Progress Energy

Crystal River Nuclear Plant
Docket No. 50-302
Operating License No. DPR-72

Ref: 10 CFR 50.55a

April 12, 2007
3F0407-15

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

Subject: Crystal River Unit 3 – Resubmittal of Relief Requests #07-001-RR, Revision 0, and #07-002-RR, Revision 0

Reference: Crystal River Unit 3 to NRC letter dated March 30, 2007, "Crystal River Unit 3 – Relief Requests #07-001-RR, Revision 0, and #07-002-RR, Revision 0"

Dear Sir:

Pursuant to 10 CFR 50.55a(a)(3)(i), Florida Power Corporation (FPC) doing business as Progress Energy Florida, Inc. (PEF), Crystal River Unit 3 (CR-3) is hereby resubmitting Relief Requests 07-001-RR, Revision 0 and 07-002-RR, Revision 0, for review and approval. This submittal corrects the name of the licensee to read "Florida Power Corporation (FPC) doing business as Progress Energy Florida, Inc. (PEF)". This submittal replicates that dated March 30, 2007 in its entirety with the exception of reference to the licensee. This submittal replaces the above referenced letter in its entirety.

Additionally, in accordance with 10 CFR 50.55a(g)(4)(iv), FPC is requesting NRC approval for use of related portions of the 1992 Edition with no Addenda of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME) Section XI.

During Refueling Outage 15, scheduled to start on November 3, 2007, CR-3 is planning to implement the repair process described in Attachment A, and to use the methods described in the attached relief requests to complete the small bore nozzle repairs on pressurizer nozzles that were not repaired in 2003.

These nozzles include:

- One (1) vent nozzle in the upper head;
- One (1) sampling nozzle in the shell;
- Three (3) lower level instrumentation nozzles in the shell and;
- One (1) thermowell penetration in the shell.

The planned repairs are similar to repairs performed at CR-3 on the pressurizer upper level sensing nozzles in 2003.

Relief Request 07-001-RR, Revision 0 (Attachment B), is seeking relief from the requirements of Article IWA-4500 of the ASME Section XI, 1989 Edition with no Addenda. The applicable Construction Code is ASME Section III 1965 Edition including Addenda through Summer 1967.

Relief Request 07-002-RR, Revision 0 (Attachment C), is seeking relief from the 1992 Edition of ASME Section XI, IWA-3300, Flaw Characterization. In lieu of fully characterizing the assumed remaining

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15760 W. Powerline Street
Crystal River, FL 34428

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flaws, CR-3 proposes, as described in the relief request, to utilize worst-case assumptions to conservatively estimate the flaw (crack) extent and orientation.

The planned repair is similar to repairs performed previously at Three Mile Island, CR-3, Millstone, St. Lucie, ANO, Unit 1, South Texas Project and other facilities.

CR-3 is respectfully requesting review and approval of these relief requests by October 1, 2007.

No regulatory commitments are being made in this submittal.

If you have any questions regarding this submittal, please contact Paul Infanger, Supervisor, Licensing and Regulatory Programs at (352) 563-4796.

Sincerely,

Michael J. Annacone
Engineering Manager

MJA/seb

Attachments:

A. Background and Description of the Planned Repair
B. Relief Request #07-001-RR, Revision 0
C. Relief Request #07-002-RR, Revision 0

xc: NRR Project Manager
Regional Administrator, Region II
Senior Resident Inspector

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

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ATTACHMENT A

BACKGROUND
AND DESCRIPTION OF THE PLANNED REPAIR

BACKGROUND AND DESCRIPTION OF THE PLANNED REPAIR

The Pressurizer lower level instrumentation, vent and sampling nozzles are all small bore (i.e., 1 $^{7}/_{16}$ inch outside diameter) nozzles that penetrate the vertical shell of the Pressurizer vessel with the exception of the vent nozzle, which penetrates the upper head. The thermowell (1.400 inch outside diameter) also penetrates the vertical shell of the Pressurizer vessel. The proposed process for the lower level instrumentation, sampling and vent nozzles, termed a half nozzle repair, removes a portion of the existing nozzle from outside the vessel. For the thermowell, the complete thermowell is removed from outside the vessel. A weld buildup (i.e. – weld pad) will be formed at the outer diameter of the vessel wall centered at the opening. The weld pad will be applied using the machine gas tungsten arc welding (GTAW) ambient temperature temper bead process.

This weld pad will then be prepared to accept a new Ni-Cr-Fe Alloy 690 nozzle/thermowell that is attached using a partial penetration "J" groove weld. A new nozzle/thermowell-to-Pressurizer weld will be deposited. The original weld will no longer function as the Pressurizer pressure boundary.

The original nozzle to Pressurizer weld and a portion of the original nozzle within the Pressurizer wall thickness will remain in place at the junction of the nozzle to Pressurizer inside surface. Also a portion of the original thermowell to Pressurizer weld will remain in place. These remaining original items will be analyzed for acceptability to remain in place. Flaws are also assumed to exist in the original welds and will not be removed.

CR-3 intends to use Code Case N-416-2 to perform a system leak test in lieu of a hydrostatic pressure test. Since this Code Case was previously approved by the NRC in Regulatory Guide 1.147 and has been previously implemented at CR-3, no Code relief is required. Code Case N-416-2 stipulates the use of the 1992 Edition of American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME) Section III for nondestructive examination (NDE) for fabrication and installation and ASME Section XI for the visual examination and system leakage test. Consequently, CR-3 has adopted the 1992 Editions of ASME Section III for NDE of the repair and ASME Section XI for the visual examination and system leak test in lieu of the 1989 Code Edition referenced in the CR-3 ASME Section XI Repair and Replacement Program. The conditional approval requirements for Code Case N-638-1, as specified in NRC Regulatory Guide 1.147 Revision 14, will also be applicable for the ultrasonic examination of the weld pads.

Pursuant to 10 CFR 50.55a(g)(4)(iv), Florida Power Corporation (FPC) will conduct the repairs in accordance with related portions of the 1989 Edition of ASME Section XI (as applicable) and the 1989 Edition of ASME Section III (as applicable) and the alternative requirements as discussed in Relief Request #07-001-RR, Revision 0 (Attachment B) and Relief Request #07-002-RR, Revision 0 (Attachment C).

Relief Request #07-001-RR, Revision 0 (Attachment B), is seeking an alternative to the requirements in IWA-4500 to perform a portion of the repair with a remotely operated weld tool, utilizing the machine GTAW process and the ambient temperature temper bead method with 50°F minimum preheat temperature and no post weld heat treatment, as described in Code Case N-638-1.

Relief Request #07-002-RR, Revision 0 (Attachment C), is seeking relief from the 1992 Edition of ASME Section XI, IWA-3300, Flaw Characterization. In lieu of fully characterizing the assumed remaining flaws, CR-3 proposes, as described in the relief request, to utilize worst-case assumptions to conservatively estimate the flaw (crack) extent and orientation.

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

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ATTACHMENT B

RELIEF REQUEST #07-001-RR, REVISION 0

**INSERVICE INSPECTION
RELIEF REQUEST #07-001-RR, REVISION 0
THIRD TEN YEAR INTERVAL**

REFERENCE CODE: The American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME), Section XI, 1989 Edition with no Addenda.

I. System/Component(s) for Which Relief is Requested:

a) Name of component:
Pressurizer Lower Level Instrument, Sampling and Vent Nozzle Penetrations and Thermowell Penetration. There are three (3) lower level instrument nozzle penetrations, one (1) sampling nozzle penetration and one (1) thermowell penetration in the shell of the Pressurizer. There is one (1) vent nozzle penetration in the upper head of the Pressurizer.

b) Function:
The nozzles, thermowell and penetration welds serve as a portion of the pressure boundary for the Pressurizer.

c) ASME Code Class:
The Pressurizer, nozzle penetrations and thermowell penetrations are ASME Class 1.

d) Category:
Examination Category B-E, Pressure Retaining Partial Penetration Welds in Vessels; Item No. B4.11 for the modified vent nozzle penetration and original penetration and Item No. B4.13 for the modified lower level instrumentation, sample nozzle and thermowell penetrations and original penetrations.

Also Category B-P Items B15.20 and B15.21 apply to the modified locations.

II. Current Code Requirement and Relief Request:

a) The activity is considered a replacement governed by ASME Section XI. ASME Section XI 1989 Edition, IWA-7320 states welding required for the installation of an item to be used for replacement shall be performed by welders who are qualified, and by using procedures that are qualified, in accordance with ASME Section IX and the additional heat treating and impact tests required by IWB-4000. ASME Section XI, IWB-4000 does not apply as it is limited to repairs to heat exchanger tube or tubesheet bore hole plugging. ASME Section XI, IWA-7510 requires all procedures for installation of items to be used for replacement shall be in accordance with IWA-4100. ASME Section XI 1989 Edition, IWA-4120(a) requires repairs to be made in accordance with the Owner's Design Specification and the original Construction Code of the component or system. Later Editions and Addenda of the Construction Code or of ASME Section III, either in their entirety or portions thereof, and Code Cases may be used. If repair welding cannot be performed in accordance with these requirements, the applicable alternative requirements of IWA-4500 and IWB-4000 may be used for Class 1 components. As stated above, IWB-4000 is not applicable for this activity.

b) In accordance with 10CFR50.55a(a)(3)(i), Florida Power Corporation (FPC), Crystal River Unit 3 (CR-3) is requesting relief from the following portion of ASME Section XI, IWA-4120(a) and its referenced IWA-4500 to perform Pressurizer nozzle and thermowell penetration repairs:

"If repair welding cannot be performed in accordance with these requirements, the applicable alternative requirements of IWA-4500 and IWB-4000 may be used for Class 1 components."

In lieu of performing the repair using the alternative welding techniques described in IWA-4500, CR-3 is proposing to perform a portion of the repair with a remotely operated weld tool, utilizing the machine gas tungsten-arc welding (GTAW) process and the ambient temperature temper bead method with 50°F minimum preheat temperature and no post weld heat treatment, as described in Code Case N-638-1. CR-3 is requesting the use of the Code Case in its entirety, except for deviations as listed in Table 1, of this Attachment. The description of the proposed alternative is provided in the following section.

c) CR-3 intends to use Code Case N-416-2 to perform a system leak test in lieu of a hydrostatic pressure test. Since this Code Case has been previously approved by the NRC, no Code relief is required. However, Code Case N-416-2 stipulates the use of the 1992 Editions of ASME Section III for nondestructive examination (NDE) of welded repairs and ASME Section XI for visual examination (VT-2) of welded repairs in conjunction with the system leakage test. Consequently, CR-3 has adopted the 1992 Edition of ASME Section III and ASME Section XI for NDE, visual examination, and system leak test associated with this replacement in lieu of the ASME 1989 Edition referenced in the CR-3 ASME Section XI Repair and Replacement Program. The conditional approval requirements for Code Case N-638-1, as specified in NRC Regulatory Guide 1.147 Revision 14, will also be applicable for the ultrasonic examination of the weld pads.

d) CR-3 has determined that the proposed alternative will provide an acceptable level of quality and safety, while allowing significant dose reductions.

III. Alternate Criteria for Acceptability:

CR-3 plans to perform Pressurizer nozzle and thermowell penetration repairs as follows:

1. Removal of a portion of the existing nozzle and thermowell.
2. Application of weld pad (or weld buildup) using F-No. 43 to the Pressurizer shell and upper head (P-No 1, Group 2) base material.

3. Machining the weld pad and bore to accept the new half nozzle/complete thermowell (P-No. 43).
4. Installing the replacement half nozzle/complete thermowell by using conventional manual GTAW and a "J" groove partial penetration weld.

The proposed alternative to the applicable portion of ASME Section XI involves the use of the ambient temperature temper bead repair described in Code Case N-638-1. This methodology is proposed to be used only for the weld pad application, Step 2 of the repair process.

Table 1 was prepared as a means to readily describe those areas where the proposed methodology deviates from the requirements of the original construction code, ASME Section XI, or Code Case N-638-1.

Table 1

Reference	Requirement	Alternative, including Reference for Justification
ASME Section III Relief		
NB-4600	Heat Treatment	50°F minimum preheat temperature and no post-weld heat treatment (PWHT) performed as described in Code Case N-638-1. {See IV.2.b) & c) below}
NB-4622.1	Except as otherwise permitted in NB-4622.7, all welds, including repair welds, shall be postweld heat treated.	50°F minimum preheat temperature and no PWHT performed as described in Code Case N-638-1. {See IV.2.b) & c) below}
NB-4622.9	Temper Bead Weld Repair	Ambient temperature temper bead welding method will be used based on Code Case N-638-1. {See IV.2.b) & c) below}
NB-4622.11	Temper Bead Weld Repair to Dissimilar Metal Welds or Buttering	Ambient temperature temper bead welding method will be used based on Code Case N-638-1. {See IV.2.b) & c) below}
NB-3357	"All vessels and vessel parts shall be given the appropriate postweld heat treatment prescribed in NB-4620."	50°F minimum preheat temperature and no PWHT performed as described in Code Case N-638-1. {See IV.2.b) & c) below}
NB-6111	Scope of Pressure Testing. "All pressure retaining components, appurtenances, and completed systems shall be pressure tested. The preferred method shall be a hydrostatic test using water as the test medium."	System leak test will be performed in lieu of a hydrostatic test per Code Case N-416-2. Note: this Code Case is approved for use by the NRC and therefore, does not require relief request.

Table 1		
Reference	**Requirement**	**Alternative, including Reference for Justification**
NB-4330	General Requirements for Welding Procedures Qualification Tests.	Code Case N-638-1 will be used in lieu of NB-4330 {(See IV.2.b & c) below}
Fig NB-4244(d)-1, Note 1	Weld deposit reinforcement if used shall be examined as required in NB-5244.	Examinations will be in accordance with Code Cases N-416-2 and N-638-1. {(See IV.2.b & c) below}
ASME Section XI Relief		
IWA-7320	Welding required for the installation of an item to be used for replacement shall be performed by welders who are qualified, and by using procedures that are qualified, in accordance with ASME Section IX and the additional heat treating and impact tests required by IWB-4000.	IWB-4000 does not apply as it is limited to repairs to heat exchanger tube or tubesheet bore hole plugging. No relief is required.
IWA-7510	All procedures for installation of items to be used for replacement shall be in accordance with IWA-4100.	See the following eleven References..
IWA-4500	Repair Welding	Code Case N-638-1 will be used in lieu of IWA-4500. {See IV.2.b) & c) below}
IWA-4531(a)	Specifies shielded metal arc welding process (SMAW) be used and establishes requirements for electrode diameters for the first, second, and subsequent layers of the repair weld and requires removal of ½ the 1st layer thickness before deposition of the second layer.	Machine GTAW to be used in lieu of the SMAW per Code Case N-638-1. {See IV.2.b) & c) below}

IWA-4531(b)	IWA-4531(b), which refers to IWA-4521(b), requires special electrode baking and handling in (b)(1) and (b)(2) to maintain a dry coating, reducing the propensity for hydrogen being introduced into the ferritic HAZ due to moisture that may be retained therein.	The machine gas tungsten-arc welding (GTAW) process uses bare filler wire and electrode that will not be baked nor maintained in holding ovens. {See IV.2.b) & c) below}
IWA-4532	Maximum interpass temperature during welding > 100°F above maximum interpass temperature during qualification as specified in ASME Section IX, QW-256 as a supplementary essential variable.	Qualification and welding process as described in Code Case N-638-1 which specifies a maximum interpass temperature of 150°F be used for the procedure qualification and 350°F be used for field welding. {See IV.2.b) & c) below}
IWA-4533(a)	Minimum 300°F preheat temperature for P-No. 1 material.	Ambient (≥ 50°F) preheat temperature used per Code Case N-638-1. {See IV.2.b) & c) below}
IWA-4533(a)(d)	450°F - 550°F Post Weld Heat Soak	Post Weld Heat Soak not used per Code Case N-638-1. {See IV.2.b) & c) below}
IWA-4533(b)	Preheating and preheating/interpass temperature monitoring using thermocouples and recording instruments.	Calculations are used in lieu of thermocouples and recording instruments to show that maximum interpass temperature (350°F) will not be exceeded. Preheat will be essentially equal to the Pressurizer ambient temperature and ≥ 50°F per Code Case N-638-1. {See IV.2.d) below}
IWA-4533(c)	Specifies SMAW process and welding techniques related thereto	Machine GTAW will be used per Code Case N-638-1. {See IV.2.b) & c) below}

IWA-4534(b)	RT required	UT and PT will be performed on the finished weld pad in accordance with ASME III, 1992 Edition, no Addenda, NB-5000. {See IV.2.e) below}
IWA-4534(b)	Non-destructive examination (NDE) performed after weld is at ambient temperature for 48 hr minimum.	NDE will be performed on the completed weld 48 hr minimum after completion of the 3rd temper bead layer. {See IV.2 f) below}
IWA-4700	"After repairs by welding on the pressure retaining boundary, a system hydrostatic test shall be performed in accordance with IWA-5000."	System leakage test will be performed in lieu of a hydrostatic test in accordance with Code Case N-416-2. Note: this Code Case is approved for use by the NRC and therefore, does not require a relief request. Its use is provided for information only.
IWA-5211(d)	System hydrostatic test conducted during plant shutdown at a pressure above nominal operating pressure or system pressure for which overpressure protection is provided	System leak test will be performed in lieu of a hydrostatic test per Code Case N-416-2. Note: this Code Case is approved for use by the NRC and therefore, does not require a relief request.
IWA-5214(b)	The test pressure and temperature for a system hydrostatic test subsequent to the component repair or replacement shall comply with the system test pressure and temperature specified in IWB-5222.	System leak test will be performed in lieu of a hydrostatic test per Code Case N-416-2. Note: this Code Case is approved for use by the NRC and therefore, does not require a relief request.
Code Case N-638-1 Relief		
N-638-1	The Code Case requires surface examination and volumetric examination (UT) of a 5 inch band of base metal surrounding the weld repair area after the 48 hr hold time.	Only a surface examination of the 5 inch band surrounding the weld (PT or MT) will be performed. {See IV.2.e) below}

N-638-1	NDE performed after weld is at ambient temperature for 48 hr minimum.	NDE will be performed on the completed weld 48 hr minimum after completion of the 3rd temper bead layer. {See IV.2 f) below}

IV. Basis for Relief:

The basis for the relief request is that the use of an ambient temperature temper bead welding process provides an equivalent acceptable level of quality and safety when compared to the temper bead welding process in ASME Sections XI and III, while offering substantial savings in accumulated radiation dose. In support of this conclusion, the process is described below, followed by technical justification for the differences between the two techniques, as well as the expected dose savings.

1. <u>Description of the process</u>

Figures 1 and 2 provide a general overview of the nozzle and thermowell configurations.

a) The existing piping will be cut away from the nozzle and the nozzle/thermowell cut close to the Pressurizer shell or upper head, as applicable. The nozzle/thermowell will then be ground flush with the Pressurizer shell or upper head, as applicable. The area around the nozzle/thermowell will be prepared for the application of the weld pad by grinding smooth and performing a surface examination (PT or MT) and ultrasonic examination of the area to be welded and the 5 inch wide band surrounding the weld area.

b) A weld pad is applied to the surface of the Pressurizer shell or upper head, as applicable, using the ambient temperature temper bead weld process and GTAW method as described in Code Case N-638-1. The weld pad is applied as a weld buildup centered on the existing opening.

c) The weld pad is prepared suitable for NDE. The pad and its HAZ below the pad are volumetrically examined (UT) to the extent practical. The weld pad and a 5 inch wide band of the Pressurizer shell or upper head, as applicable, surrounding the weld pad are also surface examined (PT or MT). The examinations and acceptance criteria are in accordance with ASME Section III, 1992 Edition, no Addenda, NB-5000.

   Ultrasonic examination, before and after welding, of the full parent material thickness beneath the weld pad, to the extent practical, is performed to discern laminar type indications therein. Laminar type indications observed will be recorded and evaluated to assure the structural integrity of the modified configuration is not adversely affected.

d) The center of the weld pad is ground or machined to re-establish a free path into the Pressurizer penetration. The outer portion of the remaining existing nozzle is removed by machining into the Pressurizer shell or upper head, as applicable. The entire thermowell is removed by machining. The weld pad is prepared to accept the new nozzle/thermowell using a "J" groove partial penetration weld.

e) The new nozzle/thermowell is inserted and welded using conventional welding and

NDE techniques (manual GTAW and progressive PT). Note that this weld is in full ASME construction code compliance and relief from code requirements is not required.

2. Justification

a) As low as reasonably achievable (ALARA)

Experience gained from the performance of similar repairs/modifications at other plants indicates that remote automated repair methods reduce the radiation dose to repair personnel and still provide acceptable levels of quality and safety. CR-3 estimates the dose saved by not providing access, installing heating pads and performing the preheat and post weld heat treatment required by the construction code would be approximately 4.8 to 7.2 REM per location.

b) Procedure Qualification

Results of procedure qualification work undertaken to date on low alloy steel base material indicate that the ambient temperature temper bead process produces sound and tough welds. Industry experience also indicates that the GTAW temper bead process can produce acceptable welds on P-No.3 Group No. 3 as well as P-No.1 Group No. 2 ferritic steel base materials. AREVA NP (AREVA) has qualified the welding process and procedures for this specific application in accordance with Code and Code Case requirements.

AREVA has also performed welding procedure qualifications using machine GTAW ambient temperature temper bead welding on low alloy steel P-No.3 Group No. 3 base materials in accordance with Code Case N-638-1. These qualifications were also performed at room temperature under similar conditions as the current application. The results of similar procedure qualification work indicate that the process produces sound and tough welds.

Other welding procedure qualification work can be compared to the current process. Specifically, the existing Code Case N-638-1 qualifications have also been performed on P-No. 3 Group No. 3 base materials, which have a higher hardenability and propensity for hydrogen embrittlement than the Pressurizer shell and upper head base material (P-No. 1 Group No. 2). These qualifications use the same F-No. 43 filler material (Alloy 52 AWS Class ERNiCrFe-7). This filler material or similar F-No. 43 filler material, Alloy 52M AWS Class ERNiCrFe-7A, will be used in this application with the same low heat input controls. These qualifications did not include a post weld heat soak. The successful qualification of the ambient temperature temper bead welding process demonstrates that the proposed alternative provides an acceptable level of quality and safety.

As previously noted, AREVA has successfully performed a machine GTAW procedure qualification using the same test assembly base material, SA-516 Gr. 70, P-No.1 Group No. 2 base material, as the Pressurizer shell/upper head. Alloy 52 AWS Class ERNiCrFe-7, F-No. 43, filler metal was used. This filler material or similar filler material, Alloy 52M, ERNiCrFE-7A, F-No. 43, will be used for this activity.

c) Weld Quality

The proposed alternative repair technique has been demonstrated as an acceptable method for performing Pressurizer nozzle repairs. The ambient temperature temper bead technique has been approved by the ASME committee per Code Case N−638−1. The ambient temperature temper bead technique has also been previously approved by the NRC as having an acceptable level of quality and safety and used successfully at several utilities (Three Mile Island, CR-3, Millstone, St. Lucie, ANO, South Texas Project and other facilities). This Code Case has been conditionally approved in Regulatory Guide 1.147, Revision 14. This conditional approval indicates that the methodology is capable of producing quality in-situ repairs.

As documented in EPRI Report GC-111050, research shows that carefully controlled heat input and bead placement allow subsequent welding passes to relieve stress and temper the heat affected zone (HAZ) of the base material. The use of the machine GTAW temper bead process will allow precise control of heat input, bead placement, and bead size and contour as compared to the SMAW process. The very precise control over these factors afforded by the machine GTAW process provides effective tempering of the HAZ.

The machine GTAW temper bead process uses a welding process that is inherently free of hydrogen. The GTAW process relies on bare welding electrodes and bare wire filler metal with no flux to introduce moisture. An inert gas blanket provides shielding for the weld and surrounding metal, which protects the region during welding from the atmosphere and any moisture it may contain and typically produces porosity free welds. In accordance with the weld procedure qualification, welding grade argon is used for the inert gas blanket. To further reduce the likelihood of any hydrogen evolution or absorption, specific controls will be used to ensure the welding electrodes, filler metal and weld region are free of all sources of hydrogen. Argon flow rates are adjusted to assure adequate shielding of the weld without creating a venturi affect that might draw oxygen or water vapor from the ambient atmosphere into the weld.

Typically preheat and post weld heat treatment are used to mitigate the effects of the solution of atomic hydrogen in ferritic materials prone to hydrogen embrittlement cracking. The susceptibility of ferritic steels is directly related to their ability to transform to martensite with appropriate heat treatment. The P-No. 1 Group No. 2 material of the Pressurizer is able to produce martensite from heating and cooling cycles associated with welding, however it is much less susceptible to martensite formation than P-No. 3 Group No. 3 base material.

d) Maximum Preheat & Interpass Temperature Measurement

Due to the location of the repair and area radiation dose rate, the placement of thermocouples for monitoring weld interpass temperature is determined to be not beneficial based on dose savings. Therefore, thermocouples are not planned for use to monitor interpass temperature during welding. The location of the Pressurizer ensures that its temperature will be above 50°F prior to welding. The maximum interpass temperatures measured during the Procedure Qualifications were less than 160°F. Temperature measurements, using a contact pyrometer, on the three upper level instrumentation nozzle weld pads in 2003 were less than 150°F.

e) Examination

All examinations will be performed in accordance with ASME Section III, 1992 Edition, NB-5000 as specified in Code Case N-416-2, using personnel qualified in accordance with IWA-2300 and/or NB-5500.

The area to be welded, plus a 5 inch surrounding band, will be surface examined (PT or MT) both prior to and following welding. All post weld exams will be performed on the completed weld no sooner than 48 hour after completion of the third temper bead layer. The entire volume of the weld pad, to the extent practical, will be scanned from the face of the pad, using examination angles of 0°, 45° RL, 60° RL and an OD creeping wave. The examination volume shall include the weld-deposited material and the ferritic vessel HAZ.

Ultrasonic examination, before and after welding, of the full parent material thickness beneath the weld pad, to the extent practical, will be performed to discern laminar type indications therein. Laminar type indications observed will be recorded and evaluated to assure the structural integrity of the modified configuration is not adversely affected.

Because this is a surface application of the temper bead process, there will be minimal impact to the volume of the Pressurizer shell/upper head in the area surrounding the weld. Since this weld is applied to the surface of the Pressurizer shell/upper head only, there is no additional useful information that can be gained by a volumetric examination of the area surrounding the weld. The weld and HAZ below will be post weld volumetrically examined to the extent possible. This reduction in the post welding inspection will provide additional dose reduction for this repair while still ensuring sound weld metal is deposited and that the process has not introduced flaws in the base material.

f) Post Weld Examination 48 Hours Minimum After Completion of the Third Temper Bead Layer

Code Case N-638-1 and IWA-4534(b) impose a 48 hour delay between completion of welding and returning to ambient temperature and final NDE. The 48 hour delay provides time for delayed hydrogen cracking to occur. Code Case N-638-1 requires the machine or automatic GTAW process to be used thereby eliminating the use of welding processes requiring flux for shielding.

As discussed in IV.2.c), the machine GTAW temper bead process uses a welding process that is inherently free of hydrogen and consistently delivers low-hydrogen welds. Furthermore, past industry experience with the use of the machine or automatic GTAW process has resulted in no detection of hydrogen cracking after the 48 hour hold NDE or subsequent in-service inspections.

EPRI Report 1013558, Temperbead Welding Applications, 48 Hour Hold Requirements for Ambient Temperature Temperbead Welding, Technical Update, December 2006, provides justification for reducing the 48 hour hold time on P-No. 3 Group No. 3 ferritic steel base material to start after completion of the third temper bead layer instead of the currently specified hold time in Code Case N-638-1 and IWA-4534(b). Report 1013558 addresses microstructural issues, hydrogen sources, tensile stress and temperature, and diffusivity and solubility of hydrogen in steels.

Also, as discussed in IV.2.c), the Pressurizer shell/upper head ferritic steel is P-No. 1 Group No. 2 carbon steel material, not P-No. 3 Group No. 3 low alloy steel. The P-No. 1 Group No. 2 HAZ is less susceptible to hydrogen induced cracking than P-No. 3 Group No. 3 due to its lower hardenability and propensity to produce untempered martensite.

There is currently an ASME Section XI action to incorporate the revised NDE hold requirement into existing Code Case N-638-3 which is the current published version. This change has been approved by the Main Committee and Board on Nuclear Codes and Standards and will be included in N-638-4.

g) Corrosion

The automated repair method described above leaves an area of ferritic carbon steel at the outside diameter (OD) of the nozzle/thermowell [inside diameter (ID) of the nozzle/thermowell penetration bore] exposed to the primary coolant. The effect of corrosion on the exposed area, including both the reduction in Pressurizer wall thickness and the release rates of Iron (Fe) to the primary coolant is evaluated by AREVA NP and concurred with by CR-3. The analysis shows that the total corrosion is insignificant when compared to the thickness of the Pressurizer shell/upper head. It is also concluded that the total estimated Fe release is significantly less than the total Fe release from all other sources. CR-3 has determined that the expected extremely low rate of material loss and Fe release rates will provide an acceptable level of safety.

h) Stresses

A stress analysis of the modified weld configuration is performed. The stress analysis demonstrates that the modified nozzle configuration complies with the criteria of NB-3000, ASME Section III, 1989 Edition, no Addenda, using design and service conditions applicable to the Pressurizer.

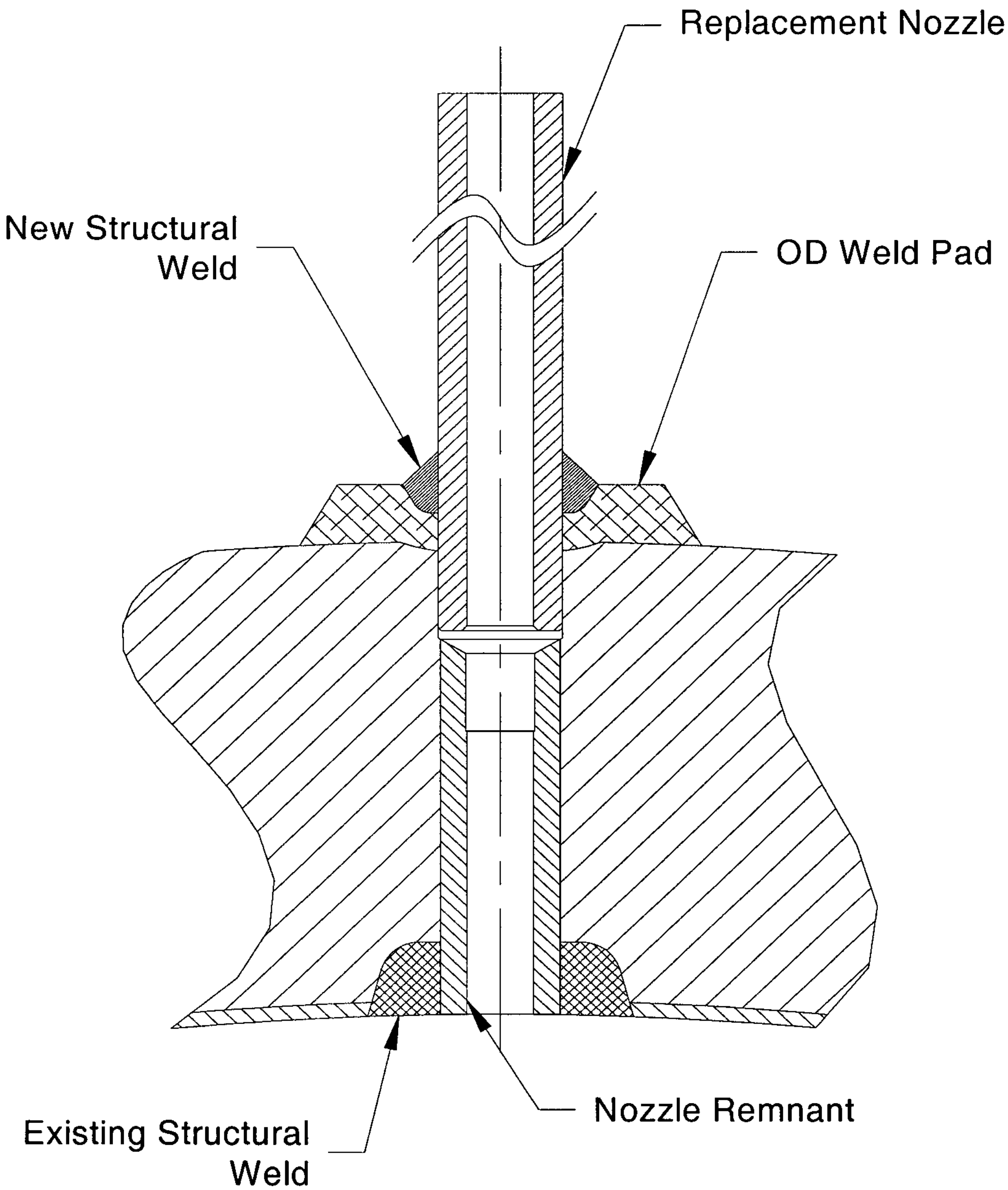
Therefore, based on the discussion above, CR-3 has determined that the proposed alternative provides an acceptable level of quality and safety while reducing radiation exposure to as low as reasonably achievable.

V. Documentation:

The use of the Code Cases and this Relief Request shall be documented on the NIS-2 Form for the repair.

VI. Implementation Schedule:

This relief request is being implemented during the Third Inservice Inspection Interval and it is only applicable to the repairs to the Pressurizer lower level instrument, sampling and vent nozzle and thermowell penetrations.



Half Nozzle Repair

Figure 1

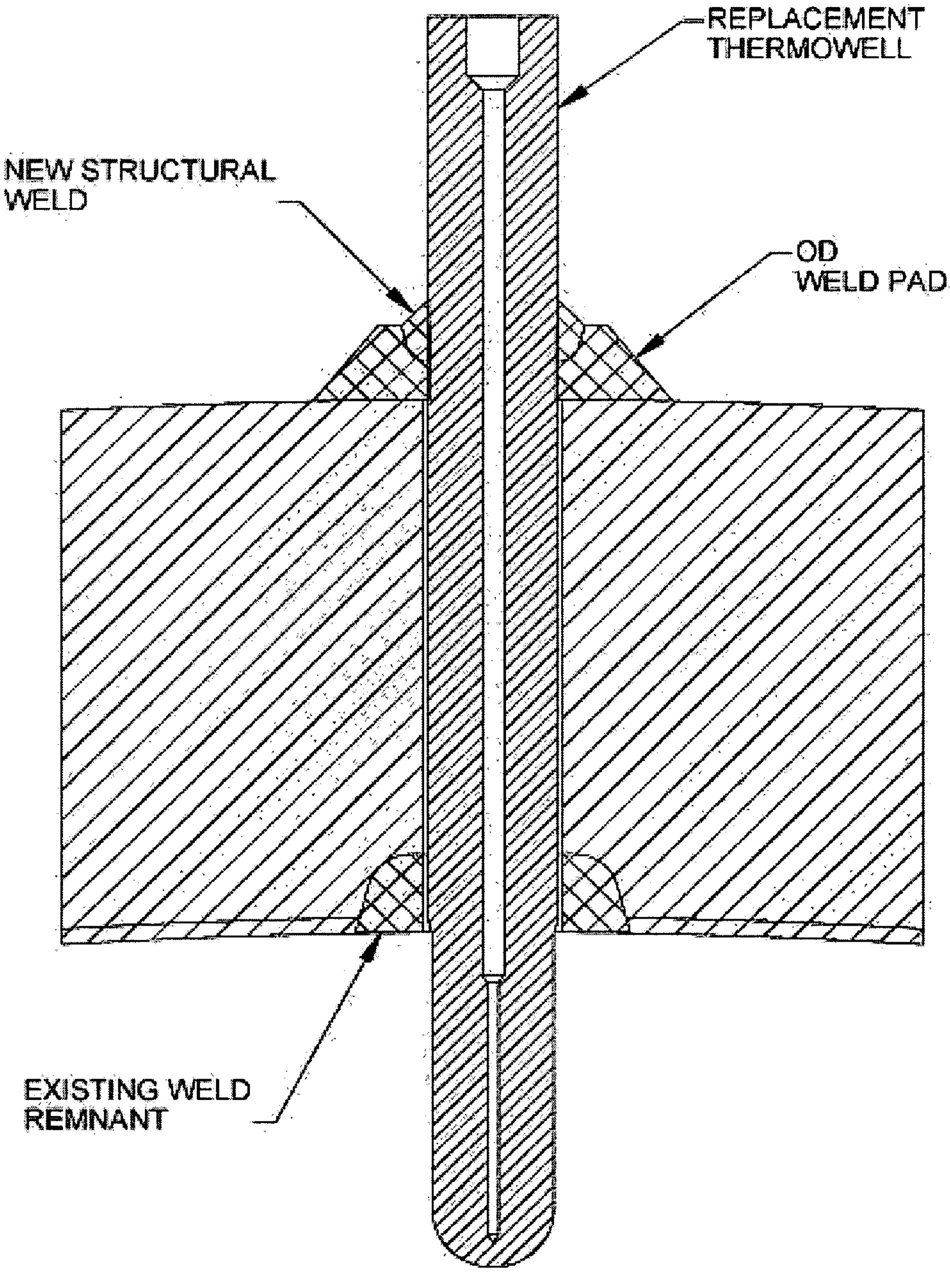

REPLACEMENT THERMOWELL
NEW STRUCTURAL WELD
OD WELD PAD
EXISTING WELD REMNANT
THERMOWELL REPAIR

Figure 2

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50 - 302 / LICENSE NUMBER DPR - 72

ATTACHMENT C

RELIEF REQUEST #07-002-RR, REVISION 0

INSERVICE INSPECTION
RELIEF REQUEST #07-002-RR, REVISION 0
THIRD TEN YEAR INTERVAL

REFERENCE CODE: The American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME), Section XI, 1989 Edition with no Addenda.

I. System/Component(s) for Which Relief is Requested:

a) Name of component:
Pressurizer Lower Level Instrument, Sampling and Vent Nozzle Penetrations and Thermowell Penetration. There are three (3) lower level instrument nozzle penetrations, one (1) sampling nozzle penetration and one (1) thermowell penetration in the shell of the Pressurizer and one (1) vent nozzle penetration in the upper head of the Pressurizer.

b) Function:
The nozzles, thermowell and penetration welds serve as the pressure boundary for the Pressurizer.

c) ASME Code Class:
The Pressurizer, nozzle penetrations and thermowell penetrations are ASME Class 1.

d) Category:
Examination Category B-E, Pressure Retaining Partial Penetration Welds in Vessels; Item No. B4.11 for the modified vent nozzle penetration and original penetration and Item No. B4.13 for the modified lower level instrumentation and sample nozzle penetrations and original penetrations and the modified thermowell penetration and original penetration.

Also Category B-P Items B15.20 and B15.21 applies to the modified locations.

II. Current Code Requirement and Relief Request:

The activity is considered a replacement governed by ASME Section XI. ASME Section XI 1989 Edition, IWA-7320 states welding required for the installation of an item to be used for replacement shall be performed by welders who are qualified, and by using procedures that are qualified, in accordance with ASME Section IX and the additional heat treating and impact tests required by IWB-4000. ASME Section XI, IWB-4000 does not apply as it is limited to repairs to heat exchanger tube or tubesheet bore hole plugging. ASME Section XI, IWA-7510 requires all procedures for installation of items to be used for replacement shall be in accordance with IWA-4100. ASME Section XI 1989 Edition, IWA-4120(a) requires repairs to be made in accordance with the Owner's Design Specification and the original Construction Code of the component or system. Later Editions and Addenda of the Construction Code or of ASME Section III, either in their entirety or portions thereof, and Code Cases may be used. If repair welding cannot be performed in accordance with these requirements, the applicable alternative requirements of IWA-4500 and IWB-4000 may be used for Class 1 components. As stated above, IWB-4000 is not applicable for this activity.

In accordance with the provisions of ASME Section XI 1989 Edition, IWA 4120(c), Florida Power Corporation (FPC), Crystal River Unit 3 (CR-3) will use the 1992 Edition, ASME Section XI, IWA-4310.

IWA-4310 requires in part that, "Defects shall be removed or reduced in size in accordance with this Paragraph." Furthermore, IWA-4310 allows that, "...the defect removal and any remaining portion of the flaw may be evaluated and the component accepted in accordance with the appropriate flaw evaluation rules of ASME Section XI." ASME Section XI, IWA-3300 requires characterization of flaws detected by inservice examination.

CR-3 is requesting relief from ASME Section XI, IWA-3300. It is assumed that flaws in the original Pressurizer Lower Level Instrument, Sampling or Vent nozzle to Pressurizer shell/upper head "J" groove weld and thermowell to pressurizer shell will not be removed. In lieu of fully characterizing the existing cracks, CR-3 proposes to utilize worst-case assumptions to conservatively estimate the crack extent and orientation. CR-3 has determined that the proposed alternative will provide an acceptable level of quality and safety, while allowing significant dose reductions.

III. Alternate Criteria for Acceptability:

In lieu of the requirements of IWA-3300, per 10 CFR 50.55a(a)(3)(i), the following alternative is proposed:

The planned repair for the subject Pressurizer nozzles and thermowell does not include removal of any flaws assumed to be present in the remaining "J" groove partial penetration welds. Therefore, per the requirements of IWA-4310, the cracks must be evaluated using the appropriate flaw evaluation rules of ASME Section XI. In addition, no additional inspections are planned to characterize the cracks. Thus, the actual dimensions of the flaw will not be fully determined. In lieu of fully characterizing the existing cracks, CR–3 will utilize worst-case assumptions to conservatively estimate the crack extent and orientation. The postulated crack extent and orientation will then be evaluated using the rules of IWB-3600.

IV. Basis for Relief:

CR-3 plans to perform Pressurizer nozzle and thermowell penetration repairs as follows:

1. Removal of a portion of the existing nozzle and thermowell.
2. Application of a weld pad or weld buildup (F-No. 43) to the Pressurizer shell/upper head (P-No 1, Group No. 2) base material.
3. Machining the weld pad and bore, as required, to remove the outer portion of the nozzle within the bore and the complete thermowell, and to accept the new half nozzle/complete thermowell (P-No. 43).
4. Installing the replacement half nozzle/complete thermowell by using conventional manual gas tungsten arc welding (GTAW) and a "J" groove partial penetration weld.

The original nozzle(s) and weld(s) and the original thermowell to Pressurizer weld will no longer function as Pressurizer vessel pressure boundary. However, the possible existence of cracks in these welds mandates that the potential for flaw growth be evaluated. The requirements of IWA-4310 allow two options for determining the disposition of discovered cracks. The subject cracks are either removed as part of the repair process or left as-is and evaluated per the rules of IWB-3600. The repair design and the inaccessibility of the inside of the Pressurizer dictated that the inside weld and nozzle portion and the original thermowell to Pressurizer weld be left intact inside the Pressurizer.

The assumptions of IWB-3500 are that the cracks are fully characterized to be able to compare the calculated crack parameters to the acceptable parameters provided in IWB-3500. In the alternative being proposed, the acceptance of the postulated crack is calculated based on the two inputs of expected crack orientation and the geometry of the welds.

Typically, an expected crack orientation is evaluated based on prevalent stresses at the location of interest. Using worst case (maximum) assumptions with the geometry of the as-left weld, the postulated crack is assumed to begin at the intersection of the Pressurizer shell/upper head inner surface and the Pressurizer nozzle/thermowell penetration bore and propagate into the Pressurizer shell/upper head carbon steel. The depth and orientation are worst-case assumptions for cracks that may occur in the remaining "J" groove partial penetration weld configuration. It is assumed that the "as-left" condition of the remaining "J" groove weld includes degraded or cracked weld material.

Fracture mechanics analyses are performed. The analyses determine if degraded "J" groove weld material could remain in the vessel, with no examination to size any flaws that might remain following the repair. Since the hoop stresses in the "J" groove weld are higher than the axial stresses, the preferential direction for cracking is axial, or radial relative to the nozzle/thermowell. It is postulated that a radial crack in the Alloy 182 weld metal would propagate by Primary Water Stress Corrosion Cracking (PWSCC) through the weld to the interface with the carbon steel shell/upper head. It is fully expected that such a crack would then blunt and arrest at the weld-to-shell/upper head interface.

Ductile crack growth through the Alloy 182 material would tend to relieve the residual stresses in the weld as the crack grew to its final size and blunted. Although residual stresses in the shell/upper head material are low, it is assumed that a small flaw could initiate in the carbon steel material and grow by fatigue. It is postulated that the small flaw in the shell/upper head would combine with a large stress corrosion crack in the weld to form a radial corner flaw that would propagate into the carbon steel shell/upper head by fatigue crack growth under cyclic loading conditions. Residual stresses are determined and are included in the analysis.

Flaw evaluations are performed for a postulated radial corner crack. Hoop stresses are used since they are perpendicular to the plane of the crack. The life of the repair is determined based on fatigue crack growth and crack growth per year of operation. It has been calculated as 40 years of additional service. The final flaw size meets the fracture toughness requirements of the ASME Code using an upper shelf value of 200 ksi for ferritic materials. The results of this analysis indicate that it is acceptable to leave the postulated cracks in the attachment weld ("J" groove) for the remaining life of the component.

An additional evaluation is performed to determine the potential for debris damage resulting from a cracked "J" groove partial penetration weld. As noted above, radial cracks are postulated to occur in the weld due to the dominance of the hoop stress at this location. The occurrence of transverse cracks that could intersect the radial cracks is considered remote. There are no identified forces that would drive a transverse crack. Only thermal and welding residual stresses could cause a transverse crack to grow. However, the presence of radial cracks limits the growth potential of the transverse cracks. The radial cracks would relieve the potential transverse crack driving forces. Hence, it is unlikely that a series of transverse cracks could intersect a series of radial cracks resulting in any fragments becoming dislodged. Even though highly unlikely, the analysis assumes worst case configurations of debris are generated by a cracked weld. The analysis concludes that there is an insignificant probability of damage to any Reactor Coolant System (RCS) or Pressurizer component resulting from debris generated because of a cracked weld.

The cited evaluations will provide an acceptable level of safety and quality in insuring that the Pressurizer shell remains capable of performing its design function with flaws existing in the original "J" groove weld.

Justification for Granting Relief

Removal of the cracks in the existing "J" groove partial penetration welds would incur excessive radiation dose for repair personnel. With the installation of the new pressure boundary welds previously described, the original function of the "J" groove partial penetration welds is no longer required. It is well understood that the cause of the cracks in the subject "J" groove welds is Primary Water Stress Corrosion Cracking (PWSCC). As shown by industry experience, the carbon steel shell of the Pressurizer impedes crack growth by PWSCC. CR-3 believes the alternative described will provide an acceptable level of quality and safety when compared to the code requirements in IWB-3500 to characterize the cracks left in service. Using flaw tolerance techniques as was done on previous pressurizer instrument nozzle repair efforts at CR-3, it will be demonstrated that the assumed worst case crack size will not grow to an unacceptable depth into the Pressurizer shell/upper head carbon steel base material over the life of the repair. Thus, the Pressurizer shell/upper head can be accepted per the requirements of IWA-4310.

V. Implementation Schedule:

This relief request is being implemented during the Third Inservice Inspection Interval and it is only applicable to the repairs to the Pressurizer lower level instrument, sampling and vent nozzle and thermowell penetration.