



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

February 12, 2009

Mr. Mano Nazar  
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 PLANT, UNIT 1 – RELIEF REQUEST NO. 3, REQUEST FOR  
ALTERNATIVE TO ASME CODE, SECTION XI REPAIR REQUIREMENTS FOR  
REFUELING WATER TANK BOTTOM (TAC NO. MD9268)

Dear Mr. Nazar:

By letter dated April 9, 2008, as supplemented by letter dated September 29, 2008, Florida Power & Light Company (FPL), the licensee, submitted Relief Request No. 3, “Alternative to ASME Code, Section XI Repair Requirements for Refueling Water Tank Bottom.” The licensee requested relief from certain American Society of Mechanical Engineers Boiler and Pressure Vessel Code requirements at St. Lucie, Unit 1.

FPL installed a reinforced vinyl ester liner on the bottom of the St. Lucie, Unit 1 Refueling Water Tank (RWT) in 1994. The Nuclear Regulatory Commission (NRC) previously approved the use of this liner as an alternative non-Code repair for the second and third 10-year inservice inspection intervals. Relief Request No. 3 was submitted to address the use of the installed RWT liner during the fourth 10-year inspection interval. Based on the enclosed safety evaluation, the staff finds the Inservice Inspection Program Request for Alternative acceptable pursuant to Title 10 of the Code of Federal Regulations, Section 50.55a(a)(3)(i).

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 Siva Lingam at (301) 415-1564.

Sincerely,

A handwritten signature in black ink, appearing to read "TH Boyce".

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

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

INSERVICE INSPECTION PROGRAM RELIEF REQUEST NO. 3

ST. LUCIE PLANT, UNIT 1

FLORIDA POWER AND LIGHT COMPANY.

DOCKET NO. 50-335

**1.0 INTRODUCTION**

By letter dated April 9, 2008, as supplemented by letter dated September 29, 2008, the Florida Power & Light Company (FPL, the licensee) requested relief from certain American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code requirements at St. Lucie, Unit 1. FPL installed a reinforced vinyl ester liner on the bottom of the St. Lucie, Unit 1 Refueling Water Tank (RWT) in 1994. The Nuclear Regulatory Commission (NRC) approved the use of this liner as an alternative non-Code repair for the second and third 10-year inservice inspection (ISI) intervals via approval of Relief Request (RR) 13, RR-07, and RR-7A. RR-3 was submitted to address the use of the installed RWT liner during the fourth 10-year inspection interval. Relief was requested from the Repair and/or Replacement requirements of the ASME Boiler and Pressure Vessel Code, Section XI, 2001 Edition through the 2003 Addenda, Articles IWA-4000 and IWC-3000. In particular, FPL proposed to leave the installed fiberglass-reinforced vinyl ester liner in place on the St. Lucie, Unit 1 RWT bottom, and to consider this installation as an alternative design equivalent to an ASME Code repair or replacement of the RWT bottom. In support of this request, FPL proposed to continue to use an augmented inspection program for the bottom liner installation.

**2.0 REGULATORY EVALUATION**

Title 10 of the Code of Federal Regulations (10 CFR), Section 50.55a(g)(4), requires, in part, that "throughout the service life of a boiling or pressurized water-cooled nuclear power facility, components (including supports) which are classified as ASME Code Class 1, Class 2 and Class 3 must meet the requirements . . . set forth in Section XI of editions of the ASME Boiler and Pressure Vessel Code . . . to the extent practical within the limitations of design, geometry, and materials of construction of the components." However, 10 CFR 50.55a(a)(3)(i) allows alternatives to the requirements of Section XI of the ASME Code, when an applicant can demonstrate that the alternative program will provide an acceptable level of quality and safety in lieu of complying with the requirements in Section XI.

The licensee submitted the subject relief request, pursuant to 10 CFR 50.55a(a)(3)(i), which proposed an alternative to the implementation of the ASME Boiler and Pressure Vessel Code,

Enclosure

Section XI, 2001 Edition through the 2003 Addenda, Articles IWA-4000 and IWC-3000. In particular, FPL proposed to leave the installed fiberglass-reinforced vinyl ester liner in place on the St. Lucie, Unit 1 RWT bottom, and to consider this installation as an alternative design equivalent to an ASME Code repair or replacement of the RWT bottom. In support of this request, FPL proposed to continue to use an augmented inspection program for the bottom liner installation during the fourth 10-year inspection interval, which begins on February 11, 2008, and ends on February 10, 2018.

### 3.0 BACKGROUND

In July 1993, a small leak approximately 3/16 inch in diameter was discovered in an area on the RWT bottom near the east side of the tank. The failure mechanism was galvanic corrosion (resulting from a galvanic couple between the exterior surface of the RWT aluminum alloy floor and the surrounding copper ground grid), which was manifested as pitting type attack. The root cause of the failure was determined to be the absence of a seal between the tank bottom plates and the concrete ring wall, which permitted the periodic ingress of water into the sand/oil cushion layer beneath the tank. This water likely contained dissolved salts that had been formerly deposited on the tank walls and in the surrounding earth. As this water permeated the sand layer beneath the tank, it rendered the soil more conductive, thus increasing the susceptibility of the exterior of the tank floor plates to corrosive galvanic attack. The root cause evaluation included a recommendation for installation of a joint sealing compound between the tank bottom plates and the concrete ring wall to prevent further ingress of water. This installation was performed via a controlled Work Order. Additionally, the area around the RWT was regraded to prevent standing water from rising to a level above the top of the ring wall foundation. Elimination of water from the sand layer beneath the tank will arrest further galvanic corrosion by eliminating the conductive electrolyte in contact with the tank floor and the ground grid. Further corrosion due to the presence of salts in the sand layer will be minimal if further water ingress is prevented.

RR-13, dated July 30, 1993, was submitted to the NRC requesting NRC approval for a non-Code repair involving the use of an epoxy coating to adhere an aluminum plate to the tank bottom over the hole. The non-Code repair was implemented using a 1/8-inch thick, 3-inch diameter piece of aluminum plate and Duromar SARUW epoxy. Additional testing confirmed that there was no further leakage from the identified location. In the RR, FPL committed to providing an ASME Code acceptable repair during the unit's fall 1994 refueling outage (SL1-13).

Engineering documents were prepared to support the implementation of a permanent ASME Code repair during the SL1-13 refueling outage. This repair, as designed, involved removal of the section of the bottom plate that contained the identified leak, and welding of a new 1/4-inch aluminum plate section to the existing bottom plate to cover the opening left by the removal of the temporarily repaired plate. When the bottom plate section was removed from the RWT bottom during the fall 1994 outage, visual inspection revealed corrosion on the exterior surface, scattered pitting, and patches of a loosely adherent white corrosion product (likely aluminum oxide). During the installation of the new plate section, difficulties were experienced in completing the ASME Code repair. The thinning of the base material, coupled with conditions associated with welding inside the contaminated environment, led to localized defects. This resulted in an inability to qualify the welds; for this reason, the ASME Code repair could not be implemented.

As an alternative to the ASME Code repair, a fiberglass reinforced vinyl ester liner (Protecto-Line 800 system, manufactured by Dudick, Inc.) was applied to the inside surface of the RWT bottom. The liner system is a 1/8-inch (approximate) thick coating consisting of a prime coat, a troweled base coat with a layer of fiberglass roving, and a top coat. Prior to application, the aluminum surfaces to receive the liner were abrasive blasted to obtain the specified surface profile and anchor pattern. The surface was inspected to ensure proper preparation for the application of the coating. The liner was applied over the entire tank bottom, and extended approximately 24-inches up the tank wall. The liner was visually inspected to verify proper installation. The installation of this liner system was performed during the fall 1994 SL1-13 refueling outage. The liner installation was a non-Code repair. For this reason, FPL submitted RR-13A dated November 16, 1994, to the NRC for approval of the use of this liner. The NRC granted relief to install and use the Protecto-Line 800 system in a letter and safety evaluation dated November 25, 1994. The RWT was placed in service immediately following the installation and inspection of the liner material; the liner system has satisfactorily performed its required functions since its installation.

Laboratory test results of the physical properties provided the necessary confirmation of the ability of the Dudick system to perform its intended functions as a liner for the RWT. Samples of the liner material (primer, coatings, filler, hardener, and fiberglass roving) were subjected to chemical analysis to confirm the composition of the liner materials, and to determine whether the amounts of impurities in the materials are within the limits specified in plant procedures for materials used in the primary system. The results of this testing were documented and indicated that the Dudick Protecto-Line 800 liner is composed of materials specified by Dudick, Inc., and that the levels of impurities in the material are within the specified limits.

#### 4.0 TECHNICAL EVALUATION

##### 4.1 Component Affected

The RWT is an above ground storage tank which provides a source of primary grade borated water for refueling, reactor coolant makeup, and reactivity control during plant operations, and accident conditions. The RWT is a Quality Group B, ASME Code Class 2 structure, and was designed and erected in accordance with American National Standards Institute (ANSI) B96.1-1967.

##### 4.2 ASME Code Requirements for which Relief was Requested

Relief was requested from the Repair and/or Replacement requirements of the ASME Boiler and Pressure Vessel Code, Section XI, 2001 Edition through the 2003 Addenda, Articles IWA-4000 and IWC-3000.

Subparagraph IWC-3132 of the 2001 Edition through the 2003 Addenda of ASME Code Section XI states that relevant flaws that are detected in ASME Code Class 2 structures or components as a result of an inservice visual examination shall be unacceptable for continued service unless it is demonstrated that the flaws are acceptable by "Supplemental Examination," "Corrective Measures or Repair Replacement," or "Evaluation."

Article IWA-4000 of the 2001 Edition through the 2003 Addenda of ASME Code Section XI provides the general and specific requirements for performing welded repairs of ASME Code Class 2 components that do not meet the acceptance standards for continued service contained in Subparagraph IWC-3132 to the 2001 Edition through the 2003 Addenda of ASME Code Section XI.

#### 4.3 Duration of Relief Request

This RR for St. Lucie, Unit 1 is applicable to its fourth 10-year ISI interval, which began on February 11, 2008, and ends on February 10, 2018.

#### 4.4 Proposed Alternative Program

Relief was requested from the Repair and/or Replacement requirements of the ASME Code, Section XI, 2001 Edition through the 2003 Addenda, Articles IWA-4000 and IWC-3000. In particular, FPL proposed to leave the installed fiberglass-reinforced vinyl ester liner (installed in 1994) in place on the St. Lucie, Unit 1 RWT bottom, and to consider this installation as an alternative design equivalent to an ASME Code repair or replacement of the RWT bottom. In support of this request, FPL proposed to continue to use an augmented inspection program for the bottom liner installation.

#### 4.5 Licensee's Basis for the Relief Request

Inspections of the RWT liner have been performed in accordance with the approved augmented inspection program. Based on the results of these inspections, FPL requested NRC approval for continued use of the installed fiberglass-reinforced vinyl ester liner during the fourth 10-year ISI interval (beginning 2/11/08) as an approved alternative design equivalent to an ASME Code repair or replacement of the RWT bottom. In support of this request, FPL proposed to continue the augmented inspection program in accordance with the previously approved schedule. This will require that the RWT be drained and a hands-on inspection of the liner performed every sixth refueling outage (approximately once every 9 years). The next hands-on inspection would occur at SL1-26. During refueling outages for which a hands-on inspection is not performed, a remote visual inspection is required. (Note that the remote visual inspections may be performed with the unit on-line, within a period approximately 3 weeks before or following the designated refueling outage.) The water level in the RWT is monitored by four Rosemount level transmitters. St. Lucie, Unit 1 Technical Specification 4.5.4 requires that the RWT be demonstrated to be operable at least once every 7 days (while in Modes 1 - 4) by verifying the water level in the tank. Although the Technical Specification action statement would not be entered until the tank volume becomes less than the minimum value (401,800 gallons of borated water), any continuous reduction in tank inventory would be noticed by Operations. This is the means by which the original RWT leak was discovered in 1993. A review of the condition report database has shown no evidence of such inventory loss. Thus, there is no evidence of leakage from the St. Lucie, Unit 1 RWT.

The use of the RWT liner with the continuation of the augmented inspection schedule is considered acceptable for the following reasons:

Special process controls were used during installation (under the direct supervision of the Nuclear Coatings Specialist).

The material of the liner, as verified through laboratory testing.

The historical performance of the liner.

The results of the inspections performed to date.

The nature of the water stored in the tank.

Also, should any RWT liner inspections indicate unacceptable results, or if there are any documented occurrences of leakage through the RWT bottom, the inspection schedule (and types of inspections required) shall be revised as follows: a full hands-on inspection shall be performed during the first refueling outage following the unacceptable inspection results or documented leakage, and during every third refueling outage thereafter (through the end of the fourth 10-year ISI interval).

#### **4.6 Staff Evaluation of the Requested Alternative Program**

The RWT is an above ground aluminum tank sitting on a sand bed and supported by a concrete ring foundation. The RWT is a Quality Group B, ASME Class 2 structure constructed in accordance with ANSI B96.1-1967. A copper ground grid is below the tank and the licensee has reported that there has been a galvanic coupling between the tank bottom and the ground grid.

The RWT was drained in 2005 (six operating cycles after the original hands-on inspection) and inspected by the Nuclear Coatings Specialist and an Engineering representative. The liner met the acceptance criteria for all of the properties listed below, and showed no degradation that could affect its ability to perform its required functions. FPL performed nondestructive tests of the coating liner to test the liner for acceptability of the following conditions and properties: hardness, delamination, adhesion, peeling, flaking, undercutting, blistering, cracking, discoloration, holidays (i.e., voids), and pinholes.

The NRC previously approved the installation of the fiberglass reinforced vinyl ester as an acceptable alternate repair method by safety evaluation dated November 25, 1994. The current liner inspection program, approved in the NRC safety evaluation of June 22, 2001, for the third 10-year ISI interval consists of the following inspections of the RWT:

Beginning with the fall 2008 refueling outage (SL1-22), and during every refueling outage for which a full, hands-on inspection is not scheduled a remote visual inspection of the RWT liner will be performed. Inspections will be performed or observed by the Nuclear Coatings Specialist (or designee) and an Engineering representative.

Draining of the borated water inventory of the tank and performing a full hands-on examination of the RWT during every sixth refueling outage (the next hands-on

inspection would occur at SL1-26). Inspections will be performed or observed by the Nuclear Coatings Specialist (or designee) and an Engineering representative.

Should any RWT liner inspections indicate unacceptable results, or if there are any documented occurrences of leakage through the RWT bottom, the inspection schedule (and types of inspections required) shall be revised as shown in Section 4.5 above.

The proposed inspection schedule outlined above is only applicable through the end of the fourth 10-year ISI interval. A separate submittal must be made to the NRC regarding a proposed inspection schedule for the period beginning with the fifth 10-year ISI interval (which begins on February 11, 2018), if the licensee intends to continue utilizing the installed non-Code repair. The proposed inspection schedule must be based on the results of inspections performed up to the time of submittal, along with the documented performance of the RWT liner.

Previous remote visual and full hands-on inspections and hands-on testing of the liner have indicated that the alternative vinyl ester coating repair is performing as expected. Previous independent test laboratory results of the liner material confirmed that the correct lining material was used. In addition, the proposed inspection schedule calls for FPL to continue its inspections of the caulking material between the RWT bottom and the concrete foundation ring wall on an annual basis. The inspection of the caulking material between the RWT bottom and the concrete ring wall will improve the chances that the sand bed will remain dry and that galvanic corrosion effects will not be significant.

#### 4.0 CONCLUSION

Based on the discussion above, the staff concludes that the fiberglass reinforced vinyl ester liner in the RWT is performing as expected and is structurally acceptable for continued service and will provide an acceptable level of quality and safety. The staff's conclusion is predicated on the licensee's continued implementation of the liner inspection program specified in the April 9, 2008, and September 29, 2008 submittals. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the proposed RR-3 for the use of this liner as an alternative non-Code repair of the RWT. This RR is authorized for the St. Lucie, Unit 1 fourth 10-year ISI interval that began on February 11, 2008 and ends on February 10, 2018.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Principle Contributor: Edward Andruszkiewicz

Date: February 12, 2009

February 12, 2009

Mr. Mano Nazar  
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 PLANT, UNIT 1 – RELIEF REQUEST NO. 3, REQUEST FOR  
ALTERNATIVE TO ASME CODE, SECTION XI REPAIR REQUIREMENTS FOR  
REFUELING WATER TANK BOTTOM (TAC NO. MD9268)

Dear Mr. Nazar:

By letter dated April 9, 2008, as supplemented by letter dated September 29, 2008, Florida Power & Light Company (FPL), the licensee, submitted Relief Request No. 3, "Alternative to AMSE Code, Section XI Repair Requirements for Refueling Water Tank Bottom." The licensee requested relief from certain American Society of Mechanical Engineers Boiler and Pressure Vessel Code requirements at St. Lucie, Unit 1.

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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 Siva Lingam at (301) 415-1564.

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/encl: Distribution via Listserv

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