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

April 22, 2011

Mr. Mano Nazar
Executive Vice President and
Chief Nuclear Officer
Florida Power and Light Company
P.O. Box 14000
Juno Beach, Florida 33408-0420

SUBJECT: TURKEY POINT, UNIT 3 - SAFETY EVALUATION FOR RELIEF REQUEST NO. 8 REGARDING REPAIR OF SPENT FUEL POOL TRANSFER CANAL DRAIN PIPING (TAC NO. ME4901)

Dear Mr. Nazar:

By letter to the Nuclear Regulatory Commission (NRC) dated October 21, 2010 (Agencywide Documents Access & Management System (ADAMS) Accession No. ML103070073), as supplemented by letter dated February 4, 2011 (ML110480049), Florida Power and Light Company (the licensee) submitted Relief Request No. 8 for NRC review and approval to repair or replace the degraded transfer canal drain piping of the spent fuel pool cooling system at Turkey Point, Unit 3. The licensee requested relief from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, IWA-4000, "Repair/Replacement Activities."

The licensee requested its relief pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(i), which allows alternatives to the ASME Code requirements based on the acceptable level of quality and safety. In a teleconference with the licensee on October 27, 2010, the NRC staff questioned the validity of submitting the relief request pursuant to 10 CFR 50.55a(a)(3)(i). The NRC staff finds that it is more appropriate that the proposed relief request be submitted based on impracticality pursuant to 10 CFR 50.55a(g)(6)(i), because it was impractical to perform the necessary repair on the degraded piping during the scheduled refueling outage when the degraded piping is required to be used. The licensee agreed with the NRC staff's assessment that the relief request should be submitted pursuant to 10 CFR 50.55a(g)(6)(i). Therefore, on October 27, 2010 (ML103010089), the NRC staff granted a verbal authorization for the use of Relief Request No. 8 in accordance with 10 CFR 50.55a(g)(6)(i).

The NRC staff concludes that granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed at Turkey Point, Unit 3. Relief Request No. 8 was granted until December 31, 2010.

If you have any questions regarding this issue, please feel free to contact Jason Paige at (301) 415-5888.

Sincerely,

Brenda Mozafari for

Douglas A. Broaddus, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-250

Enclosure: Safety Evaluation

cc w/enclosure: Distribution via Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST NO. 8 REGARDING REPAIR

OF SPENT FUEL POOL TRANSFER CANAL DRAIN PIPING

FLORIDA POWER & LIGHT CO.

TURKEY POINT UNIT 3

DOCKET NO. 50-250

1.0 INTRODUCTION

By letter to the Nuclear Regulatory Commission (NRC) dated October 21, 2010 (Agencywide Documents Access & Management System (ADAMS) Accession No. ML103070073), as supplemented by letter dated February 4, 2011 (ML110480049), Florida Power and Light Company (FPL, the licensee) submitted Relief Request No. 8 for NRC review and approval to repair or replace the degraded transfer canal drain piping of the spent fuel pool (SFP) cooling system at Turkey Point, Unit 3. The licensee requested relief from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, IWA-4000, "Repair/Replacement Activities."

On July 29, 2010, the licensee detected a leak in the transfer canal drain piping. The licensee invoked ASME Code Case N-513-2, which allows degraded piping in certain conditions to remain in service. Paragraph 2(h) of Code Case N-513-2 requires that the repair or replacement be performed no later than when the predicted flaw size exceeds the acceptance criteria or the next scheduled outage, whichever occurs first. However, the licensee was not able to repair the degraded piping during the scheduled fall 2010 refueling outage due to operational needs of the subject piping. Therefore, the licensee proposed to extend the repair/replacement of the degraded piping after the scheduled fall 2010 refueling outage.

The licensee requested its relief pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(i), which allows alternatives to the ASME Code requirements based on the acceptable level of quality and safety. In a teleconference with the licensee on October 27, 2010, the NRC staff questioned the validity of submitting the relief request pursuant to 10 CFR 50.55a(a)(3)(i). The NRC staff found that it was more appropriate that the proposed relief request be submitted based on the impracticality of 10 CFR 50.55a(g)(6)(i), because it was impractical to perform the necessary repair on the degraded piping during the scheduled refueling outage when the degraded piping is needed to be in operation. The licensee agreed with the NRC staff's assessment that the relief request should be submitted pursuant to 10 CFR 50.55a(g)(6)(i).

During a conference call on October 27, 2010 (ML103010089), the NRC informed the licensee of its decision. Subsequently the NRC, pursuant to 10 CFR 50.55a(g)(6)(i), verbally authorized the licensee's use of Relief Request No. 8. This safety evaluation documents the NRC staff's evaluation of Relief Request No. 8, and is a written confirmation of the decision made by the NRC to grant the licensee's relief request.

2.0 REGULATORY EVALUATION

As specified in 10 CFR 50.55a(g), inservice inspection (ISI) of nuclear power plant components shall be performed in accordance with the requirements of the ASME Code, Section XI, except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). Pursuant to 10 CFR 50.55a(g)(4), ASME Code, Classes 1, 2, and 3 components (including supports) must meet the requirements of the ASME Code, Section XI, "Rules for Inservice Inspection (ISI) of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components.

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

As stated in 10 CFR 50.55a(g)(6)(i), the Commission may grant such relief and may impose such alternative requirements as it determines is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed.

The Code of Record for the fourth ISI interval at Turkey Point, Unit 3 is the 1998 Edition with 2000 Addenda of ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components."

3.0 TECHNICAL EVALUATION

3.1 Proposed Relief Request No. 8

3.1.1 ASME Code Component(s) Affected

ASME Code, Code Class 3 transfer canal drain line piping of the SFP at Turkey Point Nuclear Plant, Unit 3.

3.1.2 Applicable Code Edition and Addenda

The Code of Record for Turkey Point, Unit 3 is the ASME Code, Section XI, 1998 Edition through 2000 Addenda.

3.1.3 Applicable Code Requirement

ASME Code, Section XI, 1998 Edition through 2000 Addenda, Subsection IWA-4000, allows the use of Code Cases. The licensee invoked ASME Code Case N-513-2. Paragraph 2(h) of ASME Code Case N-513-2 requires that repair or replacement be performed no later than when the predicted flaw size exceeds the acceptance criteria or the next scheduled outage, whichever occurs first.

3.1.4 Proposed Alternative and Basis for Use

The licensee detected the flaws in the transfer canal drain line less than 60 days from the fall 2010 refueling outage and fuel movements were in progress at the time of discovery. New fuel delivery and shuffles require the spent fuel pit and associated transfer canal and piping to be filled and operational. Therefore, the degraded transfer canal drain piping and the associated fuel handling system were required to remain in service during the refueling outage. In addition, the licensee stated that repair parts were not readily available at the time of leakage detection, and the repairs would also require removal of concrete and the cutting of reinforcement bars in the spent fuel pit mat. Accordingly, the licensee could not repair the degraded piping until after the fall 2010 scheduled refueling outage.

The affected section of drain line piping is non-isolable; therefore, repair or replacement is only practical when the transfer canal is drained. Upon evaluation of the flaws, the licensee determined that a design modification is a prudent and appropriate corrective action. The subject piping system is in service during a refueling outage but may be taken out-of-service after completing fuel handling and decontamination activities.

The licensee stated that the transfer canal will be drained, and the drain piping will be isolated as soon as practicable after the end of the Unit 3 fall 2010 refueling outage and plant startup. The licensee requested relief from ASME Code Case N-513-2 requiring piping replacement or repair of the through-wall leaks on the transfer canal drain piping during the next scheduled outage, which began on September 24, 2010.

According to the licensee, no system alignment would increase leakage in the affected section of pipe. Therefore, the proposed scheduling of the piping repairs after the refueling outage will not increase the health and safety risk to the public. The licensee stated that per Paragraph 2(f) of Code Case N-513-2, the piping will be observed by daily walkdowns for increased leakage or new leak locations while the transfer canal is filled. In addition, the affected section of pipe will be either tagged out-of-service or, per Paragraph 2(e) of ASME Code, Case N-513-2, the flaws will be inspected on a monthly basis until repairs or restoration is completed.

3.1.5 Duration for the Proposed Alternative

The licensee was scheduled to restore the transfer canal drain line to conformance with design requirements no later than December 31, 2010.

3.2 NRC Staff's Evaluation

The licensee requested its relief pursuant to 10 CFR 50.55a(a)(3)(i), which allows alternatives to the ASME Code requirements based on the acceptable level of quality and safety. In a

teleconference with the licensee on October 27, 2010, the NRC staff questioned the validity of submitting the relief request pursuant to 10 CFR 50.55a(a)(3)(i). The NRC staff finds that it is more appropriate that the proposed relief request be submitted based on the impracticality of 10 CFR 50.55a(g)(6)(i), because it was impractical to perform the necessary repair on the degraded piping during the scheduled refueling outage when the degraded piping is needed to be in operation. The licensee agreed with the NRC staff's assessment that the relief request should be submitted pursuant to 10 CFR 50.55a(g)(6)(i).

By letter dated February 4, 2011, the licensee provided clarifying information regarding the flaw characterization, inspection results, the root cause, and the flaw evaluation. The licensee also confirmed that the degraded piping was repaired per the ASME Code by December 31, 2010.

The proposed relief request deferred the repair or replacement of the degraded piping from the scheduled refueling outage starting September 24, 2010, to December 31, 2010. The NRC staff evaluated the licensee's assessment of the structural integrity of the degraded piping from July 29, 2010, when flaws were initially detected to the completion date of the repair on December 31, 2010.

3.2.1 Flaw Characterization

ASME Code, Case N-513-2, paragraph 2(a) requires characterization of the flaw(s). The licensee detected three pin-hole indications at the toe of welds on similar sections of the fuel transfer canal drain piping of the SFP cooling system. The subject 4-inch nominal diameter piping was fabricated with Schedule 10S, seamless, A312, Type 304 stainless steel. One pin hole was located outside containment upstream of drain valve 3-12-028 for the fuel transfer canal and two pin holes were located downstream of 3-12-029 SFP pump suction valve from the fuel transfer canal. The total leak rate was estimated to be 1 drop every 2 to 3 minutes causing boric acid crystallization on the pipe. The affected piping is classified as ASME Code, Section XI Class 3 piping (Quality Group C).

At the valve 3-12-028 location, the licensee reported a flaw length of 0.2 inch at the inside surface of the pipe using dye penetrant testing and ultrasonic testing (UT) conducted on July 29, 2010. The licensee confirmed the flaw length of 0.2 inch based on the UT inspections conducted on August 19, 2010, and September 13, 2010. However, the flaw grew to 0.50 inch based on the UT inspections conducted on October 13, 2010, and November 12, 2010.

At the valve 3-12-029 location, the licensee reported two pin holes with no measureable length on the inside surface of the pipe in the initial inspection based on dye penetrant test and UT performed on July 29, 2010. On August 19 and September 13, 2010, the licensee confirmed no measureable length for the two pin-hole flaws. On October 13, 2010 and November 12, 2010, the licensee detected a combined flaw length of 0.4 inch for the two pin holes using UT.

3.2.2 Inspections

ASME Code, Case N-513-2, paragraph 2(e) requires daily walkdowns and 30-day inspections of the degraded piping. Starting on July 30, 2010, the licensee performed daily visual examinations on the flaws to confirm the analytical conditions used in the flaw evaluation remain valid per paragraph 2.0(f) of Code Case N-513-2. Also, the licensee performed UTs of the flaws

every 30 days on August 19, September 13, October 13, and November 12, 2010. The licensee did not perform the UT in December 2010 because the licensee initiated the repair on December 6, 2010.

ASME Code, Case N-513-2, Section 5.0, requires augmented inspections to determine the extent of conditions. The licensee performed an augmented inspection to assess degradation of the affected system. A sample size of five of the most susceptible and accessible locations were examined within 30 days of detecting the flaw. No flaws were detected.

The NRC staff finds that the licensee's inspection program for the degraded piping has satisfied the requirements of Code Case N-513-2.

3.2.3 Root Cause

Transgranular stress corrosion cracking (TGSCC) is a phenomenon that produces cracks that propagate through the grains of a material and usually occurs in the presence of halogens, sulfides, or chlorides. In austenitic stainless steels, TGSCC is not usually associated with a specific metallurgical condition, but is affected by high local residual stresses, such as caused by welding or local cold work, as well as by the environment. The licensee noted that TGSCC in 300-series stainless steels is most commonly associated with chlorides.

The licensee stated that the nominal environment for the interior of the transfer canal piping would not be expected to contain sufficient chloride for TGSCC to occur due to controlled chemistry (borated clean water). The nominal external environment is ambient coastal air. For a line located in a pit that has standing water for most of the year, a constant supply of moisture and salt can be present on the external surface of the piping.

The licensee explained that the apparent cause of the Unit 3 transfer canal drain line through wall leakage is chloride-induced TGSCC initiated in the outside diameter of the piping. The leaks are located in the heat affected zone of the pipe-to-valve weld. Residual stresses from these welds are a likely source of the flaw initiation. A minor amount of stress corrosion cracking could have readily produced the final through-thickness flaws and the leaks. The TGSCC is the most likely cause due to accumulation of chlorides on the outside surface in the region of the base metal.

The NRC staff notes that under similar operating conditions, several pressurized-water reactor (PWR) nuclear plants have experienced chloride-induced TGSCC in the stainless steel, schedule 10S, piping. On February 23, 2011, the NRC issued Information Notice 2011-04, "Contaminants and Stagnant Conditions Affecting Stress Corrosion Cracking in Stainless Steel Piping in Pressurized-Water Reactors." Additional information on TGSCC can be found in PWR Owners Group document, "Outside Diameter Initiated Stress Corrosion Cracking Revised Final White Paper," PA-MSC-0474, published on October 14, 2010. The NRC staff finds that TGSCC is a plausible degradation mechanism for the subject piping at Turkey Point Unit 3.

3.2.4 Flaw Evaluation

ASME Code, Case N-513-2, paragraph 2(d) requires an evaluation for detailed flaws. The licensee derived the allowable lengths for the flaws in the degraded 4-inch piping based on the allowable flaw size derived previously for similar flaws in an 8-inch SFP cooling pipe, which has

the same design and material conditions as the 4-inch piping. The conditions involve the same pipe schedule (10S) and material (stainless steel, A312 Type 304) with the same ASME Code-specified yield strength, ultimate tensile strength, structural factor on primary membrane stress, Young's Modulus, and allowable design stress. The design pressure (150 psig) and temperature (200 degrees F) of the 4-inch and 8-inch piping are the same. The maximum operating pressure and temperature of the subject 4-inch piping are 70 psig and 120 degrees F, respectively. Both 4-inch and 8-inch pipes are ASME Code, Class 3, and subject to the same methodology for flaw analysis. The same Service Level A safety factors were applied to both pipes.

The area of concern consists of three piping segments, (1) receiving flow from the fuel transfer canal, (2) providing suction to the SFP emergency pump, and (3) drainage to the waste holdup tank. All three lines are considered structurally anchored at the grouted wall penetrations of the boric acid storage tank room. The licensee stated that these pseudo anchors would permit no rotation and no lateral movement, and offer resistance to axial translation (pipes are well supported on each end). Since the piping configuration consists of small lengths of piping anchored at each end, three valves adjacent to these anchors, the expected deadweight and seismic stress levels would be extremely small. The licensee concluded that no loading/moments, thermal or dead-weight conditions would adversely affect the pipes and the three flaws. Based on the discussion with the licensee on October 27, 2010, the NRC staff agrees that the loading on the flaws would not be significant or impact the structural integrity.

For the 8-inch pipe, the licensee calculated an allowable axial flaw length of 4.93 inches and an allowable circumferential flaw length of 14.86 inches. Based on equation (1) of Code Case N-513-2 and the allowable flaw sizes of the 8-inch pipe, the licensee derived an allowable axial flaw length of 5.05 inches and an allowable circumferential flaw length of 7.75 inches for the subject 4-inch piping.

Based on the licensee's inspection results, the most limiting flaw growth rate was demonstrated by the flaw near valve 3-12-029 [(0.4 inch – 0 inch)/30 day = 0.013 inch/day growth]. Assuming the entire flaw length is in the axial direction and propagating at a continuous linear rate, margin still existed for the flaw to reach the allowable flaw size of 5.05 inches before the repair was completed by December 31, 2010. Although undesirable, the NRC staff found that the flaw growth rate in the limited period of time from July 2010 to December 2010 would not significantly affect the overall structural integrity of the subject piping.

The licensee stated that the makeup capacity for the SFP system is 100 gallons per minute from the demineralized water system, which is much greater than the reported leak rate of 1 drop every 2 to 3 minutes and does not significantly impact the pool water level and inventory when there is direct communication between the SFP and fuel transfer canal.

Based on the above, the NRC staff found that the structural integrity of the transfer canal drain piping would be maintained until repair or replacement by December 31, 2010. Therefore, the NRC staff concluded that the proposed alternative to repair the degraded piping after the scheduled refueling outage but before December 31, 2010, was acceptable because of the following findings: (1) the operating conditions (70 psig and 120 degrees F) of the degraded piping are relatively mild (i.e., low energy); therefore, the applied loads would not likely drive the flaws to propagate significantly; (2) the flaws were located near an anchor such that the

degraded piping segment was sufficiently restraint to limit its impact on adjacent piping and systems should the degraded piping result in a double-ended guillotine break; (3) the leak rate was not significant to affect the operability of the transfer canal drain piping system or nearby piping systems; (4) the licensee demonstrated by analysis that a sufficient margin existed between the allowable flaw size and the three pin hole sizes; (5) the licensee performed successive UT and daily walkdowns to monitor flaw growth in the degraded piping. The UT results confirmed that the flaw growth was not aggressive; and (6) the licensee committed to repair the degraded piping within a relatively short period of time (July 2010 to December 2010) to establish the structural integrity of the SFP cooling system.

4.0 CONCLUSION

On the basis of its review, the NRC staff has determined that requiring the repair of the degraded SFP transfer canal drain piping during the scheduled fall 2010 refueling outage in accordance with ASME Code Case N-513-2 was impractical because of the operational need of the subject degraded piping. The NRC staff found that deferring the repair to December 31, 2010 would not challenge the structural integrity of the subject piping. Therefore, the NRC staff granted relief under Code Case N-513-2 paragraph 2(h) for the use of Relief Request No. 8 for the SFP transfer canal drain piping at Turkey Point, Unit 3.

The NRC staff concludes that granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed at Turkey Point Unit 3. Relief Request No. 8 was granted up to December 31, 2010.

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

Principal Contributor: John Tsao

Date: April 22, 2011

If you have any questions regarding this issue, please feel free to contact Jason Paige at (301) 415-5888.

Sincerely,

/RA by BMozafari for/

Douglas A. Broaddus, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-250

Enclosure: Safety Evaluation

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