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SOUTHERN COMPANY

July 2, 2015

Docket Nos.: 50-321

NL-15-1146

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

Edwin I. Hatch Nuclear Plant – Unit 1
Proposed Alternative in Accordance with 10 CFR 50.55a(z)(1) Application of
Dissimilar Weld Full-Structural Weld Overlays

Ladies and Gentlemen:

In accordance with 10 CFR 50.55a(z)(1), Southern Nuclear (SNC) Plant Hatch is proposing an In-service Inspection (ISI) Alternative with regard to the installation of full structural weld overlays on four HNP-1 welds during the Spring 2016 refueling outage.

An ISI Alternative (HNP-ISI-ALT-08-02) has been used through a majority of the fourth ISI interval for the installation of full structural weld overlays on both units; however, a new ISI alternative is needed for this activity based on the unique configuration of the four subject welds. In particular, existing weld overlay material is either adjacent to or located at those locations which are scheduled for the installation of weld overlays. The new ISI Alternative, HNP-ISI-ALT-15-01 is very similar to the existing ISI Alternative, HNP-ISI-ALT-08-02.

SNC requests approval no later than January 8, 2016 to enable installing the weld overlays during the HNP-1 Spring 2016 refueling outage, scheduled to begin on February 8, 2016.

Enclosure 1 provides the proposed Alternative HNP-ISI-ALT-15-01, Version 1.0, in the application of the dissimilar weld overlays.

This letter contains no NRC Commitments. If you have any questions, please contact Ken McElroy at 205-992-7369.

Mr. C. R. Pierce states he is Regulatory Affairs Director of Southern Nuclear Operating Company, is authorized to execute this oath on behalf of Southern Nuclear Operating Company and, to the best of his knowledge and belief, the facts set forth in this letter are true.

Respectfully submitted,

C. R. Pierce

C. R. Pierce
Regulatory Affairs Director

CRP/OCV/

Sworn to and subscribed before me this 2nd *day of* July, *2015.*

Laura Crumpton
Notary Public

My commission expires: 10-8-2017

Enclosure: Proposed Alternative HNP-ISI-ALT-15-01, Version 1

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Edwin I. Hatch Nuclear Plant – Unit 1
Proposed Alternative in Accordance with 10 CFR 50.55a(z)(1), Application of Dissimilar Weld Full-Structural Weld Overlays

Enclosure

Alternative HNP-ISI-ALT-15-01

PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(z)(1)
Application of Dissimilar Weld Full-Structural Weld Overlays
ALTERNATIVE HNP-ISI-ALT-15-01, VERSION 1.0

Plant Site-Unit:

Hatch Nuclear Plant Unit 1 (HNP-1).

Interval Dates:

Fourth ISI Interval extending from January 1, 2006 through March 31, 2016 by extending the ISI Interval to include the 1R27 outage.

Requested Date for Approval

Approval is requested by January 8, 2016.

ASME Code Components Affected:

The welds listed below are the subject of this alternative.

The first weld that this ISI Alternative applies to is dissimilar metal (DSM) weld number 1E11-1RHR-24A-R-12. This Residual Heat Removal System (RHR) weld was previously listed in Hatch ISI Alternative HNP-ISI-ALT-08-02 (which was approved by the NRC per ML090340017 and ML11139A438); however, this weld has been included in the new ISI Alternative because it is adjacent to weld number R-13 which was previously overlaid. Due to the physical configuration and the previously-installed weld overlay, this weld has been included in the new ISI Alternative. This Category B-J weld is a carbon steel valve body (A-352-LCB, P No.1 material) to stainless steel extension piece (fabricated from F304 stainless steel, P No. 8) joined by INCO-WELD A (F No. 43). The physical layout of these two RHR welds is pictorially shown as Figure 1 in Appendix 6.

There are also two Reactor Pressure Vessel (RPV) safe-end to nozzle DSM welds applicable to this ISI Alternative. The nozzles are fabricated from SA-508, CL. 2 (P No. 3), the safe-ends are fabricated from SA-182, F-304 (P No. 8), and the weld material is Alloy 82/182 (F No. 43). These two welds are located on the 12-inch B-Loop Reactor Recirculation riser lines with Figure 2 in Appendix 6 showing the general layout. The specific weld numbers are:

- 1B31-1RC-12BR-C-5 and
- 1B31-1RC-12BR-E-5

Applicable Code Edition and Addenda:

The applicable Code edition and addenda is ASME Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 2001 Edition with Addenda through 2003. The exception is that for ASME Section XI, Appendix VIII, the 2001 Edition of Section XI will be used. This exception is based on 10 CFR 50.55a(b)(2)(xxiv) which states, "The use of Appendix VIII and the supplements to Appendix VIII and Article I-3000 of Section XI of the ASME BPV Code, 2002 Addenda through the 2006 Addenda, is prohibited."

NOTE

Unless identified otherwise, all Code references provided herein are to ASME Section XI.

PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(z)(1)
Application of Dissimilar Weld Full-Structural Weld Overlays
ALTERNATIVE HNP-ISI-ALT-15-01, VERSION 1.0

Applicable Code Requirements:

IWA-4110 of ASME Section XI requires that repairs of welds be performed in accordance with Article IWA-4000. IWA-4400 requires that defects be removed or reduced to an acceptable size.

Reason for Request:

Alloy 82/182 weld configurations may have leakage or unacceptable indications during 4th Interval examinations. In this case, a full-structural overlay is the preferred method of repair. Additionally, due to weld configurations, there are Alloy 82/182 welds at HNP-1 that have significant issues with meeting the industry requirements for the examination of DSM welds. In select cases, overlay of the Alloy 82/182 welds is the preferred manner of solving these significant examination issues. However, Section XI of the American Society of Mechanical Engineers, Boiler and Pressure Vessel Code (Section XI Code) does not provide rules for the design of weld overlays or for repairs without removal of flaws. Additionally, Code Case N-504-3, which has been approved by the NRC for use, does not provide the methodology for overlaying nickel alloy welds. Therefore, this alternative is required.

Proposed Alternative and Basis for Use:

Proposed Alternative

The original intent of HNP-ISI-ALT-08-02 was to provide Hatch with an acceptable repair option when an Alloy 82/182 weld had an emergent condition which required repair (Contingency Overlay Repair). The second purpose was to address welds with a limited ultrasonic examination where the full structural weld overlay (FSWOL) will allow for an improved ultrasonic examination (Preemptive Overlay). These two conditions are described below.

Contingency Overlay Repairs - This proposed alternative may be used as a repair for unacceptable indications or for through-wall leaks. If through-wall leakage is detected at any of the Alloy 82/182 welds, a contingency FSWOL is an option. Section 2.0(a) defines crack-growth requirements and section 2.0(b) defines the design requirements.

Preemptive Overlays - As a conservative measure, preemptive FSWOLs may be applied to Alloy 82/182 welds where the ultrasonic examination is determined to be extremely limited. Section 2.0(a) defines crack-growth requirements and section 2.0(b) defines the design requirements.

In lieu of using the IWA-4000 Repair Procedures in the Section XI Code, Southern Nuclear (SNC) proposes to use the following alternative for the design, fabrication, pressure testing, and examination of the weld overlays. This alternative provides an acceptable methodology for reducing a defect in austenitic nickel alloy weld joints to an acceptable size by increasing the wall thickness through deposition of a weld overlay. The methodology is shown below.

Hatch needs a separate ISI alternative because of the special circumstances of previously-installed weld overlay material onto or near these welds. This scenario is not discussed in Hatch ISI Alternative HNP-ISI-ALT-08-2. The RHR weld and the two Reactor Recirculation welds are described below.

Residual Heat Removal Weld 1E11-1RHR-24A-R-12 and 13:

The RHR system weld 1E11-1RHR-24A-R-12 was examined during the third ISI interval with approximately 30% examination coverage. SNC has made the decision to install a weld overlay to improve the inspectability of this weld. This weld had been previously listed in HNP-ISI-ALT-08-02 but is being included in the new ISI alternative because the adjacent weld overlay on weld number 1E11-1RHR-24A-R-13 impacts the new weld overlay. The weld overlay on weld 13 was installed using 308L stainless steel during the 1984 Unit-1 outage (Figure 1 of Appendix 6 shows this configuration). The ultrasonic (UT) examination history for both welds 12 and 13 is included in Appendix 9.

The process for the new weld overlay is described in Section 1.0(a) with a more detailed description of the process in the remainder of the ISI Alternative including the appendices. This new weld overlay will encompass both RHR welds 12 and 13. The ambient temperature temperbead weld process will be used to add 52M material onto the valve body which has Inconel buttering.

Reactor Recirculation Welds 1B31-1RC-12BR-C-5 and E-5:

The remaining two welds addressed in this ISI alternative are located on the 12-inch B-Loop Reactor Recirculation riser lines with a wall thickness of approximately 1.2-inches. Both of these welds received induction heat stress improvement (IHSI) during the 1986 Unit-1 outage. During the Fall 1988 outage, both of these welds were examined and an axial indication on the safe-end side of each weld was noted. The UT results for these two welds are included in Appendix 9.

During that outage, Hatch worked with Structural Integrity (SI) to design a weld overlay taking into account the special circumstances involved with welding on the ferritic nozzles. In the present configuration, the Inconel weld overlay does not completely cover the weld and buttering but tapers to approximately the centerline of the weld.

These two weld overlays have seen continuous service since that outage with UT examinations performed during several outages (see Appendix 9 for the details). In preparation for the Spring 2016 outage, SNC personnel undertook a review of the previous UT data and based on industry issues related to Appendix VIII qualified examinations, SNC realized that either additional work in the area of nondestructive examinations would need to be performed including the fabrication of a mock-up or SNC would need to replace these weld overlays with full structural weld overlays. In discussions between SNC and our weld overlay design vendor, the decision was made to upgrade to FSWOL weld overlays.

The process for the new weld overlays for the Reactor Recirculation system riser welds is described in Section 1.0(a) with a more detailed description of the process in the remainder of the ISI Alternative including the appendices. A new overlay will be installed on each weld which will include the welds, the nozzles and the safe-ends.

1.0 General Requirements:

a) The surface of the existing weld overlays will be ground to prepare the surface for receipt of a new Alloy 52M overlay. After performance of a satisfactory liquid penetrant surface examination, a stainless steel buffer layer (ER308L) will be deposited over the stainless steel to facilitate effective deposition of the Alloy 52M overlay deposit. This buffer surface also will be required to exhibit a satisfactory liquid penetrant examination. This material will not be credited as part of the designed overlay thickness. Next the Alloy 52M overlay deposit layers will begin to produce the designed full structural overlay dimensions per the ISI Alternative. The portion of the overlay deposited over the low alloy steel material will be applied directly at ambient temperature using the temper bead technique as described in the ISI Alternative and the Alloy 182 butt weld will be spanned and tied into the stainless steel material using a single layer of Alloy 82. Alloy 82 is used because of its tolerance to solidification cracking. After completion of the overlay, the surface will be smoothed by surface grinding and then both liquid penetrant examination followed by a complete volumetric ultrasonic examination will be performed.

b) A FSWOL will be applied by deposition of weld reinforcement (weld overlay) over the Alloy 82/182 weld and the two components on either side of the weld. The weld reinforcement will consist of Alloy 52/152. (Note: As used in this alternative, the use of Alloy 52/152 refers to the family of filler metals which includes filler metals such as 52, 52M, 52MS, etc.)

When components subject to being overlaid contain levels of trace chemicals (e.g., sulfur) that could cause unacceptable indications in the Alloy 52/152 weld, an initial layer of low carbon (0.035% max.) austenitic stainless steel and/or an austenitic nickel alloy may be applied as a buffer between the base metal and the Alloy 52/152 overlay. This buffer will be considered as a "non-credited" layer and will provide an acceptable chemical composition to apply the FSWOL. Depending on the chemical composition of the base materials where the weld overlay is to be applied, there may be different ways to apply the first layer of weld material. SNC considered the effects of the buffer layer on the requirements previously set forth in this alternative. Significant points are:

- Code Case N-740, from which this alternative is derived, provides a methodology for the application of low carbon austenitic stainless and austenitic nickel alloys. Appendices 4 and 5 were included in HNP-ISI-ALT-08-02 to help the NRC's review of the alternative.

- This non-credited buffer layer will not be included in calculations required by this alternative.

- Since the FSWOL over the Alloy 82/182 weld will continue to consist of

Alloy 52/152, there will be no effect on the ability of the overlay to stop the progress of stress corrosion cracking (SCC).

- A review of the geometry by SNC and EPRI NDE personnel indicated that there will be no appreciable effect on the performance of ultrasonic examinations.

- No effects detrimental to the structure will be introduced by addition of the non-credited buffer layer.

The figures in Appendix 6 provide typical sketches of the Alloy 52/152 overlay and the materials for each component. The figures are:

- Figure 1 is the pictorial configuration of the A-Loop Hatch-1 RHR piping showing weld numbers 1E11-1RHR-24A-R-12 and -13.
- Figure 2 is the typical Hatch-1 RPV Reactor Recirculation 12-inch Riser nozzle configuration.

Due to the base metal chemical composition, a non-credited layer (not shown in the figures) may be applied as a buffer. Specific dimensions and the overlay thickness will be documented in the design package.

Prior to deposition of the non-credited buffer layer, the surface will be examined by the liquid penetrant method. Indications larger than 1/16-inch shall be removed, reduced in size, or corrected in accordance with the following requirements.

1. One or more layers of weld metal shall be applied to seal unacceptable indications in the area to be repaired, with or without excavation. The thickness of these layers shall not be used in meeting weld reinforcement design thickness requirements. Peening the unacceptable indication prior to welding is permitted.

2. If correction of indications is required, the area where the weld overlay is to be deposited, including any local repairs or initial weld overlay layer, shall be examined by the liquid penetrant method. The area shall contain no indications greater than 1/16-inch prior to the application of the structural layers of the weld overlay.

Since no credit is being taken for the non-credited buffer layer, the non-credited buffer layer will not be further discussed in this proposed alternative.

c) The Alloy 52/152 weld overlay filler metal is an austenitic nickel alloy having a chromium (Cr) content of at least 28%. The weld overlay is applied 360 degrees around the circumference of the item, e.g., safe end to nozzle weld, and will be deposited using a Welding Procedure Specification (WPS) for groove welding, qualified in accordance with the Construction Code and Owner's requirements and identified in the Repair/Replacement

Plan. As an alternative to the post-weld heat treatment requirements of the Construction Code and Owner's requirements, the provisions for ambient temperature temperbead welding will be used on the ferritic materials. (See "Ambient Temperature Temperbead Welding," which is located in Appendix 1 to this proposed alternative). The maximum area of an individual weld overlay on the finished surface of the ferritic material shall be no greater than 500 square inches.

d) Prior to deposition of the FSWOL, the surface will be examined by the liquid penetrant method. Indications larger than 1/16-inch shall be removed, reduced in size, or corrected in accordance with the following requirements.

1. One or more layers of weld metal shall be applied to seal unacceptable indications in the area to be repaired, with or without excavation. The thickness of these layers shall not be used in meeting weld reinforcement design thickness requirements. Peening the unacceptable indication prior to welding is permitted.

2. If correction of indications identified in 1.0(d) is required, the area where the weld overlay is to be deposited, including any local repairs or initial weld overlay layer, shall be examined by the liquid penetrant method. The area shall contain no indications greater than 1/16-inch prior to the application of the structural layers of the weld overlay.

e) Weld overlay deposits shall meet the following requirements:
The austenitic nickel alloy weld overlay shall consist of at least two weld layers deposited using a filler material such as that identified in 1.0(c). The first layer of weld metal deposited may not be credited toward the required thickness. Alternatively, for BWR applications, a diluted layer may be credited toward the required thickness, provided the portion of the layer over the austenitic base material, austenitic filler material weld, and the associated dilution zone from an adjacent ferritic base material contain at least 20% Cr, and the Cr content of the deposited weld metal is determined by chemical analysis of the production weld or of a representative coupon taken from a mockup prepared in accordance with the WPS for the production weld.

f) Welding will only be performed for applications predicted not to have exceeded a thermal neutron fluence of 1×10^{17} (E< 0.5 eV) neutrons per cm^2 prior to welding.

2.0 Crack Growth Considerations and Design

a) Crack Growth Considerations - Crack growth calculations will be performed as part of a design package. Flaw characterization and evaluation requirements shall be based on the as-found flaw in the case of a contingency overlay. For a preemptive overlay, a flaw in the original dissimilar metal weld with a depth of 75% and a circumference of 360 degrees that originates from the inside of the pipe is postulated for crack

growth purposes. A 75% through-wall depth flaw is the largest flaw that could remain undetected during the FSWOL preservice examination. This preservice examination will verify there is no cracking in the upper 25% of the original weld wall thickness, and thus verify that the assumption of a 75% through-wall crack is conservative. However, if any crack-like flaws are found during the preservice examination in the upper 25% of the original weld or base materials, the as-found flaw (postulated 75% through wall, plus the portion of the flaw in the upper 25%) would be used for the crack growth analysis. The size of all flaws will be projected to the end of the design life of the overlay. Crack growth, including both stress corrosion and fatigue crack growth, shall be evaluated in the materials in accordance with IWB-3640. If the flaw is at or near the boundary of two different materials, evaluation of flaw growth in both materials is required. This report will be submitted within 90 days after plant startup.

b) Design of the FSWOL

The design of the FSWOL weld is the same for preemptive overlays and for contingency overlays. The following design analysis shall be completed in accordance with IWA-4311.

1. The axial length and end slope of the weld overlay shall cover the weld and the heat affected zones on each side of the weld, and shall provide for load redistribution from the item into the weld overlay and back into the item without violating applicable stress limits of ASME Section III, NB-3200. Any laminar flaws in the weld overlay shall be evaluated in the analysis to ensure that load redistribution complies with these requirements. These requirements will usually be satisfied if the weld overlay full thickness length extends axially beyond the projected flaw by at least $0.75\sqrt{Rt}$, where R is the outer radius of the item and t is the nominal wall thickness of the item.

2. Unless specifically analyzed in accordance with 2.0(b)(1) above the end transition slope of the overlay shall not exceed 45 degrees. A slope of not more than 1:3 is recommended.

3. The thickness of the FSWOL shall be determined based on the assumption of a through-wall flaw, with a length of 360 degrees in the underlying pipe. The overlay will be applied, so that the criteria of IWB-3640 are met after the overlay is applied. The determination of the thickness shall include the deposit analysis requirements of 1.0(e).

4. The effects of any changes in applied loads, as a result of weld shrinkage from the entire overlay, on other items in the piping system (e.g., support loads and clearances, nozzle loads, changes in system flexibility and weight due to the weld overlay) shall be evaluated. The effects of water backing on the repair weld shall be considered. (There are no pre-existing flaws previously accepted by analytical evaluation welds to be considered in this evaluation.) Included are:

i. A stress analysis will be performed that demonstrates that the pressure-retaining components will perform their intended design function with the FSWOL installed. The stress analysis report will include results showing that the requirements of Subarticles NB-3200 and NB-3600 of the ASME Code, Section III are satisfied. The stress analysis will also include results showing that the requirements of IWB-3000 of the ASME Code, Section XI, are satisfied. The results will show that the postulated crack including its growth would not adversely affect the integrity of the overlaid welds. This report will be submitted within 90 days after plant startup.

ii. (Leak-before-break does not apply.)

3.0 Examination and Inspection

In lieu of all other examination requirements, the examination requirements proposed herein shall be met. Nondestructive examination methods shall be in accordance with IWA-2200, except as specified herein. Nondestructive examination personnel shall be qualified in accordance with IWA-2300. Ultrasonic examination procedures and personnel shall be qualified in accordance with Appendix VIII, Section XI, as implemented through the performance demonstration initiative (PDI). (The PDI Program Status for Code Compliance and Applicability developed in June 2005 indicates that the PDI Program is in compliance with Appendix VIII, 2001 Edition of Section XI as amended and mandated by 10 CFR 50.55a, Final Rule dated October 1, 2004.) Ultrasonic examination will be performed to the maximum extent achievable.

Pre-Overlay Examinations

For welds overlaid due to leakage no examinations will be performed. In lieu of performing ultrasonic examinations when there is leakage, the flaw will be assumed to be 100% through the original wall thickness for the entire circumference.

For welds overlaid because the examination coverage is severely limited no additional examinations are practical. The flaw will be assumed to be 100% through the original wall thickness for the entire circumference.

For welds overlaid because of unacceptable indications, the flaw size would be defined by qualified ultrasonic examinations.

Post-Overlay Examinations

There are two examinations to be performed after the overlay is installed, i.e., the Acceptance Examination of the Overlay and the Preservice Examination. The purpose of the Acceptance Examination is to assure a quality overlay was installed. The purpose of the Preservice Examination is to provide a baseline for future examinations and to locate and size any cracks that might have propagated into the upper 25% of the original wall

thickness and evaluate accordingly. While listed below as two separate examinations the two examinations may be performed during the same time period. SNC will provide the NRC, within 14 days after the completion of the ultrasonic examination of the weld overlay installations, (1) the examination results of the weld overlays and (2) a discussion of any repairs to the overlay material and/or base metal and the reason for repair.

The NDE requirements listed below cover the area that will be affected by application of the overlay. Any SCC degradation would be in the DM weld or the adjacent heat affected zone (HAZ). Further, the original weld and adjacent base materials have received a radiographic examination (RT) prior to the initial acceptance of the existing butt weld. The proposed surface and volumetric examinations provide adequate assurance that any defects produced by welding of the overlay or by extension of pre-existing defects will be identified.

a) Acceptance Examination of the Overlay

1. The weld overlay shall have a roughness average (RA) of 225 microinches (250 RMS) or better and a flatness sufficient to allow for adequate examination in accordance with procedures qualified per Appendix VIII. The weld overlay shall be examined to verify acceptable configuration.

2. The weld overlay and the adjacent base material for at least ½ inch from each side of the weld overlay shall be examined using the liquid penetrant method. The weld overlay shall satisfy the surface examination acceptance criteria for welds of the Construction Code or ASME Section III, NB-5300. The adjacent base metal shall satisfy the surface examination acceptance criteria for base material of the Construction Code or ASME Section III, NB-2500. If ambient temperature temperbead welding is used, the liquid penetrant examination shall be conducted at least 48 hours after the third layer of the weld overlay has been completed. See Appendix 7 for hold time justification.

3. The examination volume A-B-C-D in Figure 1, which is provided in Appendix 2 to this proposed alternative, shall be ultrasonically examined to assure adequate fusion (i.e., adequate bond) with the base metal and to detect welding flaws, such as interbead lack of fusion, inclusions, or cracks. The interface C-D shown between the overlay and the weld includes the bond and the heat affected zone from the overlay. If ambient temperature temperbead welding is used, the ultrasonic examination shall be conducted at least 48 hours after the third layer of the weld overlay has been completed. See Appendix 7 for hold time justification.

4. Planar flaws shall meet the preservice examination standards of Table IWB-3514-2. In applying the acceptance standards, wall thickness "t_w" shall be the thickness of the weld overlay. For weld overlay examination

volumes with unacceptable indications, the unacceptable indications will be removed and the volume will be re-welded. Reexamination per IWB-2420 is not required because unacceptable indications will be removed and the volume will be re-welded.

5. Laminar flaws shall meet the acceptance standards of Table IWB-3514-3 with the additional limitation that the total laminar flaw shall not exceed 10% of the weld surface area and that no linear dimension of the laminar flaw area exceeds 3.0 inches. Additional requirements are:

   i. The reduction in coverage of the examination volume in Figure 1 (which is provided in Appendix 2 to this proposed alternative) due to laminar flaws shall be less than 10%. The dimensions of the uninspectable volume are dependent on the coverage achieved with the angle beam examination of the overlay.
   ii. Any uninspectable volume in the weld overlay beneath a laminar flaw shall be assumed to contain the largest radial planar flaw that could exist within that volume. This assumed flaw shall meet the preservice examination standards of Table IWB-3514-2. In applying the acceptance standards, wall thickness "t_w" shall be the thickness of the weld overlay. Both axial and circumferential planar flaws shall be assumed.
   iii. If the preservice acceptance criteria of Table IWB-3514-2 are not met, the assumed flaw shall be evaluated and shall meet the requirements of IWB-3640. The IWB-3640 evaluation shall be submitted to the NRC within 90 calendar days of the completion of the refueling outage. If the assumed flaw is not acceptable for continued service per IWB-3640, the lamination shall be removed or reduced in area such that the assumed flaw is acceptable per IWB-3640.

6. After completion of all welding activities, affected restraints, supports, and snubbers shall be VT-3 visually examined to verify that design tolerances are met.

b) Preservice Inspection

1. The examination volume A-B-C-D in Figure 2, which is provided in Appendix 3 to this proposed alternative, shall be ultrasonically examined. The angle beam shall be directed perpendicular and parallel to the piping axis, with scanning performed in four directions, to locate and size any cracks that might have propagated into the upper 25% of the original wall thickness or into the weld overlay. (Additionally, the AB dimension will be extended such that the overlay will be scanned to the extent practical).

2. The preservice examination acceptance standards of Table IWB-3514-2 shall be applied to planar indications in the weld overlay material. If the indication is found acceptable per Table IWB-3514-2 the weld overlay will be placed in service and the inservice schedule and acceptance criteria of 3(c) will be followed. In applying the

acceptance standards, wall thickness, t_w, shall be the thickness of the weld overlay. Planar flaws not meeting the preservice acceptance standards of Table IWB-3514-2 shall be repaired. Re-examination per IWB-2420 is not required because unacceptable indications will be removed and the volume will be re-welded.

3. Cracks in the outer 25% of the original wall thickness shall meet the design analysis requirements as addressed in Section 2.0, "Crack Growth Considerations and Design," of this proposed alternative.

c) Inservice Inspection

Inservice examinations of the FSWOLs will be performed in accordance with Q-4300 and 4310 of Appendix Q to the 2004 Edition of Section XI with Addenda through 2005 with modifications. Appendix 8 shows Q-4300 and 4310 with the SNC modifications shown in italics.

4. Pressure Testing

A system leakage test shall be performed in accordance with IWA-5000.

5. Documentation

Use of this proposed alternative shall be documented on ASME Form NIS-2 or NIS-2A.

Basis for Use

The use of weld overlay materials resistant to SCC (e.g., Alloy 52/152) that create low tensile or compressive residual stress profiles in the original weld provide increased assurance of structural integrity. The weld overlay is of sufficient thickness and length to meet the applicable stress limits from ASME Section III, NB-3200. Crack growth evaluations for SCC and fatigue of any as-found flaws or any conservatively postulated flaws will ensure that structural integrity will be maintained.

As a part of the design of the weld overlay, the weld length, surface finish, and flatness are specified in order to allow qualified ASME Section XI, Appendix VIII UT examinations, as implemented through the EPRI Performance Demonstration Initiative (PDI) Program, of the weld overlay and the required volume of the base material and original weld. The examinations specified in this proposed alternative, versus those limited examinations performed on the original dissimilar welds, will provide improved assurance of structural integrity. Further, if no flaws are found in the upper 25% of the original wall thickness by the preservice UT examinations, the postulated 75% through-wall flaw for the preemptive overlays is conservative for crack growth evaluations. If a flaw is detected in the upper 25% of the original material during the preservice examination, the actual flaw size will be used for the crack growth evaluations.

To aid the NRC in their review of this package, the following additional general

information is enclosed:

- Based on the proposed process for the existing weld overlays described in this alternative, SNC does not see an issue with the buffer distance question raised by the NRC.
- Hatch-1 has not implemented risk-informed ISI for the fourth ISI interval.
- The latest electro-chemical potential (ECP) values for Hatch-1 are enclosed as Appendix 10.
- SNC does not plan on performing UT examinations of these welds prior to the application of the new weld overlays.
- SNC NDE personnel are working with our vendor who is designing these weld overlays to ensure maximum coverage.

The implementation of the alternative reduces the likelihood for SCC in the identified welds and improves piping geometries to permit Appendix VIII UT examinations as implemented through the PDI program. Weld overlay repairs of dissimilar metal welds have been installed and performed successfully for many years in both PWR and BWR applications. The alternative provides improved structural integrity and reduced likelihood of leakage for the primary system. Accordingly, the use of the alternative provides an acceptable level of quality and safety in accordance with 10 CFR 50.55a(z)(1).

Duration of Proposed Alternative:

The proposed alternative is applicable to the 4th ISI Interval.

Precedents:

This proposed alternative is technically similar to HNP-ISI-ALT-08-02, Version 1.0 with the technical differences being (1) the new ISI Alternative applies to only Unit-1 piping and vessel welds that have existing weld overlays located within the area where the new weld overlays are to be installed; (2) the new ISI Alternative expands the allowable surface area for ferritic material from 300 to 500 square inches when using the ambient temperature temperbead welding process per N-638-4; (3) a Note has been added at the end of Appendix 8 that although the new ISI Alternative expires at the end of the fourth ISI Interval, Hatch intends to meet these requirements in the fifth ISI interval; (4) a new Appendix 9 has been added to address the UT examination history for the welds affected by this ISI Alternative; (5) a new Appendix 10 has been added to show the ECP values for Hatch-1 for the last two years of plant operation; and (6) SNC has provided additional general information in the ISI Alternative under the Basis for Use to aid in the NRC review.

This proposed alternative is also technically similar to ISI-GEN-ALT-07-01, Version 2.0 previously developed for Farley Nuclear Plant Unit 2 and Vogtle Electric Generating Plant Unit 1. ISI-GEN-ALT-07-01, Version 2.0 was approved by NRC Safety Evaluation dated March 10, 2008.

References: TAC Numbers MD8948 and MD8949 for the HNP-ISI-ALT-08-02, Version 1.0 NRC safety evaluation. The ADAMS Accession Numbers for the two ISI Safety Evaluations associated with HNP-ISI-ALT-08-02 are ML090340017 and ML11139A438.

The ADAMS Accession Number for the Farley and Vogtle SER is ML080580291.

Status: Awaiting NRC approval.

APPENDIX 1
AMBIENT TEMPERATURE TEMPERBEAD WELDING

1.0 GENERAL REQUIREMENTS

(a) This appendix applies to dissimilar austenitic filler metal welds between P-Nos. 1, 3, 12A, 12B, and 12C[1] materials and their associated welds and welds joining P-No. 8 or 43 materials to P-No. 1, 3, 12A, 12B, and 12C materials with the following limitation: This Appendix shall not be used to repair SA-302 Grade B material unless the material has been modified to include from 0.4% to 1.0% nickel, quenching and tempering, and application of a fine grain practice. ([1]P-No. 12C designation refers to specific material classifications originally identified in ASME Section III and subsequently reclassified in a later Edition of ASME Section IX).

(b) The maximum area of an individual weld overlay based on the finished surface over the ferritic base material (the RHR valve and the Reactor Recirculation nozzles) shall be 500 square inches.

(c) Repair/replacement activities on a dissimilar-metal weld in accordance with this Appendix are limited to those along the fusion line of a nonferritic weld to ferritic base material on which 1/8-inch, or less of nonferritic weld deposit exists above the original fusion line.

(d) If a defect penetrates into the ferritic base material, repair of the base material, using a nonferritic weld filler material, may be performed in accordance with this Appendix, provided the depth of repair in the base material does not exceed 3/8-inch.

(e) Prior to welding the area to be welded and a band around the area of at least 1-1/2 times the component thickness or 5 inches, whichever is less, shall be at least 50 degrees Fahrenheit.

(f) Welding materials shall meet the Owner's Requirements and the Construction Code and Cases specified in the Repair/Replacement Plan. Welding materials shall be controlled so that they are identified as acceptable until consumed.

(g) Peening may be used, except on the initial and final layers.

2.0 WELDING QUALIFICATIONS

The welding procedures and the welding operators shall be qualified in accordance with ASME Section IX and the requirements of 2.1 and 2.2 provided below.

APPENDIX 1 (Continued)
AMBIENT TEMPERATURE TEMPERBEAD WELDING

2.1 Procedure Qualification

(a) The base materials for the welding procedure qualification shall be of the same P-Number and Group Number, as the materials to be welded. The materials shall be postweld heat treated to at least the time and temperature that was applied to the materials being welded.

(b) The root width and included angle of the cavity in the test assembly shall be no greater than the minimum specified for the repair.

(c) The maximum interpass temperature for the first three layers of the test assembly shall be 150 degrees Fahrenheit.

(d) The test assembly cavity depth shall be at least 1 inch. The test assembly thickness shall be at least twice the test assembly cavity depth. The test assembly shall be large enough to permit removal of the required test specimens. The test assembly dimensions surrounding the cavity shall be at least the test assembly thickness and at least 6 inches. The qualification test plate shall be prepared in accordance with Figure 1-1.

(e) Ferritic base material for the procedure qualification test shall meet the impact test requirements of the Construction Code and Owner's Requirements. If such requirements are not in the Construction Code and Owner's Requirements, the impact properties shall be determined by Charpy V-notch impact tests of the procedure qualification base material at or below the lowest service temperature of the item to be repaired. The location and orientation of the test specimens shall be similar to those required in (f) below, but shall be in the base metal.

(f) Charpy V-notch tests of the ferritic heat-affected zone (HAZ) shall be performed at the same temperature as the base metal test of (e) above. Number, location, and orientation of test specimens shall be as follows:

(i) The specimens shall be removed from a location as near as practical to a depth of one-half the thickness of the deposited weld metal. The coupons for HAZ impact specimens shall be taken transverse to the axis of the weld and etched to define the HAZ. The notch of the Charpy V-notch specimen shall be cut approximately normal to the material surface in such a manner as to include as much HAZ as possible in the resulting fracture. When the material thickness permits, the axis of a specimen shall be inclined to allow the root of the notch to be aligned parallel to the fusion line.

(ii) If the test material is in the form of a plate or a forging, the axis of the weld shall be oriented parallel to the principal direction of rolling or forging.

APPENDIX 1 (Continued)
AMBIENT TEMPERATURE TEMPERBEAD WELDING

(iii) The Charpy V-notch test shall be performed in accordance with ASME Section II, Part A, SA-370. Specimens shall be in accordance with SA-370, Figure 11, Type A. The test shall consist of a set of three full-size 10 mm X 10 mm specimens. The lateral expansion, percent shear, absorbed energy, test temperature, orientation and location of all test specimens shall be reported in the Procedure Qualification Record.

(g) The average lateral expansion value of the three HAZ Charpy V-notch specimens shall be equal to or greater than the average lateral expansion value of the three unaffected base metal specimens. However, if the average lateral expansion value of the HAZ Charpy V-notch specimens is less than the average value for the unaffected base metal specimens and the procedure qualification meets all other requirements of this appendix, either of the following shall be performed:

(1) The welding procedure shall be requalified.

(2) An Adjustment Temperature for the procedure qualification shall be determined in accordance with the applicable provisions of NB-4335.2 of Section III, 2001 Edition with 2002 Addenda. The RT_{NDT} or lowest service temperature of the materials for which the welding procedure will be used shall be increased by a temperature equivalent to that of the Adjustment Temperature.

2.2 Performance Qualification

Welding operators shall be qualified in accordance with ASME Section IX.

3.0 WELDING PROCEDURE REQUIREMENTS

The welding procedure shall include the following requirements.

(a) The weld metal shall be deposited by the automatic or machine GTAW process.

(b) Dissimilar metal welds shall be made using A-No. 8 weld metal (ASME Section IX, QW-442) for P-No. 8 to P-No. 1, 3, or 12 (A, B, or C) weld joints or F-No. 43 weld metal (ASME Section IX QW-432) for P-No. 8 or 43 to P-No. 1, 3, or 12 (A, B, or C) weld joints.

APPENDIX 1 (Continued)
AMBIENT TEMPERATURE TEMPERBEAD WELDING

(c) The area to be welded shall be buttered with a deposit of at least three layers to achieve at least 1/8-inch overlay thickness, with the heat input for each layer controlled to within ±10% of that used in the procedure qualification test. The heat input of the first three layers shall not exceed 45,000 J/inch under any conditions. Particular care shall be taken in the placement of the weld layers of the austenitic overlay filler material at the toe of the overlay to ensure that the HAZ and ferritic base metal are tempered. Subsequent layers shall be deposited with a heat input not exceeding that used for layers beyond the third layer in the procedure qualification.

(d) The maximum interpass temperature for field applications shall be 350°F for all weld layers regardless of the interpass temperature used during qualification. The interpass temperature limitation of QW-406.3 need not be applied.

(e) The interpass temperature shall be determined by (e)(1). If it is not possible to use (e)(1) then (e)(2) and (e)(3) may be used in combination.

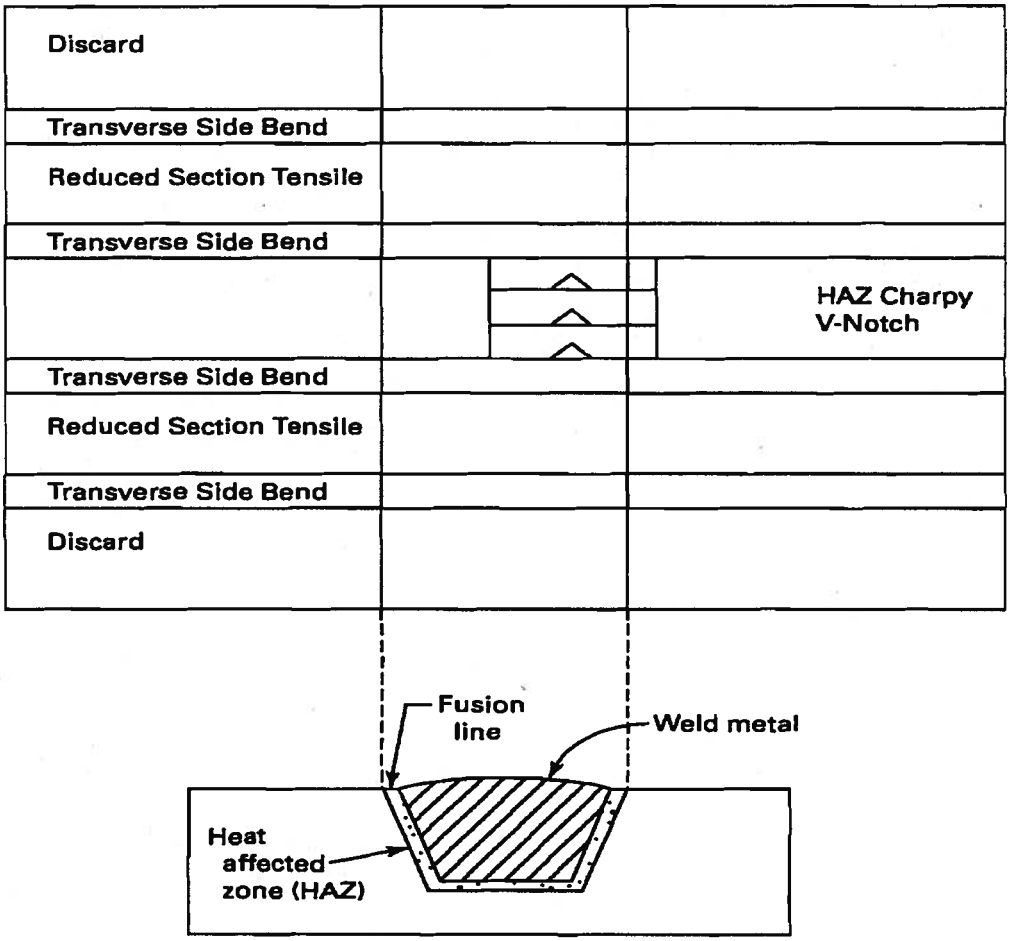
(1) Temperature measurement (e.g., pyrometers, temperature indicating crayons, thermocouples) during welding. Trending of the interpass temperatures during installation of overlays using contact pyrometers has shown that the difference between the observed temperatures and the maximum allowable interpass temperature of 350°F is large and considerable margin exists. Based on this trending, there is reasonable assurance that the temperature of any bead will not approach the maximum allowable temperature. SNC will monitor the interpass temperature every weld pass for the first three layers. For additional layers, the frequency of measuring interpass temperature may be reduced when the temperature is at least 100°F below the 350°F limit and trend data supports a reduced monitoring frequency.

(2) Heat flow calculations using the variables listed below as a minimum.
- (i) welding heat input
- (ii) initial base material temperature
- (iii) configuration, thickness, and mass of the item being welded
- (iv) thermal conductivity and diffusivity of the materials being welded
- (v) arc time per weld pass and delay time between each pass
- (vi) arc time to complete the weld

(3) Measurement of the maximum interpass temperature on a test coupon that is equal to or less than the thickness of the item to be welded. The maximum heat input of the welding procedure shall be used in the welding of the test coupon.

(f) Particular care shall be given to ensure that the weld region is free of all potential sources of hydrogen. The surfaces to be welded, filler metal, and shielding gas shall be suitably controlled.

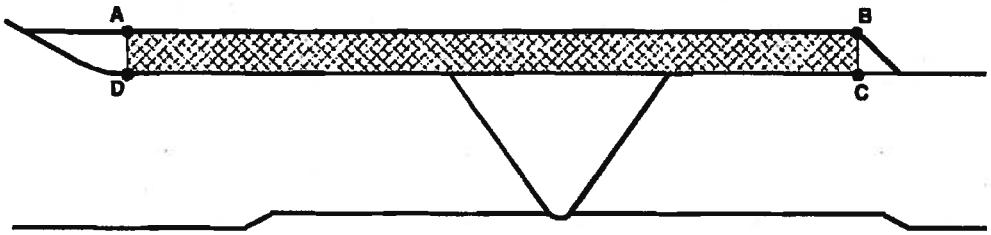
APPENDIX 1 (Continued)
AMBIENT TEMPERATURE TEMPERBEAD WELDING



Base metal Charpy impact specimens are not shown. This figure illustrates a similar-metal weld.

FIGURE 1-1: QUALIFICATION TEST PLATE

APPENDIX 2
ACCEPTANCE EXAMINATION VOLUME



Examination Volume A-B-C-D

FIGURE 1: ACCEPTANCE EXAMINATION VOLUME

APPENDIX 3
PRESERVICE EXAMINATION VOLUME

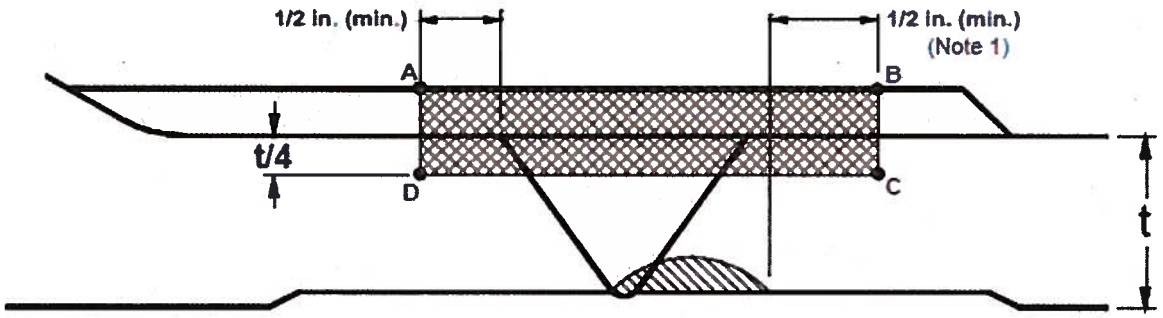


FIGURE 2: PRESERVICE EXAMINATION VOLUME

APPENDIX 4 **COMPARISON OF PROPOSED ALTERNATIVE WITH N-504-3**	
CODE CASE N-504-3	**PROPOSED ALTERNATIVE**
Use Of Code Case Reduce a defect to a flaw of acceptable size by weld overlay on austenitic SS piping. (Material covered is P-8).	**Use Of Alternative** Reduce a defect to a flaw of acceptable size by weld overlay on austenitic stainless steel, low alloy steel, carbon steel, or austenitic nickel alloy components and associated welds. 1.0(a) of Appendix 1 - Materials covered are P-8 or P-43 and P-1, 12A, 12B or 12C or between P-1, 3, 12A, 12B or 12C. Also includes P-8 to P-43, P-8 to P-8 or P-43 to P-43 joined with austenitic filler materials.
Reinforcement Weld Metal (b) Reinforcement weld metal shall be low carbon (0.035% max.) austenitic stainless steel applied 360 deg. around the circumference of the pipe, and shall be deposited in accordance with a qualified welding procedure specification identified in the Repair Program. The submerged arc method shall not be used for weld overlay.	**Filler Metal** 1.0(c) The Alloy 52/152 weld overlay filler metal is an austenitic nickel alloy having a chromium (Cr) content of at least 28%. The weld overlay is applied 360 degrees around the circumference of the item, e.g., safe end to nozzle weld, and will be deposited using a Welding Procedure Specification for groove welding, qualified in accordance with the Construction Code and Owner's requirements and identified in the Repair/Replacement Plan.
Repair Of Indications Prior To Overlay (c) Prior to deposition of the weld reinforcement, the surface to be repaired shall be examined by the liquid penetrant method. Indications greater than 1⁄16in. are unacceptable and shall be prepared for weld reinforcement in accordance with (1) or (2) below: (c)(1) Unacceptable indication shall be excavated to the extent necessary to create a cavity that can be repaired using qualified welding procedures. (c)(2) One or more layers of weld overlay shall be applied to seal unacceptable indications in the area to be	**Repair Of Indications Prior To Overlay** 1.0(d) Prior to deposition of the FSWOL, the surface will be examined by the liquid penetrant method. Indications larger than 1/16-inch shall be removed, reduced in size, or corrected in accordance with the following requirements. 1.0(d)(1) One or more layers of weld metal shall be applied to seal unacceptable indications in the area to be repaired, with or without excavation. The thickness of these layers shall not be used in meeting weld reinforcement design thickness requirements. Peening the unacceptable indication

APPENDIX 4 COMPARISON OF PROPOSED ALTERNATIVE WITH N-504-3	
CODE CASE N-504-3	**PROPOSED ALTERNATIVE**
repaired without excavation. The thickness of these layers shall not be included in meeting weld reinforcement design thickness requirements. (d) If the preparation of (c)(1) or (2) above is required, the area where the weld reinforcement is to be deposited, including any local repairs or initial weld overlay layers, shall be examined by the liquid penetrant method, and shall contain no indications greater than 1⁄16 in. prior to application of the structural layers of the weld overlay.	prior to welding is permitted. 1.0(d)(2) If correction of indications is required, the area where the weld overlay is to be deposited, including any local repairs or initial weld overlay layer, shall be examined by the liquid penetrant method. The area shall contain no indications greater than 1/16-inch prior to the application of the structural layers of the weld overlay.
Weld Reinforcement (e) The weld reinforcement shall consist of a minimum of two weld layers having as-deposited delta ferrite content of at least 7.5 FN. The first layer of weld metal with delta ferrite content of least 7.5 FN shall constitute the first layer of the weld reinforcement design thickness. Alternatively, first layers of at least 5 FN may be acceptable based on evaluation. (This Code Case does not address nickel alloy weld overlays).	**Weld Reinforcement** (This alternative does not address austenitic SS). 1.0(e) The austenitic nickel alloy weld overlay shall consist of at least two weld layers deposited using a filler material identified in 1.0(c). The first layer of weld metal deposited may not be credited toward the required thickness. Alternatively, for BWR applications, a diluted layer may be credited toward the required thickness, provided the portion of the layer over the austenitic base material, austenitic filler material weld, and the associated dilution zone from an adjacent ferritic base material contain at least 20% Cr.
Design of the Weld Overlay	**Design of the Weld Overlay**

APPENDIX 4 **COMPARISON OF PROPOSED ALTERNATIVE WITH N-504-3**	
CODE CASE N-504-3	**PROPOSED ALTERNATIVE**
(f) The design shall provide for access for the examinations required by (i) and (j), and shall be in accordance with (1), (2), or (3) below. (f)(1) For circumferentially oriented flaws greater than 10% of the pipe circumference, axial flaws equal to or greater than 1.5 in. in length, or 5 or more axial flaws of any length, the weld reinforcement shall provide the necessary wall thickness to satisfy the flaw evaluation procedures of IWB-3640. The flaw shall be assumed to be 100% through the original pipe wall thickness for the entire circumference of the pipe. The axial length and end slope of the reinforcement shall be sufficient to provide for load redistribution from the pipe into the deposited weld metal and back into the pipe without violating applicable stress limits of Section III for primary local and bending stresses and secondary peak stresses. (These requirements will usually be satisfied if the overlay full thickness length extends axially at least 0.75 $\sqrt{Rt}$, beyond each end of the observed flaws, where R and t are the outer radius and nominal wall thickness of the pipe, prior to depositing the weld overlay, and the end slope is no steeper than 45 deg.) (f)(2)& (3) Provides alternate design requirements when circumferential cracking is less than 10% or there are 4 axial flaws or less.	2.0(b) The design of the FSWOL weld is the same for preemptive overlays and for contingency overlays. The following design analysis shall be completed in accordance with IWA-4311. 2.0(b)(1) The axial length and end slope of the weld overlay shall cover the weld and the heat affected zones on each side of the weld, and shall provide for load redistribution from the item into the weld overlay and back into the item without violating applicable stress limits of ASME Section III, NB-3200. Any laminar flaws in the weld overlay shall be evaluated in the analysis to ensure that load redistribution complies with these requirements. These requirements will usually be satisfied if the weld overlay full thickness length extends axially beyond the projected flaw by at least 0.75 $\sqrt{Rt}$, where R is the outer radius of the item and t is the nominal wall thickness of the item. 2.0(b)(2) Unless specifically analyzed in accordance with 2(b) 1 above, the end transition slope of the overlay shall not exceed 45 degrees. A slope of not more than 1:3 is recommended. 2.0(b)(3) The thickness of the FSWOL shall be determined based on the assumption of a through-wall flaw, with a length of 360 degrees in the underlying pipe. The overlay will be applied, so that the criteria of IWB-3640 are met after the overlay is applied. The determination of the thickness shall include the deposit analysis requirements of 1(e). (Not in the proposed alternative).
Evaluation of the Weld Overlay	**Evaluation of the Weld Overlay**

APPENDIX 4 COMPARISON OF PROPOSED ALTERNATIVE WITH N-504-3	
CODE CASE N-504-3	**PROPOSED ALTERNATIVE**
(g) An evaluation of the repaired weldment, as well as other welds and components in the system affected by the weld reinforcement, shall be performed in accordance with (1) through (3). (g)(1) The Owner shall comply with IWA-1400(p). (g)(2) The evaluation shall consider residual stresses produced by the weld overlay with other applied loads on the system. The effects of water backing on the repair weld shall be considered. The evaluation shall demonstrate that the requirements of IWB-3640 are satisfied for the design life of the repair, considering potential flaw growth due to fatigue and the mechanism believed to have caused the flaw. The flaw growth evaluation shall be performed in accordance with Appendix C. (g)(3) The evaluation of other welds and components in the system shall consider potential increases in loading, including shrinkage effects, due to all weld overlays in the system, and shall identify and record the magnitude and location of the maximum shrinkage stress developed. These welds and components shall meet the applicable stress limits of the Construction Code. Shrinkage stresses shall be included with other applied loads on the system in any IWB-3640 flaw evaluations required for the system. In addition, the effect of shrinkage from weld overlays on the affected portion of the system restraints, supports, and snubbers shall be evaluated to determine whether design tolerances are exceeded.	2.0(a) Crack growth calculations will be performed as part of a design package. Flaw characterization and evaluation requirements shall be based on the as-found flaw in the case of a contingency overlay. For a preemptive overlay, a flaw in the original dissimilar metal weld with a depth of 75% and a circumference of 360 degrees that originates from the inside of the pipe is postulated for crack growth purposes. The size of all flaws will be projected to the end of the design life of the overlay. Crack growth, including both stress corrosion and fatigue crack growth, shall be evaluated in the materials in accordance with IWB-3640. If the flaw is at or near the boundary of two different materials, evaluation of flaw growth in both materials is required. 2.0(b)(4) The effects of any changes in applied loads, as a result of weld shrinkage from the entire overlay, on other items in the piping system (e.g., support loads and clearances, nozzle loads, changes in system flexibility and weight due to the weld overlay) shall be evaluated. The effects of water backing on the repair weld shall be considered. A stress analysis will be performed that demonstrates that the pressure-retaining components will perform their intended design function with the overlay installed. The stress analysis report will include results showing that the requirements of Subarticles NB-3200 and NB-3600 of the ASME Code, Section III are satisfied. The stress analysis will also include results showing that the requirements of IWB-3000 of the ASME Code, Section XI, are satisfied. The results will show that the postulated crack including its growth would not adversely affect the integrity of the overlaid welds.
Pressure Testing	**Pressure Testing**
(h) The completed repair shall be pressure	4.0 A system leakage test shall be performed in

APPENDIX 4 COMPARISON OF PROPOSED ALTERNATIVE WITH N-504-3	
CODE CASE N-504-3	**PROPOSED ALTERNATIVE**
tested in accordance with IWA-5000. If the flaw penetrated the original pressure boundary prior to welding, or if any evidence of the flaw penetrating the pressure boundary is observed during the welding operation, a system hydrostatic test shall be performed in accordance with IWA-5000. If the system pressure boundary has not been penetrated, a system leakage, inservice, or functional test shall be performed in accordance with IWA-5000.	accordance with IWA-5000.
Nondestructive Examinations (NDE) (i) Preservice examinations shall be performed in accordance with IWB-2200 and shall include the weld and volume identified below. Examination procedures shall be specified in the Repair Program. Liquid penetrant (PT) and ultrasonic (UT) examinations of the overlay shall be performed. Grinding and machining of the as-welded overlay surface may be used to improve the surface finish for such examinations, when the overlay thickness is not reduced below design requirements. The acceptance standards of Table IWB-3514-2	**Nondestructive Examinations (NDE)** 3.0 In lieu of other NDE requirements, the NDE requirements in the alternative shall be met. NDE methods shall be in accordance with IWA-2200, except as specified herein. NDE personnel shall be qualified in accordance with IWA-2300. UT procedures and personnel shall be qualified per Appendix VIII. 3.0(a)(1) The weld overlay shall have a roughness average (RA) of 225 micro-inches (250 RMS) or better and a flatness sufficient to allow for adequate examination in accordance with procedures qualified per Appendix VIII. 3.0(a)(2) Perform a liquid penetrant examination of the overlay and ½-inch on either side of the overlay. Acceptance standards for the PT of the weld overlay, meet weld Construction Code criteria or NB-5300. Base material meet base material criteria or NB-2500. A 48-hour hold time after the third layer is completed is imposed when ambient temperature temperbead welding is used. 3.0(a)(3) Perform an ultrasonic (UT) examination per Figure 1, Appendix 2 to ensure adequate fusion with the base metal and to detect welding flaws. 3.0(a)(4) Use the acceptance standards of Table

APPENDIX 4 COMPARISON OF PROPOSED ALTERNATIVE WITH N-504-3	
CODE CASE N-504-3	**PROPOSED ALTERNATIVE**
shall apply for planar flaws.	IWB-3514-2 for planar flaws. Unacceptable indications will be removed and the volume will be re-welded. A 48-hour hold time after the third layer is completed is imposed when ambient temperature temperbead welding is used.
The acceptance standards of Table IWB-3514-3 shall apply for laminar flaws provided the reduction in coverage of the examination volume is less than 10%. The dimensions of the uninspectable volume are dependent on the coverage achieved with the angle beam examination. Any uninspectable volume in the weld overlay shall be assumed to contain the largest radial planar flaw that could exist within that volume. The assumed planar flaw shall meet the inservice examination acceptance standards of Table IWB-3514-2. Both axial and circumferential flaws shall be assumed. As an alternative to the assumed planar flaw, radiography in accordance with the Construction Code shall be used to examine the uninspectable volume in the weld overlay. The radiographic acceptance criteria of the Construction Code shall apply. Ultrasonic examinations shall verify the integrity of the newly applied weld reinforcement. Examinations shall also be performed to identify the original flaws in the outer 25% of the underlying pipe wall as a benchmark for subsequent examinations of the overlay.	3.0(a)(5) The acceptance standards of Table IWB-3514-3 shall apply for laminar flaws with the additional limitation that the total laminar flaw shall not exceed 10% of the surface area and no linear dimension of the laminar flaw area is in excess of 3 inches. Reduction in coverage is limited to 10%. The dimensions of the uninspectable volume are dependent on the coverage achieved with the angle beam examination of the overlay. Any uninspectable volume in the weld overlay beneath a laminar flaw shall be assumed to contain the largest radial planar flaw that could exist within that volume. The assumed flaw shall meet the preservice examination standards of Table IWB- 3514-2. If the preservice acceptance criteria of Table IWB-3514-2 are not met, the assumed flaw shall be evaluated and shall meet the requirements of IWB-3640. If the assumed flaw is not acceptable for continued service per IWB-3640, the lamination shall be removed or reduced in area such that the assumed flaw is acceptable per IWB-3640. 3.0(b)(1) The examination volume A-B-C-D in Figure 2, Appendix 3 shall be ultrasonically examined. The angle beam shall be directed perpendicular and parallel to the piping axis, with scanning performed in four directions, to locate and size any cracks that might have propagated into the upper 25% of the original wall thickness or into the weld overlay. (Additionally, the A-B dimension will be extended such that the overlay will be scanned to the extent practical). 3.0(b)(2) Meet the acceptance criteria of IWB-3514-2 for planar indications in the overlay. Wall thickness t_w is the thickness of the overlay. Planar flaws not meeting the preservice acceptance

APPENDIX 4 **COMPARISON OF PROPOSED ALTERNATIVE WITH N-504-3**	
CODE CASE N-504-3	**PROPOSED ALTERNATIVE**
	standards of Table IWB-3514-2 shall be repaired. 3.0(b)(3) Cracks in the outer 25% of the original wall thickness shall meet the design analysis requirements as addressed in Section 2, "Crack Growth Considerations and Design." 3.0(c) Inservice examinations of the overlays will be performed in accordance with Q-4300 and 4310 of Appendix Q to the 2004 Edition of Section XI with Addenda through 2005 with modifications. Appendix 8 shows Q-4300 and 4310 with the SNC modifications shown in italics.
(k) VT-3 of snubbers, supports and restraints after welding	3.0(a)(6) After completion of all welding activities, affected restraints, supports, and snubbers shall be VT-3 visually examined to verify that design tolerances are met.
(l) Reference to other applicable requirements of IWA-4000	IWA-4000 requirements would be met unless an alternative provided
(m) Use of case to be documented on an NIS-2 form	5.0 Use of case to be documented on an ASME Form NIS-2 (or ASME Form NIS-2A).

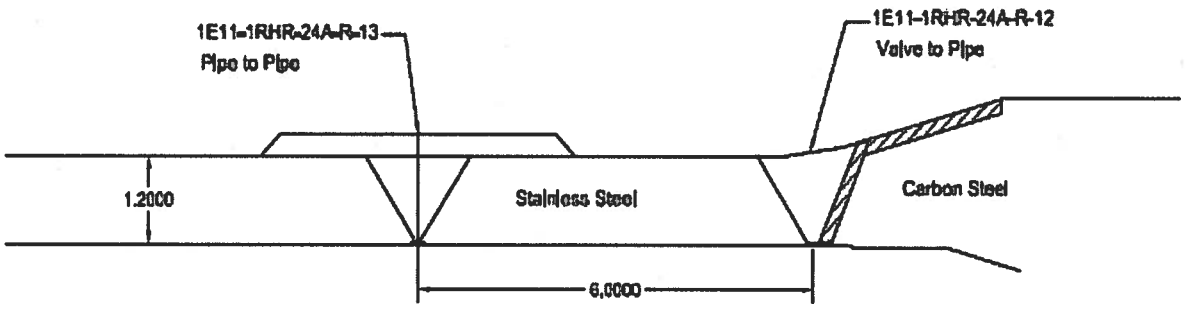
APPENDIX 5 **COMPARISON OF APPENDIX 1 OF PROPOSED ALTERNATIVE WITH N-638-1**	
N-638-1	**APPENDIX 1 OF THE PROPOSED ALTERNATIVE**
Code Case N-638-1 provides rules for automatic or machine GTAW temperbead welding without pre-heat or post weld heat treatment. The case covers similar and dissimilar welding for cavity and overlay repairs. The code case permits the use of NDE examinations in accordance with the case in lieu of those in the Construction Code. This case has a broader scope of use then Appendix 1.	Appendix 1 is invoked in by 1.0(c) of the alternative for use of ambient temperature temperbead welding as an alternative to the post weld heat treatment requirements of the Construction Code and Owner's requirements. The appendix provides the ambient temperature temperbead requirements applicable to dissimilar metal weld overlay repairs. NDE requirements are in lieu of the Construction Code and were covered in Section 3.0 of the alternative.
1.0 General Requirements	1.0 General Requirements
Scope of welds in the Reply	(a) Scope of welds. Same as N-638-1
(a) Max area of finished surface of the weld limited to 100 square inches and half of the ferritic base metal thickness. (Note: the depth requirement is for the ferritic material. There is no need to limit either surface area or depth for welding on austenitic SS or nickel alloys since no post weld heat treatment is required.)	(b) Surface area limitation is expanded to 500 square inches over the ferritic material to match the wording in ASME Code Case N-638-4. This Code Case has been conditionally approved by the NRC in Regulatory Guide 1.147 for both Revision 16 (issued in October 2010) and Revision 17 (issued in August 2014).
(b) (c) (d) (e) (f)	(c) (d) (e) (f) (g) are the same requirements as listed for N-638-1
1.0 Welding Qualifications The welding procedures and welding operators shall be qualified per Section IX and the requirements of 2.1 and 2.2	2.0 Welding Qualifications The welding procedures and welding operators shall be qualified per Section IX and the requirements of 2.1 and 2.2
2.1 Procedure Qualification Sections (a) (d) (e) (f) (g) Section (h) Section (i) Section (j)	2.1 Procedure Qualification Sections (a) (b) (c) (d) (e) same as in N-638-1 for equivalent paragraphs. Equivalent paragraph not in Appendix 1. Section (f) same as (i) from N-638-1. Section (g) changed the first sentence adding "lateral expansion" in front of "value"

APPENDIX 5 COMPARISON OF APPENDIX 1 OF PROPOSED ALTERNATIVE WITH N-638-1	
N-638-1	**APPENDIX 1 OF THE PROPOSED ALTERNATIVE**
	both at the beginning and end of the sentence. Additional provisions as follow were added: However if the average lateral expansion value of the HAZ Charpy V-notch specimens is less than the average value of the unaffected base metal specimen and the procedure qualification meets all other requirements of this appendix, either of the following shall be performed: (1) The welding procedure shall be requalified. (2) An Adjustment Temperature for the procedure qualification shall be determined in accordance with the applicable provisions of NB-4335.3 of Section III, 2001 Edition with 2002 Addenda. RT_{ndt} or lowest service temperature of the materials for which the welding procedure will be used shall be increased by a temperature equivalent to that of the Adjustment Temperature. This is identical wording to N-638-2, which has been approved by ASME.
Section (b) Provisions for welding in a pressurized environment	Not included for overlays in Appendix 1.
Section (c) Provisions to address radiation effects	Not included in Appendix 1. Thermal neutron limitation imposed in the proposed alternative.
1.1 Performance Qualification Welding operators shall be qualified in accordance with Section IX.	2.2 Performance Qualification Welding operators shall be qualified in accordance with Section IX.
3.0 Welding Procedure Requirements	3.0 Welding Procedure Requirements
(no corresponding section)	(e) Section added to clarify temperature measurement requirements. This is identical wording to N-638-2, which has been approved by

APPENDIX 5 **COMPARISON OF APPENDIX 1 OF PROPOSED ALTERNATIVE WITH N-638-1**	
N-638-1	**APPENDIX 1 OF THE PROPOSED ALTERNATIVE**
	ASME.
(a) (b) (c)	(a) (b) (c) same as N-638-1 except last two sentences deleted in (c) from N-638-1 since not applicable to this proposed alternative.
(d)	(d) same as N-638-1 but the following added: The interpass temperature of QW-406.3 need not be applied. This is identical wording to N-638-2, which has been approved by ASME.
(no corresponding section)	(e) Section added to clarify temperature measurement requirements. This is identical wording to N-638-2, which has been approved by ASME.
(e)	(f) same as (e) from N-638-1
4.0 Examination The final weld surface and the band around the area defined in paragraph 1.0(d) of N-638-1 shall be examined using surface and ultrasonic methods when the completed weld has been at ambient temperature for at least 48 hours.	Examination and Inspection is shown in Section 3 of the proposed alternative.
5.0 Documentation	Documentation is shown in Section 5 of the proposed alternative.
(no corresponding section)	Pressure Testing is shown in Section 4 of the proposed alternative.

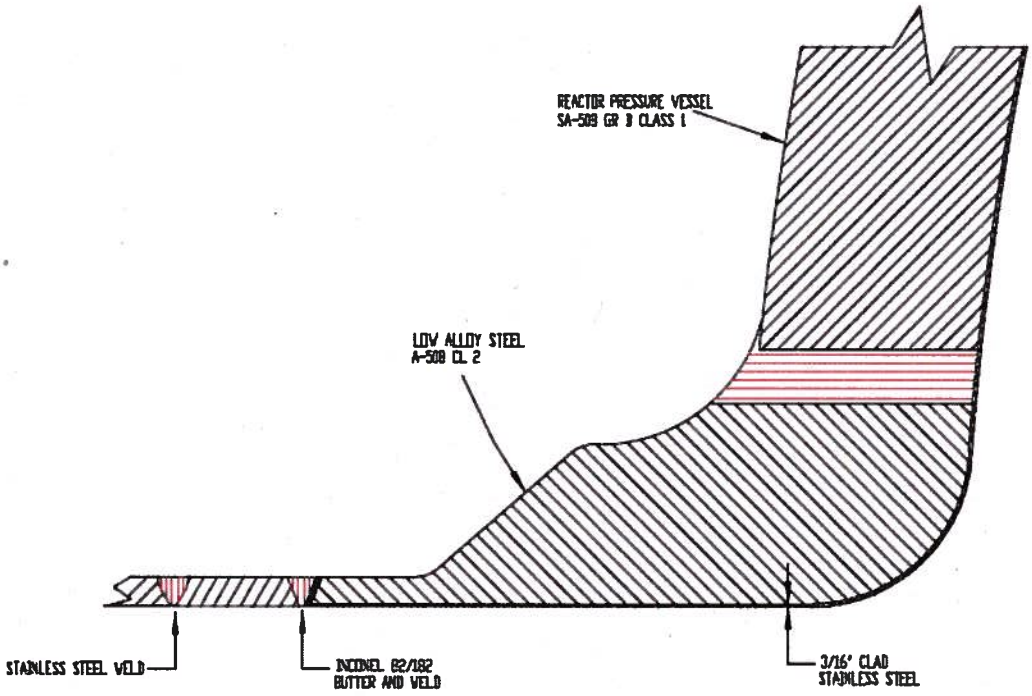
APPENDIX 6

FIGURE 1
HATCH-1 RESIDUAL HEAT REMOVAL CONFIGURATION



APPENDIX 6 (Continued)

FIGURE 2
HATCH-1 REACTOR RECIRCULATION INLET NOZZLE



TYPICAL HATCH-1 RPV NOZZLE CONFIGURATION

APPENDIX 7
JUSTIFICATION FOR PERFORMING EXAMINATIONS 48 HOURS AFTER THE COMPLETION OF THE THIRD WELD LAYER

American Society of Mechanical Engineers (ASME) Code, Section XI, Code Case N-638-1 requires (when ambient temperbead welding is used over ferritic materials) that surface and ultrasonic examinations be performed when the completed weld has been at ambient temperature for least 48 hours. This delay was provided to allow sufficient time for hydrogen cracking to occur (if it is to occur) in the heat affected zone (HAZ) of ferritic materials prior to performing examinations, to ensure detection by non-destructive examinations (NDE). However, based on research and industry experience, EPRI has provided a technical basis for starting the 48-hour hold after completion of the third temperbead weld layer rather than waiting for the weld overlay to cool to ambient temperature. Weld layers beyond the third layer are not designed to provide tempering to the ferritic HAZ during ambient temperature temperbead welding. EPRI has documented their technical basis in Technical Update report 1013558, "Repair and Replacement Applications Center: Temperbead Welding Applications 48-Hour Hold Requirements for Ambient Temperature Temperbead Welding" (ADAMS Accession No. ML070670060). The technical data provided by EPRI in their report is based on testing performed on SA-508, Class 2 low-alloy steels, which is the nozzle material. After evaluating all of the issues relevant to hydrogen cracking such as microstructure of susceptible materials, availability of hydrogen, applied stresses, temperature, and diffusivity and solubility of hydrogen in steels, EPRI concluded that: "...[t]here appears to be no technical basis for waiting the 48 hours after cooling to ambient temperature before beginning the NDE of the completed weld. There should be no hydrogen present, and even if it were present, the temperbead welded component should be very tolerant of the moisture..." EPRI also notes that over 20 weld overlays and 100 repairs have been performed using temperbead techniques on low alloy steel components over the last 20 years. During this time, there has never been an indication of hydrogen cracking by the non-destructive examinations performed after the 48-hour hold or by subsequent ISI examinations.

In addition, the ASME database, C&S Connect, for Code Case N-638-4 contains background material consisting of a Technical Basis Paper to support the 48-hour hold time alternative. The Technical Basis Paper (ADAMS Accession No. ML070790679) points out that the introduction of hydrogen to the [ferritic] HAZ is limited to the first weld layer since this is the only weld layer that makes contact with the [ferritic] base material. While the potential for the introduction of hydrogen to the [ferritic] HAZ is negligible during subsequent weld layers, these layers provide a heat source that accelerates the dissipation of hydrogen from the [ferritic] HAZ in non-water backed applications. The Technical Basis Paper concludes that there is sufficient delay time to facilitate the detection of potential hydrogen cracking when NDE is performed 48 hours after completion of the third weld layer.

APPENDIX 7
JUSTIFICATION FOR PERFORMING EXAMINATIONS 48 HOURS AFTER THE COMPLETION OF THE THIRD WELD LAYER (Continued)

Furthermore, the solubility of hydrogen in austenitic materials such as Alloy 52M is much higher than that of ferritic materials while the diffusivity of hydrogen in austenitic materials is lower than that of ferritic materials. As a result, hydrogen in the ferritic HAZ tends to diffuse into the austenitic weld metal, which has a much higher solubility for hydrogen. This diffusion process is enhanced by heat supplied in subsequent weld layers.

Based on this information, SNC concludes that performing NDE 48 hours after the third weld layer is installed will provide an acceptable level of quality and safety. As a precedent see the April 6, 2007, safety evaluation for Arkansas Nuclear One, Unit 1 (TAC NO. MD4019) and the December 19, 2007 safety evaluation for Farley Nuclear Plant Units 1 and 2 (TAC NOS. MD6304 and MD6305).

NOTE

Since the original Hatch ISI Alternative HNP-ISI-ALT-08-02 was approved by the NRC, the NRC has conditionally approved N-638-4 in both Revisions 16 and 17 of Regulatory Guide 1.147.

APPENDIX 8
Q-4300 EXAMINATION REQUIREMENTS

Q-4300 Inservice Examination Requirements

(a) The weld overlay examination volume in Fig. Q-4300-1 shall be added to the inspection plan and shall be ultrasonically examined during the first or second refueling outage following application.

(b) The weld overlay examination volume in Fig. Q-4300-1 shall be ultrasonically examined to determine if any new or existing cracks have propagated into the upper 25% of the pipe base material or into the overlay. The angle beam shall be directed perpendicular and parallel to the pipe axis, with scanning performed in four directions.

Modified Q-4300 Inservice Flaw Evaluation Requirements

(a) Flaws characterized as SCC in the Alloy 52/152 weld overlay are unacceptable and the use of IWB-3514-2 and IWB-3640 for SCC evaluation in the Class 1 overlay material is prohibited.

(b) For non-SCC flaws in the Alloy 52/152 overlay, Table IWB-3514-2 must be used to evaluate recordable indications prior to the use of the acceptance criteria of IWB-3600. If the requirements of Table IWB-3514-2 cannot be satisfied, the acceptance criteria of IWB-3600 shall be satisfied. For unacceptable indications, the weld overlay (or the portion of the weld overlay containing the unacceptable indication) shall be removed and corrected by a repair/replacement activity in accordance with IWA-4000.

(c) If examinations reveal crack growth or new cracking in the upper 25% of the original weld or base materials, the as-found flaw (postulated 75% through wall, plus the portion of the flaw in the upper 25%) will be used to re-evaluate the crack growth analysis. The size of all flaws will be projected to the end of the design life of the overlay. Crack growth, including both stress corrosion and fatigue crack growth, shall be evaluated in the materials in accordance with IWB-3640. If the flaw is at or near the boundary of two different materials, evaluation of flaw growth in both materials is required. For unacceptable indications, the weld overlay shall be removed, including the original defective piping weldment, and corrected by a repair/replacement activity in accordance with IWA-4000.

Modified Q-4300 Re-examination Requirements

(a) Weld overlay examination volumes that show no indication of crack growth or new cracking shall be placed into a population to be examined on a sampling basis. Twenty-five percent of this population shall be examined once every ten years.

APPENDIX 8
Q-4300 EXAMINATION REQUIREMENTS (Continued)

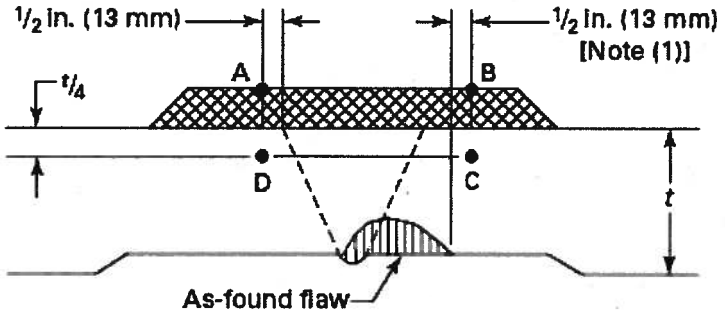
(b) If inservice examinations reveal *acceptable* crack growth or new cracking *in the upper 25% of the original weld or base materials*, the weld overlay examination volume shall be reexamined during the first or second refueling outage following discovery of the growth or new cracking. Weld overlay examination volumes that show no additional indication of crack growth or new cracking shall be placed into a population to be examined on a sample basis. Twenty-five percent of this population shall be examined once every ten years.

(c) *If inservice examinations reveal acceptable non-SCC flaws in the overlay material, the weld overlay examination volume shall be reexamined during the first or second refueling outage following discovery of the growth or new cracking. Weld overlay examination volumes that show no additional indication of crack growth or new cracking shall be placed into a population to be examined on a sample basis. Twenty-five percent of this population shall be examined once every ten years.*

Q-4310 Additional Examinations

If inservice examinations reveal an unacceptable indication, crack growth into the weld overlay design thickness, or axial crack growth beyond the specified examination volumes, additional weld overlays, equal to the number scheduled for the current inspection period, shall be examined prior to return to service. If additional unacceptable indications are found in the second sample, a total of 50% of the total population of weld overlays shall be examined prior to operation. If additional unacceptable indications are found, the entire remaining population of weld overlays shall be examined prior to return to service.

APPENDIX 8
Q-4300 EXAMINATION REQUIREMENTS (Continued)



Examination Volume A–B–C–D

NOTE:
(1) For axial or circumferential flaws, the axial extent of the examination volume shall extend at least ½ in. (13 mm) beyond the as-found flaw and at least ½ in. (13 mm) beyond the toes of the original piping weldment, including weld end butter, where applied.

FIG. Q-4300-1 PRESERVICE AND INSERVICE EXAMINATION VOLUME

NOTE

Hatch ISI Alternative HNP-ISI-ALT-15-01 describes the detailed examinations to be performed during the 1R27 Outage (Spring 2016). The examinations discussed in this Appendix will also be performed during later outages when Hatch is in the fifth ISI Interval. Hatch ISI Alternative HNP-ISI-ALT-15-01 will expire after this outage but the Hatch ISI Plans will be updated to address the requirements of Appendix 8.

APPENDIX 9
APPLICABLE ULTRASONIC EXAMINATION HISTORY

1B31-1RC-12BR-C-5

- 12-inch Safe-end to Nozzle, wall thickness ~ 1.20-inches
- Overlaid in 1988
- 1988 axial indication on the safe-end side - 0.15-inches through wall; 43.1-inches clockwise and measured length was 0.30 inches
- Examinations since Weld Overlay installed: 94, 91, 90 & 88
- Post overlay indications seen CW/CCW at same depth and length

1B31-1RC-12BR-E-5

- 12-inch Safe-end to Nozzle, wall thickness ~ 1.20-inches
- Overlaid in 1988
- 1988 Axial indication on the safe-end side - 0.85 inches through wall; 2.3-inches clockwise and measured length was 0.40-inches
- Examinations since Weld Overlay installed: 06, 94, 91, 90 & 88
- 2006 detected post overlay depth .60-inches through wall

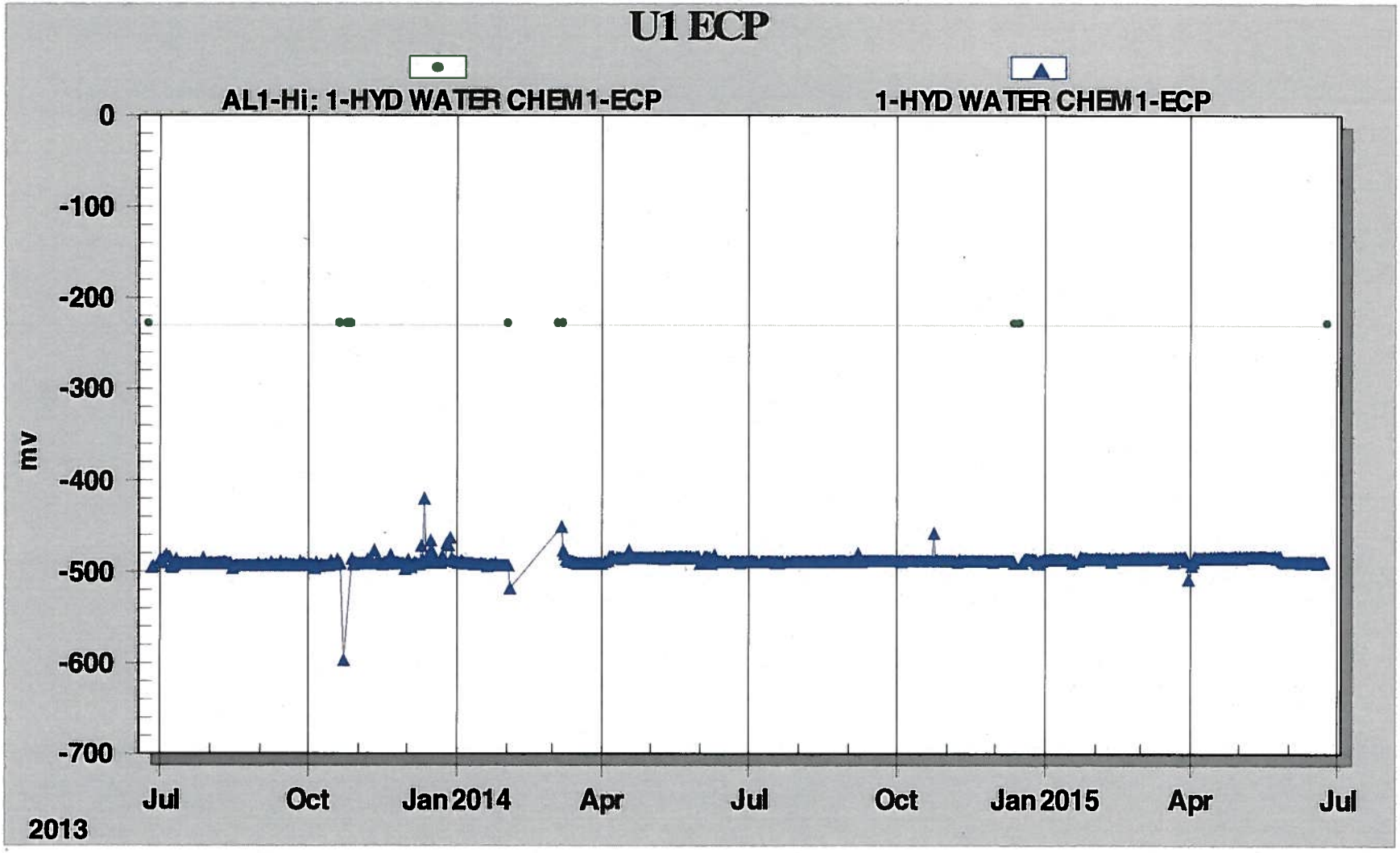
1E11-1RHR-24A-R-12

- 24-inch Valve to Pipe (DSM), wall thickness ~ 1.20-inches
- Scheduled to be overlaid in 1R27 (2016)
- Examinations: 06, 94, 91, 90, 88, 86, 84, 82 & 74 (Preservice Examination)
- Previous examination coverage (2006) was 28 percent due to configuration
- No relevant indications reported

1E11-1RHR-24A-R-13

- 24-inch Pipe to Pipe, wall thickness ~ 1.20-inches
- Overlaid in 1984 – Resurfaced in 1986
- 1984 Axial indication 0.60-inches through wall at 16.25-inches clockwise on the downstream side
- Examinations since Weld Overlay applied: 06, 94, 91, 90, 87, 86, 85 & 84
- No relevant indications detected since overlay was applied

APPENDIX 10


U1 ECP
AL1-Hi: 1-HYD WATER CHEM1-ECP
1-HYD WATER CHEM1-ECP
0
-100
-200
-300
-400
-500
-600
-700
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Jul
Oct
Jan 2014
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