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SOUTHERN COMPANY
Energy to Serve Your World℠

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NL-07-1320

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50-424

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

Joseph M. Farley Nuclear Plant
Vogtle Electric Generating Plant
Proposed Alternative for Application of
Pressurizer Nozzle Full-Structural Weld Overlays

Ladies and Gentlemen:

Pursuant to 10 CFR 50.55a(a)(3)(i), Southern Nuclear Operating Company (SNC) hereby requests NRC approval of proposed alternative ISI-GEN-ALT-07-01, Version 1.0 to allow the application of full-structural weld overlays over the pressurizer nozzle dissimilar metal welds. This proposed alternative is similar to the NRC approved alternative ISI-GEN-ALT-06-03, with the differences being:

1. Section 2(b)4i incorporates the requirement that the stress evaluation be submitted to the NRC prior to entering Mode 4.

2. Section 3, Post-Overlay Examinations, incorporates the requirement that the examination results, along with a discussion of any repairs, be provided to the NRC within 14 days after the completion of the ultrasonic examinations.

3. Section 3(c) incorporates the requirement that inservice examinations of the FSWOLs be performed in accordance with Q-4300 of Appendix Q.

4. Section 3.0(e)(1) of Appendix 1 incorporates the SNC letter dated March 15, 2007 to redefine the frequency of interbead temperature measurements.

Non-technical changes were made to various sections. Sections 3(a)2 and 3(a)3 of the alternative, plus section 3.0(a) of Appendix 4 to the alternative incorporates revised 48-hour hold time requirements.

This alternative is for the Farley Nuclear Plant (FNP) 4th ISI Interval and for the Vogtle Electric Generating Plant (VEGP) 3rd ISI Interval. The details of the 10 CFR 50.55a request for alternative are contained in Enclosure 1 and the associated SNC commitments are listed in Enclosure 2.

Approval is requested by October 7, 2007 to support the Unit 1 outage at VEGP beginning March 2008.

If you have any questions, please advise.

Sincerely,

B. J. George
Manager, Nuclear Licensing

BJG/JLS/daj

Enclosures:
1. Request for Alternative - ISI-GEN-ALT-07-01, Version 1.0 – Application of Pressurizer Nozzle Full-Structural Weld Overlays
2. ISI-GEN-ALT-07-01, Version 1.0 – Commitment Table

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Enclosure 1

Request for Alternative - ISI-GEN-ALT-07-01, Version 1.0
Application of Pressurizer Nozzle Full-Structural Weld Overlays

Enclosure 1

SOUTHERN NUCLEAR OPERATING COMPANY
ISI-GEN-ALT-07-01, VERSION 1.0
PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(a)(3)(i)
APPLICATION OF PRESSURIZER NOZZLE FULL-STRUCTURAL WELD OVERLAYS

This proposed alternative meets the technical requirements previously set forth in the April 3, 2007, NRC safety evaluation for alternative ISI-GEN-ALT-06-03, Revision 2.0 (as supplemented by letter dated March 15, 2007) with the single exception that the start of the 48-hour clock prior to performing examinations has been revised. This change to the start of the 48-hour clock has previously been approved by the NRC for Arkansas Nuclear One-Unit 1; therefore, this proposed alternative does not contain any technical content that has not already been approved by the NRC.

NOTE

Unless identified otherwise, each reference to ISI-GEN-ALT-06-03 pertains to Revision 2.0, as supplemented by letter dated March 15, 2007.

Plant Site-Unit: Vogtle Electric Generating Plant (VEGP) Unit 1 and Joseph M. Farley Nuclear Plant (FNP) Unit 2.

Interval Dates: VEGP-1 Third ISI Interval from May 31, 2007 through May 30, 2017.

FNP-2 Fourth ISI Interval from December 1, 2007 through November 30, 2017.

NOTE

Southern Nuclear Operating Company (SNC) will request approval to revise the FNP-2 ISI program ISI Interval dates to match those for FNP-1. Dates shown above reflect the change.

Requested Date for Approval : To facilitate the NRC's approval of this proposed alternative, SNC made the determination to not submit technical material in this alternative that was not previously approved by the NRC for SNC or for another utility. Expedited approval is requested by October 7, 2007, in order to support the design and documentation requirements for the VEGP-1 outage that is scheduled to begin in March 2008, or possibly late 2007.

Preemptive Overlays

A preemptive full-structural weld overlay (FSWOL) will be applied to each of the VEGP-1 and FNP-2 pressurizer dissimilar metal (DSM) welds as described below.

1. VEGP-2 installed preemptive FSWOLs during the Spring 2007 refueling outage per ISI-GEN-ALT-06-03. (For Information Only)

2. FNP-1 is scheduled to have preemptive FSWOLs applied during the Fall 2007 refueling outage per ISI-GEN-ALT-06-03. (For Information Only)

3. VEGP-1 is scheduled to have preemptive full-structural weld overlays (FSWOLs) applied during the Spring 2008 refueling outage. Ultrasonic examinations of the similar or dissimilar metal welds are not currently planned prior to the installation

of the preemptive FSWOLs.

4. Ultrasonic examinations were performed on each of the FNP-2 dissimilar metal butt welds during the Spring 2007 refueling outage. As a result of ultrasonic indications detected in the surge nozzle dissimilar metal weld, the weld was overlaid per ISI-GEN-ALT-06-03. FNP-2 is scheduled for preemptive FSWOLs of the remaining welds during the Spring 2010 refueling outage. Additional ultrasonic examinations of the similar or dissimilar metal welds are not currently planned prior to the installation of the preemptive FSWOLs.

Contingency Overlay Repairs

For this alternative, contingency weld overlays apply only to VEGP-1 and FNP-2 because VEGP-2 welds are overlaid and contingency overlays for FNP-1 are covered in ISI-GEN-ALT-06-03. If a through-wall flaw in any of the FNP or VEGP dissimilar metal welds is visually observed, the leak will be attributed to Pressurized Water Stress Corrosion Cracking (PWSCC) and a FSWOL will be applied. No ultrasonic examinations are planned prior to applying the contingency overlay repair and only the nozzle with the leak will be repaired.

ASME Code Components Affected:

The following (Risk-Informed) Category R-A VEGP-1 and FNP-2 pressurizer dissimilar metal welds are to be overlaid.

VEGP-1	FNP-2
11201-V6-002-W17 (Relief)	APR1-4205-49DM (Spray)
11201-V6-002-W18 (Safety)	APR1-4501-1DM (Safety)
11201-V6-002-W19 (Safety)	APR1-4502-1DM (Safety)
11201-V6-002-W20 (Safety)	APR1-4503-1DM (Safety)
11201-V6-002-W21 (Spray)	APR1-4504-1DM (Relief)
11201-V6-002-W22 (Surge)	

The following (Risk-Informed) Category R-A VEGP-1 and FNP-2 pressurizer similar metal welds are subject to being overlaid in conjunction with the dissimilar metal weld.

VEGP-1	FNP-2
11201-030-45 (Spray)	APR1-4205-48 (Spray)
11201-053-6 (Surge)	APR1-4501-2 (Safety)
11201-056-1 (Safety)	APR1-4502-2 (Safety)
11201-057-1 (Safety)	APR1-4503-2 (Safety)
11201-058-1 (Safety)	APR1-4504-2&3 (Relief)
11201-059-1 (Relief)	

SOUTHERN NUCLEAR OPERATING COMPANY
ISI-GEN-ALT-07-01, VERSION 1.0
PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(a)(3)(i)
APPLICATION OF PRESSURIZER NOZZLE FULL-STRUCTURAL WELD OVERLAYS

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 latest edition and addenda incorporated by reference in paragraph (b)(2) of this section, is prohibited."

NOTE

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

Applicable Code Requirements:

IWA-4110 of ASME Section XI requires that repairs of welds shall be performed in accordance with Article IWA-4000. IWA-4300 requires that defects be removed or reduced to an acceptable size.

Currently, pressurizer weld examinations are performed at VEGP and FNP using a Risk-Informed Program (Category R-A). The examinations performed are the same as those volumetric examinations specified in Section XI, Table IWB-2500-1, Category B-J and B-F. After the installation of the weld overlays these similar and dissimilar metal welds will no longer be included in the Risk-Informed ISI population, but will be examined in accordance with this proposed alternative.

Reason for Request:

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. Code Case N-504-2, which has been approved by the NRC for use, does not provide the methodology for overlaying nickel alloy welds joining austenitic and ferritic base materials. As a result, by letter dated August 10, 2006, as supplemented by letters dated October 20, 2006, January 3, 2007, and February 21, 2007, SNC submitted a proposed alternative to the requirements of the Section XI Code. SNC proposed to use a full-structural weld overlay to mitigate or repair dissimilar metal welds on a contingency and preemptive basis and to overlay adjacent similar metal welds when necessary. ISI-GEN-ALT-06-03, Revision 2 was authorized by NRC letter dated March 8, 2007. Subsequently, by letter dated March 15, 2007, SNC requested relief from the requirements of the approved alternative to change the frequency of interpass temperature measurements required by paragraph 3(e) of Appendix 1. The alternate frequency for interpass temperature monitoring was authorized by NRC letter dated April 3, 2007. Reference TAC Numbers MD2794, MD2795, MD2796 and MD2797. This approved alternative has expired for VEGP and remains in effect only through November 30, 2007 for FNP; therefore, it is necessary to develop a new alternative to complete the weld overlay campaigns.

SOUTHERN NUCLEAR OPERATING COMPANY
ISI-GEN-ALT-07-01, VERSION 1.0
PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(a)(3)(i)
APPLICATION OF PRESSURIZER NOZZLE FULL-STRUCTURAL WELD OVERLAYS

Proposed Alternative and Basis for Use:

Proposed Alternative

ISI-GEN-ALT-06-03 was used to develop this proposed alternative in conjunction with the below listed requirements from the April 3, 2007 safety evaluation. Note: the below listed requirements were never added to ISI-GEN-ALT-06-03.

1. Section 2(b)4i incorporates the requirement that the stress evaluation be submitted to the NRC prior to entering Mode 4.

2. Section 3, Post-Overlay Examinations, incorporates the requirement that the examination results, along with a discussion of any repairs, be provided to the NRC within 14 days after the completion of the ultrasonic examinations.

3. Section 3(c) incorporates the requirement that inservice examinations of the FSWOLs be performed in accordance with Q-4300 of Appendix Q.

4. Section 3.0(e)(1) of Appendix 1 incorporates the SNC letter dated March 15, 2007 to redefine the frequency of interbead temperature measurements.

Non-technical changes were subsequently made to various sections to update the alternative to the current status. Sections 3(a)2 and 3(a)3 of the alternative, plus section 3.0(a) of Appendix 4 to the alternative incorporate the revised 48-hour hold time requirements. The revised 48-hour hold time requirements were previously authorized for Arkansas Nuclear One, Unit 1 by the NRC in the April 6, 2007, safety evaluation Reference TAC Number MD4019. See Appendix 7 for the technical justification.

Alternative

A scheduled preemptive FSWOL will be applied to each of the FNP-2 and VEGP-1 pressurizer Alloy 82/182 safe-end welds as shown in the previously indicated schedule. For a preemptive FSWOL, there is no known flaw; therefore, a flaw must be assumed. Section 2(a) defines crack-growth requirements and section 2(b) defines the design requirements.

If through-wall leakage is detected by visual examination on any of the Farley or Vogtle pressurizer Alloy 82/182 safe-end welds, a contingency FSWOL will be applied. In lieu of performing ultrasonic examinations, the flaw will be assumed to be 100% through the original wall thickness for the entire circumference. Flaw characterization will be based on the as-found flaw size as discussed in section 2(a).

Due to the proximity of the adjacent similar metal piping welds, preemptive or contingency overlay of the safe-end welds may preclude the examination of the adjacent similar metal piping weld(s); therefore, the overlay will be extended over the adjacent similar metal piping welds, as necessary. This is expected to include all adjacent similar metal welds with the possible exception of those on the surge lines,

where there may be sufficient separation between the dissimilar metal weld and the similar metal weld to allow examination of the similar metal weld after the dissimilar metal weld is overlaid. FNP-2 similar metal welds APR1-4504-2 and APR1-4504-3 are only a few inches apart; therefore, both welds may be overlaid along with the dissimilar metal weld.

These similar metal welds will not be inspected prior to installing the overlay. The selection and examination of the similar metal weld population is currently performed using an NRC approved risk-informed application. The risk-informed application uses failure probability analysis, probabilistic risk assessment, and an expert panel evaluation to identify the piping components that require examination. The piping components selected for examination are only a small portion of the total population of similar metal welds; however, the basic intent of identifying and repairing flaws before piping integrity is challenged is maintained by the risk-informed application. As a final step in the selection process, a statistical model was used to assure that a sufficient number of welds are being examined. The welds adjacent to the dissimilar metal welds were not selected for examination in the risk-informed application and it is concluded that these adjacent similar metal welds do not need to be examined to maintain an acceptable level of quality and safety. After the overlay is applied, these welds will be removed from the risk-informed weld population and examined in accordance with this proposed alternative.

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

1. **General Requirements**:

   (a) A FSWOL will be applied by deposition of weld reinforcement (weld overlay) on the outside surface of the low alloy steel pressurizer nozzles (P-No. 3) to the stainless steel safe end (P-No. 8), inclusive of the Alloy 82/182 weld that joins the two items. In addition, the overlay may be extended to include the adjacent wrought stainless steel to stainless steel welds (P-No. 8 to P-No. 8) to improve their inspectability. There are no requirements specified in this proposed alternative for these stainless steel to stainless steel welds (such as flaw growth calculations) because they are not susceptible to stress corrosion cracking in a PWR water environment. The weld reinforcement will consist of Alloy 52/152.

   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.
- This non-credited buffer layer will not be included in calculations required by this alternative.
- Since the FSWOL over the Alloy 82/182 dissimilar metal 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 PWSCC.
- 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.

Figures 1, 2, and 3 in Appendix 6 provide typical sketches of the Alloy 52/152 overlay and the materials for each component. If the base metal chemical composition requires, a non-credited layer (not shown in the figures) may be applied as a buffer. Specific dimensions and the overlay thickness are proprietary information and 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.

(b) 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 nozzles. (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 300 square inches.

(c) 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(c) 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.

(d) 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(b). The first layer of weld metal deposited may not be credited toward the required thickness. Alternatively, 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 contains at least 24% Cr. The Cr content of the deposited weld metal as 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 shall contain at least 24% Cr.

(e) 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. Crack Growth Considerations and Design

(a) Crack Growth Considerations - Crack growth calculations will be performed as part of a proprietary 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.

(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(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(d).

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. (There are no pre-existing flaws previously accepted by analytical evaluation in the Farley or Vogtle welds to be considered in this evaluation.) Included are:

    i. A stress analysis will be performed that demonstrates that the pressurizer nozzles 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 in the nozzles would not adversely affect the integrity of the overlaid welds. This analysis will be provided to the NRC prior to entering Mode 4.

    ii. The original leak-before-break (LBB) analyses will be confirmed to be valid after the weld overlays are applied, the amount of shrinkage is determined, and the shrinkage stresses are calculated.

3. 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

Preemptive overlays for VEGP-1 are scheduled to be applied during the next scheduled refueling outage (Spring 2008). SNC does not plan to perform ultrasonic

examinations of the dissimilar metal welds or similar metal welds on VEGP-1 prior to the installation of the overlays. Four of the six dissimilar welds on VEGP-1 have coverage less than 50% and for the other two dissimilar metal welds that are examinable, it is estimated about 0.6 Rem would be required to perform the examinations.

Preemptive overlays for FNP-2 are scheduled to be applied during Spring 2010. Two pressurizer Alloy 82/182 butt welds at FNP-2 were examined using a PDI qualified ultrasonic testing method during the Fall 2005 outage with no evidence of PWSCC. Each of the six FNP-2 pressurizer safe end to nozzle welds was examined during the Spring 2007 outage to meet MRP-139 requirements. As a result of ultrasonic indications detected in the surge nozzle dissimilar metal weld the weld was overlaid per ISI-GEN-ALT-06-03. SNC does not plan to perform ultrasonic examinations of the dissimilar metal welds or similar metal welds during the outage prior to the application of the overlays. For the remaining five welds it is estimated that about 0.5 Rem would be required to perform the examinations.

Since SNC intends to apply full-structural weld overlays, designed for a worse case through-wall flaw that is 360 degrees in circumference, the dose received from examination of these welds (prior to the overlay being applied) would result in a hardship without a compensating increase in the level of quality and safety.

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 PWSCC degradation would be in the Alloy 82/182 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.

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(a) Acceptance Examination of the Overlay

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. 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 justification.

3. The examination volume A-B-C-D in Figure 1a, 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 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. Re-examination 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 1a (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 days after plant startup. 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.

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, "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 of Appendix Q to the 2004 Edition of Section XI with Addenda through 2005.

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 PWSCC (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 PWSCC 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.

The implementation of the alternative reduces the likelihood for PWSCC 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(a)(3)(i).

Duration of Proposed Alternative: The proposed alternative is applicable to VEGP-1 from May 31, 2007, through May 30, 2017 and applicable for FNP-2 from December 1, 2007 through November 30, 2017.

SOUTHERN NUCLEAR OPERATING COMPANY
ISI-GEN-ALT-07-01, VERSION 1.0
PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(a)(3)(i)
APPLICATION OF PRESSURIZER NOZZLE FULL-STRUCTURAL WELD OVERLAYS

Precedents: This proposed alternative meets the technical requirements set forth in the April 3, 2007, NRC safety evaluation for alternative ISI-GEN-ALT-06-03, Revision 2.0 (as supplemented by letter dated March 15, 2007) with the single exception that the start of the 48-hour clock prior to performing examinations has been revised. This change to the start of the 48-hour clock has previously been approved by the NRC for Arkansas Nuclear One-Unit 1.

References: None

Status: Awaiting NRC approval.

SOUTHERN NUCLEAR OPERATING COMPANY
ISI-GEN-ALT-07-01, VERSION 1.0
PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(a)(3)(i)

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[1] 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.

(b) The maximum area of an individual weld overlay based on the finished surface over the ferritic base material shall be 300 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.

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.

[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.

APPENDIX 1
AMBIENT TEMPERATURE TEMPERBEAD WELDING (Continued)

(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.

(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.

(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 350^0F 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 350^0F is large and considerable margin exists. Based on this trending, there is reasonable

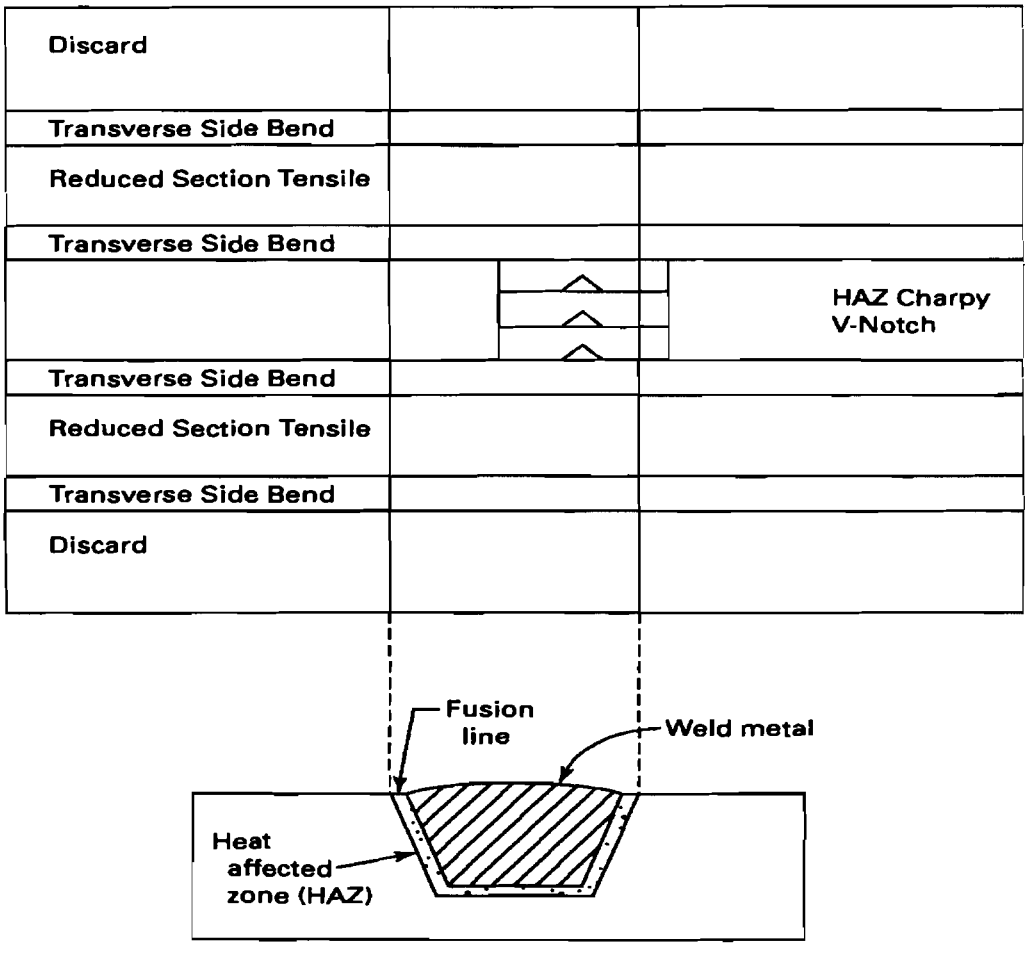
assurance that the temperature of any bead will not approach the maximum allowable temperature. For the surge nozzle, SNC will measure the interpass temperature at a frequency of at least every fifth bead deposition. After the third layer is completed, there is sufficient weld thickness where the heat of welding will not affect the low-alloy steel base material; therefore, interpass temperature measurements will not be necessary. For the smaller diameter safety, relief, and spray nozzles, 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 100^0 F below the 350^0 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
AMBIENT TEMPERATURE TEMPERBEAD WELDING (Continued)



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

Figure 1-1: QUALIFICATION TEST PLATE

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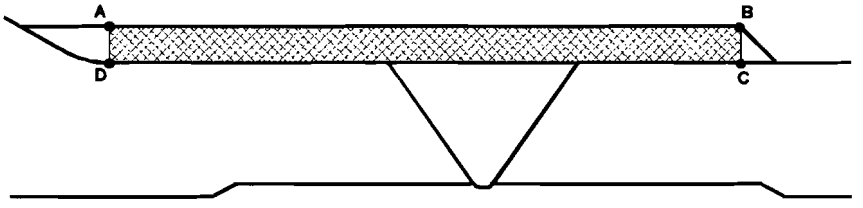
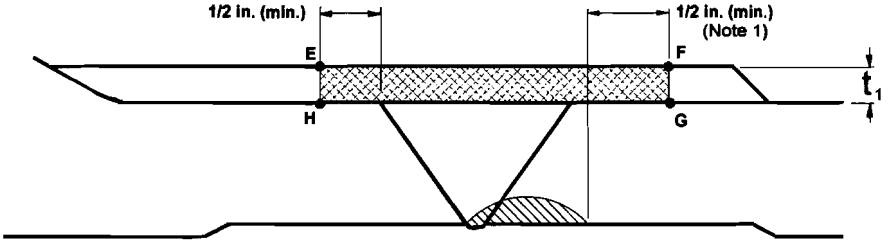
ISI-GEN-ALT-07-01, VERSION 1.0
PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(a)(3)(i)

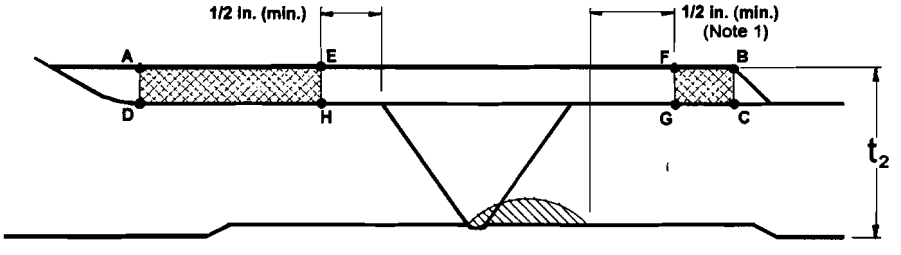
APPENDIX 2
UT ACCEPTANCE EXAMINATION VOLUME



a. Acceptance Examination Volume A-B-C-D



b. Thickness (t1) for Table IWB-3514-2



c. Thickness (t2) for Table IWB-3514-2

FIGURE 1: ACCEPTANCE EXAMINATION VOLUME

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PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(a)(3)(i)

APPENDIX 3
PRESERVICE EXAMINATION VOLUME

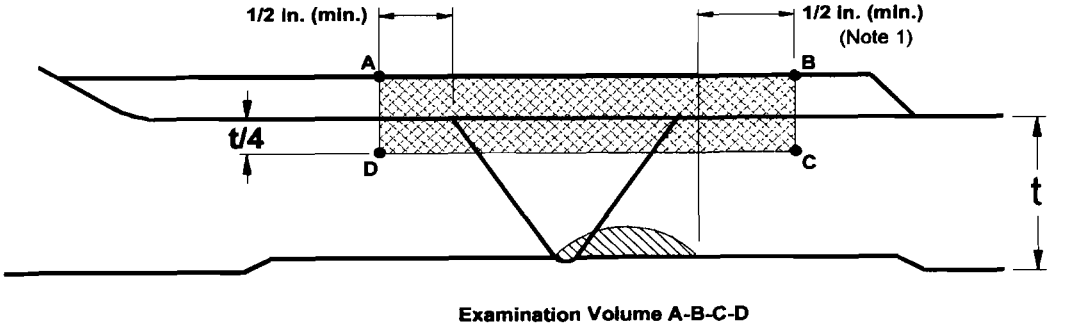

FIGURE 2: PRESERVICE EXAMINATION VOLUME

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PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(a)(3)(i)

APPENDIX 4
COMPARISON OF SNC-PROPOSED ALTERNATIVE VERSUS CODE CASE N-504-2

Comparison of Proposed Alternative with N-504-2	
CODE CASE N-504-2	**PROPOSED ALTERNATIVE**
N-504-2 for weld overlay repair of SS piping.	Proposed alternative is for dissimilar metal weld overlay repairs.
Reply-reduce a flaw to acceptable size by weld overlay on austenitic SS piping	*Reply*- reduce a flaw to acceptable size by weld overlay on austenitic stainless steel or austenitic nickel alloy piping, components and associated welds
Material covered is P-8	Per Section 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
(b) Filler Material – low C (0.035% max) SS	(b) Filler Materials – Low C (0.035% max) SS or austenitic nickel alloy (28% Cr min.)
(c) (d) Repair of indications prior to overlay	(c) Repair of indications prior to overlay (Same as N-504-2)
(e) Weld Reinforcement Min. 2 layers with-7.5 FN. In first austenitic SS layer 5 FN acceptable by evaluation.	(d) Weld Reinforcement (1) Min. 2 layers with-7.5 FN. In first layer 5FN acceptable if deposited weld metal less than 0.02% C. (2) Provides requirements for austenitic nickel alloy weld overlay.
(f) (g) Design Requires flaw evaluation of the existing flaw based on IWB-3640 for design life. Requires postulated 100% through wall for design of the weld overlay (full-structural) except for four or fewer axial flaws. Meet ASME Section III for primary local and bending stresses and secondary peak stresses. Requires end transition slope less than 45 degrees. Axial length requirement usually met if overlay 0.75 $(Rt)^{1/2}$ beyond flaws. Shrinkage and other applied loads evaluated on other items and other flawed welds in system.	2.0 Design Requires flaw evaluation of the existing flaw based on IWB-3640. Flaw evaluation of both materials required if flaw is at or near the boundary. Requires postulated 100% through wall for design (full-structural) of the weld overlay. Axial length and end slope shall cover the weld and heat affected zones and shall provide for load redistribution into the item and back into the overlay either out violating stress limits. There is no exception for four or fewer axial flaws. Design analysis per IWA-4311. Meet ASME Section III, NB-3200 applicable stress limits. Any laminar flaws in the weld overlay evaluated to ensure load distribution meets NB-3200. Same as N-504-2 for shrinkage and evaluation of other existing flaws.

APPENDIX 4
COMPARISON OF SNC-PROPOSED ALTERNATIVE VERSUS CODE CASE N-504-2
(Continued)

Comparison of Proposed Alternative with N-504-2	
N-504-2	**PROPOSED ALTERNATIVE**
(i) No specific reference given for acceptance examination of the weld overlay. Acceptance criteria of the Construction Code and Section III would be applicable. (Causes problems with volumetric acceptance criteria since construction criteria based on RT examination rather than UT examination. Also presents difficulty in determining applicable criteria for laminar flaws in the overlay) Preservice Exams to the methods of IWB-2200. Exam procedures shall be specified in the Repair Program. Acceptance standard-IWB-3514-2 (planar flaws). UT exams to verify integrity of new applied weld reinforcement. Include upper 25% of pipe wall in the examination.	3.0 Examination and Inspection Examinations in the proposed alternative shall be met in lieu of all other exams. NDE methods to IWA-2200 except as specified in the case. NDE personnel qualified to IWA-2300. UT procedures and personnel qualified to Section XI, Appendix VIII. (a) Acceptance Examinations-Surface finish 250 micro-inch (or 225 RA) and flatness sufficient to allow adequate examination in accordance with Appendix VIII procedures. PT 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. UT examination for acceptance Figure 1 shows the examination volume. IWB-3514-2 for planar flaw acceptance. IWB-3514-3 for laminar flaw acceptance with additional limitation not to exceed 10% of the surface area and no linear dimension in excess of 3 inches. Reduction in coverage limited to 10%. Criteria for radial planar flaw size in the uninspected volume for IWB-3640 evaluation. VT-3 of affected restraints, snubbers and supports to verify design tolerances are met. (b) Preservice Examinations Figure 2 defines the examination volume. Angle beam exam parallel and perpendicular to piping axis. Scan in four directions to locate and size flaws. Acceptance criteria IWB-3514-2 for the overlay. Wall thickness t_w is the thickness of the overlay. Flaws in outer 25% of base material meet design requirements of 2.0.

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PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(a)(3)(i)

APPENDIX 4
COMPARISON OF SNC-PROPOSED ALTERNATIVE VERSUS CODE CASE N-504-2
(Continued)

Comparison of Proposed Alternative with N-504-2	
N-504-2	**PROPOSED ALTERNATIVE**
	(c) Inservice Examinations Use Q-4300 of Appendix Q to the 2004 Edition of Section XI with Addenda through 2005. (d) Additional Examinations Use Q-4300 of Appendix Q to the 2004 Edition of Section XI with Addenda through 2005.
(h) System Hydrostatic Test if pressure boundary penetrated (leak). System Leakage Test if pressure boundary not penetrated (no leak).	4.0 Pressure Testing System Leakage Test per IWA-5000
(k) VT-3 of snubbers, supports and restraints after welding	Covered under 3.0 (a) Acceptance Examinations
(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 Documentation Use of case to be documented on an ASME Form NIS-2 (or ASME Form NIS-2A).

SOUTHERN NUCLEAR OPERATING COMPANY
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PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(a)(3)(i)

APPENDIX 5
COMPARISON OF SNC-PROPOSED ALTERNATIVE VERSUS CODE CASE N-638-1

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 than Appendix 1.	Appendix 1 is invoked by 1(b) 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 300 square inches over the ferritic material. (Note: Code Case N-638-3 which has been approved by ASME but has not been issued in Supplement 9. Residual stress analyses results show that stresses for 100 square inches through 500 square inches surface area overlays very similar.)
(b) (c) (d) (e) (f)	(c) (d) (e) (f) (g) same as requirements listed for N-638-1
1.0 Welding Qualifications The welding procedures and welding operators shall be qualified in accordance with Section IX and the requirements of 2.1 and 2.2	2.0 Welding Qualifications The welding procedures and welding operators shall be qualified in accordance with Section IX and the requirements of 2.1 and 2.2

APPENDIX 5
COMPARISON OF SNC-PROPOSED ALTERNATIVE VERSUS CODE CASE N-638-1
(Continued)

Comparison of Appendix 1 of Proposed Alternative with N-638-1	
N-638-1	**APPENDIX 1 OF THE PROPOSED ALTERNATIVE**
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" 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-4335.2 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.

SOUTHERN NUCLEAR OPERATING COMPANY
ISI-GEN-ALT-07-01, VERSION 1.0
PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(a)(3)(i)

APPENDIX 5
COMPARISON OF SNC-PROPOSED ALTERNATIVE VERSUS CODE CASE N-638-1
(Continued)

Comparison of Appendix 1 of Proposed Alternative with N-638-1	
N-638-1	**APPENDIX 1 OF THE PROPOSED ALTERNATIVE**
3.0 Welding Procedure Requirements	3.0 Welding Procedure Requirements
(a) (b) (c) (d)	(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) 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.

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PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(a)(3)(i)

APPENDIX 6
TYPICAL FIGURES

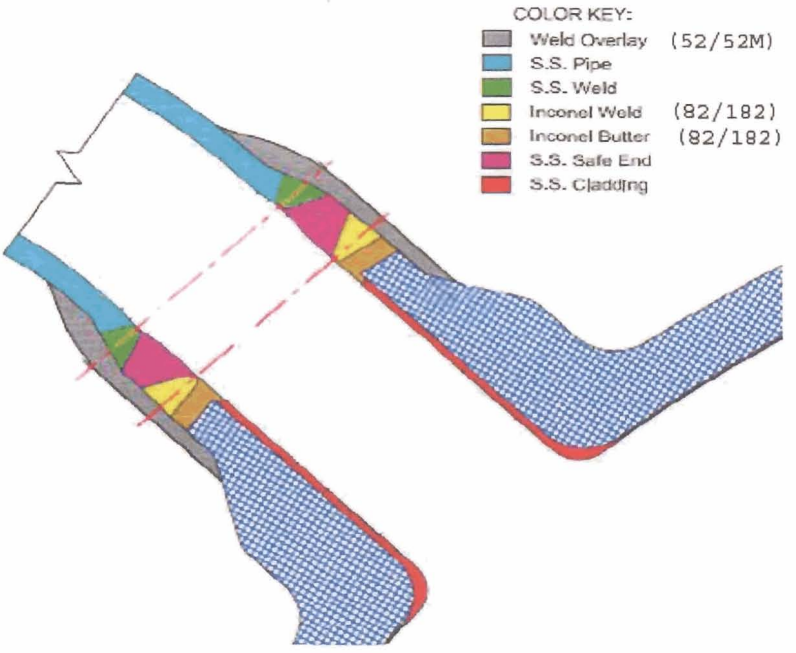

Figure 1 – Typical safety / relief nozzle configuration

SOUTHERN NUCLEAR OPERATING COMPANY
ISI-GEN-ALT-07-01, VERSION 1.0
PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(a)(3)(i)

APPENDIX 6
TYPICAL FIGURES
(Continued)

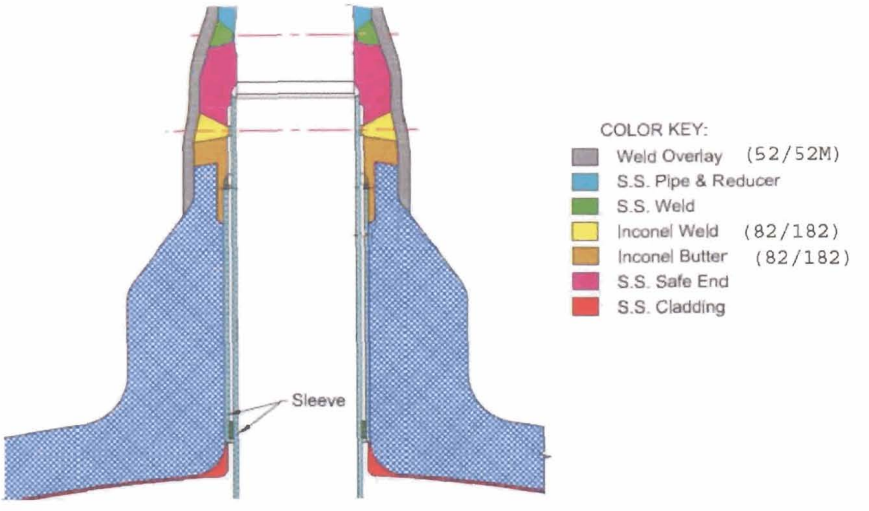

Figure 2 – Typical spray nozzle configuration

SOUTHERN NUCLEAR OPERATING COMPANY
ISI-GEN-ALT-07-01, VERSION 1.0
PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(a)(3)(i)

APPENDIX 6
TYPICAL FIGURES
(Continued)

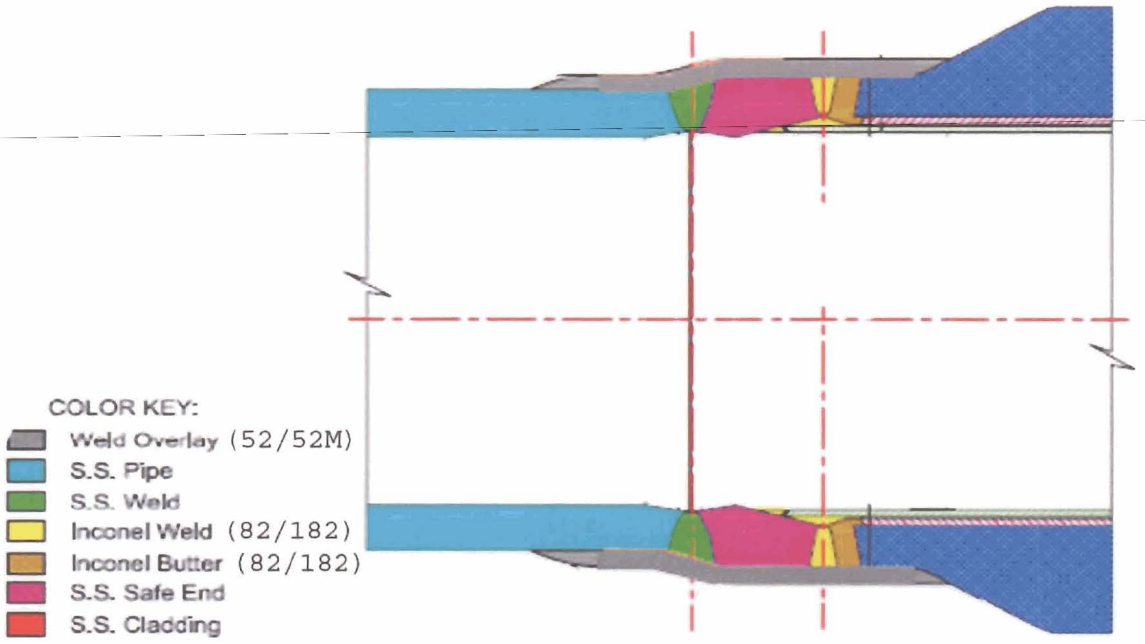

Figure 3 – Typical surge nozzle configuration

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ISI-GEN-ALT-07-01, VERSION 1.0
PROPOSED ALTERNATIVE IN ACCORDANCE WITH 10 CFR 50.55a(a)(3)(i)

APPENDIX 7
JUSTIFICATION FOR THE CHANGE TO THE 48 HOUR HOLD TIME

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 material of the FNP and VEGP pressurizer nozzles.. 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.

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.)

Enclosure 2

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Commitment Table

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Commitment Table

List of Regulatory Commitments

Commitment	Type		Scheduled Completion Date (If Required)
	One-Time Action	Continuing Compliance	
SNC will report to the NRC, prior to entering Mode 4, the stress analysis report which 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 in the nozzles would not adversely affect the integrity of the overlaid welds.	X		Vogtle 1, Outage 1R14 (Spring 2008), prior to entering Mode 4 Farley 2, Outage 2R20 (Spring 2010), prior to entering Mode 4
SNC will report to 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.	X		Vogtle 1, Outage 1R14 (Spring 2008), within 14 days after ultrasonic examination of weld overlay installations Farley 2, Outage 2R20 (Spring 2010), within 14 days after ultrasonic examination of weld overlay installations
SNC will report to the NRC, within 90 days after plant startup, the IWB-3640 evaluation performed for any assumed flaw in any uninspectable volume in the weld overlay beneath a laminar flaw, if that assumed flaw failed to meet the preservice acceptance criteria of Table IWB-3514-2.	X		Vogtle 1, Outage 1R14 (Spring 2008), within 90 days after startup Farley 2, Outage 2R20 (Spring 2010), within 90 days after startup