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May 8, 2002
JPN-02-010

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop O-P1-17
Washington, DC 20555-0001

Subject: James A. FitzPatrick Nuclear Power Plant
Docket No. 50-333
License No. DPR-59
Relief Request RR-28, Revision 1 for the
Third 10-Year Inservice Inspection Interval Program Plan

Reference:

1. USNRC Letter, R. Emch to H. Sumner, dated May 31, 2000, regarding "Edwin I. Hatch Nuclear Plant, Units 1 and 2 – Third Ten-Year Interval Inservice Inspection Program, Relief Request Nos. RR-25 and RR-26 (TAC Nos. MA6123 and MA6124)"

2. Entergy letter, JPN-01-020, dated December 3, 2001, regarding "Relief Request RR-28 for Third 10-Year Inservice Inspection Interval Program Plan"

Dear Sir:

This letter submits Revision 1 of Relief Request RR-28 which requests the use of ASME Section XI Code Case N-562-1 for weld overlay on carbon steel service water piping under the Third Ten-Year Inservice Inspection Interval Program Plan for the James A. FitzPatrick (JAF) Nuclear Power Plant.

This revision (Attachment 1) incorporates responses to questions that were emailed to Entergy Nuclear Operations, Inc. (ENO) on April 22, 2002 and discussed at a teleconference held on April 23, 2002 between ENO and the NRC staff. Attachment 2 contains the questions and responses on revision 0 of the subject relief request (Reference 2). A similar request for relief was approved for the Hatch Plant, Units 1 and 2 (Reference 1). Approval for this relief request is needed by June 15, 2002 to support planning and resource scheduling of the upcoming Refueling Outage R015.

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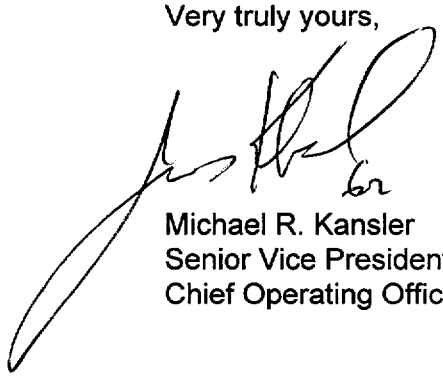
There are no new commitments made by this letter. If you have any questions, please contact Ms. Charlene Faison at 914-272-3378.

Very truly yours,



Michael R. Kansler
Senior Vice President and
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Attachments: As stated

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Attachment 1 to JPN-02-010
JAMES A. FITZPATRICK
THIRD INSPECTION INTERVAL
RELIEF REQUEST NO. 28, Rev. 1

A: ARTICLE IDENTIFICATION/COMPONENT INDENTIFICATION:

IWA-4000/All ISI Class 3 moderate energy service water piping.

B: REPAIR REQUIREMENTS

ASME Code, Section XI, IWA-4310 requires that the defect be removed or reduced in size in accordance with Article IWA.

C: RELIEF REQUESTED:

Relief is requested from removing defects and repairing in accordance with the design specification or the original construction code for internal wall thinning or pitting resulting from conditions such as, but not limited to, microbiological corrosion; cavitations induced pitting; erosion/corrosion and/or localized pitting corrosion.

The ASME Section XI Code Committee recognized that an alternative existed for internal wall thinning of Class 3 piping systems which have experienced degradation mechanisms such as flow-assisted corrosion (FAC) and/or microbiological corrosion that would provide an acceptable repair configuration. This alternative repair technique involves the application of additional weld metal on the exterior of the piping system, which restores the wall thickness requirement. Code Case N-562-1 was approved by the ASME Section XI Code Committee on July 30, 1998. However, it has not been incorporated into NRC Regulatory Guide 1.147 and thus is not available for application at nuclear power plants.

Pursuant to 10 CFR 50.55a(a)(3)(i), relief is requested to use Code Case N-562-1 on the basis that the proposed alternative will provide an acceptable level of quality and safety. This relief request applies to all ASME Class 3 Moderate Energy (i.e., less than or equal to 200°F and/or less than or equal to 275 psig maximum operating conditions) carbon steel plant service water piping systems.

ENO also proposes to use the following welding processes on piping that can be drained: Gas Tungsten Arc Welding (GTAW) - manual and/or automated, Gas Metal Arc Welding (GMAW) and Flux Core Arc Welding (FCAW). These processes offer other advantages such as higher deposition rates or automated remote welding over the Shielded Metal Arc Welding (SMAW) method.

D: BASIS FOR RELIEF

Code Case N-562-1 provides alternative requirements to those of IWA-4000 and for the repair of internal piping system defects or degradation. The ASME XI Code Committee determined that such the weld overlay would ensure that an adequate level of quality and safety was being maintained. Therefore, the proposed alternative is justified per 10CFR50.55a(a)(3)(i) as the proposed repair will provide an acceptable level of quality and safety. The primary purpose for implementing this repair method is to allow adequate time

for additional examination of adjacent piping so that pipe replacement can be planned to reduce impact on system availability including Maintenance Rule applicability, availability of replacement materials and cost. In addition, use of Code Case N-562-1 may reduce outage schedules, as installation of a weld overlay would avoid the need for a pipe replacement and corresponding system lineups and draindowns during scheduled refueling outages.

A similar relief request was approved at Southern Nuclear Operation Company's Hatch Plant, Units 1 and 2 (Reference SER dated May 31, 2000, TAC Nos. MA6123 and MA 6124).

E: PROPOSED ALTERNATIVE REPAIR TECHNIQUE:

ENO will implement the requirements of Code Case N-562-1 in its entirety with the additional restrictions and exceptions as described below, for Class 3 moderate energy (i.e., $\leq$ 200°F and/or $\leq$ 275 psig maximum operating pressure) piping system repairs resulting from phenomenon such as flow-assisted corrosion and/or microbiological corrosion. These types of defect are typically identified by small leaks in the piping system or by pre-emptive non-code and code-required examinations performed by the Licensee to monitor the degradation mechanisms. The repair technique described in Code Case N-562-1 will be utilized whenever engineering evaluation determines that such a repair is suitable for the particular defect or degradation being resolved.

Provisions for use of this Code Case will be addressed in the repair and replacement program procedure. Those provisions will require that adjacent areas be examined to verify that the repair will encompass the entire flawed area and that there are no other unacceptable degraded locations within a representative area dependent on the degradation mechanism present. An evaluation of the degradation and an estimation of the remaining service life will be performed as required by Entergy Design Engineering procedures for any type of wall thinning detected by NDE methods. This includes MIC, Flow Accelerated Corrosion (FAC), etc. The calculation ensures that there is adequate remaining service life and margin to the design code minimum allowable wall thickness. This calculation aids the responsible engineer in determining the next required inspection. The repair will be considered to have a maximum service life of two fuel cycles unless specific approval is requested and received from the NRC to make it permanent.

For piping in which a through wall flaw has been detected, the piping shall be drained prior to performing the repair.

For water-backed piping, only the SMAW process shall be used as described in Code Case N-562-1.

For piping where the water can be drained, ENO proposes the following welding processes may be used as appropriate: Gas Tungsten Arc Welding (GTAW) - manual and/or automated, Gas Metal Arc Welding (GMAW) and Flux Core Arc Welding (FCAW). These processes offer other advantages such as higher deposition rates or automated remote welding over the SMAW method. Some of the RHR service water piping is in high radiation areas where repairs performed using the SMAW process would result in increased exposure

to plant personnel. Using the other processes or automated welding techniques would reduce exposure to personnel (ALARA).

The NRC had previously approved JAF relief request No. 6 (Reference SER dated November 25, 1998, TAC No. MA0711) to utilize ASME Section XI Code Case N-532. Code Case N-532 provides alternatives for the documentation requirements for repair and replacement activities. Code Case N-532 allows use of Form NIS-2A in lieu of Form NIS-2 as required by Code Case N-562-1, paragraph 7.0. Therefore, ENO will document the use of Code Case N-562-1 on Form NIS-2A in lieu of Form NIS-2.

F: IMPLEMENTATION SCHEDULE

The relief request is applicable for the Third 10-Year Interval and will be utilized upon receipt of NRC approval.

G: ATTACHMENTS TO THE RELIEF REQUEST:

Code Case N-562-1.

Approval Date: July 30, 1998

See Numeric Index for expiration and any reaffirmation dates.

Case N-562-1
Alternative Requirements for Wall Thickness Restoration of Class 3 Moderate Energy Carbon Steel Piping
Section XI, Division 1

Inquiry: As an alternative to replacement or internal weld repair, what requirements may be applied for wall thickness restoration of Class 3 moderate-energy carbon steel piping systems that have experienced internal wall thinning or pitting from conditions such as, but not limited to, flow-assisted corrosion and microbiological corrosion?

Reply: It is the opinion of the Committee that areas of Class 3 moderate energy (i.e., less than or equal to 200°F or and less than or equal to 275 psig maximum operating conditions) carbon steel piping experiencing internal thinning or pitting may have the wall thickness restored externally by means of a weld-deposited carbon or low-alloy steel reinforcement on the outside surface of the piping in accordance with the following requirements. Excluded from these provisions are conditions involving corrosion-assisted cracking or any other form of cracking.

1.0 GENERAL REQUIREMENTS

(a) The wall thickness restoration shall be performed in accordance with a Repair/Replacement Plan satisfying the requirements of IWA-4150.[1]

(b) The wall thickness restoration shall meet the requirements of IWA-4000,[2] except as stated in this Case.

(c) If the minimum required thickness of deposited weld metal necessary to satisfy the requirements of para. 3.0 is greater than the nominal thickness for the size and schedule of the piping, the provisions of this Case shall not apply. In addition, the total thickness of filler metal applied over multiple repairs shall not exceed the original nominal thickness of the piping.

2.0 INITIAL EVALUATION

The material beneath the surface to which the weld overlay is to be applied shall be evaluated to establish the existing average wall thickness and the extent and configuration of degradation to be reinforced by the weld overlay. Consideration shall be given to the cause of degradation. The extent of degradation in the piping, and the effect of the repair on the piping, shall be evaluated in accordance with IWA-4160.[3]

3.0 DESIGN

3.1 General Design Requirements

(a) Unless otherwise established by theoretical or experimental analysis, or by proof testing as provided for in para. 3.3 or para. 3.4, the full thickness of the weld overlay shall extend a distance of at least s in each direction beyond the area predicted, over the design life of the restoration to infringe upon the required thickness.[4]

where

$s = \geq \frac{3}{4}\sqrt{Rt_{nom}}$

R = outer radius of the component

t_{nom} = nominal wall thickness of the component

Edges of the weld overlay shall be tapered to the existing piping surface at a maximum angle ("α" in Fig. 1) of 45 deg. Final configuration of the reinforcement shall permit the examinations and evaluations required herein, including any required preservice or inservice examinations of encompassed or adjacent welds.

[1] IWA-4140 in the 1989 Edition with the 1991 Addenda through 1995 Edition. IWA-4130 (Repair Progam) in the 1989 Edition with the 1990 Addenda and earlier Editions and Addenda.

[2] IWA-4000/7000 and IWC/IWD-4000/7000, as applicable, in the 1989 Edition with the 1990 Addenda and earlier Editions and Addenda.

[3] IWA-4150 in the 1989 Edition with the 1991 Addenda through 1995 Edition. IWA-4130 (Repair Program) in the 1989 Edition with the 1990 Addenda and earlier Editions and Addenda.

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

(b) The thickness shall be sufficient to maintain required thickness for the predicted life of the repair, and, except for the tapered edges, the overlay shall have a uniform thickness.

(c) The tensile strength of the weld filler metal for the reinforcement shall be at least that specified for the base metal to which it is applied.

(d) The predicted maximum degradation of the overlaid piping and the overlay over the design life of the restoration shall be considered in the design. The predicted degradation of the piping shall be based upon in-situ inspection and established data for similar base metals. If the weld overlay is predicted to become exposed to the corroding medium, the predicted degradation of the overlay shall be based upon established data for base metals or weld metals with similar chemical composition to that of the filler metal used for the weld overlay.

(e) The effect of weld overlay application on interior coating shall be addressed in the Repair/Replacement Plan [Repair Program].

3.2 Design

The design of weld overlays not prequalified by paras. 3.3, 3.4, or 3.5 shall be in accordance with the applicable requirements of the Construction Code or ND-3100 and ND-3600 (including Appendix II), and shall consider the weld overlay as an integral portion of the piping or component upon which it is applied (not as a weld). The allowable stress values of the base metal shall apply to the design of the deposited weld metal. The following factors shall be considered, as applicable, in the design and application of the reinforcement:

(a) The shrinkage effects, if any, on the piping.

(b) Stress concentrations caused by application of the overlay or resulting from existing and predicted piping internal surface configuration.

3.3 Proof Test Qualification as a Piping Product

As an alternative to design, the configuration of weld overlays may be qualified by performance of proof testing of a mockup in accordance with the following requirements:

(a) A satisfactory mockup burst test shall qualify the design or configuration for application in the same orientation on the same type of item, and the same location on fittings, when the following conditions are satisfied (see Fig. 1):

(1) the base metal is of the same P-No. and Group Number when impact properties are applicable, as the base metal tested;

(2) the specified minimum tensile strength of the item does not exceed that specified for the base metal tested;

(3) the average thickness of the overlay areas is at least the thickness of the mockup plug, u;

(4) the overlap on the full thickness of base metal, s, is at least that of the mockup;

(5) the transition angle at the outer edges of the overlay, α, is not greater than that of the mockup;

(6) the overlay surface finish is similar to or smoother than that tested;

(7) the maximum proportionate axial dimension, L/D, is not more than that tested;

(8) the maximum proportionate circumferential dimension, C/D, is not more than that tested;

(9) the nominal diameter is not less than one-half nor more than two times the diameter tested;

(10) the nominal thickness/diameter ratio, t/D, is not less than one-half nor more than three times the t/D, ratio tested.

(b) The mockup base shall consist of new base material of similar configuration, or type of item, as the item to be overlaid. A rounded-corner segment of the base material shall be removed to represent the maximum proportionate size (axial dimension of L and circumferential dimension of C) and location of thinning or pitting to be compensated for by the weld overlay. A plug of the same base metal and of uniform thickness u, which shall not exceed the smallest average thickness on which the overlays will be permanently applied, shall be full-penetration welded around the opening and flush with the outside surface of the piping. Alternatively, an equivalent volume of base metal may be removed from the inside surface of the mockup by machining or grinding, without need for welding in a closure plug.

(c) The mockup weld overlay shall be applied in accordance with the design or specified configuration using the specified weld filler metal. Maximum section thickness at the overlaid opening (weld metal plus base metal plug, $u + w$) shall not exceed $87\frac{1}{2}\%$ of the nominal thickness of the piping.

(d) Straight pipe equivalent to a minimum of one pipe diameter, or one-half diameter for piping over NPS 14, shall be provided (butt-welded to the mockup, if necessary) beyond both ends of the overlay. The piping shall be capped and the completed mockup assembly shall be thoroughly vented and hydrostatically

pressure tested to bursting. To qualify the design for general application within the limits of para. 3.3(a), burst pressure shall not be less than:

$$P = \frac{2tS_{act}}{D_o}$$

where

P = minimum acceptable burst pressure, psi
t = minimum specified thickness (excluding manufacturing tolerance) of the base metal being tested, in.
S_{act} = reported actual tensile strength of the base metal being tested, psi
D_o = outside diameter of the pipe, in.

(e) If flexibility analysis was required by the original Construction Code, the effect of the weld overlay shall be reconciled with the original analysis. In this case, for rectangular-shaped overlays on piping designed to 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 overlays on straight pipe and adjacent welds; 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 overlay is not less than $2\frac{1}{2}\sqrt{Rt_{nom}}$ from any branch reinforcement in Fig. 1.

3.4 Proof Test Qualification for Specific Applications

As an alternative to design by analysis or proof test qualification as a piping product, the design or configuration of weld overlays may be qualified for limited service conditions using the provisions of ND-6900. "Proof Tests to Establish Design Pressure," except that component hydrostatic testing is not required (other than as required by IWA-4000[2]). The mockups shall be fabricated and tested in accordance with the provisions of para. 3.3(b), (c), and (d), and shall be applied in accordance with the provisions and conditions of para. 3.3(a). The provisions of para. 3.3(e) shall be met.

3.5 Prequalified Design

Application of weld overlays on straight pipe, portions of tees not less than $2\frac{1}{2}\sqrt{Rt_{nom}}$ from any branch reinforcement in Fig. 1 standard elbows, and associated welds to correct limited degradation shall be exempt from the requirements of para. 3.2 through para. 3.4, provided all of the following conditions are satisfied in Fig. 1:

(a) All of the requirements of para. 3.1 apply.

(b) The provisions of para. 3.3(e) shall be met.

(c) The full thickness of weld overlay shall not exceed a maximum axial length of the greater of six in. or the outside diameter of the piping.

(d) The finished overlay shall be circular, oval, full-circumferential, or rectangular in shape.

(1) For each repair, the maximum dimension compensated by a circular overlay shall not exceed $\frac{2}{3}$ the nominal outside diameter of the piping.

(2) Rectangular overlays shall be aligned parallel with or perpendicular to the axis of the piping, and corners shall be rounded with radii not less than the overlay thickness.

(3) For oval overlays, the end radii shall not be less than $\frac{3}{4}\sqrt{Rt_{nom}}$, and the axis of the overlay shall be aligned parallel with or perpendicular to the axis of the piping.

(e) The distance between toes of adjacent overlays shall not be less than t_{nom}.

4.0 Water-backed Applications

(a) Manual application of overlays on water-backed piping shall be restricted to P-No. 1 base materials. Welding of such overlays shall use the SMAW process and low-hydrogen electrodes. In addition, the surface examination required in para. 6.0 shall be performed no sooner than 48 hours after completion of welding. For such overlays consideration should be given to using a temper bead technique similar to that described in IWA-4650.[5]

(b) Piping with wall thickness less than the diameter of the electrode shall be depressurized before welding.

5.0 INSTALLATION

(a) The entire surface area to which the weld overlay is to be applied shall be examined using the liquid penetrant or magnetic particle method, with acceptance criteria in accordance with ND-2500/5300 for the product form (base metal or weld) involved.

(b) If through-wall repairs are required to satisfy the acceptance criteria, or result from application of the

[5] IWA-4540 in the 1989 Edition with the 1991 Addenda through the 1995 Edition. IWE-4200 in the 1986 Edition with the 1988 Addenda through the 1989 Edition with the 1990 Addenda. IWE-4320 in the 1986 Edition with the 1987 Addenda and earlier Editions and Addenda.

weld overlay, they shall be accomplished by sealing with weld metal using a qualified weld procedure suitable for open-root welding. This weld shall be examined in accordance with para. 5.0(a). In addition, the first layer of overlay over the repaired area shall be examined in accordance with para. 5.0(a).

(c) Overlay weld metal shall be deposited using a grove-welding procedure qualified in accordance with Section IX and the Construction Code, Section X and Section III, or IWA-4610 and either IWA-4620 or IWA-4650.[6] The qualified minimum thickness specified in the weld procedure does not apply to the weld overlay or associated base metal repairs.[7]

(d) The surface of the weld overlay shall be prepared by machining or grinding, as necessary, to permit performance of surface and volumetric examinations required by para. 6.0. For ultrasonic examination, a surface finish of 250 RMS or better is required.

6.0 EXAMINATION

(a) The completed weld overlay 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 ND-5300.

(b) The weld overlay, including the existing piping upon which it is applied, shall be examined to verify acceptable wall thickness.

(c) Weld overlays shall be volumetrically examined as base metal repairs when required by the Construction Code, except as follows:

(1) Weld overlays not exceeding 10 in.^{2} surface area are exempt from volumetric examination.

(2) Other weld overlays shall be exempt from volumetric examination when the finished applied thickness (w in Fig. 1) does not exceed.

(a) $\frac{1}{3}t$ for $t \leq \frac{3}{4}$ in.

(b) $\frac{1}{4}$ in. for $\frac{3}{4}$ in. $< t \leq 2\frac{1}{2}$ in.

(c) The lesser of $\frac{3}{8}$ in. or 10% of t for $t > 2\frac{1}{2}$ in.

where

t = finished full-section thickness of compensated area (e.g., $w + u$, in Fig. 1)

When volumetric examination is required, the full volume of the finished overlay, excluding the tapered edges, but including the volume of base metal required for the design life of the overlay, shall be examined using either the ultrasonic or radiographic method, and shall, to the depth at the surface of the existing piping, satisfy the acceptance criteria for weldments of the Construction Code or ND-5300. The volume of the existing piping, beneath the weld overlay, taken credit for in the design, shall satisfy the volumetric acceptance criteria of ND-2500/5300 for the product form, or IWA-3000.[8]

(d) Follow-up inspection shall be scheduled as necessary to confirm any design assumptions relative to rate or extent of future degradation.

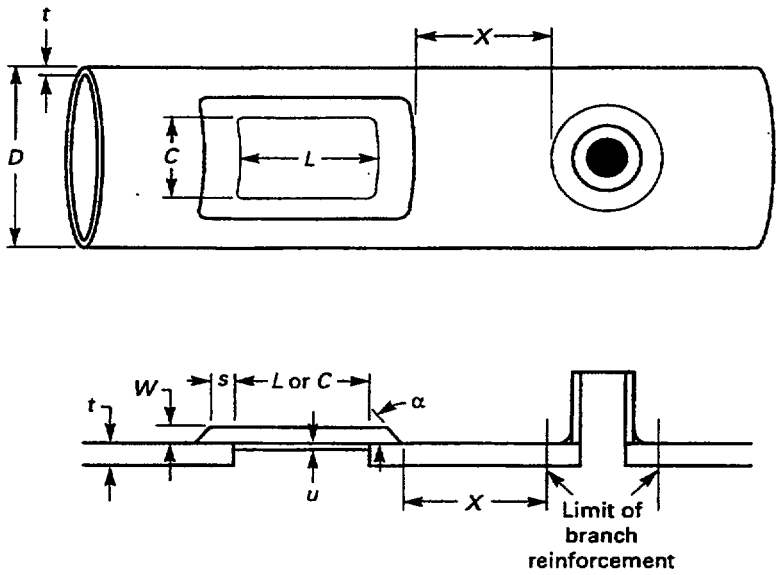
7.0 DOCUMENTATION

Use of this Case shall be documented on an NIS-2 Form.

[6] IWA-4500 and either IWA-4510 or IWA-4540 in the 1989 Edition with the 1991 Addenda through 1995 Edition. IWA-4510 or IWE-4200 in the 1986 Edition with the 1988 Addenda through 1989 Edition with the 1990 Addenda. IWB-4320 or IWE-4320 in the 1986 Edition with the 1987 Addenda or earlier Editions and Addenda.

[7] Exception to IWA-4000.

[8] IWA-3000 and IWB-3514 in the 1989 Edition with the 1990 Addenda and earlier Editions and Addenda.



$$X \geq 2^1/_2 \sqrt{Rt_{nom}}$$

FIG. 1

Attachment 2 to JPN-02-010
RAI on James A. FitzPatrick
Relief Request RR-28, Rev. 0

The following are the three questions discussed and the responses provided at the April 23, 2002 teleconference between Entergy Nuclear Operations, Inc. (ENO) and the NRC staff:

1. The relief request states that, "An evaluation of the degradation mechanism will be performed to determine the re-examination schedule to be performed over the life of the repair." Will this evaluation include an evaluation of the rate of degradation so that an area which is corroded but not below minimum will not be corroded below minimum before the next scheduled examination?

Response: An evaluation of the degradation and an estimation of the remaining service life are both required to be performed by Entergy procedures for any type of wall thinning detected by NDE methods. This includes MIC, Flow Accelerated Corrosion (FAC), etc. The calculation ensures that there is adequate remaining service life and margin to the design code minimum allowable wall thickness. This calculation aids the responsible engineer in determining the schedule for the next required inspection.

2. The relief request states, "Entergy Nuclear Operations, Inc. (ENO) also proposes to use the following welding processes for the weld overlay: Shielded Metal Arc Welding (SMAW); Gas Tungsten Arc Welding (GTAW) -manual and/or automated); Gas Metal Arc Welding (GMAW) and Flux Core Arc Welding (FCAW). The overlays may be installed on water backed piping or piping that is empty. Provide justification for the use of welding processes other than SMAW on water backed piping, since the code case only allows use of the SMAW process on water-backed welds.

Response: The weld metal deposition process is a variable that is or shall be controlled using Section IX of the ASME B&PV Code. Restricting the overlay to one process, such as SMAW, also restricts the ability to use lower heat input and higher production rate processes that have equal mechanical and metallurgical properties. There are advantages to all welding processes; SMAW's major advantage is portability and wide pool of qualified operators; GMAW and FCAW have the advantage of higher deposition with less shrinkage distortion; GTAW has the advantage of achieving high quality welds using remote equipment for high radiation environments. For welding on water backed/filled piping, ENO agrees to use only the SMAW process as required by Code Case N-562-1, Section 4.0. For piping that is drained, use of the other proposed welding techniques may be considered as applicable.

3. Paragraph 5.0 in Code Case N-562-1 states that through wall repairs may be required to satisfy the acceptance criteria. Also, the relief request states, "These types of defect are typically identified by small leaks in the piping system". Through wall repairs on water backed welds are unacceptable. Justify that welds made on wet base metal will be acceptable or clarify that weld repairs shall not be performed on surfaces that are wet or exposed to water, such as from small leaks in the piping system filled with water.

Response: ENO agrees that for weld repair on piping where a through-wall defect has been noted, the piping shall be drained prior to installing the weld overlay.