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

February 3, 2021

Mr. Don Moul
Executive Vice President, Nuclear
Division and Chief Nuclear Officer
Florida Power & Light Company
Mail Stop: EX/JB
700 Universe Blvd.
Juno Beach, FL 33408

SUBJECT: ST. LUCIE PLANT, UNIT NO. 2 - APPROVAL OF ALTERNATIVE TO USE ASME CODE CASE N-513-4 FOR ALTERNATE REPAIR OF INTAKE COOLING WATER SYSTEM (EPID L-2020-LLR-0021)

Dear Mr. Moul:

By letter dated February 7, 2020, Florida Power & Light Company (FPL) submitted a request to the U.S. Nuclear Regulatory Commission (NRC) for the use of an alternative to certain requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (BPV) Code, Section XI, at St. Lucie Plant (St. Lucie), Unit No. 2.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(2), FPL requested to use the alternative on the basis that complying with the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that FPL has adequately addressed all the regulatory requirements set forth in 10 CFR 50.55a(z)(2).

The NRC authorizes the use of the proposed alternative in Relief Request No. 17 for St. Lucie, Unit No. 2 until the SL2-25 refueling outage, the leak rate from the flaws exceeds 90 gallons per minute, or the existing flaws grow to exceed the allowable flaw size, whichever occurs first. All other requirements in ASME BPV 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.

If you have any questions, please contact St. Lucie Project Manager, Natreon Jordan, at (301) 415-7410 or by e-mail to Natreon.Jordan@nrc.gov.

Sincerely,

Undine S. Shoop

Digitally signed by Undine S. Shoop
Date: 2021.02.03 07:16:28 -05'00'

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

Docket No. 50-389

Enclosure: As stated

cc: Listserv

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

SAFETY EVALUATION BY THE OFFICE NUCLEAR REACTOR REGULATION

RELIEF REQUEST NO. 17

ALTERNATE REPAIR OF INTAKE COOLING WATER SYSTEM

FLORIDA POWER & LIGHT COMPANY

ST. LUCIE PLANT, UNIT NO. 2

DOCKET NO. 50-389

1.0 INTRODUCTION

By letter dated February 7, 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20038A380), Florida Power & Light (FPL, the licensee) proposed an alternative to the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, paragraph IWD-3120(b) and article IWD-3400 for St. Lucie Unit No. 2 (St. Lucie, Unit 2).

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(2), the licensee proposed to use ASME Code Case N-513-4 to demonstrate that a degraded elbow in the 2A intake cooling water (ICW) system piping is operable without repair or replacement in accordance with the ASME Code, Section XI on the basis that complying with the specified ASME Code requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

On February 10, 2020 (ADAMS Accession No. ML20044E680), the U.S. Nuclear Regulatory Commission (NRC) verbally authorized the use of Relief Request 17 for St. Lucie, Unit No. 2 until the SL2-25 refueling outage, which is scheduled for February 17, 2020, the leak rate from the flaws exceeds 90 gallons per minute (gpm), or the existing flaws grow to exceed the allowable flaw size, whichever occurs first. The NRC staff determined that the proposed alterative is technically justified and provides reasonable assurance of structural integrity of the affected piping. This safety evaluation documents the technical basis for the NRC's verbal authorization.

2.0 REGULATORY EVALUATION

Adherence to Section XI of the ASME Code is mandated by 10 CFR 50.55a(g)(4), which states, in part, that ASME Code Class 1, 2, and 3 components will meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME Code, Section XI.

The regulation at 10 CFR 50.55a(z) states, in part, that alternatives to the requirements of paragraphs (b) through (h) of 10 CFR 50.55a or portions thereof may be used when authorized

by the Director, Office of Nuclear Reactor Regulation. A proposed alternative must be submitted and authorized prior to implementation. The applicant or licensee must demonstrate that: (1) *Acceptable level of quality and safety*. The proposed alternative woul43wwd provide an acceptable level of quality and safety; or (2) *Hardship without a compensating increase in quality and safety*. Compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Based on the above, 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 the NRC to authorize the use of the proposed alternative.

3.0 TECHNICAL EVALUATION

3.1 Relief Request 17

3.1.1 ASME Code Component(s) Affected

The affected component is an ASME Code Class 3 elbow on the discharge side of Pump 2A of the ICW piping, designated as System 21, I-30"-CW-9. The nominal pipe wall thickness is 0.375 inches, and the nominal pipe size is 30 inches. The operating temperature and pressure are 95 degrees Fahrenheit (°F) and 90 pounds per square inch gauge (psig), respectively. The design temperature and pressure are 125 °F and 90 psig, respectively. The pipe is made of ASTM A-234, Grade WPB or WPBW.

3.1.2 Applicable Code Edition and Addenda

The ASME Code, Section XI, 2007 Edition with Addenda through 2008 is the Code of Record for the Fourth 10-Year Inservice Inspection (ISI) interval.

The ASME Code, Section III, Class 3, 1971 Edition with Addenda through Summer 1973, is the Code of Record during the construction.

3.1.3 Applicable Code Requirement

For ASME Code Class 3 components, paragraph IWA-4000 of ASME Code, Section XI, 2007 Edition states that the requirements of IWA-4000 may be used.

3.1.4 Reason for Request

On February 3, 2020, while operating, the licensee declared the "A" train ICW system inoperable, which resulted in entry into the Action statement of Limiting Condition for Operation (LCO) 3.7.4 in the plant Technical Specifications. The licensee identified two holes in an elbow just downstream of the 2A ICW Pump discharge butterfly valve. The pump discharges fluid into a pipe down through the discharge valve which then enters a 30-inch elbow that directs the flow to the 2A ICW header. The licensee stated that although forensics have not been performed, it is reasonable to assume that flow turbulence caused degradation of the internal pipe coatings leading to the degradation of the elbow wall creating the two holes on the elbow. The licensee reported that the flaw sizes have not grown since first detected as the leaks have been plugged, and no additional leakage has been detected.

The licensee indicated that ASME Code Case N-513-3, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping, Section XI, Division 1," provides criteria to allow temporary acceptance of flaws, including through-wall flaws in moderate energy Class 2 or 3 piping without performing repair or replacement activities. The NRC has approved Code Case N-513-3 for generic use in Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 18 (ADAMS Accession No. ML16321A336), with the condition that the repair or replacement activity temporarily deferred under the provisions of this Code Case shall be performed during the next scheduled outage.

The licensee stated that ASME Code Case N-513-3 does not address the evaluation of flaws in certain locations of moderate energy piping components, such as elbows. ASME Code Case N-513-4, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping, Section XI, Division 1," (Revision 4, May 7, 2014) contains several revisions to ASME Code Case N-513-3 including expanding the applicability of the Code Case beyond straight pipes to include elbows. The NRC has not approved ASME Code Case N-513-4 for generic use. The licensee proposed to use ASME Code Case N-513-4 to allow temporary acceptance of the degraded elbow in the ICW piping without repair or replacement to avoid a mid-cycle plant shutdown. The licensee explained that the use of the proposed alternative in lieu of immediate repair or replacement would allow extent of condition examinations and allow time to plan for long-term repair. The licensee stated that a mid-cycle plant shutdown would result in additional risk. Such a shutdown may not be necessary when a degraded ASME Code component is shown to retain adequate margin to fulfill the component's function. The license indicated that acceptance of this Relief Request will make the 2A ICW header operable. This will remove the single-point vulnerability of having only one of two ICW headers operable.

3.1.5 Proposed Alternative

The licensee proposed to use ASME Code Case N-513-4 to allow the degraded ICW pipe to remain in service. The licensee stated that it will repair the subject pipe in accordance with the ASME Code, Section XI at the next scheduled refueling outage or prior to exceeding the allowable flaw size, whichever occurs first.

3.1.6 Basis for Use

The NRC approved ASME Code Case N-513-3 in Regulatory Guide 1.147 to allow temporary acceptance of partial through-wall or through-wall leaks for an operating cycle provided all conditions of the Code Case and NRC conditions are met. Code Case N-513-3 also requires licenses to demonstrate system operability considering the effects of leakage. The ASME created Code Case N-513-4 to achieve greater flexibility in application and other improvements. For example, Code Case N-513-4 is applicable to elbows, bent pipe, reducers, expanders, branch tees, and external tubing or piping attached to heat exchangers.

The licensee stated that for a leaking flaw in a pipe, the allowable leakage rate will be determined by dividing the critical leakage rate by a safety factor of four. The critical leakage rate is determined as the highest leakage rate that can be tolerated and will be based on factors such as the allowable loss of inventory or the maximum leakage that can be tolerated relative to room flooding, among others.

Effect of Leaks on ICW Train 2A Header Flow and Adjacent Areas

The licensee indicated that there are two through-wall leaks located in the 30-inch elbow just downstream of isolation valve SB21163 for ICW Pump 2A. The licensee stated that the leaks cannot be isolated from the ICW headers while on-line. The licensee reported that the 2A ICW train flow is not affected because the combined leakage is estimated to be approximately 5 to 10 gpm. The licensee indicated that the design basis ICW header flow is 14,500 gpm. The normal and accident ICW header flow rates are throttled by the component cooling water (CCW) heat exchanger outlet temperature control valves (TCV) 14.4A and 14.4B. These valves throttle ICW header flow to achieve and maintain the CCW outlet temperature at a 100°F set point. The licensee stated that the leakage in the 2A ICW piping does not affect the operability and functionality of the 2B ICW train because the 2A and 2B ICW trains are independent.

The licensee further stated that the extended power uprate (EPU) analysis confirmed that an ICW flow rate of 14,140 gpm is sufficient to remove the required heat loads during a loss of coolant accident (LOCA) event at the EPU conditions. The EPU LOCA analysis also conservatively uses a maximum ICW inlet temperature of 95 °F. The licensee recognized that increased leakage reduces the margin available for the cooling capability of the 2A ICW train to adequately cool the 2A CCW heat exchanger. The licensee stated that, however, the ICW header flow would still be able to meet the design basis LOCA minimum flow requirements assuming total leakage up to 90 gpm (using a safety factor of four). A significant margin would still exist with the allowable leak rate of 90 gpm because the system design basis flow of 14,500 gpm is 360 gpm greater than the 14,140 gpm that is required to remove the EPU LOCA heat loads.

The licensee stated that if the flaw size exceeds the allowable flaw sizes or exceeds the leak allowance, the ICW header will be declared inoperable.

Flooding Evaluation

The licensee stated that besides the impact on the ICW header flow margin, the leakage would spray seawater on adjacent equipment and on the floor area below. The water spraying will wet the tube steel support and the coated ICW piping below the elbow and the concrete. However, the licensee has installed housekeeping plugs in both through-wall flaws to eliminate the spray from the leaks and potential damage to adjacent equipment. The licensee stated that should leakage occur, based on the layout of the intake structure, leakage up to the nominal flow of 360 gpm or more would not cause flooding because the water would flow to the intake bay below.

Flaw Characterization

The licensee performed ultrasonic testing (UT) to characterize the length and extent of the two flaws. The two flaws identified are referred to as the “East Through Wall” flaw which was measured to be 0.5-inch axially by 0.375-inch circumferentially and the “West Through Wall” flaw which was measured to be 0.75-inch axially by 0.75-inch circumferentially. The licensee was not able to measure a full set of UT wall thickness around to the “West Through Wall” flaw due to an interference with the existing pipe support.

The licensee characterized the flaws in accordance with the standards of the ASME Code, Section XI, IWA-3300 based on UT straight beam and angled beam. The licensee characterized two flaws in the 30-inch diameter ICW pipe as a single flaw having a

circumferential extent of 7 inches with a surrounding wall thickness of 0.300 inch and having an axial extent of 1.75 inches with a surrounding wall thickness of 0.194 inch.

The licensee also measured pipe wall thickness directly surrounding the leak and did not observe additional pitting. ASME Code Case N-513-4 paragraph 2(a) requires the inspection of the full pipe circumference at the flaw location to characterize the length and depth of all flaws in the pipe section. Due to interferences with the existing pipe support, the licensee could only measure pipe wall thickness on 76 percent of the pipe circumference on a plane approximately 5 inches below the flaw location. The licensee remarked that while the information is useful in characterizing the state of the pipe and confirming that the as-found leaks and thinning are localized, its measurement does not fully satisfy the code case requirement.

Structural Integrity

The licensee stated that the design pressure and temperature of the degraded portion of the pipe is 90 psig and 125 °F, respectively. Therefore, the subject piping meets the applicability criteria for ASME Code Case N-513-4 because the maximum operating temperature is not above 200 °F and the operating pressure does not exceed 275 psig.

The licensee performed a flaw evaluation to demonstrate that the degraded pipe meets the structural integrity requirements of ASME Code Case N-513-4 and ASME Code, Section XI, Appendix C. The licensee evaluated the two planar flaws in the axial and circumferential directions. The licensee enveloped all the UT measured pipe wall thickness values and bounded the effects of any other areas of erosion/corrosion within the degraded piping. The flaw evaluation considers both the pressure and design basis bending stress on the piping and gives an allowable flaw size in both the circumferential and axial directions. The licensee stated that based on its flaw evaluation, the subject piping is structurally sound even with the two flaws. The licensee derived a maximum allowable flaw size of 1.75 inches in the axial direction and 10 inches in the circumferential direction.

The licensee characterized the “East Through Wall” flaw as extending approximately 1.75 inches beyond the through-wall flaw location. Comparison of the “East” and “West” flaw thickness measurements near the leak shows that in general, thinning is more extensive near the “East” flaw. The licensee could not fully inspect the “West” flaw due to interferences with the adjacent pipe support, which reduces the accuracy of the characterization of the circumferential flaw. Therefore, to compensate for the unexamined circumference, the licensee assumed that the “West” flaw extends no more than 1.75 inches into the obstructed area. The licensee stated that the characterized circumferential through-wall flaw should be approximately 8.75 inches (7 inches + 1.75 inches), which is still less than the allowable circumferential length of 10 inches.

Monitoring

The licensee stated that it will monitor the leakage daily as required by paragraph 2(f) of ASME Code Case N-513-4 to confirm that the evaluation assumptions remain valid. Specifically, the licensee stated that it will perform walkdowns twice daily to monitor the flaws. If there is a significant change in the leakage rate, the licensee will question the evaluation assumptions and track the leakage with a corrective action. The licensee would re-inspect the flaws per paragraph 2(f) of the Code Case and will perform examinations in accordance with the method described in paragraph 2(a) of the Code Case.

The licensee stated that ASME Code Case N-513-4 includes provisions for periodic UT inspection of the flaw not to exceed thirty days if a flaw growth evaluation is not performed. ASME Code Case N-513-4 also requires augmented inspections of at least five similar susceptible locations to that of the flaw. The licensee stated that a corrective action or similar mechanism will track completion of this activity.

The licensee stated that it intends to repair or replace the elbow during the next scheduled refueling outage using an ASME Code approved method.

3.1.7 Duration of Proposed Alternate

The proposed alternative is requested until Mode 5 of the SL2-25 refueling outage, currently scheduled for February 17, 2020.

4.0 NRC STAFF EVALUATION

The NRC staff has evaluated Relief Request 17 pursuant to 10 CFR 50.55a(z)(2). Specifically, the NRC has reviewed flaw characterization, system operability, structural integrity, flooding evaluation, and hardship justification in the proposed alternative as follows.

Flaw Characterization

The NRC noted that one hole is 0.5 inch axially by 0.375 inch circumferentially, and the other hole is 0.75 inch axially by 0.75 inch circumferentially. The NRC staff finds it acceptable that the licensee ultrasonically inspected the wall thickness of the pipe at the vicinity of two holes to characterize the length and depth of the flaws underneath the holes.

The NRC staff notes that the outside surface dimensions of the two holes do not reveal the extent of the flaw size below the hole at the inside surface of the pipe. The NRC staff further notes that based on industry operating experience with the service water piping, corrosion or erosion will cause wall thinning from the inside surface of the pipe, which eventually manifests into a through-wall hole. The ASME Code, Section XI, IWA-3300 requires pipe degradation be characterized or sized in terms of a rectangle or square that fully contains the area of the flaw. Based on IWA-3300, the licensee combined the two holes into a single flaw and characterized the single flaw as being 1.75 inches in the axial direction and 7 inches in the circumferential direction. However, because the wall thickness of the portion of the pipe circumference was not measured, the licensee conservatively added 1.75 inches to the 7 inches. Therefore, the licensee characterized the flaw as 1.75 inches axially and 8.75 inches circumferentially. The NRC staff finds that the licensee appropriately characterized the flaw based on the ASME Code, Section XI, IWA-3300.

System Operability

The NRC staff finds that the operability of the 2A ICW system will be maintained as long as the leak rate from the two holes does not exceed 360 gpm. From this leak rate, the licensee derived an allowable leak rate of 90 gpm using a safety factor of four. The NRC staff finds that a safety factor of four on the leak rate is acceptable because it provides reasonable assurance for the operability and functionality of the degraded pipe. The NRC staff notes that if the leak rate from the two holes exceeded 90 gpm, the relief request would no longer be valid, and the licensee will need to take corrective actions. The NRC staff notes that the licensee has stopped the leak from the elbow with temporary plugs. The licensee will monitor the elbow twice daily to

ensure any potential leakage will not exceed 90 gpm. The NRC staff finds that the operability and functionality of the degraded ICW piping will not be significantly affected because there is sufficient margin in the mass flow rate in the ICW piping to provide cooling to the safety-related equipment.

Structural Integrity

The licensee evaluated the degraded elbow in accordance with ASME Code Case N-513-4 and derived an allowable flaw of size 1.75 inch in the axial direction and 10 inches in the circumferential direction. The allowable flaw size bounds the characterized flaw size of 1.75 inch in the axial direction and 8.75 inch in the circumferential direction. As such, the NRC staff finds that the elbow will remain stable under all design basis loading conditions. The NRC staff notes that the two holes were discovered by February 3, 2020. The refueling outage is scheduled to begin on February 17, 2020, during which the license will perform the ASME Code repair. The NRC staff does not expect the flaw to grow aggressively during this short period of time. If the flaws do grow unexpectedly, the licensee will detect the growth during the twice daily walkdowns and will take corrective actions. The NRC staff finds that the licensee's flaw evaluation has adequately demonstrated the structural integrity of the 2A ICW piping.

Flooding Evaluation

The NRC staff finds that no safety-related components or equipment were affected by the leakage except the water spray had wetted the portion of the ICW piping that is located below the elbow and pipe support. The licensee has temporarily stopped the leakage from both holes in the subject elbow. The licensee will monitor the leaking elbow twice daily. Should leakage occur, the water will drain to the intake bay, and the licensee will take corrective actions. Therefore, the NRC staff finds that flooding in the area where the leaking elbow is located is not a safety concern.

Hardship Justification

The NRC staff finds that without the proposed alternative, the licensee would have to shut down the plant to perform the repair or replacement in accordance with the ASME Code, Section XI. The NRC staff recognizes that a plant shutdown would result in undue risk. An unscheduled mid-cycle plant shutdown and subsequent restart would add additional loading on various safety-related piping and components. The NRC staff notes that the licensee has demonstrated that the leaking elbow will maintain reasonable structural integrity for a limited duration. Therefore, the NRC staff finds that complying with the specified ASME Code requirement to repair or replace the degraded elbow would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Based on the information provided, the NRC staff finds that: (1) there is an adequate margin between the size of the existing flaws and the allowable flaw size for the 2A ICW piping, (2) the existing flaws are reasonably expected to be stable and not growing for the period of the requested alternative, (3) the leak rate from the existing flaws is less than the allowable leak rate, thus the 2A ICW system is capable of performing its intended function, (4) the twice-daily walkdowns are acceptable to monitor for changes in leak rate and/or potential flaw growth, and (5) the licensee's hardship justification is acceptable. Therefore, the NRC staff finds that the proposed alternative will provide reasonable assurance that the structural integrity of the 2A ICW piping will be maintained until the SL2-25 refueling outage.

5.0 CONCLUSION

The NRC staff concludes that the proposed alternative provides reasonable assurance of structural integrity of the subject ICW system piping. The NRC staff finds that complying with the requirements of the ASME Code, Section XI would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the NRC authorizes the use of Relief Request 17 at St. Lucie, Unit 2 until Mode 5 of the SL2-25 refueling outage, the leak rate from the flaws exceeds 90 gpm, or the existing flaws grow to exceed the allowable flaw size, whichever occurs first.

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

Principle Contributor: J. Tsao, NRR

SUBJECT: ST. LUCIE PLANT, UNIT NO. 2 - APPROVAL OF ALTERNATIVE TO USE ASME CODE CASE N-513-4 FOR ALTERNATE REPAIR OF INTAKE COOLING WATER SYSTEM (EPID L-2020-LLR-0021) DATED FEBRUARY 3, 2021

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