10 CFR 50.55a(a)(3)(i)

Palo Verde Nuclear Generating Station

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102-06014-DCM/SAB/RJR
June 04, 2009

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

Dear Sirs:

SUBJECT: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2 and 3
Docket Nos. STN 50-528, 50-529 and 50-530
Submission of Relief Request 36 Revision 1 to the American Society of Mechanical Engineers Section XI, Inservice Inspection Program Third Interval

The enclosure to this letter contains Inservice Inspection Relief Request 36, Revision 1, which will be used for the repair of reactor coolant system (RCS) cold leg dissimilar metal (DM) welds during the third inservice inspection interval. This relief request was previously submitted by Arizona Public Service Company (APS) and approved by the NRC as a repair for RCS hot leg and pressurizer DM welds during the second and third inservice inspection interval. APS' commitment to the Materials Reliability Project, MRP-139, Revision 1, "Primary System Piping Butt Weld Inspection and Evaluation Guideline," necessitates the addition of the cold leg DM welds to the original request.

APS requests the NRC approval of this relief request to support the Unit 2 fall 2009 refueling outage, U2R15. Approval is requested by October 3, 2009.

This letter contains no new commitments or revisions to existing commitments. Should you need further information regarding this relief request, please contact Russell A. Stroud, Licensing Section Leader, at (623) 393-5111.

Sincerely,

Scott A. Bauer for DCM

DCM/RAS/RJR/gat

A047
NRR

Enclosures: Relief Request 36 Revision 1- Proposed Alternative: Use of Full-Structural Weld Overlays in the Repair of Dissimilar Metal Welds, Third Interval - Units 1, 2, and 3

cc:

E. E. Collins Jr.	NRC Region IV Regional Administrator
J. R. Hall	NRC NRR Project Manager
R. I. Treadway	NRC Senior Resident Inspector for PVNGS

ENCLOSURE

Relief Request No. 36 Revision 1
Proposed Alternative: Use of Full–Structural Weld Overlays in the Repair of Dissimilar Metal Welds,
Third ISI Interval - Units 1, 2, and 3

Attachments
1. Ambient Temperature Temper Bead Welding Procedure
2. Comparison of APS proposed Alternative Verses Code Cases N-504-2 and N-638-1

Background

In preparation for the 2009 fall outage and pursuant to 10 CFR 50.55a(a)(3)(i), Arizona Public Service Company (APS) is re-submitting Relief Request 36 as Relief Request 36, Revision 1. Revision 1 of Relief Request 36 adds 11 dissimilar metal welds located in the cold leg loops of Palo Verde Units 1, 2, and 3. The additional welds are listed in Section 1.0 of the request.

The proposed alternatives to the requirements of the ASME Boiler and Pressure Vessel Code, 2001 Edition, 2003 Addenda, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components" contained in this submittal, Revision 1, are identical to those submitted by letters dated February 8, May 16, and June 18, 2007, and letter dated May 8, 2008, and approved by the NRC on June 21, 2007, and November 10, 2008. Changes from the APS submittal of May 8, 2008, have been identified with a revision bar. Revision 1 of Relief Request 36 proposes alternatives to Section IWA-4410 which stipulates that weld repairs be performed in accordance with Sub-article IWA-4400 and IWA-4420 which requires that defects be removed or reduced to an acceptable size. The proposed alternative is the application of full-structural weld overlay which is discussed in Section 5.0 of this enclosure. Attachment 1 contains the Ambient Temperature Temper Bead Welding procedure that will be used and Attachment 2 contains a comparison of the APS proposed alternative verses Code Cases N-504-2 and N-638-1. Any required material tables and drawings of the proposed weld overlays will be available on-site prior to the application of the overlay.

In developing the original Relief Request 36, APS reviewed NRC questions and Licensee responses to similar ASME alternatives. APS provided responses to those questions in Attachment 3 of the previous two submittals. Since the responses would not be significantly changed by this revision, those questions and answers have not been included in this submittal.

A full-structural weld overlay (FSWOL) has been completed in all 3 Palo Verde units on the following dissimilar metal welds using Relief Request 36.

U-1	Description	Zone	Size	DM Weld Item Number	SM Weld Item Number
Pressurizer	Spray nozzle to safe end	29	4	5-33	29-1
Pressurizer	Safety nozzle to safe end	31	6	5-32	31-13
Pressurizer	Safety nozzle to safe end	31	6	5-29	31-1
Pressurizer	Safety nozzle to safe end	31	6	5-30	31-5
Pressurizer	Safety nozzle to safe end	31	6	5-31	31-9
Pressurizer	Surge nozzle to safe end	20	12	5-34	20-1
RC Pipe	Surge nozzle to safe end	20	12	6-4	20-11
RC Pipe	SDC nozzle to safe end	21	16	6-11	21-20
RC Pipe	SDC nozzle to safe end	22	16	7-9	22-1

U-2	Description	Zone	Size	DM Weld Item Number	SM Weld Item Number
Pressurizer	Spray nozzle to safe end	29	4	5-33	29-1
Pressurizer	Safety nozzle to safe end	31	6	5-32	31-13
Pressurizer	Safety nozzle to safe end	31	6	5-29	31-1
Pressurizer	Safety nozzle to safe end	31	6	5-30	31-5
Pressurizer	Safety nozzle to safe end	31	6	5-31	31-9
Pressurizer	Surge nozzle to safe end	20	12	5-34	20-1
RC Pipe	Surge nozzle to safe end	20	12	6-10	20-11
RC Pipe	SDC nozzle to safe end	21	16	6-11	21-20
RC Pipe	SDC nozzle to safe end	22	16	7-9	22-1

U-3	Description	Zone	Size	DM Weld Item Number	SM Weld Item Number
Pressurizer	Spray nozzle to safe end	29	4	5-33	29-1
Pressurizer	Safety nozzle to safe end	31	6	5-32	31-13
Pressurizer	Safety nozzle to safe end	31	6	5-29	31-1
Pressurizer	Safety nozzle to safe end	31	6	5-30	31-5
Pressurizer	Safety nozzle to safe end	31	6	5-31	31-9
Pressurizer	Surge nozzle to safe end	20	12	5-34	20-1
RC Pipe	Surge nozzle to safe end	20	12	6-10	20-11
RC Pipe	SDC nozzle to safe end	21	16	6-11	21-20
RC Pipe	SDC nozzle to safe end	22	16	7-9	22-1

1.0 ASME Code Components Affected

PVNGS Unit: 1, 2, and 3
Description: Category B-J welds
Item numbers: B9.11
Code Class: 1

Cold Leg Category B-J Welds

U-1	Description	Zone	Size	DM Weld Item Number	SM Weld Item Number
Cold Leg	SI 1A nozzle to safe end	23	14	9-10	23-1
Cold Leg	SI 1B nozzle to safe end	24	14	11-10	24-1
Cold Leg	SI 2A nozzle to safe end	25	14	13-10	25-1
Cold Leg	SI 2B nozzle to safe end	26	14	15-9	26-1
Cold Leg	PZR Spray 1A nozzle to safe end	27	3	9-11	27-44
Cold Leg	PZR Spray 1B nozzle to safe end	28	3	11-11	28-45
Cold Leg	Drain Line 1A nozzle to safe end	32	2	8-18	32-1
Cold Leg	Drain Line 1B nozzle to safe end	33	2	10-18	33-1
Cold Leg	Drain Line 2A nozzle to safe end	34	2	12-18	34-1
Cold Leg	Letdown Line nozzle to safe end	36	2	14-18	36-1
Cold Leg	Charging Line nozzle to safe end	37	2	13-11	37-34

U-2	Description	Zone	Size	DM Weld Item Number	SM Weld Item Number
Cold Leg	SI 1A nozzle to safe end	23	14	9-10	23-1
Cold Leg	SI 1B nozzle to safe end	24	14	11-10	24-1
Cold Leg	SI 2A nozzle to safe end	25	14	13-10	25-1
Cold Leg	SI 2B nozzle to safe end	26	14	15-9	26-1
Cold Leg	PZR Spray 1A nozzle to safe end	27	3	9-11	27-44
Cold Leg	PZR Spray 1B nozzle to safe end	28	3	11-11	28-45
Cold Leg	Drain Line 1A nozzle to safe end	32	2	8-18	32-1
Cold Leg	Drain Line 1B nozzle to safe end	33	2	10-18	33-1
Cold Leg	Drain Line 2A nozzle to safe end	34	2	12-18	34-1
Cold Leg	Letdown Line nozzle to safe end	36	2	14-18	36-1
Cold Leg	Charging Line nozzle to safe end	37	2	13-11	37-34

U-3	Description	Zone	Size	DM Weld Item Number	SM Weld Item Number
Cold Leg	SI 1A nozzle to safe end	23	14	9-10	23-1
Cold Leg	SI 1B nozzle to safe end	24	14	11-10	24-1
Cold Leg	SI 2A nozzle to safe end	25	14	13-10	25-1
Cold Leg	SI 2B nozzle to safe end	26	14	15-9	26-1
Cold Leg	PZR Spray 1A nozzle to safe end	27	3	9-11	27-44
Cold Leg	PZR Spray 1B nozzle to safe end	28	3	11-11	28-45
Cold Leg	Drain Line 1A nozzle to safe end	32	2	8-18	32-1
Cold Leg	Drain Line 1B nozzle to safe end	33	2	10-18	33-1
Cold Leg	Drain Line 2A nozzle to safe end	34	2	12-18	34-1
Cold Leg	Letdown Line nozzle to safe end	36	2	14-18	36-1
Cold Leg	Charging Line nozzle to safe end	37	2	13-11	37-34

2.0 Applicable Code Edition and Addenda

The American Society of Mechanical Engineers (ASME) ISI Code of Record for the third 10-year inservice inspection (ISI) interval is the 2001 Edition and Addenda through 2003.

As allowed by 10 CFR 50.55a, ASME Section XI, 2001 Edition will be used for Appendix VIII, "Performance Demonstration for Ultrasonic Examinations."

3.0 Applicable Code Requirements

Subarticle IWA-4410 of ASME Section XI requires that repairs of welds shall be performed in accordance with Sub-article IWA-4400. IWA-4420 requires that defects be removed or reduced to an acceptable size. The following Code Cases form the basis of the proposed alternative and Attachment 2 contains a comparison of the APS proposed alternative versus the Code Cases:

- Code Case N-504-2[1], "Alternative Rules for Repair of Class 1, 2 and 3 Austenitic Stainless Steel Piping, Section XI, Division 1," with the requirements of ASME Section XI, Non-mandatory Appendix Q, "Weld Overlay Repair of Class 1, 2 and 3 Austenitic Stainless Steal Piping Weldments."

[1] Regulatory Guide 1.147, Revision 15, Table 5 identifies this Code Case as Superseded.

- Code Case N-638-1[2], "Similar and Dissimilar Metal Welding using Ambient Temperature Machine GTAW Temper Bead Technique."

4.0 Reason for Request

Primary Water Stress Corrosion Cracking (PWSCC) has been identified as a degradation mechanism for Alloy 82/182 welds and weld buttering. APS has concluded that the application of a FSWOL over the Alloy 82/182 welds is an appropriate course of action to ensure the integrity of the reactor coolant pressure boundary.

The 2001 Edition and Addenda through 2003 of the Code does not provide rules for the design of weld overlays or for repairs without removal of flaws. In addition, Code Case N-504-2[3], which had been approved by the NRC for use and subsequently superseded, does not provide the methodology for overlaying nickel alloy welds joining austenitic and ferritic base materials; therefore, APS proposes the following alternative.

5.0 Proposed Alternative and Basis for Use

Proposed Alternative

A FSWOL is one of the repair methods that may be required to be applied to any of the Alloy 82/182 dissimilar metal welds identified in Section 1.0 of this request. If a FSWOL is to be applied to any of these welds, a flaw will be assumed to be 100% through the original wall thickness for the entire circumference of the FSWOL design.

In some cases, the application of a FSWOL on a weld identified in Section 1.0 may preclude the examination of an adjacent similar metal piping weld. In those cases, the overlay will be extended over the adjacent similar metal piping welds. Which similar metal welds will be overlaid will be determined after designing the dimensions of the dissimilar metal FSWOL.

Similar metal welds will not be inspected prior to installing the overlay. If the overlay extends over adjacent similar metal welds, then these welds will be examined in accordance with the proposed alternative. In addition, the overlays will be designed to improve the weld configurations for future examinations.

In lieu of using the existing IWA-4000 Repair Procedures in the 2001 Edition and Addenda through 2003 Section XI Code, APS 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. ASME Code references in this alternative are to the 2001 Edition and

[2] Regulatory Guide 1.147 Revision 15 , Table 2, identifies this Code Cases as Conditionally Acceptable.
[3] This revision of Code Case N-504 was used in the original submittal of Relief Request 36 and is compared to the proposed alternative in Attachment 2.

Addenda through 2003 for Section III and 2001 Edition and Addenda through 2003 for Section XI as modified by 10 CFR 50.55a. This methodology is based on ASME Code Case N-740 and only the applicable requirements of the Code Case are presented below as alternatives.

5.1 General Requirements:

(a) A full-structural weld overlay will be applied by deposition of Alloy 52 weld reinforcement (weld overlay) on the outside surface of the carbon steel (P-No. 1 or 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 will be extended (when required) to include the adjacent wrought stainless steel to stainless steel welds (P-No. 8 to P-No. 8).

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. Specific dimensions of the overlay thickness will be in the design package.

(b) The Alloy 52 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 Temper Bead Welding will be used on the ferritic nozzles. (See "Ambient Temperature Temper Bead Welding," which is located in Attachment 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 weld overlay, 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 5.1(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 identified in 5.1(b) above. The first layer of weld metal deposited will not be credited toward the required thickness because of chemical dilution.

Alternatively, the first 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 shall be at least 24%. Content may be 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.

(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.

5.2 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 or until the next scheduled inservice inspection. 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 shall consider the most limiting of the two materials.

(b) Design of the FSWOL

The design of the weld overlay shall satisfy the following, using the assumptions and flaw characterization restrictions in 5.2(a) above. 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 the above. 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 5.2(b)1 above, the end transition slope of the overlay shall not exceed 45 degrees.

3. The thickness of the FSWOL shall be determined based on a flaw 100% through the original wall thickness for the entire circumference in the underlying pipe. The overlay will be applied so that the criteria of IWB-3640 are met for the assumed flaw after the overlay is applied.

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 Palo Verde welds to be considered in this evaluation).

    i. Prior to plant restart following the outage, a stress analysis will be performed that demonstrates that the 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 will not adversely affect the integrity of the overlaid welds. This analysis will be performed as part of the overlay design package and will be available for NRC review.

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

5.3 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 EPRI 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 by 10 CFR 50.55a, Final Rule dated October 1, 2004. Ultrasonic examination will be performed to the maximum extent achievable.

Pre-Overlay Examinations

APS does not plan to perform UT of the dissimilar metal welds or the adjacent similar metal welds identified in the scope of this request prior to the installation of the overlays. Since APS intends to apply full-structural overlays designed for a worst case through-wall flaw that is 360 degrees in circumference, the dose received from the examination of these welds 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, 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 to evaluate them accordingly. While listed below as two separate examinations they will be performed during the same time period. An identification of the examination coverage of each overlay will be developed and available for NRC review prior to plant startup.

The NDE requirements listed below cover the area that will be affected by the 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) during installation. 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

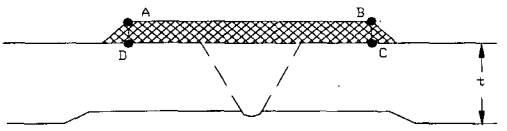
1. The weld overlay shall have a surface finish of 250 micro-inches RMS or better and a flatness sufficient to allow for adequate examination in accordance with

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 1/2 inch from each side of the weld 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 temper bead welding is used, the liquid penetrant examination shall be conducted at least 48 hours after the completed overlay has returned to ambient temperature.

3. The examination volume A-B-C-D in Figure 1 below 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 temper bead welding is used, the UT shall be conducted at least 48 hours after the completed overlay has returned to ambient temperature. APS will be using Relief Request 37, previously approved on June 21, 2007, which authorized the 48-hour hold time to begin following the completion of the third layer of the weld overlay. Since Relief Request 37 was approved for the remainder of the third inspection interval and modifies the welding process described in Relief Request 36, Revision 1, Relief Request 37 is not being resubmitted.

Figure 1:
ACCEPTANCE EXAMINATION



Examination Volume A-B-C-D

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 the aforementioned Figure 1 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 shall be assumed to contain the largest radial planar flaw that could exist within that volume. This assumed flaw shall meet the inservice 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 lamination shall be removed or reduced in area such that the assumed flaw is acceptable per IWB-3514-2.

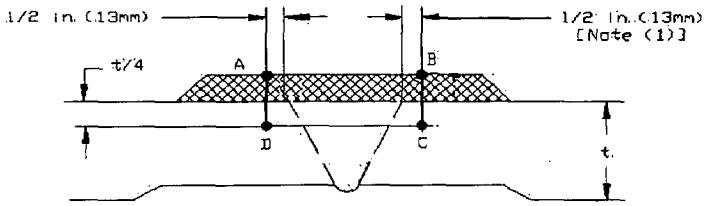
6. After completion of all welding activities, affected restraints, supports, and snubbers shall be VT-3 examined to verify that design tolerances are met.

(b) Preservice Inspection

1. The examination volume A-B-C-D in Figure 2, provided below, 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 base material or into the weld overlay.

Figure 2:

PRESERVICE AND INSERVICE EXAMINATION VOLUME



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 inch beyond the toes of the original weld, including weld end butter, where applied.

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 5.3(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 5.2, "Crack Growth Considerations and Design," of this proposed alternative.

(c) Inservice Inspection

APS proposes that the following Inservice Inspection rules be followed.

1. The weld overlay examination volume A-B-C-D in Figure 2 shall be added to the applicable inspection plans and shall be ultrasonically examined during the first or second refueling outage following application.

2. The weld overlay examination volume in Figure 2 shall be ultrasonically examined to determine if any new or existing cracks have propagated into the upper 25% of the base material or into the overlay. The angle beam shall be

directed perpendicular and parallel to the piping axis, with scanning performed in four directions.

3. The inservice examination acceptance standards of Table IWB-3514-2 shall be applied to planar indications detected in the weld overlay material. If the planar indication is found acceptable per Table IWB-3514-2, the weld overlay will be re-examined in accordance with 5.3(c)5. If the inservice acceptance criteria of Table IWB-3514-2 are not met, the planar flaw may be evaluated in accordance with IWB-3640, provided that the flaw is not caused by PWSCC. If accepted for continued service the weld overlay will be re-examined in accordance with 5.3(c)5. If the flaw is not acceptable for continued service per IWB-3640, then it shall be repaired.

4. Cracks in the outer 25% of the base metal shall meet the design analysis requirements as addressed in Section 5.2, "Crack Growth Considerations and Design," of this proposed alternative. Weld overlay examination volumes that show indication of crack growth or new cracking will be re-examined in accordance with 5.3(c)5. Weld overlay examination volumes that show no indication of crack growth or new cracking shall be placed into a population group for each unit to be examined on a sample basis. Twenty-five percent of this population shall be examined once every ten years.

5. Successive Examinations - The weld overlay examination volume shall be reexamined during the first or second refueling outage following discovery of:
   - Growth of indications in the overlay material or the presence of new indications in the overlay material.
   - Crack growth or new cracking in the outer 25% of the base metal.

(d) Scope Expansion

If inservice examinations reveal an unacceptable indication, crack growth into the weld overlay design thickness, or axial crack growth beyond the specified examination volume, additional weld overlay examination volumes, 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 overlay examination volumes shall be examined prior to operation. If additional unacceptable indications are found, the entire remaining population of weld overlay examination volumes shall be examined prior to return to service.

5.4 Pressure Testing

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

5.5 Documentation

Use of this proposed alternative shall be documented on ASME Form NIS-2, "Owner's Report for Repairs or Replacements."

Basis for Use

The use of weld overlay materials resistant to PWSCC (e.g., Alloy 52) 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 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 metal welds, will provide improved assurance of structural integrity. Further, if no flaws are found in the outer 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 would 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 EPRI 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).

Impact on Leak-Before-Break Analysis

The FSWOL repairs will only be applied to welds that are not credited in the Palo Verde leak-before-break (LBB) analysis. The only welds credited in the LBB analysis are the large piping welds within the main reactor coolant system (RCS) piping which are not dissimilar metal welds as defined by the Materials Reliability Project, MRP-139, Revision 1, "Primary System Piping Butt Weld Inspection and Evaluation Guideline."

The welds credited in the Palo Verde LBB analysis are:

- Hot leg RCS piping at the Steam Generator
- Hot leg RCS piping at the Reactor Vessel
- Cold leg RCS piping at the Steam Generator

- Cold leg RCS piping at the Reactor Coolant Pump inlet and outlet
- Cold leg RCS piping at the Reactor Vessel

6.0 Duration of Proposed Alternative

The proposed alternative requested would be applicable for the remainder of the third Inservice Inspection Interval for Units 1, 2, and 3.

7.0 Conclusion

10 CFR 50.55a(a)(3) states:

"Proposed alternatives to the requirements of paragraphs (c), (d), (e), (f), (g), and (h) of this section or portions thereof may be used when authorized by the Director of the Office of Nuclear Reactor Regulation. The applicant shall demonstrate that:

(i) The proposed alternatives would provide an acceptable level of quality and safety, or
(ii) Compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety."

The post-overlay examinations and stress analysis, conducted prior to plant restart, discussed in this relief request provide an acceptable level of quality and safety. Additionally, not performing some volumetric examinations prior to applying the FSWOL will reduce the dose to examination personnel and keep exposure ALARA. Therefore, APS requests that the proposed alternative be authorized pursuant to 10 CFR 50.55a(a)(3)(i).

APS requests the Staff's approval of this Relief Request to support the Unit 2's fall 2009 refueling outage, U2R15. Approval is requested by October 3, 2009.

8.0 References

1. ASME Boiler and Pressure Vessel Code, Code Case N-740
2. ASME Boiler and Pressure Vessel Code, Code Case N-504-2
3. ASME Boiler and Pressure Vessel Code, Code Case N-638-1

9.0 Precedent

- Palo Verde Units 1, 2, and 3 – Relief Request Nos. 36 and 37 Re: Alterations to Weld Overlay Requirements for Inservice Inspection (TAC Nos. MD4272, MD4273, MD4274, MD5579, MD5580, and MD5581), Approved June 21, 2007 (Agencywide Documents Access and Management System [ADAMS] No. ML071560008).

- Palo Verde Units 1, 2, and 3 – Relief Request Nos. 18 and 36 Re: Third 10-Year Inservice Inspection Program Interval (TAC Nos. MD8712, MD8713, and MD8714), Approved November 10, 2008 (ADAMS No. ML08301572).

There are no technical differences between the previously approved requests and this submittal.

RELIEF REQUEST 36, Revision 1

ATTACHMENT 1
AMBIENT TEMPERATURE TEMPER BEAD WELDING

Ambient Temperature Temper Bead Welding

1.0 GENERAL REQUIREMENTS

(a) This appendix applies to dissimilar austenitic filler metal welds joining P-Nos. 8 or 43 materials to P-No. 1 and 3 materials.

(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 along 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, 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.

(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. 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.

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 F-No. 43 weld metal (ASME Section IX QW-432) for P-No. 8 or 43 to P-No. 1 and 3 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. 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 degrees Fahrenheit for all weld layers regardless of the interpass temperature used during qualification.

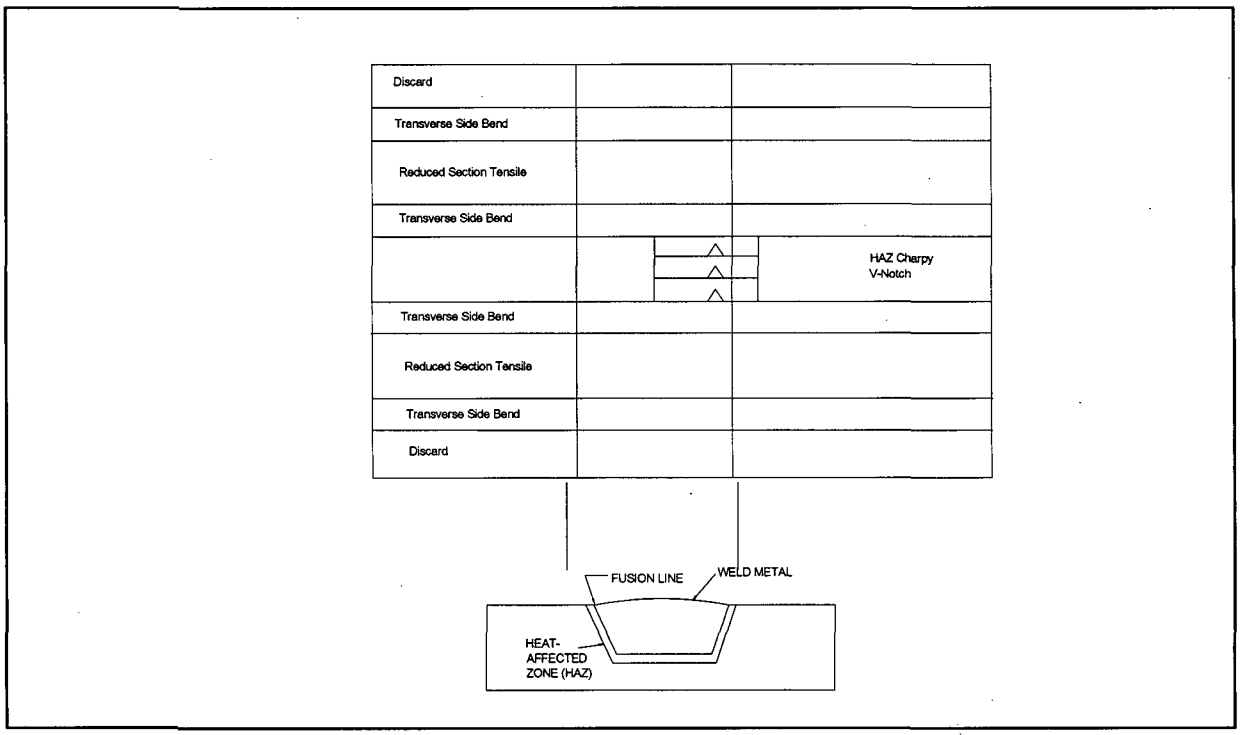
(e) The interpass temperature shall be determined by temperature measurement (e.g., pyrometers, temperature indicating crayons, thermocouples) during welding. If it is not possible to use this method then (e)(1) and (e)(2) may be used in combination.

(1) 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

(2) 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.

Ambient Temperature Temper Bead Welding

(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.



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

Figure 1-1
QUALIFICATION TEST PLATE

RELIEF REQUEST 36, Revision 1

ATTACHMENT 2

COMPARISON OF APS-PROPOSED ALTERNATIVE VERSUS CODE CASES N-504-2 and N-638-1

Comparison of APS Proposed Alternative Verses Code Cases N-504-2 and N-638-1

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) materials covered are P-8, P-43, P-3 and P-1. 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) 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) Minimum of 2 layers.
(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.

Comparison of APS Proposed Alternative Verses Code Cases N-504-2 and N-638-1

Comparison of Proposed Alternative with N-504-2 (Continued)	
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 and flatness sufficient to allow adequate examination in accordance with Appendix VIII procedures. PT overlay and ½-inch on either side of the overlay. Acceptance standards for PT-weld overlay, Meet weld Construction Code criteria or NB-5300, base material-Meet base material criteria or NB-2500. 48 hr hold time after item reaches room temperature imposed if ambient temperature temper bead welding imposed. UT examination for acceptance-Figure 1 shows the examination volume. 48 hour hold time after item reaches room temperature imposed if ambient temperature temper bead welding imposed. 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.

Comparison of APS Proposed Alternative Verses Code Cases N-504-2 and N-638-1

Comparison of Proposed Alternative with N-504-2 (Continued)	
N-504-2	**PROPOSED ALTERNATIVE**
	(c) Inservice Examinations Examination required 1st or 2nd refueling outage following application. Examination volume the same as preservice. acceptance standards the same as preservice except IWB-3600 evaluation permitted as an alternative to IWB-3514-2 for the weld overlay. Future examination requirements define depending on examination results. (d) Additional Examinations Similar to Code examination expansion rules.
(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 will 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 NIS-2 form

Comparison 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 temper bead 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 Attachment 1.	Appendix 1 invoked in 1.0 (b) for use of ambient temperature temper bead 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 temper bead 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 for RR 36 materials
(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. 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
2.1 Procedure Qualification Paragraphs (a) (d) (e) (f) (g) Paragraph (h) Paragraph (i) Paragraph (j) Paragraph (b) Provisions for welding in	2.1 Procedure Qualification Paragraphs (a) (d) (e) same as in N-638-1 for equivalent paragraphs. Equivalent paragraph not in Appendix 1. Paragraph (f) same as (i) from N-638-1. (j) Paragraph (g) changed the first sentence adding "lateral expansion" in front of "value" both at the beginning and end of the sentence.

Comparison of Proposed Alternative with N-638-1	
N-638-1	**APPENDIX 1 OF THE PROPOSED ALTERNATIVE**
a pressurized environment Paragraph (c) Provisions to address radiation effects	Not included for overlays in Attachment 1. Not included in Attachment 1. Thermal neutron limitation imposed in the proposed alternative 1.0(e).
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
(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.
	(e) Paragraph 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	3.0 Examination and Inspection in the proposed alternative for requirements.
5.0 Documentation	5.0 Documentation in the proposed alternative.
	4.0 Pressure Testing in the proposed alternative.