst-case corrosion for the system must be incorporated in the design. Structural

pads are required to be directly measured for the on-going effects of corrosion, so these conservative multipliers do not apply to the design of reinforcing pads. In addition, compensatory measures are included to account for any uncertainties in the corrosion rates used, thus providing reasonable assurance that structural integrity and leakage integrity will be maintained. These measures include limiting the design life of reinforcing pads to a maximum of one refueling cycle, and requiring on-going monitoring as follows:

- For structural pads, including their attachment welds and the surrounding area, a baseline thickness examination will be performed followed by monthly thickness monitoring for the first three months. The subsequent examination frequency will be based on the results of corrosion rates calculated as a result of this monitoring, but at a minimum of quarterly.

- Areas containing pressure pads will be visually observed at least once per month to monitor for evidence of leakage. If the areas containing pressure pads are not accessible for direct observation, then monitoring will be accomplished by visual assessment of surrounding areas, or ground surface areas above pressure pads on buried piping, or by monitoring of leakage collection systems, if available.

Regardless of when during a fuel cycle a repair is performed, each repair will be considered to have a maximum service life until no later than the end of the next refueling outage, when a permanent repair or replacement must be performed. The Code Case specifies additional requirements for design of reinforcing pads, installation, examination, pressure testing, and inservice monitoring.

Code Case N-789-1 was approved by ASME Codes and Standards on November 13, 2013; however, it has not been incorporated into Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," and, thus, is not available for application at nuclear power plants without specific NRC approval.

6. Duration of Proposed Alternative

Use of the proposed alternative is requested for the duration of the ISI intervals identified in Section 2. In the case of ANO-1, GGNS, RBS, and WF3, approval of this relief request is anticipated within 1-1/2 years prior to the end of their current ISI intervals; therefore, this request also includes the 4th ISI intervals for GGNS, RBS, and WF3 and the 5th ISI interval for ANO-1.

Code Case N-789-1, paragraph 1(e) requires that reinforcing pads, including those installed during refueling outages, shall not remain in service beyond the end of the next refueling outage. Therefore, regardless of when the pressure or structural pad is installed, Entergy will comply with this requirement with the following clarifications:

- Reinforcing pads installed before the end of the 10-year ISI interval will be removed during the next refueling outage after installation, even if that refueling outage occurs after the end of the 10-year ISI interval. In this case, absent detrimental defects or degradation, duration of the proposed alternative would be until the first refueling outage after the end date of the ISI interval for the applicable Entergy plant.

- Some piping systems are required to be functional and cannot be repaired during refueling outages. The repair of this piping can only be performed when the plant is operating. For this unique case, the reinforcing pad will have to be removed prior to, but no later than, the refueling outage unless specific regulatory relief is obtained.

7. Precedents

A similar alternative was approved for application of Code Case N-789 for ten (10) Exelon Nuclear Power Plants (a total of 17 Units) on May 10, 2012 (Reference 2). Differences between that Code Case and Code Case N-789-1 referenced in this relief request are as follows:

- Design: Paragraph 3.1(a) was revised to clarify the difference between pressure pads and structural pads.
- Design Requirements: Figure 2 was clarified to agree with 3.1(a)(1) to require the design corrosion rate for pressure pads to be twice the actual measured corrosion rate at the location, or if not known then four times the maximum corrosion rate for the system. (See clarification 1 Section 5, above.)
- Water-Backed Applications: A new paragraph 4(b) was inserted: "When welding a reinforcing pad to a leaking area, precautions shall be taken to prevent welding on wet surfaces, such as installation of a gasket or sealant beneath the pad."
- Pressure Testing: A new sentence was added to 7: "Reinforcing pads attached to piping that has not been breached shall be equipped with pressure taps for performance of pressure testing."
- Inservice Monitoring:

  A new sentence was added to paragraph 8(b): "Provisions shall be made for access to structural pads on buried piping during operation in order to accomplish these examinations."

  A new paragraph 8(c) was added requiring pressure pads to be monitored once per month for leakage.

  Paragraph 8(e) of the revised Code Case now specifically requires that all reinforcing pads, regardless of when they are installed, shall have a maximum service life until the end of the next refueling outage.

The NRC also approved an alternative for application of Code Case N-789-1 for two (2) Excel Energy Nuclear Power Plants on May 4, 2015 (Reference 3). A similar repair relief request (RR-3-43) was approved for Indian Point Nuclear Generating Unit No. 3 on February 22, 2008 (Reference 1).

8. References

1) Entergy Indian Point Nuclear Generating Unit No. 3, Safety Evaluation for Temporary Non-Code Repair (Relief Request RR-3-43), February 22, 2008 – See Adams Accession No. ML080280073
2) Exelon Generation Company, LLC, Safety Evaluation for Use of Code Case N-789, May 10, 2012 - See Adams Accession No. ML12121A637

3) Excel Energy Safety Evaluation for Use of Code Case N-789-1, May 4, 2015 – See Adams Accession No. ML15079A003

9. Enclosure

1. ASME Code Case N-789-1, "Alternative Requirements for Pad Reinforcement of Class 2 and 3 Moderate-Energy Carbon Steel Piping for Raw Water Service, Section XI, Div. 1"

RELIEF REQUEST RR EN-15-1, Rev. 1

ENCLOSURE

ASME Code Case N-789-1,

Alternative Requirements for Pad Reinforcement of Class 2 and 3 Moderate-Energy Carbon Steel Piping for Raw Water Service, Section XI, Division 1

Approval Date: November 13, 2013

Code Cases will remain available for use until annulled by the applicable Standards Committee.

Case N-789-1
Alternative Requirements for Pad Reinforcement of Class 2 and 3 Moderate-Energy Carbon Steel Piping for Raw Water Service
Section XI, Division 1

Inquiry: As an alternative to replacement or internal weld repair in accordance with IWA-4400, what requirements may be applied for wall reinforcement of Class 2 and 3 moderate-energy carbon steel raw water[1] piping systems that have experienced internal wall thinning from localized erosion, corrosion, and cavitation or pitting?

Reply: It is the opinion of the Committee that, in lieu of meeting IWA-4400, areas of Class 2 and 3 moderate-energy [i.e., less than or equal to 200°F (93°C) and less than or equal to 275 psig (1.9 MPa) maximum operating conditions] carbon steel raw water piping experiencing internal wall thinning from localized erosion, corrosion, and cavitation or pitting may have the wall reinforced by applying reinforcing pads to the outside surface of the piping in accordance with the following requirements. Excluded from these provisions are conditions involving flow-accelerated corrosion (FAC), corrosion-assisted cracking, or any other form of cracking.

1 GENERAL REQUIREMENTS

(a) Application of the reinforcing pad shall be performed in accordance with a Repair/Replacement Plan satisfying the requirements of IWA-4150.

(b) The design, materials, and installation shall meet the requirements of the Construction Code and IWA-4000, except as stated in this Case.

(c) If the minimum required thickness of reinforcing pad necessary to satisfy the requirements of 3 is greater than the nominal thickness for the size and schedule of the piping, this Case shall not be used.

(d) Additional reinforcement or repair is not permitted on top of an existing reinforcing pad.

(e) Reinforcing pads, including those installed during a refueling outage, shall not remain in service beyond the end of the next refueling outage.

(f) This Case may only be applied to piping not required to be ultrasonically examined for inservice inspection.

2 INITIAL EVALUATION

(a) The material beneath the surface to which the reinforcing pad is to be applied and the adjacent area shall be ultrasonically measured to establish the existing wall thickness and the extent and configuration of degradation to be corrected by the reinforcing pad.

(b) The cause and rate of degradation shall be determined. If the cause is determined to be flow-accelerated corrosion (FAC), corrosion-assisted cracking, or any other form of cracking, this Case shall not apply. The extent and rate of degradation in the piping shall be evaluated to ensure that there are no other unacceptable locations within the surrounding area that could affect the integrity of the repaired piping. The dimensions of the surrounding area to be evaluated shall be determined by the Owner, considering the type of degradation present.

(c) The effects of the repair on the piping and any remaining degradation shall be evaluated in accordance with IWA-4311.

3 DESIGN

3.1 TYPES OF REINFORCING PADS

(a) Reinforcing pads may be used for leak prevention only (pressure pad), or for leak prevention plus structural reinforcement of thinned areas including areas that do, or are expected to, penetrate the piping wall (structural pad).

(1) Pressure pads are designed to retain pressure, and may be used only where the piping is predicted to retain full structural integrity until the next refueling outage assuming a corrosion rate of either 2 times the actual measured corrosion rate in that location, or 4 times the estimated maximum corrosion rate for the system.

[1] Raw water is defined as water such as from a river, lake, or well or brackish/salt water; used in plant equipment, area coolers, and heat exchangers. In many plants it is referred to as "Service Water."

(2) Structural pads are designed for pressure plus structural reinforcement and may be used where the piping is predicted not to retain full structural integrity until the next refueling outage.

3.2 GENERAL DESIGN REQUIREMENTS — PRESSURE AND STRUCTURAL PADS

(a) The design of reinforcing pads shall be in accordance with the applicable requirements of the Construction Code or Section III (NC-3100, ND-3100 and NC-3600, ND-3600 including Appendix II).

(b) The reinforcing pad shall be sized to encompass the unacceptable area with the attachment welds located on adjacent base material of sufficient thickness to accommodate the design stresses.

(c) The plate for the reinforcing pad shall be rolled or otherwise formed to fit the contour of the piping to achieve proper weld fit-up.

(d) The thickness of the reinforcing pad shall be sufficient to maintain required thickness until the next refueling outage.

(e) The tensile strengths of the plate and weld filler metal for the reinforcing pad shall be at least that specified for the base metal to which it is applied.

(f) The predicted maximum degradation of the reinforced piping until the next refueling outage shall be included in the design. The predicted degradation of the piping shall be based on in-situ inspection of, and established data for, similar base metals in similar environments. If the reinforcing pad is predicted to become exposed to the raw water, the predicted degradation of the reinforcing pad shall be based upon established data for base metals or weld metals with similar chemical composition to that used for the reinforcing pad.

(g) Material for reinforcing pads shall be ferritic, with welds of compatible weld filler metal.

(h) The following factors shall be included, as applicable, in the design and application of the pad:

(1) shrinkage effects, if any, on the piping

(2) stress concentrations caused by installation of the reinforcing pad or resulting from existing and predicted piping internal surface configuration

(3) effects of welding on any interior coating

(4) added weight of the pad with respect to any design analyses that could be affected

(i) If flexibility analysis was required by the original Construction Code, the effect of the reinforcing pad shall be reconciled with the original analysis. For rectangular-shaped reinforcing pads on piping designed to NC-2650, ND-3650 and aligned parallel or perpendicular to the axis of the piping, unless a lower stress intensification factor [SIF or (i)] is established, an SIF (i) of 2.1 shall be applied for reinforcing pads on straight pipe and adjacent welds. Also, a stress multiplier of 1.7 shall be applied to the SIF (i) for standard elbows, and an SIF (i) of 2.1 shall be applied for tees and branch connections when the toe of the attachment weld is not less than $2.5\sqrt{Rt_{nom}}$ from any branch reinforcement in Figure 1.

(j) Corners of reinforcing pad plates shall be rounded with radii not less than the reinforcing pad thickness, and the toes of attachment welds at the corners shall have 1 in. (25 mm) minimum radius.

(k) The distance between toes of attachment welds and other attachments or branch reinforcement (Figure 1 and 2) shall not be less than the following equation:

$$d = 2.5\sqrt{Rt_{nom}}$$

where

d = minimum distance between toes of fillet welds of adjacent fillet welded attachments
R = the outer radius of the piping
t_{nom} = nominal thickness of the piping

(l) When permitted by the design, suitable gasket material may be applied inside the pad to prevent moisture during welding (see Figures 1 and 2).

3.3 SPECIFIC DESIGN REQUIREMENTS — PRESSURE PADS

Pressure pads shall meet the requirements of 3.2, Figure 2, and the following:

(a) Fillet-welded pressure pads shall be designed to withstand the membrane strain of the piping in accordance with the requirements of the Code specified in 3.2(a) such that the following criteria are satisfied:

(1) The allowable membrane stress is not exceeded in the piping or the pad.

(2) The strain in the pad does not result in fillet weld stresses exceeding allowable stresses for such welds.

(b) Design as a reinforced opening in accordance with the Construction Code shall satisfy (a).

(c) As an alternative to (a), pressure pads may be designed as structural pads in accordance with 3.4 or as prequalified designs in accordance with 3.5.

3.4 SPECIFIC DESIGN REQUIREMENTS — STRUCTURAL PADS

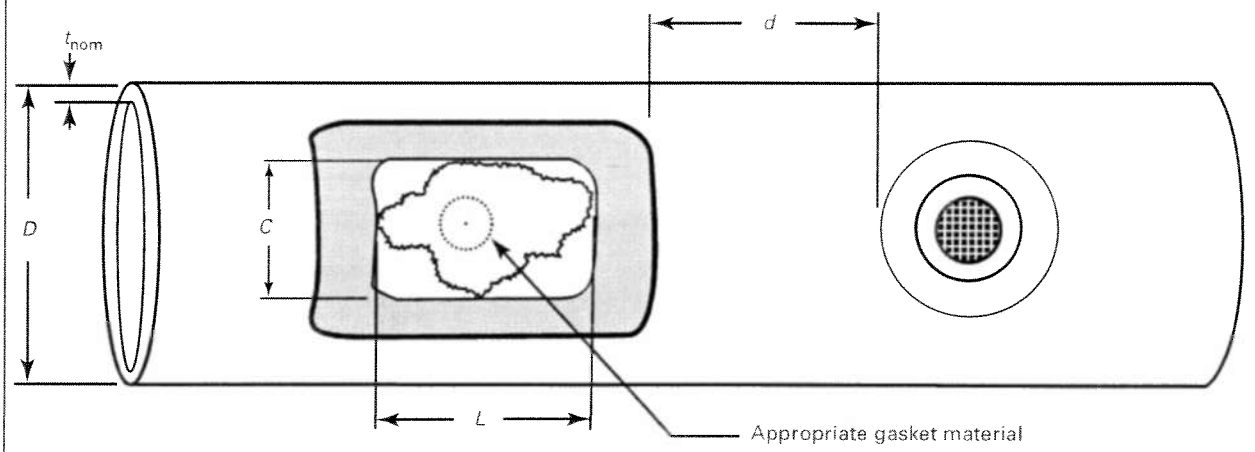
Structural pads shall meet the requirements of 3.2, Figure 1, and the following:

(a) Unless otherwise established by analysis in accordance with the requirements of 3.2(a), structural pads shall be attached by partial penetration attachment welds (see Figure 1) that extend for a distance of at least s in each direction beyond the area predicted, by the next refueling outage, to infringe upon the required thickness.[2]

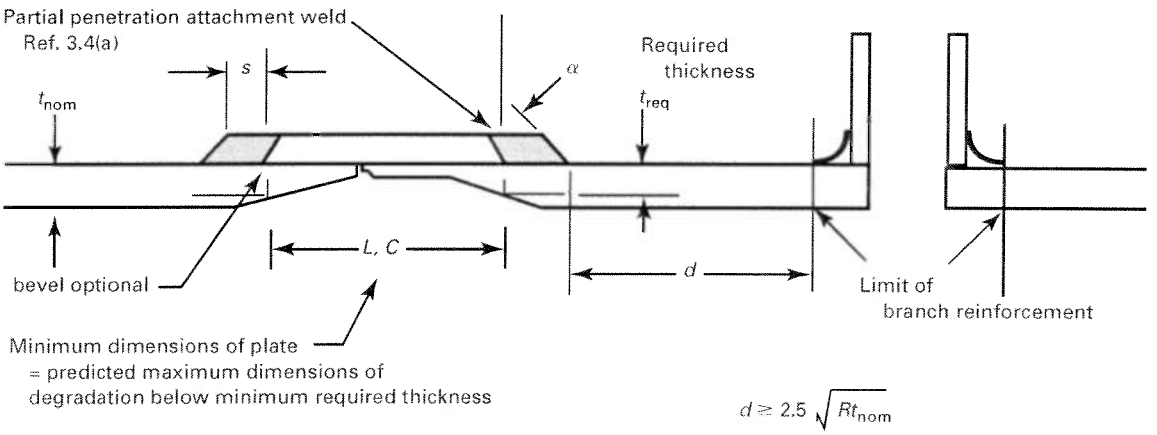
$$s \geq 0.75\sqrt{Rt_{nom}}$$

[2] Design thickness as prescribed by the Construction Code.

Figure 1
Structural Pad



C = predicted circumferential growth of degradation
L = predicted axial growth



where

R = outer radius of the component
s = 1 in. (25 mm) minimum
t_{nom} = nominal wall thickness of the component

(b) The thickness of the partial penetration attachment welds shall equal the thickness of the pad and the edges of the welds shall be tapered to the piping surface at a maximum angle ("α" in Figure 1) of 45 deg.

(c) Final configuration of the structural pad including attachment welds shall permit the examinations and evaluations required herein, including any required preservice or inservice examinations of encompassed or adjacent welds.

(d) Except for the tapered edges, the structural pad plate and attachment welds shall have a uniform thickness.

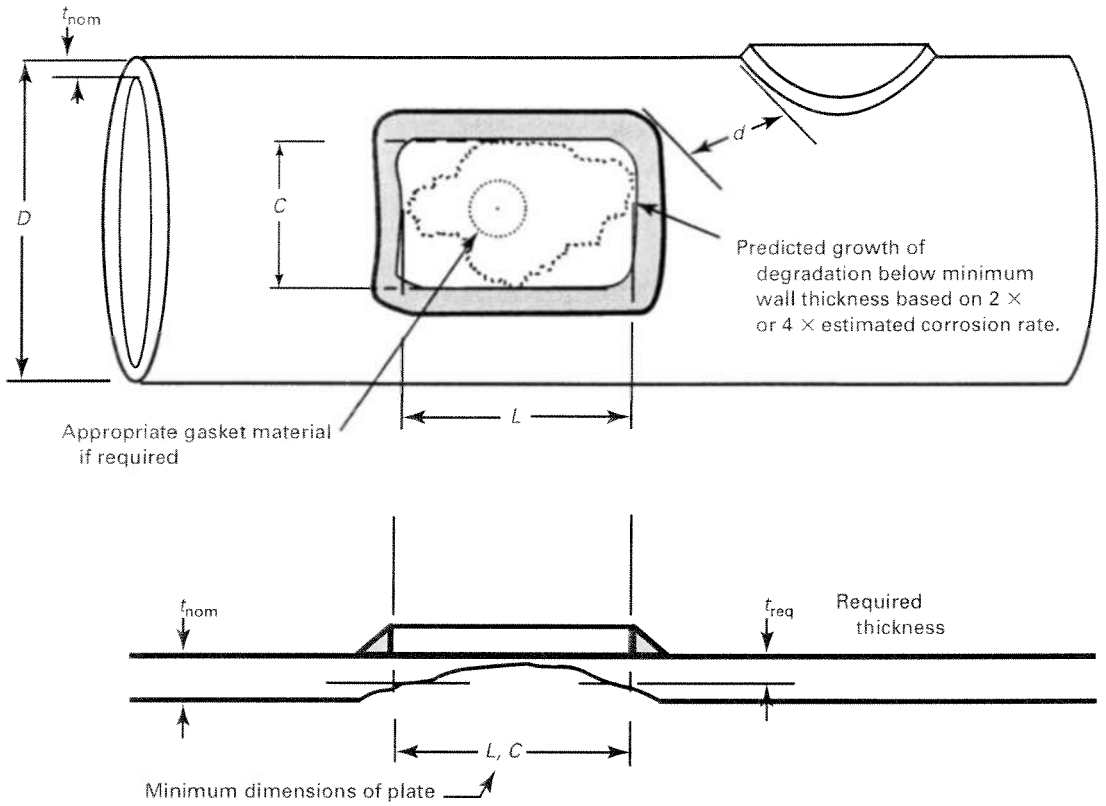
3.5 PREQUALIFIED DESIGN

Application of structural pads on straight pipe, standard elbows, and associated welds shall be exempt from the requirements of 3.2(a), provided all of the following conditions are satisfied.

(a) All other requirements of 3.1, 3.2, and 3.4 are satisfied.

(b) The axial length of structural pad plus width of partial penetration attachment welds shall not exceed the greater of 6 in. (150 mm) or the outside diameter of the piping.

Figure 2
Pressure Pad



(c) The finished structural pad shall be circular, oval, or rectangular in shape.

(1) The maximum dimension compensated by a circular structural pad shall not exceed two-thirds of the nominal outside diameter of the piping.

(2) Rectangular structural pads shall be aligned parallel with or perpendicular to the axis of the piping.

(3) For oval structural pads, the end radii shall not be less than $0.75\sqrt{Rt_{nom}}$, and the axis of the structural pad shall be aligned parallel with or perpendicular to the axis of the piping.

4 WATER-BACKED APPLICATIONS

(a) Attachment welds on water backed piping shall be applied using the SMAW process with low-hydrogen electrodes.

(b) When welding a reinforcing pad to a leaking area, precautions shall be taken to prevent welding on wet surfaces, such as installation of a gasket or sealant beneath the pad.

(c) For piping materials other than P-No. 1, Group 1, the surface examination required in 6 shall be performed no sooner than 48 hr after completion of welding.

5 INSTALLATION

(a) The base material in the area to be welded shall be cleaned to bare metal.

(b) Weld metal shall be deposited using a groove – welding procedure qualified in accordance with Section IX and the Construction Code.

(c) Provisions for venting during the final closure weld, or for pressurizing for leak-testing, shall be included, if necessary.

(d) The surface of the attachment weld shall be prepared, if necessary, by machining or grinding to permit performance of surface and volumetric examinations required by 6. For ultrasonic examination, a surface finish of 250 RMS or better is required.

6 EXAMINATION

(a) The completed attachment weld shall be examined using the liquid penetrant or magnetic particle method and shall satisfy the surface examination acceptance criteria for welds of the Construction Code or Section III (NC-5300, ND-5300).

(b) Except for the tapered edges, partial penetration attachment welds, including the piping base metal upon which they are applied, shall be ultrasonically measured to verify acceptable wall thickness.

(c) Partial penetration attachment welds shall be volumetrically examined when full penetration girth welds in the piping are required by the Construction Code to be volumetrically examined. Where configuration does not permit meaningful volumetric examination, the first layer, each $\frac{1}{2}$ in. (13 mm) thickness of weld deposit, and the final surface shall be examined in accordance with (a) in lieu of volumetric examination.

(d) If volumetric examination is required, the full volume of the attachment weld, excluding the tapered edges, but including the volume of base metal required for the intended life of the reinforcing pad, shall be examined in accordance with the Construction Code or Section III, using either the ultrasonic or radiographic method, and shall, to the depth at the surface of the piping, satisfy the acceptance criteria for weldments of the Construction Code or Section III (NC-5320, ND-5320 or NC-5330, ND-5330). Any volume of the piping beneath the reinforcing pad that is credited in the design shall satisfy the volumetric acceptance criteria of Section III (NC-5320, ND-5320 or NC-5330, ND-5330), as applicable.

7 PRESSURE TESTING

In lieu of IWA-4540, a system leakage test of the repair/replacement activity shall be performed in accordance with IWA-5000 prior to, or as part of, returning to service.

Reinforcing pads attached to piping that has not been breached shall be equipped with pressure taps for performance of pressure testing.

8 INSERVICE MONITORING

(a) Upon completion of the repair, inspections shall be performed for structural pads, using ultrasonic or direct thickness measurement, to record the thickness of the plate, the thickness at the attachment welds, including the underlying base metal, and to the extent examinable in a 3 in. (75 mm) wide band, surrounding the repair, as a baseline for subsequent monitoring of the repair.

(b) The Owner shall prepare a plan for additional thickness monitoring for structural pads using ultrasonic or direct thickness measurement to verify that minimum design thicknesses, as required by the Construction Code or Section III, are maintained until the next refueling outage. The monitoring shall be monthly for the first quarter and the subsequent frequency shall be based on the results of the monitoring activities, but at least quarterly.

Provisions shall be made for access to structural pads on buried piping during operation to accomplish these examinations.

(c) Areas containing pressure pads shall be monitored monthly for evidence of leakage. If the areas containing pressure pads are not accessible for direct observation, monitoring shall be accomplished by observation of surrounding areas or ground surface areas above pressure pads on buried piping; or leakage collection systems, if available, shall be monitored.

(d) If the results of the monitoring program identify leakage or indicate that the structural margins required by 3 will not be maintained until the next refueling outage, additional repair/replacement activities not prohibited by 1(d) shall be performed prior to encroaching upon the design limits.

(e) All reinforcing pads, regardless of when installed, shall be removed no later than the end of the next refueling outage.

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