August 1, 2007

Mr. J. A. Stall
Senior Vice President, Nuclear
and Chief Nuclear Officer
Florida Power and Light Company
P.O. Box 14000
Juno Beach, Florida 33408-0420

SUBJECT: ST. LUCIE NUCLEAR PLANT, UNIT 1 - SAFETY EVALUATION FOR RELIEF REQUEST NO. 27 REGARDING EXAMINATION METHODOLOGY OF REACTOR PRESSURE VESSEL FLANGE-TO-UPPER WELD (TAC NO. MD2955)

Dear Mr. Stall:

By a letter dated August 29, 2006, Florida Power and Light Company (the licensee) submitted Relief Request (RR) No. 27 for St. Lucie, requesting relief from reactor pressure vessel flange-to-upper shell weld examination techniques to more recent updated methodologies.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the licensee's proposed alternative and has concluded that pursuant to Title 10 of the *Code Federal Regulation* (10 CFR) Section 50.55a(a)(3)(i) it provides reasonable assurance of quality and safety. Therefore, relief is granted pursuant to 10 CFR 50.55a(a)(3)(i) for the remainder of the third 10-year inservice inspection interval at St. Lucie, Unit 1, as the proposed alternative would provide an acceptable level of quality and safety.

Further details on the bases for the NRC staff's conclusions are contained in the enclosed safety evaluation. If you have any questions regarding this issue, please feel free to contact Brenda Mozafari at (301) 415-2020.

Sincerely,

/RA/

Thomas H. Boyce, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-335

Enclosure: Safety Evaluation

cc w/enclosure: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

THIRD 10-YEAR INTERVAL INSERVICE INSPECTION

REQUEST FOR RELIEF NO. 27

ST. LUCIE PLANT, UNIT 1

FLORIDA POWER AND LIGHT COMPANY

DOCKET NUMBER 50-335

1.0 INTRODUCTION

The staff has reviewed and evaluated the information provided by Florida Power and Light Company (FPL, the licensee) in its letter dated August 29, 2006, which proposed its Third 10-Year Interval Inservice Inspection Program Plan Request for Relief (RR) No. 27 for St. Lucie Plant, Unit 1.

2.0 REGULATORY REQUIREMENTS

Inservice inspection (ISI) of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Class 1, 2, and 3 components is performed in accordance with Section XI of the ASME Code and applicable addenda as required by Title 10 *Code of Federal Regulations* (10 CFR) 50.55a(g), except where specific relief has been granted by the Nuclear Regulatory Commission (NRC) pursuant to 10 CFR 50.55a(g)(6)(i). It states in 10 CFR 50.55a(a)(3) that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if: (i) the proposed alternatives would provide an acceptable level of quality and safety or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components.

The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The ASME Code of record for the St. Lucie

Plant, Unit 1, 10-year interval inservice inspection program, is the 1989 Edition with no Addenda of Section XI of the ASME Code.

3.0 EVALUATION

RR No. 27

ASME Code Components

ASME Code, Section XI, Class 1 Reactor Pressure Vessel (RPV) Flange-to-Upper Shell Weld Number 7-203.

ASME Code Requirements

ASME Code, Section XI, Table IWB-2500-1, Examination Category B-A, Item B1.30 requires essentially 100% volumetric examination of the reactor vessel-to-flange weld in accordance with Appendix I, Article 1-2000.

ASME Code, Section XI, Appendix I, Article 1-2100 requires that volumetric examination of vessel welds greater than 2 inches in thickness be conducted in accordance with ASME Code, Section V, Article 4 as supplemented by Appendix I. Supplements identified in Table 1-2000-1 shall also be applied.

ASME Code Case N-460, *Alternative Examination Coverage for Class 1 and Class 2 Welds*, as an alternative approved for use by the NRC in Regulatory Guide (RG 1.147), Revision 14, *Inservice Inspection Code Case Acceptability*, *Section XI, Division 1*, states that a reduction in examination coverage due to part geometry or interference for any ASME Class 1 or 2 weld is acceptable provided that the reduction is less than 10 percent, i.e., greater than 90 percent examination coverage is obtained.

Licensee's Basis for Relief Request (As Stated)

> FPL is required to perform the UT [ultrasonic] examination of the reactor vessel-to-flange weld in accordance with the requirements of 10 CFR 50.55a, plant Technical Specifications, and the 1989 Edition, No Addenda of the ASME [Code,] Section XI. This [ASME] Code Edition invokes the examination requirements of [ASME Code] Appendix I, Article 1-2000 that essentially prescribes 20-year old examination methodology. The examination is performed from the reactor vessel inside surface and the flange surface. This examination methodology is typically "qualified" by calibration on side drilled holes in a calibration block fabricated from similar material.
>
> In the 1989 Addenda of ASME [Code,] Section XI, a Qualification by performance demonstration [ASME Code, Section XI,] Appendix VIII, approach for UT examinations of reactor vessel welds, excluding the flange to shell weld, was introduced. In September 1999, 10 CFR 50.55a was issued and required an expedited implementation of the ASME

[Code,] Section XI, 1995 Edition with 1996 Addenda, Appendix VIII supplements in accordance with specific dates. Although the reactor flange-to-upper shell weld is excluded from [ASME Code,] Appendix VIII requirements, FPL believes that supplementing the ASME [Code,] Section XI, Appendix I examination from the flange surface with the performance of the reactor vessel inside surface examination using procedures, equipment, and personnel qualified by demonstration in accordance with ASME [Code,] Section XI, 1995 Edition, 1996 Addenda, Appendix VIII, Supplement 4 (clad-base metal interface) and 6 (vessel welds other than clad-base metal interface) surpasses the quality of the generic examination techniques specified by the referencing [ASME] Code Edition and will provide an acceptable level of safety.

ASME [Code,] Section XI, Appendix VIII qualified procedures are technically superior to the standard ASME Code, Section V, Article 4 methodologies that are amplitude based. Enhanced performance is possible by (a) increased sensitivity to flaws, (b) demonstrated flaw measurement capability using amplitude independent sizing techniques, and (c) compatibility of the [ASME Code,] Appendix VIII examination technique with the flange-to-shell weld joint geometry resulting in good ultrasonic beam coverage.

(a) Increased sensitivity to Flaws: An [ASME Code,] Appendix VIII qualified procedure is more sensitive to flaws because the exam sensitivity level compares to the ASME [Code] DAC (distance amplitude correction) level of 10 percent DAC. Previous examinations of the reactor vessel shell welds in accordance with ASME [Code], Section V were conducted at the less sensitive level of 50 percent DAC for flaws located in the outer 80 percent of the material thickness and 20 percent DAC for flaws located from the clad-base metal interface to a depth of about 20 percent thickness (i.e., near surface region).

The [ASME Code,] Appendix VIII qualified procedures offer an additional level of assurance in the detection of flaws because the procedure requires that all signals interpreted by the analyst as flaws, regardless of amplitude response, shall be measured and assessed in accordance with the applicable criteria. The [ASME Code,] Appendix VIII procedure recognizes that some flaws can exhibit low amplitude response depending on orientation. This evidence has not been factored into the ASME [Code] Section V techniques that have traditionally had a flaw response cut-off point of 20 percent DAC.

(b) Demonstrated Flaw Measurement Capability using Amplitude Independent Sizing Techniques: 54-ISI-801, "Automated UT of PWR Vessel Shell Welds" in
accordance with ASME [Code,] Section XI, Appendix VIII, Supplements 4 and 6 was demonstrated in 2004 to the Electric Power Research Institute (EPRI) Performance Demonstration Initiative (PDI). The reference

number for the performance demonstration test is PDQS [Performance Demonstration Qualification Summary] No. 449.

The [ASME Code,] Appendix VIII qualified procedure complies with ASME Code, Section XI, 1995 Edition with 1996 Addenda as modified by 10 CFR 50.55a. The procedure was qualified using tip diffraction sizing techniques, which are amplitude independent. The amplitude based flaw bounding criteria specified in ASME [Code] Section V procedures have been proven inaccurate because the size of the reflection is measured. This may or may not accurately reflect true flaw sizes.

(c) Compatibility of the [ASME Code,] Appendix VIII technique to the flange-to-shell weld joint resulting in good ultrasonic beam coverage and synergy with the previous examination: The [ASME Code,] Appendix VIII, Supplement 4 and 6 qualified examination procedure requires the use of multiple angle beam transducers to examine the weld and heat affected zone. The qualified procedure requires the exam volume to be examined with sound beams in four orthogonal directions, although it has also been successfully demonstrated as a single sided examination technique. The increment size is 0.5 inch for dual side examinations and 0.2 inch for single side examinations. When examination coverage using [ASME Code,] Appendix VIII techniques are combined with the manual examination performed from the flange seal surface, the maximum coverage will be obtained. It is not anticipated that greater coverage could be obtained scanning along the ID [inside diameter] surface by using additional transducers and beam angles due to the fact that the flange taper geometry will partially obstruct the path of all transducers. This is a common limitation for the flange-top-shell weld joint.

The last remote mechanized exam of the flange-to-shell weld was conducted in 1996. At that time 45, 55, and 50/70 degree exam angles were used, and the results were acquired and analyzed using an automated ultrasonic exam system. No indications were found exceeding the allowable limits of Section XI. Scan limitations were reported due to the flange inside surface configuration.

Florida Power & Light will ensure that the flange-to-shell weld is examined from the inside surface with ultrasonic examination techniques qualified by demonstration in lieu of standard amplitude based ultrasonic examination techniques currently specified.

The examination will be conducted to the maximum extent practical in four orthogonal directions. When these results are combined with the manual examination performed from the flange seal surface, the coverage is expected to be 68 percent minimum.

The examination sensitivity and flaw measurement capability of the proposed alternative are superior to the method prescribed and coverage will be acceptable, considering the difficult geometric presentation.

Licensee's Proposed Alternative Examination (As Stated)

FPL requests an alternative to the ASME [Code,] Section XI, Article 1-2100 required examination from the reactor vessel inside surface. FPL proposes supplementing the ASME [Code,] Section XI, 1989 Edition, No Addenda, Appendix I examination from the flange surface with the examination from the reactor vessel inside surface using procedures, equipment, and personnel qualified by demonstration to perform remote mechanized examination of the reactor vessel flange-to-shell weld from the inside surface in accordance with ASME Code 1995 Edition, 1996 Addenda, Section XI, Appendix VIII, Supplements 4 and 6, in lieu of Section V, Article 4 requirements. The ASME [Code,] Section XI, 1995 Edition, 1996 Addenda Appendix VIII qualified procedures, 54-ISI-801, "Automated UT of PWR Vessel Shell Welds," have been demonstrated to perform detection, length sizing and through-wall sizing of reactor vessel shell welds, including those of similar thickness and material composition as the flange-to-shell weld. The procedures, equipment, and personnel for the remote mechanized examination from the inside surface have been qualified by demonstration in accordance with the Performance Demonstration Initiative (PDI) Program.

NRC Staff's Evaluation

In addition to performing the ASME Code-required ultrasonic examination from the flange surface by a manual means, the licensee has proposed to examine the RPV Flange-to-Upper Shell Weld 7-203 from the reactor vessel inside surface by using procedures, equipment, and personnel qualified by PDI. The licensee will use remote mechanized equipment to examine the reactor vessel flange-to-shell weld from the inside surface in accordance with the PDI requirements. In September 1999, 10 CFR 50.55a was issued and required an expedited implementation of the ASME Code, Section XI, 1995 Edition with 1996 Addenda, Appendix VIII supplements in accordance with specific dates and specific components to be examined. The RPV flange-to-upper shell weld was not included in the September 1999, 10 CFR 50.55a PDI requirements.

The licensee noted that the PDI qualified procedures are technically superior to the previous ASME Code, Section V, Article 4 methodologies that are amplitude based. The PDI examinations are more sensitive to identifying flaws, because the examination sensitivity levels, detailed procedure criteria, and blind demonstrations enhance or verify their effectiveness. Prior to implementing PDI examinations, in accordance with ASME Code, Section V, volumetric examinations were conducted at the less sensitive level of 50 percent DAC for flaws located in the outer 80 percent of the material thickness and 20 percent DAC for flaws located from the clad-base metal interface to a depth of about 20 percent of the material thickness. In addition the PDI qualified procedures provide a higher level of flaw probability of detection because all

signals are interpreted as flaws are not dependent on minimum amplitude response. All indications will be measured and assessed in accordance with the applicable criteria.

The NRC staff determined that the licensee's proposed alternative to use the ASME Code, Section XI Appendix VIII examination requirements in the performance of the reactor vessel inside surface volumetric examination surpasses the quality of the examination techniques specified by the 1989 Edition of Section V of the ASME Code. Therefore, the licensee's proposed alternative and the ASME Code-required manual examinations from the flange surface provide reasonable assurance of quality and safety of the RPV Flange-to-Upper Shell Weld Number 7-203.

4.0 CONCLUSION

The NRC staff has reviewed the licensee's submittal and concludes that the licensee's proposed alternative provides reasonable assurance of quality and safety and is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the third 10-year ISI interval at St Lucie, Unit 1.

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Date: August 1, 2007

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