SEP 2 8 2018

L-2018-188
10 CFR 50.4
10CFR 50.55a

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

Re: St. Lucie Unit 1
Docket No. 50-335
Inservice Inspection Plan
Fifth Ten-Year Interval Unit 1 Relief Request 6

Reference:

1. FPL Letter L-2018-162 dated August 31, 2018, "Inservice Inspection Plan Fifth Ten-Year Interval Unit 1 Relief Request 6." ADAMS Accession No. ML18243A030

In Reference 1 above, FPL requested Code relief for the continued use of the reinforced vinyl ester liner on the bottom of the Unit 1 Refueling Water Tank (RWT) that was installed in 1994. Florida Power and Light (FPL) proposed to leave the installed fiberglass-reinforced vinyl ester liner in place on the Unit 1 RWT bottom, and to consider this installation as an alternative design equivalent to a Code repair or replacement of the RWT bottom. However, FPL was subsequently informed that the relief request referenced the outdated version of the 10 CFR Code for proposed alternatives. The relief request attached to this letter references the current version of the Code with no other changes.

Please contact Ken Frehafer at (772) 467-7748 if there are any questions about this submittal.

Very truly yours,

Michael J. Snyder
Licensing Manager
St. Lucie Plant

MJS/KWF

Attachment

cc: St. Lucie NRC Program Manager, USNRC
Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, St. Lucie Plant

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Proposed Alternative
In Accordance with 10 CFR 50.55a(z)(1)

-demonstrate that the alternative program will provide an acceptable level of quality and safety in lieu of complying with the requirement in Section XI.

1. **ASME Code Component(s) Affected**

The Refueling Water Tank (RWT) is described in Section 6.3.2.2.1 of Reference 2. 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 [Ref 1, Sections 3.1.2.2, 3.1.2.8, and 3.5.4]. The RWT is a Quality Group B, ASME Class 2 structure, and was designed and erected in accordance with ANSI B96.1-1967 [Ref 2, Table 6.3-2].

2. **Applicable Code Edition and Addenda**

The American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Rules for Inservice Inspection of Nuclear Power Plant Components, Section XI, 2007 Edition with Addenda through 2008 as amended by 10CFR50.55a, is the Code of Record for the St. Lucie Unit 1 5th 10-year interval [Ref 3].

3. **Applicable Code Requirement**

Relief is being requested from ASME Code, Section XI, 2007 Edition with Addenda through 2008 [Ref 3], Articles IWA-4000 and IWC-3000. Subparagraph IWC-3132 [Ref 3] states that relevant flaws are detected in ASME Code Class 2 Structures or components as a result of in-service 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”.

Article IWA-4000 [Ref 3] 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 [Ref 3].

4. **Reason for Request**

In July 1993, a small leak approximately 3/16 inch in diameter was located in an area on the RWT bottom near the east side of the tank. A code repair of the RWT bottom was attempted in Fall 1994 Unit 1 Refueling Outage (SL1-13). This repair, as designed, involved removal of the section of the bottom plate which contained the identified leak and welding of a new 1/4" aluminum plate section to the existing bottom plate to cover the opening left by the removal of the unacceptable section of the tank bottom. 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 code repair. The wall 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 code repair could not be implemented.

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As an alternative to the 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 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.

Via Reference 7 the NRC authorized FPL's use of the RWT lining along with an augmented inspection program, in lieu of a Code repair or replacement for the remainder of the second ten-year ISI interval. The liner system has satisfactorily performed its required functions since its installation. Subsequent relief requests [Refs 8 thru 16] were submitted and approved by the NRC for consideration of this installation as an alternative design equivalent to a code repair or replacement of the RWT bottom.

This request proposes to leave the installed fiberglass reinforced vinyl ester liner (installed in 1994) in place on Unit 1 RWT bottom, along with the augmented inspection program, in lieu of a Code repair or replacement for the fifth ten-year interval.

5. Proposed Alternative and Basis for Use

Proposed Alternative

As an alternative to the 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" (approximate) thick coating consisting of a prime coat, a trowelled 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 Unit 1 refueling outage in accordance with plant modification requirements. Personnel training, surface preparation, liner installation, and visual inspections were performed under the direction of FPL Nuclear Engineering's Coatings Specialist. 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.

Basis

A description of the process used to qualify the design, a description of the installation process, and the inspection program to monitor the condition of the repairs is included in this section.

Design Qualification Process:

The RWT was designed in accordance with ANSI B96.1, "Welded Aluminum Alloy Field Erected Storage Tanks" [Ref 4]. The main base plates are 0.25 inches thick, and are welded to a 0.375 inch thick annular base plate. The tank is supported on an 8.5' high by 2' wide reinforced concrete ring wall foundation. The RWT base is anchored to the ring wall foundation with 45 two-inch diameter ASTM A36 carbon steel anchor bolts.

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The RWT bottom plates are continuously supported by structural fill material. There is a 6" thick sand and oil cushion placed on approximately 8 feet of Class I fill compacted to 95% of maximum dry density; underlying this is Class I fill compacted to 98% of maximum dry density. The tank shell is supported directly by the concrete ring wall and does not depend on the bottom plate for structural support. Per ANSI B96.1 [Ref. 4], the flat bottom of the tank is not subject to specific design rules for calculating minimum thickness and allowable stresses are not given for the tank bottom. The function of the bottom plate is to provide a barrier between the tank fluid and the underlying fill material. The bottom plate does not transfer loads to the shell or the annular base plate and ring wall foundation. Pressure stress loads are carried by the fill beneath the tank bottom. Therefore, the tank bottom may be considered a liner.

During the various repairs made to the RWT bottom, the support conditions of the bottom plate have not been changed from the original design.

FPL performed confirmatory testing prior to the submittal of Relief Requests RR-07 and RR-7A **[Refs** 8 and 10] to verify the manufacturer's published information concerning the physical properties of the Dudick Protecto-Line 800 system. These test results provide the necessary confirmation of the ability of the Dudick system to perform its intended functions as a liner for the St. Lucie Unit 1 RWT.

FPL performed chemical testing prior to the submittal of Relief Requests RR-07 and RR-7A [Refs 8 and 10] to confirm the composition of the liner materials. The results of this testing indicate that the Protecto-Line 800 liner system is composed of the materials specified by Dudick, Inc., and does not exceed the acceptable limits for impurities as specified by FPL Administrative Procedures for materials in contact with the primary system.

The fiberglass-reinforced vinyl ester liner was installed during the Fall 1994 refueling outage (SL1-13). Coinciding with subsequent refueling outages, remote and visual inspections have been performed. The liner met all acceptance criteria, and showed no degradation that could affect its ability to perform its required functions. Minor anomalies observed during remote inspection were determined to be acceptable. The liner has been determined to be acceptable since its installation.

Previous detailed evaluations, including root cause evaluation, and inspection results of the installed liner have been documented in previous requests and approvals of the Relief Request for the alternate RWT bottom repair and are listed below:

- Second 10-Yr ISI Interval, Relief Request 13A
    - FPL Request, Letter No. L-94-291, dated November 16, 1994 [Ref 6].
    - NRC Approval, TAC No. M90762, dated November 25, 1994 [Ref 7].
- Third 10-Yr ISI Interval Relief Request 7/7A
    - FPL Request, Letter L-96-329, dated January 6, 1997 [Ref 8].
    - NRC Denial , TAC No. M97706, dated May 27, 1997 [Ref 9].
    - FPL Request, Letter No L-2000-211, dated October 18, 2000 [Ref 10].
    - NRC Approval, TAC No. MA0965 , dated June 18, 1999 [Ref 11].
    - NRC Approval, TAC No. MB0324, dated February 27, 2001 [Ref 12].
    - NRC Approval, TAC No. MB0324 , dated June 22, 2001 [Ref 13].
- Fourth 10-Yr ISI Interval, Relief Request 3
    - FPL Request, Letter No. L-2008-214, dated September 29, 2008 [Ref 15].

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- NRC Approval, TAC No. MD9268, dated February 12, 2009 [Ref 16].

Installation Process Summary:

Florida Power and Light proposes to continue to use the installed fiberglass-reinforced vinyl ester liner (Dudick Protecto-Line 800 system) in place on the Unit 1 Refueling Water Tank (RWT) bottom as a permanent alternative design, and also proposes to continue to use the RWT to meet its required Technical Specification functions. This request requires no new installation.

Installation of the liner material was performed under the direction of FPL's Nuclear Coatings Specialist as a special process. As such, the liner was pre-engineered for use and installed via a controlled Engineering document for plant change/modifications. Special process controls included applicator certification and training, and QC 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. Up-front vendor testing of the material, post-installation testing of the installed liner, and additional post-installation testing and evaluation of the physical and chemical properties of the liner material, were performed to confirm the adequacy of the product for its intended use.

Testing of the liner material was performed during the installation in accordance with manufacturer's recommendations. In addition to visual inspection performed by the Nuclear Coatings Specialist, the installed liner was subjected to (a) millage testing to confirm required thickness, and (b) high-voltage spark testing to confirm the absence of holidays and pinholes.

Following the initial installation, FPL has utilized an NRC-approved inspection program consisting primarily of visual inspection. During the first refueling outage following the installation of the liner, the RWT was drained and a full hands-on inspection was performed. Subsequently, this hands-on inspection is performed every sixth refueling outage. The hands-on inspection is a visual inspection, enhanced as required by limited physical testing to evaluate specified properties of the liner (e.g., knife test for hardness and undercutting, sounding with a hammer to detect delamination and adhesion). During all operating cycles in which the hands-on inspection is not performed, a remote visual inspection (utilizing a camera on a remote-controlled submersible device) is performed. The original inspection schedule specified hands-on inspections every third outage. The satisfactory inspection data (i.e., no significant findings) allowed the interval between hands-on inspections to be extended to six outages; this was implemented via NRC review and approval of Relief Request 7A. All visual inspections have been performed by FPL's Nuclear Coatings Specialist, who is a qualified coatings industry expert (Vice Chairman of ASTM Committee D33 on Protective Coating and Lining Work for Power Generation Facilities; Vice Chairman of EPRI Nuclear Utilities Coatings Council; Vice Chairman of BWROG Coatings; NACE technical advisor for International Coatings Inspection certification).

Visual inspection is the industry standard for detecting defects in coating material after initial installation. NRC has provided guidance for safety related coatings evaluations [Ref. 5] which references an EPRI report providing confirmatory support for coatings inspection methods that rely upon visual inspection as the primary acceptance methodology, augmented by appropriate physical testing when required. Physical testing, however, is typically destructive in nature, and should only be used to determine the size or cause of a detected defect. Reference 5 documents NRC review and documents that it provides adequate supporting evidence that the containment coatings monitoring approach contained in ASTM D5163 (as implemented by licensees and endorsed by the NRC in Regulatory Guide 1.54 Rev. 1 and NUREG 1801, Volume 2, Appendix XI.S8) is valid.

The water level in the RWT is monitored by four Rosemount level transmitters. Unit 1 Technical Specification 4.5.4 requires that the RWT be demonstrated to be operable at least once every seven 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 NAMS database has shown no evidence of such inventory loss. Thus there is no evidence of leakage from the Unit 1 RWT.

Since the liner was installed as a special process, with special process inspections performed at the time of installation, use of visual hands-on inspections (the industry standard) in conjunction with remote visual inspections is an acceptable method of confirming the continued acceptable condition of the liner.

The aluminum/liner interface is inspected every cycle. During the hands-on inspection (when the tank is drained), the interface is inspected visually; also, a knife test is used to ensure that there is no undercutting of the liner at the interface. During the remote visual inspections, an inspection of the interface around the entire circumference of the tank is specifically performed. No problems in this area have been identified.

No issues have been identified with the aluminum surface above the liner. This material was originally chosen because of its resistance and imperviousness to the chemical solution of the borated water contained within the tank. Thus, even if the borated water within the tank were to find a path to the region behind the liner, it would not adversely affect the condition of the aluminum.

The exterior of the RWT wall is inspected as part of the System and Component Engineering walkdown program. This program is controlled via Engineering Guidelines. System walkdowns are performed on a quarterly basis. 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 this system indicated acceptable inspection findings for all these 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 Unit 1 RWT). The use of the liner in the RWT was based on the manufacturer’s recommendation for use of this system for applications involving concentrated acid spills, acid neutralization, and caustic handling areas. The vinyl ester material used for the liner has good to excellent chemical resistance to 10% solutions of acids, and excellent resistance to mineral acids such as boric acid. The Technical Specification required RWT concentration of 1720 ppm boric acid is much less than the 10% 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 lack of a specific projected service life was recognized when the proposed

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inspection program was developed by FPL. The inspection program that has been used (and that is proposed for use during the fifth ten-year ISI inspection interval) is designed to detect any minor defects in the liner material prior to the failure of the liner. Thus, this program (in conjunction with the monitoring of the RWT 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.

During the hands-on inspection (when the tank was drained), areas of discoloration are examined by physical scraping of the surface to determine the source. The discoloration has been determined during the hands on inspection to be a surface phenomenon, with no depth of penetration; there is no evidence that this source of the discoloration is coming into the tank from below the tank bottom through a leak in the tank liner material. During the remote visual inspections (when the tank was full of water), particulate matter and other minor debris have been observed to have settled onto the tank bottom; this material appears to be the source of discoloration observed.

<u>Post-installation Inspections</u>:

The inspection schedule for the fourth ten-year ISI interval as approved in Relief Request 3 **[Ref 16]** is listed in Table 1.

In accordance with Reference 16, remote visual inspections were performed using a remotely controlled submersible device outfitted with a camera. The liner was inspected for peeling, flaking, undercutting, blistering, and cracking. During each of these inspections, the liner was found to be in an acceptable condition, with no evidence of degradation.

In accordance with Reference 16, full hands-on inspection of the RWT liner was performed during every sixth refueling outage. For this inspection, the RWT was completely drained; inspectors entered the tank to perform a hands-on inspection. Inspections were performed by the Nuclear Coatings Specialist (or designee) and an Engineering representative. The liner was inspected for acceptability of the following properties:

- Hardness
- Delamination
- Adhesion
- Peeling
- Flaking
- Undercutting
- Blistering
- Cracking
- Checking
- Discoloration
- Holidays
- Pinholes

The following post-installation inspections were performed during the fourth ten-year ISI interval, as part of the work orders. The results of each of the inspections are summarized below:

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SL1-22 - Remote Visual Inspection

The RWT liner was found to be in an acceptable condition. There was no evidence of any peeling, flaking, undercutting, blistering, or cracking observed on the liner. The edges of the liner material were observed to be adhering to the aluminum tank; no peeling or undercutting was in evidence. Some irregularities were observed on the surface of the liner. These were a result of either (a) troweling performed when the liner was installed or (b) changes in the elevation of floor plates at locations of overlapping weld joints.

There were some discolored areas noted during the inspection. These areas appeared to be due to the presence of unknown debris that had settled to the bottom of the tank, and not due to any failure of the liner material. There was no evidence of deterioration of the liner at these locations, or at any of the locations where the debris was observed.

There were several areas where Duromar patches had been applied to the liner material during the hands-on inspection performed during refueling outage SL1-20. These patches had been applied where minor cracking had been observed in the topmost layer of the vinyl ester liner. These cracks had not penetrated the topmost of the three layers constituting the Dudick protective liner, and did not constitute a leakage path. The Duromar SAR-UW patches had been installed to ensure that the floor structure would maintain full design capabilities. These patches were closely examined during the most recent inspection; there was no evidence of any peeling, flaking, undercutting, blistering, or cracking observed in the patch areas, or in the liner material immediately surrounding the patches.

SL1-23 Remote Visual Inspection

The RWT liner was found to be in an acceptable condition. There was no evidence of any peeling, flaking, undercutting, blistering, or cracking observed on the liner. The edges of the liner material were observed to be adhering to the aluminum tank; no peeling or undercutting was in evidence. Some irregularities were observed on the surface of the liner. These were a result of either (a) troweling performed when the liner was installed or (b) changes in the elevation of floor plates at locations of overlapping weld joints.

There were some discolored areas noted during the inspection. These areas appeared to be due to the presence of unknown debris that had settled to the bottom of the tank, and not due to any failure of the liner material. There was no evidence of deterioration of the liner at these locations, or at any of the locations where the debris was observed.

There were several areas where Duromar patches had been applied to the liner material during the hands-on inspection performed during refueling outage SL1-20. These patches had been applied where minor cracking had been observed in the topmost layer of the vinyl ester liner. These cracks had not penetrated the topmost of the three layers constituting the Dudick protective liner, and did not constitute a leakage path. The Duromar SAR-UW patches had been installed to ensure that the floor structure would maintain full design capabilities. These patches were closely examined during the most recent inspection; there was no evidence of any peeling, flaking, undercutting, blistering, or cracking observed in the patch areas, or in the liner material immediately surrounding the patches.

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SL1-24 Remote Visual Inspection

The RWT liner was found to be in an acceptable condition. There was no evidence of any peeling, flaking, undercutting, blistering, or cracking observed on the liner. The edges of the liner material were observed to be adhering to the aluminum tank; no peeling or undercutting was in evidence. Some irregularities were observed on the surface of the liner. These were a result of either (a) troweling performed when the liner was installed or (b) changes in the elevation of floor plates at locations of overlapping weld joints.

There were some discolored areas noted during the inspection. These areas appeared to be due to the presence of unknown debris that had settled to the bottom of the tank, and not due to any failure of the liner material. There was no evidence of deterioration of the liner at these locations, or at any of the locations where the debris was observed.

There were several areas where Duromar patches had been applied to the liner material during the hands-on inspection performed during refueling outage SL1-20. These patches had been applied where minor cracking had been observed in the topmost layer of the vinyl ester liner. These cracks had not penetrated the topmost of the three layers constituting the Dudick protective liner, and did not constitute a leakage path. The Duromar SAR-UW patches had been installed to ensure that the floor structure would maintain full design capabilities. These patches were closely examined during the most recent inspection; there was no evidence of any peeling, flaking, undercutting, blistering, or cracking observed in the patch areas, or in the liner material immediately surrounding the patches.

SL1-25 Remote Visual Inspection

The RWT liner was found to be in an acceptable condition. There was no evidence of any peeling, flaking, undercutting, blistering, or cracking observed on the liner. The edges of the liner material were observed to be adhering to the aluminum tank; no peeling or undercutting was in evidence. Some irregularities were observed on the surface of the liner. These were a result of either (a) troweling performed when the liner was installed or (b) changes in the elevation of floor plates at locations of overlapping weld joints.

There were some discolored areas noted during the inspection. These areas appeared to be due to the presence of unknown debris that had settled to the bottom of the tank, and not due to any failure of the liner material. There was no evidence of deterioration of the liner at these locations, or at any of the locations where the debris was observed.

There were several areas where Duromar patches had been applied to the liner material during the hands-on inspection performed during refueling outage SL1-20. These patches had been applied where minor cracking had been observed in the topmost layer of the vinyl ester liner. These cracks had not penetrated the topmost of the three layers constituting the Dudick protective liner, and did not constitute a leakage path. The Duromar SAR-UW patches had been installed to ensure that the floor structure would maintain full design capabilities. These patches were closely examined during the most recent inspection; there was no evidence of any peeling, flaking, undercutting, blistering, or cracking observed in the patch areas, or in the liner material immediately surrounding the patches.

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SL1-26 Hands on Inspection

The RWT was completely drained during SL1-26, and a complete hands-on inspection was performed to evaluate the performance of the installed liner. The inspections performed on the RWT liner by the Nuclear Coatings Specialist were non-destructive in nature. The majority of the inspections were visual only. Some of the inspections (i.e., hardness, undercutting) involved the application of pressure with the edge or point of a knife or paint scraper; this did not result in any cutting of the liner surface. The inspections for delamination and adhesion involved physical sounding, in which the liner surface was struck with a hammer. The liner was only struck hard enough to enable the inspector to listen to the sound made; the force applied was insufficient to cause any damage to the liner.

Two coating anomalies were noted during the hands-on inspection. The coating anomalies observed between the wall and stiffener ring, were approximately 2”-3” in length and less than 1-2 mils in estimated depth. An investigation was performed by the coating SME to define and classify these anomalies by applying a minor scraping action to determine total height and depth. In both cases the anomalies were not visible after scraping using 3X magnification and 360 lumens <6”.

The acceptance criterion for cracking is that “the liner shall be considered acceptable if there are no areas of cracking observed”. The definition of cracking is “small breaks in the liner which extend from the surface to the substrate”. From this definition, it is noted that the condition observed during the SL1-26 inspection did not constitute an unacceptable condition as defined in the inspection criteria (i.e., the crack did not penetrate the topmost of the three layers constituting the Dudick protective liner). The areas in question were capable of maintaining zero leakage in their as-found condition. Both were classified as non-defects, were no longer visible and no actions were required.

Based on the inspection findings and the discussion above, the installed liner was determined to be acceptable. The minor anomalies noted were determined to be acceptable. Thus, the liner met the acceptance criteria for all of the properties listed above, and showed no degradation which could affect its ability to perform its required functions.

SL1-27 – Remote Visual Inspection

The RWT liner was found to be in an acceptable condition. There was no evidence of any peeling, flaking, undercutting, blistering, or cracking observed on the liner. The edges of the liner material were observed to be adhering to the aluminum tank; no peeling or undercutting was in evidence. Some irregularities were observed on the surface of the liner. These were a result of either (a) troweling performed when the liner was installed or (b) changes in the elevation of floor plates at locations of overlapping weld joints.

There were some discolored areas noted during the inspection. These areas appeared to be due to the presence of unknown debris that had settled to the bottom of the tank, and not due to any failure of the liner material. There was no evidence of deterioration of the liner at these locations, or at any of the locations where the debris was observed.

Duromar SAR-UW patches had been installed during SL1-20 to ensure that the floor structure would maintain full design capabilities. These patches were closely examined during the inspection and there was no evidence of any peeling, flaking, undercutting, blistering, or cracking observed in the patch areas, or in the liner material immediately surrounding the patches.

SL1-28 – Remote Visual Inspection

There was no evidence of any peeling, flaking, undercutting, blistering, however a small area of stress cracking was observed on the liner in the area of Duromar repair number 3 located near the hatch. The cracks were approximately 6" in length at three locations adjacent to the patch. These repairs had been performed during the hands-on inspection performed during refueling outage SL1-20. The patches had been applied where minor stress cracking had been observed in the topmost layer of the vinyl ester liner. These cracks had not penetrated the topmost of the three layers of the protective liner, and did not constitute a leakage path. The Duromar SAR-UW patches had been installed to ensure that the floor structure would maintain full design capabilities. These patches were closely examined during the most recent inspection; there was no evidence of any peeling, flaking, undercutting, blistering, however cracking was observed in the liner material immediately surrounding the 2 patches. The stress cracks are currently identified as unacceptable, requiring a "hands on" inspection of the liner during the next refueling outage, which is SL1-29.

The edges of the liner material were observed to be adhering to the aluminum tank; no peeling or undercutting was in evidence. Some irregularities were observed on the surface of the liner. These were a result of either (a) troweling performed when the liner was installed or (b) changes in elevation of floor plates at locations of overlapping weld joints.

There were some discolored areas noted during the inspection. These areas appeared to be due to the presence of unknown debris that had settled to the bottom of the tank, and not due to any failure of the liner material. There was no evidence of deterioration of the liner at these locations, or at any of the locations where debris was observed.

There have been no documented occurrences of leakage that indicate that there is a current leak. As stated in the most current approved relief request [Ref. 16], the water level in the RWT is monitored by four Rosemount level transmitters. St. Lucie, Unit 1 Technical Specifications [Ref. 1], Section 4.5.4 requires that the RWT be demonstrated operable in accordance with the Surveillance Frequency Control Program, at least once every 7 days, (while Modes 1-4) by verifying the water level in the tank. Continuous reduction in tank inventory would be noticed by Operations. This is how the original leak in 1994 was identified. A review of the Action Requests in NAMS has shown no evidence of leakage from the Unit 1 RWT.

Additionally, as part of the Chemistry Department Groundwater Protection Program, the ground water in the vicinity of the U1 RWT is monitored for potential contamination. The location of the monitoring wells are shown and maintained in accordance with this program. There is a recovery well and two monitoring wells adjacent to the tank that are monitored at least quarterly. This monitoring would provide additional indication of potential leak.

Based on the unacceptable inspection findings discussed above, a hands on inspection must be performed during the next refueling outage (SL1-29) to more accurately evaluate the stress cracks. Other minor anomalies noted were determined to be acceptable.

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Inspections to be performed during the fifth 10-year ISI Inspection Interval

Inspections for the fifth 10-year ISI inspection interval follows the same inspection criteria approved by the NRC as part of Relief Request 3, for the fourth 10-year ISI inspection [Ref 16]. The inspection criteria requires that 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.

During the last inspection of the fourth 10-year ISI inspection Interval, unacceptable stress cracks adjacent to a previous patch were identified as part of a remote video inspection in SL1-28. Because of this unacceptable condition, a “hands on” inspection of the liner during the first refueling outage of the fifth 10-year ISI inspection interval (SL1-29), is required.

The acceptance criterion for cracking is that “the liner shall be considered acceptable if there are no areas of cracking observed”. The definition of cracking is “small breaks in the liner which extend from the surface to the substrate”. Although the stress cracks were identified as unacceptable, the video inspection could not determine if the cracks penetrated all three layers of the protective liner. The hands on inspection during SL1-29 will determine the extent of the cracking and if the condition should be considered a defect and if additional actions are required.

Due to the unacceptable condition, in addition to full hands on inspection during SL1-29, and the subsequent inspection schedule has been revised to require a hands on inspection for every third refueling outage thereafter. For every refueling outage a full, hands-on inspection is not scheduled, a remote visual inspection of the RWT liner will be performed. As an option, the remote visual inspections may be performed with the unit on-line, within a period approximately three weeks before or following the designated refueling outage. The proposed augmented inspection schedule for the fifth-year ISI Inspection Interval is shown in Table 2.

The proposed inspection schedule is only applicable through the end of the fifth ten-year ISI interval. A separate submittal will be made to the NRC regarding a proposed inspection schedule for the period beginning with the sixth ten-year ISI interval (which begins on February 11, 2028). The proposed inspection schedule will be based on the results of inspections performed up to the time of submittal, along with the documented performance of the RWT liner.

Inspection of Caulking Material

The conditions at the bottom of the RWT shall be inspected on an annual basis to verify that the corrective measures implemented (i.e., the caulking material between the RWT bottom and the concrete ring wall) continue to prevent ingress of standing or rain water beneath the RWT **[Ref 12]**.

6. Duration of Request

This relief request is applicable to the St. Lucie Unit 1 Fifth 10-year Inservice Inspection Interval which will begin February 11, 2018 and ends February 10, 2028.

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7. <u>Precedents</u>

There are several precedents for installation of a repair without removal of the initiating defect. Examples of these precedents are listed below:

“St. Lucie Plant, Unit No. 1 – Relief Request No. 7 Regarding Alternate Repair for Intake Cooling Piping (TAC No. MF2529),” SER Dated January 30, 2014, Ascension No. ML14013A304.

St. Lucie Plant, Unit No. 1 – Relief Request No. 3, Request for Alternative to ASME Code, Section XI Repair Requirements for Refueling Water Tank Bottom (TAC No. MD9268)”, SER Dated February 12, 2009.

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8. References

1. St. Lucie Unit 1 Technical Specifications, Amendment 244
2. St. Lucie Unit 1 UFSAR Amendment 28
3. ASME Code, Section XI, “Rules For Inservice Inspection of Nuclear Power Plant Components,”2007 Edition with Addenda through 2008.
4. ANSI B96.1-1967, “Welded Aluminum Alloy Field Erected Storage Tanks”.
5. “NRC Staff Review Guidance Regarding Generic Letter 2004-02 Closure in the Area of Coatings Evaluation”, prepared by NRC Staff, Steam Generator Tube Integrity and Chemical Engineering Branch, Division of Component Integrity, Office of Nuclear Reactor Regulation, March 2008.
6. FPL Letter L-94-291 from D. A. Sager to U. S. Nuclear Regulatory Commission, “In-Service-Inspection Plan Second Ten-Year Interval, Relief Request 13A – Request for Authorization of an Alternative Non-Code Repair, dated November 16, 1994. [ML17309A754]
7. NRC Letter from Mohan C. Thadani (NRC) to Mr. J. H. Goldberg (FPL), "Subj: Proposed Alternative (Relief Request 13A) to the ASME Code for Replacement of the Refueling Water Tank Bottom at St. Lucie Unit No. 1 (TAC No. M90762)", dated November 25, 1994
8. FPL Letter L-96-329 from J. A. Stall to U.S. Nuclear Regulatory Commission “Request for Authorization of Alternative Refueling Water Tank Bottom Design”, dated January 6, 1997. [ML17229A188]
9. NRC Letter from Frederick J. Hebdon (NRC) to Mr. Thomas F. Plunkett (FPL), “Safety Evaluation of St. Lucie 1, Refueling Water Tank Bottom Epoxy Lining Relief Request (TAC No. M97706)”, dated May 27, 1997
10. FPL Letter L-2000-211 from R. S. Kundalkar to U.S. Nuclear Regulatory Commission, Revised Relief Request 7A, dated October 18, 2000. [ML003762390]
11. NRC Letter from Sheri R. Peterson (NRC) to Mr. Thomas F. Plunkett (FPL), dated June 18, 1999 [Subj: Relief from ASME Code Requirements Related to the Inservice Inspection Program Third 10-Year Interval for St. Lucie Plant, Unit 1 (TAC No. MA0965)].
12. NRC Letter from Richard P. Correia (NRC) to Mr. T. F. Plunkett (FPL), dated February 27, 2001 [Subj: St. Lucie Plant, Unit 1 – Evaluation of Relief Request 7A Regarding the Visual Inspection Frequency of the Refueling Water Tank Liner for the Third 10-Year Inservice Inspection Interval (TAC No. MB0324)].

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13. NRC Letter from Brendan T. Moroney (NRC) to Mr. J. A. Stall (FPL), dated June 22, 2001 [Subj: St. Lucie Plant, Unit 1 – Requested Correction/Clarification to Safety Evaluation Re: Relief Request 7A (TAC No. MB0324)].

14. FPL Letter L-2008-079 from G. L. Johnston to U.S. Nuclear Regulatory Commission, Inservice Inspection Plan, Fourth Ten-Year Interval Unit 1 Relief Request 3, dated April 9, 2008. [ML081120115]

15. FPL Letter L-2008-214 from E. S. Katzman to U.S. Nuclear Regulatory Commission, RAI Response to Unit 1 Fourth Ten-Year Interval Relief Request 3, dated September 29, 2008. [ML082750040]

16. Letter from Thomas H. Boyce (NRC) to Mr. Mano Nazar (FPL), dated February 12, 2009 [Subj: 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)].

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Table 1
ST. LUCIE UNIT 1 -REFUELING WATER TANK
INSPECTIONS PERFORMED FOR THE
FOURTH TEN-YEAR INSERVICE INSPECTION INTERVAL [Ref. 16]
(February 11, 2008 – February 10, 2018)

OUTAGE	REMOTE VISUAL INSPECTION	FULL HANDS-ON INSPECTION
SL1-22	X	
SL1-23	X	
SL1-24	X	
SL1-25	X	
SL1-26		X
SL1-27	X	
SL1-28	X	

Table 2
ST. LUCIE UNIT 1 -REFUELING WATER TANK
PROPOSED SCHEDULE FOR INSPECTIONS FOR THE
FIFTH TEN-YEAR INSERVICE INSPECTION INTERVAL
(February 11, 2018 – February 10, 2028)

OUTAGE	REMOTE VISUAL INSPECTION	FULL HANDS-ON INSPECTION
SL1-29		X
SL1-30	X	
SL1-31	X	
SL1-32		X
SL1-33	X	
SL1-34	X	
SL1-35		X

NOTES:
(1) The proposed inspection schedule is only applicable through the end of the fifth ten-year ISI interval. A separate submittal will be made to the NRC regarding a proposed inspection

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schedule for the period beginning with the sixth ten-year ISI interval (which begins on February 11, 2028). The proposed inspection schedule will be based on the results of inspections performed up to the time of submittal, along with the documented performance of the RWT liner.

(2) If any inspections indicate unacceptable results, or if there are any documented occurrences of leakage through the RWT bottom, the inspection schedule 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 fifth ten-year ISI interval).