From: Walpole, Robert W
To: Guzman, Richard
Subject: [External_Sender] DRAFT Letter
Date: Tuesday, April 03, 2018 2:54:04 PM
Attachments: Relief Request IP2-ISI-RR-05_JW DRAFT-4 CA.DOCX

Rich,

Here is a copy of the draft letter we will discuss today.

Thanks

Bob Walpole

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April XX, 2018

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

SUBJECT: Relief Request Number IP2-ISI-RR-05- Proposed Alternative to Use Reactor Vessel Head Penetration Embedded Flaw Weld Repair Method

Indian Point Energy Center, Unit 2
Docket No. 50-247
License No. DPR-26

Dear Sir or Madam:

Pursuant to 10 CFR 50.55a(z)(1), Entergy Nuclear Operations, Inc. request NRC approval of a relief request to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," on the basis that the current code requirements result in hardship and/or unusual difficulty. The proposed relief request is provided in the attachment to this letter.

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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 April XX, 2018.

This letter contains no new commitments.

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

Sincerely,

BSF/jmg

Attachment: Relief Request IP2-ISI-RR-05

cc: c. Bakken (ECH)
J. Elnitsky (ECH)
J. Ventosa (WPO)
D. Jacobs (ECH)
L. Martin (ECH)
T. Vitale (IPEC)
J.M. Giddens (ECH)
All above w/o attachments
NRC Project Manager (IPEC)
NRC Senior Resident Inspector (IPEC)

RELIEF REQUEST IP2-ISI-RR-05

1. ASME Code Component(s) Affected:

Component: Reactor Pressure Vessel (RPV) Head Penetration #3

Code Class: 1

Unit: Indian Point Electric Center, Unit 2 (IPEC-2)

Interval: Fifth (5^{th})

2. Applicable Code Edition and Addenda:

ASME Section XI, 2007 Edition through 2008 Addenda

ASME Section XI Code Case N-729-4

ASME Section III, 1965 Edition through Summer 1965 Addenda including Code Cases 1332, 1335, 1339, and 1359 (Original Construction Code)

ASME Section III, Subsection NB, 2001 Edition/2003 Addenda

3. Applicable Code Requirement:

IWA-4000 of ASME Section XI contains requirements for removing defects such as weld defects from ASME components. The specific ASME Section XI Code requirements for which use of the proposed alternative is being requested are as follows:

- IWA-4421 states:

  Defects shall be removed or mitigated in accordance with the following requirements:

  (a) Defect removal by mechanical processing shall be in accordance with IWA-4462.

  (b) Defect removal by thermal methods shall be in accordance with IWA-4461.

  (c) Defect removal or mitigation by welding or brazing shall be in accordance with IWA-4411.

  (d) Defect removal or mitigation by modification shall be in accordance with IWA-4340.

  - Note that use of IWA-4340 for "Mitigation of Defects by Modification" is prohibited by the NRC in 10 CFR 50.55a(b)(2)(xxv).

- IWA-4411 states in part:

  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.

  (a) 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 IWA-4221(c).

The Construction Code that will be used for performing defect removal and repair of welds on the RPV head at IPEC-2 is the 2001 Edition/2003 Addenda of ASME Section III. Requirements applicable to repair of weld defects are specified in NB-4450 as follows:

- NB-4451, which provides general requirements for removal of weld metal defects, states:

  Defects in weld metal detected by the examinations required by NB-5000, or by the tests of NB-6000, shall be eliminated and repaired when necessary.

- NB-4452, which provides requirements for eliminating weld surface defects without welding, states:

  Weld metal surface defects may be removed by grinding or machining, and need not be repaired by welding, provided that the requirements of (a) through (c) below are met.

  (a) The remaining thickness of the section is not reduced below that required by NB-3000.

  (b) The depression, after defect elimination, is blended uniformly into the surrounding surface.

  (c) The area is examined by a magnetic particle or liquid penetrant method in accordance with NB-5110 after blending and meets the acceptance standards of NB-5300 to ensure that the defect has been removed or reduced to an imperfection of acceptable limit. Defects detected by visual or volumetric method and located on an interior surface need only be reexamined by the method which initially detected the defect when the interior surface is inaccessible for surface examination.

- NB-4453.1, which provides requirements for repairing weld defects with welding, states:

  Defects may be removed by mechanical means or by thermal gouging processes. The area prepared for repair shall be examined by a liquid penetrant or magnetic particle method in accordance with NB-5110, and meet the acceptance standards of NB-5340 or NB-5350. This examination is not required where defect elimination removes the full thickness of the weld and where the backside of the weld joint is not accessible for removal of examination materials.

4. Reason for Request:

IPEC-2 is presently in Refueling Outage 2R23. While performing the VT-2 visual examination of the Reactor Pressure Vessel Head (RPVH) required by Code Case N-729-4 (Item No. B4.10)[1], a white substance was observed on the annulus region of RPVH Penetration #3. Gamma spectroscopy testing of the white substance detected the presence of Cs-137, Co-58, and Co-60 indicating that reactor coolant leakage commenced approximately 90 to 180 days earlier. Ultrasonic (UT) and eddy current (ET) examinations of the Control Rod Drive Mechanism (CRDM), performed in accordance with Code Case N-729-4, nozzle of RPVH Penetration #3 did not reveal any indications. It should also be noted that the VT-2 visual examination of the RPVH did not identify any other relevant indications or base material wastage.

Follow-up surface examinations were also performed on the partial penetration J-groove weld of RPVH Penetration #3 using the liquid penetrant (PT) and ET techniques. The PT and ET examinations confirmed the presence of relevant indications on the face of the J-groove weld. One of the indications was determined to be axial with some measureable through-weld and is believed to be the initiation source of leakage. Although the depth of this indication could not be conclusively established, its location and characteristics (i.e. dark appearance rather than red indicating that water prevented the red die from penetrating the indication) indicate that this indication was likely the through-weld leakage source.

Due to the through-weld indication described above, a weld repair of the subject J-groove weld is necessary. As an alternative to the defect removal and weld repair provisions of ASME Section XI, IWA-4000 and ASME Section III, NB-4450, Entergy proposes to repair the subject J-groove weld using the embedded flaw repair process as described in WCAP-15987-P-A (Reference 1).

5. Proposed Alternative and Basis for Use:

Pursuant to 10 CFR 50.55a(z)(1), Entergy proposes to repair the J-groove weld of RPVH Penetration #3 using an embedded flaw repair process as an alternative to the defect removal and weld repair provisions of ASME Section XI, IWA-4000 and ASME Section III, NB-4450. The proposed embedded flaw repair process is described in WCAP-15987-P-A (Reference 1) and was approved by the NRC in Reference 2.

Basis for Use:

Entergy believes that the proposed embedded flaw repair process based on WCAP-15987-P-A provides an acceptable level of quality and safety. In the Safety Evaluation Report for WCAP-15987-P-A, the NRC documented the same conclusion subject to their specified conditions and limitations (Reference 2). Consistent with WCAP-15987-P-A methodology, the following repair requirements will be met.

[1] Code Case N-729-4 as amended in 10CFR50.55a(g)(6)(ii)(D)

5.1 J-Groove Weld Repair Methodology

A. The interface boundary between the J-groove weld and stainless steel cladding will be located with a hand-held ferrite meter instrument that identifies this interface boundary. This technique has been used successfully for positive identification of the weld cladding interface to ensure that all of the Alloy 82/182 material of the J-groove weld is overlaid during the repair. Markings are made to locate the interface as well as a boundary of at least one half inch outboard of the stainless steel cladding and Alloy 82/182 interface.

B. The J-groove weld will be sealed off from the primary water environment by deposition of a 360 degree overlay consisting of at least three (3) layers of Alloy 52 or 52M weld metal. The seal weld will extend onto and encompass the outside diameter of the Alloy 600 penetration nozzle by at least ½". (The seal weld on the Alloy 600 tube will consist of at least 2 layers of Alloy 52 or 52M weld metal.) It will also extend at least ½" beyond the stainless steel cladding interface after deposition of the ER309L buffer layer discussed in paragraph 3 below. Excavation or partial excavation of J-groove weld flaws is not required.

C. Prior to application of three (3) Alloy 52/52M repair weld layers on the cladding surface, a minimum of three beads (one layer) of Alloy ER309L weld metal shall be deposited at the periphery of the seal weld (at the repair-to-clad interface). The Alloy ER309L weld passes serve as a buffer layer to ensure that the outer passes of the Alloy 52/52M overlay are not deposited on the original cladding material. The Alloy ER309L weld passes are not permitted to come into contact with the Alloy 600 weld metal. However, if unacceptable indications are identified at the periphery of the embedded flaw weld overlay repair during final examination, and repair welding is required, Alloy 52/52M material may extend beyond the ER309L weld beads to accommodate the repair.

D. Nondestructive examinations of the completed seal weld repair of the J-groove weld and preservice/inservice inspections will be performed as summarized below:

Flaw Orientation	Repair NDE	ISI NDE (Note 1)
Axial	UT and Surface (Notes 2 and 3)	UT and Surface (Notes 2 and 3)
Circumferential	UT and Surface (Notes 2 and 3)	UT and Surface (Notes 2 and 3)

Note:

1) Preservice and inservice inspection to be consistent with 10 CFR 50.55a(g)(6)(ii)(D), which requires the implementation of Code Case N-729-4 with conditions; or NRC approved alternatives to these specified conditions.

2) UT personnel and procedures qualified in accordance with 10 CFR 50.55a(g)(6)(ii)(D), ·which requires the implementation of Code Case N-729-4 with conditions. UT examination is performed from the inside diameter of tube to interrogate the accessible portion of the J-groove repaired region. The UT plus surface examination coverage must equal 100 percent.

3) Surface examination shall comply with the acceptance standards of ASME Section III, NB-5350. The frequency of examination shall be as follows:

   a. Perform surface examination during the first and second refueling outage after installation or repair of the embedded flaw repair.

   b. When the surface examination of 3.a. provides acceptable results, then reinspection of the embedded flaw repair will be continued at a frequency of every other refueling outage. If these examinations identify unacceptable results that require flaw removal, flaw reduction to acceptable dimensions, or welded repair the requirements of 3.a above shall be applied during the next refueling outage.

5.2 Technical Basis for Proposed Alternative

A. The purpose of the proposed alternative is to embed and isolate the Alloy 600 (Inconel 82/182) J-groove weld and any identified flaws. The repair overlay welds are not credited for providing structural strength to the original pressure boundary materials.

B. As discussed in WCAP-15987-P, the embedded flaw repair technique is considered a permanent repair. As long as a PWSCC flaw remains isolated from the primary water environment, it cannot propagate. Since an Alloy 52/52M weldment is considered highly resistant to PWSCC, a new PWSCC flaw should not initiate and grow through the Alloy 52/52M seal weld to reconnect the primary water environment with the embedded flaw. Structural integrity of the affected J-groove weld will be maintained by the remaining unflawed portion of the weld. Alloy 52/52M weld metal is highly resistant to PWSCC, as demonstrated by multiple laboratory tests, as well as over twenty years of service experience in replacement steam generators.

C. The residual stresses produced by the embedded flaw technique have been measured and found to be relatively low because of the small seal weld thickness. This implies that no new flaws will initiate and grow in the area adjacent to the repair weld. There are no other known mechanisms for significant flaw propagation in the reactor vessel closure head and penetration tube region since cyclic loading is negligible, as described in WCAP-15987-P. Therefore, fatigue driven crack growth should not be a mechanism for further crack growth after the embedded flaw repair process is implemented.

D. The thermal expansion properties of Alloy 52 or 52M weld metal are not specified in the ASME Code. In this case, the properties of the equivalent base metal (Alloy 690) should be used. For Alloy 690, the thermal expansion coefficient at 600 degrees Fahrenheit (F) is 8.2E-6 in/in/degree F as found in Section II part D. The Alloy 600 base metal has a coefficient of thermal expansion of 7.8 E-6 in/in/degree F, a difference of about 5 percent. The effect of this small difference in thermal expansion is that the weld metal will contract more than the base metal when it cools, thus producing a compressive stress on the Alloy 82/182 J-groove weld. This beneficial effect has already been accounted for in the residual stress measurements reported in the technical basis for the embedded flaw repair, as noted in the WCAP-15987-P.

E. The proposed embedded flaw repair process is supported by applicable generic and plant specific technical bases, and is therefore considered to be an alternative to Code

requirements that provides an acceptable level of quality and safety, as required by 10 CFR 50.55a(z)(1).

6. Duration of Proposed Alternative:

Relief is requested for the Fifth Ten-Year interval (effective from June 1, 2016 through May 31, 2026). It should be noted that the current refueling outage at IPEC-2 is intended to be the last refueling outage since IPEC-2 is presently scheduled to begin decommissioning in 2020.

7. Precedent:

1. Relief was approved for IP2 & 1P3 during the 3rd ISI Interval, dated 10/05/2004, NRC Safety Evaluation (TAC NOS. MC3281 AND MC3282) (Reference 3).

2. Relief was approved for IP2 during the 4th ISI Interval, dated 09/19/2007, NRC Safety Evaluation (TAC No. MD4702) (Reference 4)

3. FENOC Relief Request 2-TYP-3-RV-04, Rev. 1 for Beaver Valley Power Station, Unit 2 dated November 16, 2016

4. SCE&G Relief Request RR-4-05 for Virgil C. Summer Nuclear Station dated February 24, 2014

5. Exelon Relief Request 14R-10 for Byron Station, Units 1 and 2 dated December 29, 2016

8. References:

1. Westinghouse Topical Report, WCAP-15987-P, Revision 2-P-A, “Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations," dated December 2003.

2. Letter H. N. Berkow (U.S. NRC) to H. A. Sepp (Westinghouse Electric Company), "Acceptance for Referencing - Topical Report WCAP-15987-P, Revision 2, 'Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetration,' (TAC NO. MB8997)," dated July 3,2003 [ML031840237]