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

May 31, 2019

Mr. Don Moul
Vice President, Nuclear Division
and Chief Nuclear Officer
Florida Power & Light Company
Mail Stop NT3/JW
15430 Endeavor Drive
Jupiter, FL 33478

SUBJECT: ST. LUCIE PLANT, UNIT NO. 1 – SAFETY EVALUATION FOR RELIEF REQUEST NO. 6 FOR THE FIFTH 10-YEAR INSERVICE INPECTION INTERVAL (EPID L-2018-LLR-0116)

Dear Mr. Moul:

By letter dated August 31, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18243A030), as supplemented by letters dated September 28, 2018, and March 7, 2019 (ADAMS Accession Nos. ML18271A093 and ML19066A011, respectively), Florida Power & Light Company (the licensee) submitted Relief Request No. 6 for the fifth 10-year inservice inspection interval of St. Lucie Plant, Unit No 1. Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), the licensee proposed to leave a fiberglass-reinforced vinyl ester liner that was installed on the refueling water tank bottom internal surface in 1994 in place and to consider this installation as an alternative to the repair requirements specified in American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Articles IWA-4000 and IWC-3000 on the basis that the alternative provides an acceptable level of quality and safety.

The Nuclear Regulatory Commission staff reviewed the submittal and, as set forth in the enclosed safety evaluation, concludes that the licensee's proposed alternative to the ASME Code, Section XI, provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(z)(1), the NRC staff authorizes the use of the proposed alternative for the fifth inservice inspection interval of St. Lucie Plant, Unit No. 1, which is scheduled to end on February 10, 2028.

If you have any questions regarding this issue, please contact the project manager, Mr. Michael Wentzel, at (301) 415-6459 or by e-mail at Michael.Wentzel@nrc.gov.

Sincerely,

Undine Shoop, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-335

Enclosure:
Safety Evaluation

cc: Listserv

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO RELIEF REQUEST NO. 6

FIFTH 10-YEAR INSERVICE INSPECTION INTERVAL

FLORIDA POWER & LIGHT COMPANY

ST. LUCIE PLANT, UNIT NO. 1

DOCKET NO. 50-335

1.0 INTRODUCTION

By letter dated August 31, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18243A030), as supplemented by letters dated September 28, 2018, and March 7, 2019 (ADAMS Accession Nos. ML18271A093 and ML19066A011, respectively), Florida Power & Light (the licensee) submitted its Relief Request No. 6 for the fifth 10-year inservice inspection (ISI) interval of St. Lucie Plant, Unit No. 1 (St. Lucie 1). The request addresses the fiberglass-reinforced vinyl ester liner that was installed on the refueling water tank (RWT) bottom internal surface in 1994. The Nuclear Regulatory Commission (NRC) staff's authorization for the liner installation is documented in the safety evaluation dated November 25, 1994 (ADAMS Accession No. ML17228A925).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), the licensee proposed to leave the liner in place on the RWT bottom and to consider this installation as an alternative to the repair requirements specified in American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Articles IWA-4000 and IWC-3000, on the basis that the alternative provides an acceptable level of quality and safety.

2.0 REGULATORY EVALUATION

Components (including supports) that are classified as ASME Code Class 1, Class 2, and Class 3 must meet the requirements in 10 CFR 50.55a(g)(4), "Inservice inspection standards requirement for operating plants," throughout the service life of a boiling- or pressurized-water reactor, to the extent practical, within the limitations of design, geometry, and materials of construction of the components. The exception is the design and access provisions and preservice examination requirements set forth in Section XI of editions and addenda of the ASME Code that become effective subsequent to editions specified in paragraphs (g)(2) and (3) of 10 CFR 50.55a and that are incorporated by reference in paragraph (a)(1)(ii) or (iv) for snubber examination and testing of 10 CFR 50.55a.

The provision in 10 CFR 50.55a(z)(1) allows that alternatives to the requirements of paragraph (g) of 10 CFR 50.55a may be used, when authorized by the NRC, if the licensee demonstrates that the proposed alternative provides an acceptable level of quality and safety.

Based on the foregoing discussion and subject to the following technical evaluation, the NRC staff finds that regulatory authority exists for the licensee to request the use of an alternative and for the staff to authorize the proposed alternative.

3.0 TECHNICAL EVALUATION

3.1 ASME Code Component(s) Affected

The affected component is the RWT, which is an above-ground aluminum storage tank and 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 an ASME Code Class 2 component. The RWT is also described in St. Lucie 1 Updated Final Safety Analysis Report Section 6.3.2.2.1 (ADAMS Accession No. ML18320A265).

3.2 Applicable ASME Code Edition and Addenda

The applicable Code of record for St. Lucie 1 is the 2007 Edition through the 2008 Addenda of ASME Code, Section XI, as incorporated by reference in 10 CFR 50.55a.

3.3 Applicable ASME Code Requirements

Articles IWA-4000 and IWC-3000 of ASME Code, Section XI specify the requirements for repair and replacement activities that are applied to the subject RWT. Subparagraphs IWC-3132.1, 3132.2, and 3132.3 indicate that relevant flaws that are detected in ASME Code Class 2 structures and components, as a result of 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 analytical evaluation. In addition, Article IWA-4000 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 paragraph IWC-3132.

3.4 Reason for Request

In July 1993, the licensee detected a small pin-hole leak (approximately 3/16 inch in diameter) in an area on the RWT bottom. A code repair of the RWT bottom was attempted in the Fall 1994 Refueling Outage (Refueling Outage SL1-13). The repair, as designed, involved the removal of the section of the bottom plate that contained the identified leak and the welding of a new aluminum plate section to the existing bottom plate to cover the opening left by the removal of the unacceptable section of the tank bottom. The licensee stated that during the installation of the new plate section, difficulties were experienced in completing the Code repair. The wall-thinning of the base material, coupled with conditions associated with welding inside the contaminated environment, led to localized defects. These conditions resulted in an inability to qualify the welds. Therefore, the code repair could not be implemented satisfactorily.

As an alternative to the Code repair, a fiberglass-reinforced, vinyl ester liner was applied to the internal surface of the RWT bottom. 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 RWT was placed in service immediately following the installation and

inspection of the liner material. The NRC authorized the use of the RWT liner, along with an augmented inspection program, in lieu of a Code repair or replacement for the remainder of the second 10-year ISI interval. The NRC authorization is documented in the letter dated November 25, 1994.

The licensee stated that the liner system has satisfactorily performed its required functions since its installation. Subsequent relief requests were submitted and authorized by the NRC for consideration of this installation as an alternative design equivalent to a Code repair or replacement of the RWT bottom. Among the related previous requests, Relief Request 3 addressed the use of the liner for the fourth 10-year ISI interval, as documented in the licensee's letters dated April 9, 2008 and September 29, 2008 (ADAMS Accession Nos. ML081120115 and ML082750040, respectively). The NRC staff's authorization of Relief Request 3 is documented in the letter dated February 12, 2009 (ADAMS Accession No. ML090410362). This relief request (Relief Request 6) proposes to continuously use the liner for the fifth 10-year interval.

3.5 Licensee's Proposed Alternative

This relief request proposes to leave the liner in place on the St. Lucie 1 RWT bottom, along with an augmented inspection program, in lieu of a Code repair or replacement for the fifth 10-year interval. The proposed augmented inspection program is the same as that used in the previous relief request for the fourth 10-year interval (Relief Request 3). Table 1 describes the specific inspection schedule for the fifth interval (February 11, 2018 – February 10, 2028).

Table 1. Proposed RWT Inspections for the Fifth Interval

Refueling Outage	Remote Visual Inspection	Full Hands-on Inspection
SL1-29	-	To be conducted
SL1-30	To be conducted	-
SL1-31	To be conducted	-
SL1-32	-	To be conducted
SL1-33	To be conducted	-
SL1-34	To be conducted	-
SL1-35	-	To be conducted

3.6 Licensee's Basis of the Proposed Alternative

Pursuant to 10 CFR 50.55a(z)(1), the licensee requested the relief on the basis that the proposed alternative will provide an acceptable level of quality and safety. In its basis, the licensee described the liner installation process, the previous approvals for installation and use of the liner, and the inspection program to monitor the condition of the liner. The licensee's basis of the proposed alternative is summarized below.

The RWT is an above-ground aluminum tank. The RWT base is anchored to the ring wall foundation and the tank bottom is continuously supported by structural fill material. The liner was applied over the entire tank bottom internal surface and extended approximately 24 inches up the tank wall during the fall 1994 refueling outage. The installation process was performed

via a controlled engineering document for plant change/modifications. Special process controls included applicator certification and training, as well as quality control hold-point inspections for environmental conditions, surface preparation, mixing, and testing. The tank surface to which the liner was applied was sandblasted and visually inspected to confirm proper surface preparation.

The installation process also involved up-front vendor testing of the material, post-installation testing of the installed liner, and additional testing and evaluation of the physical and chemical properties of the liner material to confirm the adequacy of the product for its intended use. The installed liner was also subjected to millage testing to confirm required thickness, and high-voltage spark testing to confirm the absence of holidays and pinholes.

The installation and use of the liner are documented in previous relief requests and associated NRC approvals. The NRC letters, which authorized the previous relief requests, include the following: (a) letter dated November 25, 1994 for the second inspection interval; (b) letter dated June 22, 2001 for the third inspection interval (ADAMS Accession No. ML011710149); and (c) letter dated February 12, 2009 for the fourth inspection interval.

Following the initial installation, the licensee implemented an NRC-approved inspection program that consisted of full hands-on inspections and remote visual inspections. The full hands-on inspection is a visual inspection to detect liner degradation and is enhanced, as required, by limited physical testing to evaluate specified properties of the liner (e.g., knife test for aluminum/liner interface adhesion; and sounding test with a hammer to detect delamination). These hands-on inspections are performed while the tank is drained. During all operating cycles in which a hands-on inspection is not performed, a remote visual inspection is performed by utilizing a camera on a remote-controlled submersible device.

In this current relief request, the license proposed an inspection schedule for the RWT, as described in Table 1 above, for the fifth 10-year ISI interval (February 11, 2018–February 10, 2028). A full hands-on inspection will be performed every third refueling outage and a remote visual inspection will be performed during the refueling outages in which a full hands-on inspection is not performed, consistent with the NRC-approved inspection program and criteria.

There is no specific projected service life for the tank liner provided by the liner manufacturer. This liner material is commonly used for extreme chemical conditions (i.e., an environment more severe than that in the RWT). The vinyl ester material used for the liner has good-to-excellent chemical resistance to 10-percent solutions of acids, and excellent resistance to mineral acids, such as boric acid. St. Lucie 1 Technical Specification (TS)-required RWT concentration of 1900 parts-per-million (ppm) boric acid is much less than the 10-percent concentration evaluated above. Thus, the conditions in the RWT are considered mild compared to the conditions for which the manufacturer recommends use of this liner material.

The inspection program, which has previously been used and is proposed for use during the fifth 10-year ISI inspection interval, is designed to detect any minor defects in the liner material prior to the failure of the liner. Thus, the inspection program, in conjunction with the monitoring of the RWT water level, will provide indications if the liner begins to approach the end of its effective service life. This methodology is consistent with industry standards and NRC-approved safety related coatings inspection programs.

The water level in the RWT is monitored by four water level transmitters. TS 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. During the water-level monitoring, any continuous reduction in tank inventory would be identified by the plant personnel. A review of the operating experience database has shown no evidence of such inventory loss. Thus, there is no evidence of leakage from the St. Lucie 1 RWT.

3.7 Duration of the Proposed Alternative

The duration of the relief request is the fifth 10-year ISI interval of St. Lucie 1, which began on February 11, 2018, and is scheduled to end on February 10, 2028.

3.8 NRC Staff Evaluation

The licensee applied the fiberglass-reinforced vinyl ester liner on the St. Lucie 1 RWT bottom internal surface in 1994, as approved in the NRC safety evaluation dated November 25, 1994. The licensee has continuously used the liner since its application. The most recent authorization for the use of the liner is for the fourth interval, as documented in the NRC safety evaluation dated February 12, 2009. In this current relief request, the licensee proposed to use the RWT bottom liner for the fifth interval, consistent with the approaches of the previously authorized relief requests for the use of the liner.

The NRC staff previously accepted the licensee's approach of using physical and chemical tests for the liner to confirm that the quality of the applied liner meets the manufacturer's specifications. The licensee clarified that the liner does not have a specific service life and that the borated-water environment inside the tank is not conducive to significant degradation in the liner, as confirmed by industry operating experience and plant-specific inspection results. In addition, the licensee has continued to use the liner since installation. Therefore, the technical evaluation of the NRC staff for this request focused on the inspection activities to detect and monitor potential degradation of the tank liner and base material as further described below.

TS 4.5.4 requires that the operability of the RWT be demonstrated by verifying the water level in the tank in accordance with the Surveillance Frequency Control Program. In its relief request, the licensee stated that, in accordance with the TS requirements, the operability of the RWT will be demonstrated at least once every 7 days (while in MODES 1–4) by verifying the water level in the tank. The NRC staff finds that the TS requirements for monitoring the tank water level provides reasonable assurance that potential leakage due to degradation in the liner-applied tank will be detected in a timely manner. Therefore, a significant adverse impact will not occur on the safety function of the RWT.

The licensee also provided the following information related to the inspections of the RWT exterior surfaces: The exterior of the RWT wall is inspected as part of the System and Component Engineering walkdown program. The system walkdowns are performed on a quarterly basis and the RWT is included in System 07 (Containment Spray System). The walkdown reports for this system document inspections for leakage, evidence of corrosion, and surface condition (i.e., pits and gouges) of the RWT. The most recent walkdown report for the system indicated acceptable inspection findings for these criteria.

In addition, the licensee stated that, as part of the Chemistry Department Groundwater Protection Program, the ground water in the vicinity of the RWT is monitored for potential contamination. The licensee explained that it monitors a recovery well and two monitoring wells adjacent to the tank at least quarterly and that this monitoring can provide additional indication of a potential leak.

The NRC staff finds that, in conjunction with the TS requirements for the tank water level monitoring, the exterior surface inspections and ground water monitoring activities for the tank provide reasonable assurance that potential leakage would be detected prior to significant degradation of the RWT.

In addition, the proposed inspections include the following inspections of the RWT liner: (1) remote visual inspections performed using a remotely controlled submersible device equipped with a camera, and (2) full hands-on inspections, in which the RWT is drained and inspectors enter the tank to perform hands-on inspections. The full hands-on inspections are visual inspections that are enhanced, as required, by limited physical testing to evaluate specified properties of the liner (e.g., knife testing to confirm the adhesion of liner/metal interface areas and sounding testing to detect liner delamination). These inspections are performed to detect potential liner degradation, such as delamination, peeling, flaking, undercutting, blistering, cracking, discoloration, holidays and pinholes.

The augmented inspection program proposed in this request is similar to those proposed in the previously approved relief requests for the use of the liner. The previously approved inspection program is summarized below.

A full hands-on examination of the RWT after draining of the borated water inventory of the tank will be performed every sixth refueling outage. 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. If any RWT liner inspections indicate unacceptable results or 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.

The licensee provided a summary of the inspection results for the previous fourth ISI interval, as follows. Remote visual inspections were performed during Refueling Outages SL1-22, 23, 24, 25, 27 and 28. A full hands-on inspection was performed during Refueling Outage SL1-26. The remote visual inspections performed during Refueling Outages SL1-22 through 25 and SL1-27 revealed no evidence of any peeling, flaking, undercutting, blistering or cracking on the liner. The full hands-on inspection performed during Refueling Outage SL1-26 found minor coating anomalies (approximately 2–3 inches in length and less than 0.001–0.002 inches in estimated depth). After investigation that involved application of a minor scraping action and inspections with magnification, these anomalies were determined to be acceptable because the anomalies did not penetrate down to the base metal.

During the remote visual inspection of Refueling Outage SL1-28 (the last inspection and refueling outage of the fourth interval), the licensee confirmed that there was no evidence of any peeling, flaking, undercutting, or blistering. However, the inspection detected a small area of cracking on the liner in the area of Duromar repair number 3 located near the hatch. The previous Duromar patch repair had been performed during Refueling Outage SL1-20 (hands-on inspection) where minor cracking had been observed in the topmost layer of the vinyl ester liner. In contrast, the video inspection could not determine if the cracks detected during Refueling Outage SL1-28 penetrated all three layers of the protective liner. The licensee identified these cracks as unacceptable, on the conservative assumption that the cracks penetrated the protective liner.

Based on the conservative disposition of the cracks as unacceptable, the license proposed the inspection schedule described in Table 1 in Section 3.5 of this safety evaluation, in accordance

with the augmented inspection program that was accepted in the previous relief request for the fourth inspection interval. Specifically, the licensee proposed to perform a full hands-on inspection during the upcoming refueling outage (Refueling Outage SL1-29) in which cracks were detected, as discussed above. Thereafter, a full hands-on inspection will be performed during every third outage (through the end of the fifth 10-year interval). During all the other outages of the fifth interval, the remote visual inspections will be performed, as described in Table 1.

The NRC staff notes that the proposed full hands-on inspection schedule (every third outage) for the fifth interval is an update to the fourth interval full hands-on inspection schedule (every sixth outage). This update is based on the inspection results observed during Refueling Outage SL1-28 (observation of cracks in the liner with the conservative assumption of full penetration of the crack in the liner down to the base metal). This inspection interval is also consistent with the inspection program that was acceptable to the NRC staff for the previous relief request for the fourth interval. The licensee also proposed to perform the full hands-on inspection during the upcoming outage (Refueling Outage SL1-29) to monitor the currently identified cracks, consistent with the augmented inspection program for the liner that has been implemented at the facility through the previously approved relief requests.

The licensee clarified that the inspection and repair procedures for Refueling Outage SL1-29 will be the same as the procedures used during the previous fourth inspection interval. The licensee further confirmed that the procedures are consistent with those specified in the previously approved relief request for the fourth interval. The procedures are summarized as follows: During the upcoming Refueling Outage (SL1-29), the RWT will be drained and complete hands-on inspection of the tank bottom liner will be performed. The inspection will include the degraded areas identified during Refueling Outage SL1-28. In the acceptance criteria, cracking is defined as small breaks in the liner that extend from the surface to the substrate. When cracking is observed, repair will be made by applying one coat of Duromar SAR-UW. The repair coat will be extended at least one inch onto the existing sound liner material surrounding the crack.

In its review, the NRC staff finds the proposed alternative for the continued use of the liner is acceptable because: (1) the TS requirements for monitoring the tank water level provides reasonable assurance that potential leakage due to degradation in the liner-applied tank will be detected in a timely manner such that significant adverse impact will not occur on the safety function of the RWT; (2) in conjunction with the TS requirements for the tank water level monitoring, the exterior surface inspections and ground water monitoring activities for the tank provide reasonable assurance that potential leakage would be detected prior to significant degradation of the RWT; (3) the inspection results revealed no evidence of any peeling, flaking, undercutting, blistering or cracking on the liner except for the cracks detected during Refueling Outage SL1-28; (4) the currently identified cracks were identified as unacceptable on the conservative assumption that the cracks penetrated all liner layers down to the base metal (forming a leakage path); (5) the proposed inspection schedule is adequately revised to monitor the currently identified cracks and potential degradation of the liner; and (6) the licensee will perform inspection and repair activities, as needed, in accordance with the plant procedures, which are effective to manage cracking in the RWT coating.

4.0 CONCLUSIONS

As set forth above, the NRC staff has determined that the proposed alternative in Relief Request 6 provides an acceptable level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed the regulatory requirements set forth in

10 CFR 50.55a(z)(1). Therefore, the NRC staff authorizes the use of the proposed alternative for the fifth ISI interval of St. Lucie 1, which is scheduled to end on February 10, 2028. All other ASME Code, Section XI requirements for which relief was not specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: S. Min

Date: May 31, 2019

SUBJECT: ST. LUCIE PLANT, UNIT NO. 1 – SAFETY EVALUATION FOR RELIEF REQUEST NO. 6 FOR THE FIFTH 10-YEAR INSERVICE INPECTION INTERVAL (EPID L-2018-LLR-0116) DATED MAY 31, 2019

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