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

June 27, 2017

Mr. Mano Nazar
President and Chief Nuclear Officer
Nuclear Division
Florida Power & Light Company
Mail Stop EX/JB
700 Universe Blvd.
Juno Beach, FL 33408

SUBJECT: TURKEY POINT NUCLEAR GENERATING, UNIT NOS. 3 AND 4 – FLOOD HAZARD MITIGATION STRATEGIES ASSESSMENT (CAC NOS. MF7984 AND MF7985)

Dear Mr. Nazar:

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the U.S. Nuclear Regulatory Commission (NRC) issued a request for information to all power reactor licensees and holders of construction permits in active or deferred status, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(f), "Conditions of Licenses" (hereafter referred to as the "50.54(f) letter"). The request was issued in connection with implementing lessons learned from the 2011 accident at the Fukushima Dai-ichi nuclear power plant, as documented in the NRC's Near-Term Task Force (NTTF) report (ADAMS Accession No. ML111861807).

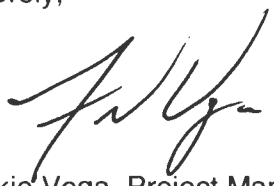
Enclosure 2 to the 50.54(f) letter requested that licensees reevaluate flood hazards for their sites using present-day methods and regulatory guidance used by the NRC staff when reviewing applications for early site permits and combined licenses. Concurrent with the reevaluation of flood hazards, licensees were required to develop and implement mitigating strategies in accordance with NRC Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (ADAMS Accession No. ML12054A735). In order to proceed with implementation of Order EA-12-049, licensees used the current licensing basis flood hazard or the most recent flood hazard information, which may not be based on present-day methodologies and guidance, in the development of their mitigating strategies.

By letter dated December 20, 2016 (ADAMS Accession No. ML17012A065), Florida Power and Light Company (the licensee), submitted its mitigation strategies assessment (MSA) for Turkey Point Nuclear Generating, Units 3 and 4 (Turkey Point). The MSAs are intended to confirm that licensees have adequately addressed the reevaluated flooding hazards within their mitigating strategies for beyond-design-basis external events. The purpose of this letter is to provide the NRC's assessment of the Turkey Point MSA.

The NRC staff has concluded that the Turkey Point MSA was performed consistent with the guidance described in Appendix G of Nuclear Energy Institute 12-06, Revision 2, as endorsed by Japan Lessons-Learned Division (JLD) interim staff guidance (ISG) JLD-ISG-2012-01, Revision 1, and that the licensee has demonstrated that the mitigation strategies are reasonably protected from reevaluated flood hazards conditions for beyond-design-basis external events. This closes out the NRC's efforts associated with CAC Nos. MF7984 and MF7985.

If you have any questions, please contact me at 301-415-1617 or at Frankie.Vega@nrc.gov.

Sincerely,



Frankie Vega, Project Manager
Hazards Management Branch
Japan Lessons-Learned Division
Office of Nuclear Reactor Regulation

Enclosure:
Staff Assessment Related to the Mitigating Strategies for Turkey Point

Docket Nos. 50-250 and 50-251

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STAFF ASSESSMENT BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO MITIGATION STRATEGIES FOR

TURKEY POINT NUCLEAR GENERATING, UNIT NOS. 3 AND 4

AS A RESULT OF THE REEVALUATED FLOODING HAZARD NEAR-TERM

TASK FORCE RECOMMENDATION 2.1- FLOODING

CAC NOS. MF7984 AND MF7985

1.0 INTRODUCTION

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the U.S. Nuclear Regulatory Commission (NRC) issued a request for information to all power reactor licensees and holders of construction permits in active or deferred status, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(f), "Conditions of Licenses" (hereafter referred to as the "50.54(f) letter"). The request was issued in connection with implementing lessons-learned from the 2011 accident at the Fukushima Dai-ichi nuclear power plant, as documented in the NRC's Near-Term Task Force (NTTF) report (ADAMS Accession No. ML111861807).

Enclosure 2 to the 50.54(f) letter requested that licensees reevaluate flood hazards for their site(s) using present-day methods and regulatory guidance used by the NRC staff when reviewing applications for early site permits and combined licenses. Concurrent with the reevaluation of flood hazards, licensees were required to develop and implement mitigating strategies in accordance with NRC Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (ADAMS Accession No. ML12054A735). That order requires holders of operating reactor licenses and construction permits issued under 10 CFR Part 50 to modify the plants to provide additional capabilities and defense-in-depth for responding to beyond-design-basis external events, and to submit to the NRC for review a final integrated plan (FIP) that describes how compliance with the requirements of Attachment 2 of the order was achieved. In order to proceed with implementation of Order EA-12-049, licensees used the current licensing basis (CLB) flood hazard or the most recent flood hazard information, which may not be based on present-day methodologies and guidance, in the development of their mitigating strategies.

The NRC staff and industry recognized the difficulty in developing and implementing mitigating strategies before completing the reevaluation of flood hazards. The NRC staff described this issue and provided recommendations to the Commission on integrating these related activities in COMSECY-14-0037, "Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flood Hazards," dated November 21, 2014 (ADAMS Accession No. ML14309A256). The Commission issued a staff requirements memorandum on March 30, 2015 (ADAMS Accession No. ML15089A236), affirming that the Commission expects licensees for operating nuclear power plants to address the reevaluated flood hazards, which are considered beyond-design-basis external events, within their mitigating strategies.

Nuclear Energy Institute (NEI) 12-06, Revision 2, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" (ADAMS Accession No. ML16005A625), has been endorsed by the NRC as an appropriate methodology for licensees to perform assessments of the mitigating strategies against the reevaluated flood hazards developed in response to the March 12, 2012, 50.54(f) letter. The guidance in NEI 12-06, Revision 2, and Appendix G in particular, supports the proposed Mitigation of Beyond-Design-Basis Events rulemaking. The NRC's endorsement of NEI 12-06, including exceptions, clarifications, and additions, is described in NRC Japan Lessons-Learned Division (JLD) Interim Staff Guidance (ISG) JLD-ISG-2012-01, Revision 1, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (ADAMS Accession No. ML15357A163). Therefore, Appendix G of NEI 12-06, Revision 2, describes acceptable methods for demonstrating that the reevaluated flooding hazard is addressed within the Turkey Point Nuclear Generating, Units 3 and 4 (Turkey Point) mitigating strategies for beyond-design-basis external events.

2.0 BACKGROUND

By letter dated March 11, 2013 (ADAMS Accession No. ML130950216), as supplemented by letters dated January 31, 2014 (ADAMS Accession No. ML14055A365), February 26, 2014 (ADAMS Accession No. ML14073A065), April 25, 2014 (ADAMS Accession No. ML14149A479), and August 7, 2014 (ADAMS Accession No. and ML14234A085), Florida Power and Light Company (FPL, the licensee) submitted its flood hazard reevaluation report (FHRR) for Turkey Point. By letter dated December 4, 2014 (ADAMS Accession No. ML14324A816), the NRC staff issued the staff assessment of the FHRR for Turkey Point. By letter dated November 4, 2015 (ADAMS Accession No. ML15301A200), the NRC issued a supplement to its staff assessment of flood-causing mechanisms reevaluation for Turkey Point (hereafter referred to as the Mitigating Strategies Flood Hazard Information (MSFHI) letter). The MSFHI letter provided the reevaluated flood hazard mechanisms that exceeded the current design basis (CDB) for Turkey Point which are suitable input for the mitigating strategies assessment (MSA). For Turkey Point, the mechanisms listed as not bounded by the CDB in the MSFHI letter are local intense precipitation (LIP), seiche, tsunami, storm surge, and combined events flooding.

By letter dated December 20, 2016 (ADAMS Accession No. ML17012A065), FPL submitted its Turkey Point MSA for review by the NRC staff.

3.0 TECHNICAL EVALUATION

3.1 Turkey Point's FLEX Strategies

Turkey Point's FLEX strategy is described in the document titled, "Florida Power & Light Company's Turkey Point Units 3 and 4, Status of Required Actions for EA-12-049 Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, and Submittal of the Turkey Point Site FLEX Final Integrated Plan" which was submitted by letter dated June 20, 2016 (ADAMS Accession No. ML16181A189). The NRC staff evaluated the Turkey Point strategies as developed and implemented under Order EA-12-049. This evaluation is documented in a safety evaluation issued by letter dated October 28, 2016 (ADAMS Accession No. ML16279A455). The safety evaluation concluded that Turkey Point has developed guidance and proposed designs which, if implemented appropriately, should adequately address the requirements of Order EA-12-049.

The licensee stated in its MSA that the existing FLEX strategy can be successfully implemented and deployed as designed for all applicable flood-causing mechanisms.

A brief summary of the licensee's FLEX strategies is as follows:

- For Phase 1, immediately following the occurrence of an extended loss of alternating current power/loss of ultimate heat sink (ELAP/LUHS) event, the reactor will trip and the plant will initially stabilize at no-load reactor coolant system (RCS) temperature and pressure conditions, with reactor decay heat removal via steam release to the atmosphere through the steam generator (SG) main steam safety valves (MSSV) or, if available, the Steam Dump to Atmosphere (SDTA) valves. The turbine driven auxiliary feedwater (TDAF) pump will provide flow to the SGs with suction from the unit's Condensate Storage Tank (CST). Load stripping of non-essential loads will begin within 90 minutes after the occurrence of an ELAP, however, operators will implement the dc load shed based on the ELAP scenario (ELAP only vs. ELAP with a severe hurricane). This load shedding should ensure that the batteries have sufficient capacity to supply power to required loads for at least 21 hours (ELAP only) and 49 hours (ELAP with a severe hurricane).

- For Phase 2, the primary strategy for core cooling would be to continue using the SGs as a heat sink, with makeup water supplied by the CST. Operators will deploy a FLEX well pump unit to refill the CST from an artesian well drawing from the Floridian aquifer. Following dc load stripping and prior to battery depletion, one 550-kilowatt (kW), 480 Vac generator will be deployed from the FLEX equipment storage building (FESB) to each unit to repower essential battery chargers within 8 hours of ELAP initiation (or 18 hours for a hurricane event), as well as repowering charging pumps, boric acid transfer pumps, and ventilation. In order to maintain sufficient borated RCS inventory in Phase 2, a manifold and hoses from the FLEX well pump are deployed and provide makeup water which is mixed with borated water from the boric acid storage tanks. A re-powered boric acid transfer pump and charging pump are used to mix and inject the borated makeup water into the reactor coolant system.

- For Phase 3, a National SAFER Response Center (NSRC) will provide high capacity pumps and large turbine-driven DGs (diesel generators), which could be used to restore one RHR (residual heat removal) cooling train per unit to cool the cores in the long-term.

3.2 Evaluation of Flood Protection Features

The purpose of the MSA was to determine if the licensee's mitigating strategies are adequate as-is, need to be modified, or new mitigating strategies need to be developed to address hazard exceedances as described in the MSFHI letter. In its MSA, the licensee assessed the potential impacts of the following flood-causing mechanisms that were not bounded by the CDB: LIP; hurricane induced Probable Maximum Storm Surge (PMSS), Probable Maximum Tsunami (PMT), Seiche, and Combined Events Flooding. The licensee stated that LIP and PMSS exceed the corresponding flooding hazards in the CLB for the Turkey Point Site. The licensee also states that PMT, seiche, and combined events flood hazards are not addressed in the CLB and are thus, not bounded. However, the licensee explained that the Turkey Point site is not affected by seiche flooding and the combined events considered in the flooding reevaluation are included in the reevaluations performed for the PMSS and PMT events and therefore, combined events are not evaluated separately. The NRC agrees with this assessment for combined

events and sieche flood hazards as documented in the FHRR staff assessment. Further evaluations of the LIP, PMSS, and PMT and flood protection features are provided below.

LIP Flood

In Section 2.3.1.1 of its MSA, the licensee described the two LIP scenarios considered as part of this evaluation. The LIP Scenario A occurs during normal plant operations when no special flood protection measures required for hurricane readiness are in place. The LIP Scenario B occurs when the plant is operating under hurricane readiness procedures. For both scenarios, the licensee focused its LIP analysis on the Turbine Building and Component Cooling Water (CCW) areas, which are open-air structures. Under normal conditions, rainwater entering these open-air structures can escape by passive drainage. When hurricane readiness procedures are in place, rainwater is prevented from draining out of the CCW area because floor drains are plugged, stoplogs are inserted in doorways, and pumps are placed in this area to remove rainwater. Tables 2.2-1 and 2.2-2 of the MSA summarize the LIP flooding parameters for both scenarios. For Scenario A the maximum water elevation reported in the MSA was 17.24 ft. National Geodetic Vertical Datum of 1988 (NAVD88) and for scenario B the maximum water elevation was 16.57 ft. NAVD88. Both of these elevations were reported in the CCW areas. The licensee stated no equipment or connections required for FLEX are present in the CCW area; therefore, the LIP event will not affect the FLEX strategy. The critical auxiliary feedwater Phase 1 pumps are located in the turbine building. The licensee stated that such pumps would remain above the maximum water elevation by approximately 7.5 inches and therefore would not be affected by the LIP flood. Additionally, the licensee stated that, given the small depth and short duration of the LIP event, such an event would not impact the deployment times considered in the FLEX design. Regarding Phase 3, the licensee stated that the deployment of NSRC equipment occurs well after the LIP flood has receded and therefore will not be affected by such an event.

The NRC staff reviewed the licensee's assessment of the reevaluated LIP event as compared to the existing FLEX strategies in the Turkey Point FIP. The NRC staff also compared the maximum water surface elevations reported in the MSA for both LIP scenarios with the values reported in the MSFHI letter. The staff notes that for Scenario A, the MSFHI value for maximum water elevation matches the value reported in the MSA. For Scenario B, a maximum water elevation of 16.57 ft. NAVD88 was reported in the MSA; whereas, the MSFHI reports a maximum water elevation of 20.8 ft. NAVD88. The staff reviewed the FLEX storage locations, deployment paths, staging areas, and overall strategy proposed in the FIP and confirmed that there are no FLEX equipment and components in the CCW areas. Therefore, reported maximum water elevations due to the LIP events would not impact the FLEX strategies. The staff also confirmed that the LIP flood elevations in the turbine building would not affect Phase 1 FLEX structures, systems, and components. The staff agrees that, based on the expected time of 75 minutes for the LIP floods to recede, the LIP event would not impact any FLEX strategy, since no FLEX deployment activity is assumed to occur in the first 2 hours of an ELAP. As a result, the staff confirms that there appears to be sufficient time for flood waters to recede prior to the FLEX response activity taking place and therefore, no impact is expected to occur as a result of the reevaluated LIP hazard. The NRC staff concludes that the applicable FLEX strategies can be implemented as described in the FIP.

Probable Maximum Storm Surge

In the MSA, Section 2.1.2 describes the PMSS flood for Turkey Point that is postulated to be caused by a probable maximum hurricane (PMH). Table 2.2-3 of the MSA summarizes the

PMSS parameters (including 20 year sea level rise). The licensee's PMSS still water level is 17.3 ft. NAVD88 and includes the effects of 10-percent exceedance high tide, probable maximum surge, wave setup, and sea level rise. The maximum water level calculated by the license by combining the PMSS and coincident windwave runup is 19.1 ft. NAVD88 where protection is afforded by the eastern powerblock flood barriers. The reevaluated PMSS reaches an elevation of 18.0 ft. NAVD88 on the north side, 17.5 ft. NAVD88 on the west, and 17.9 ft. NAVD88 on the south flood protection walls.

The licensee stated that components and equipment associated with FLEX Phase 1 are protected by the site's flood protection barriers including stop logs. The licensee stated that the FESB is located above the PMSS and therefore, FLEX Phase 2 equipment is protected and will be available when needed for the PMSS event. The licensee explained that the transport and use of the portable FLEX equipment is not affected since the storm surge and associated wave run-up will be below plant grade 5 hours after the maximum storm surge elevation occurs. Regarding Phase 3, the licensee stated that the deployment of NSRC equipment occurs well after the PMSS flood has receded and therefore, will not be affected by such event.

The licensee stated that even though the actual height of the flood barrier is above the current PMSS elevations assuming wave run-up and are adequate for the current sea-level, some segments of the barrier will require modifications when considering the projected 20 year sea level rise. The licensee committed to modify, as required, the flood barriers in order to account for this increase in sea-level rise and reestablish the desired factor of safety and margin as recommended by industry standards. Additionally, the licensee emphasized that available physical margin is currently available and will be maintained/enhanced by plan modification as required.

The NRC staff reviewed the PMSS flood elevations provided in the MSA and the information provided in the FIP, which included details regarding the flood protection levels for the PMSS provided by the flood barriers including stop logs. As stated in the FIP, flood protection is provided to an elevation of 17.70 ft. NAVD88 using stop logs at entrances to the north, south, and west sides of the facility. Additional wave run-up protection is provided at 19.70 ft. NAVD88 on the east side of the facility. The NRC staff notes that the reevaluated PMSS elevations reported in the MSA exceed the barrier by 0.3 ft. on the north side and 0.2 ft. on the south side. The NRC staff confirmed that the FESB finished floor is above the flood stage elevation and that the FLEX strategy was designed in such way that Phase 2 FLEX equipment would not be required until the flood waters have receded. Therefore, the NRC staff concludes that the licensee appears to have adequately assessed the combined effects of the PMSS flooding for the impact on the FLEX strategies and that the applicable FLEX strategies can be implemented as currently designed.

Probable Maximum Tsunami

In the MSA, Section 2.1.3 describes the PMT postulated for the Turkey Point site, which is combined with wind wave activity and antecedent 10 percent exceedance tide. The licensee calculated the maximum water surface elevation for the Turkey Point site to be 13.9 ft. NAVD88, which remains below plant grade at 15.7 ft. NAVD88.

The staff reviewed the information provided in the MSA and notes that the PMT water elevation reported in the MSA differs from the value of 14.8 ft. NAVD88 reported by the staff in the MSFHI letter. Since both of these reported PMT maximum water elevations are below the plant grade elevation of 15.7 ft. NAVD88, the NRC staff concludes that such difference would not impact the

FLEX strategies. The NRC concludes that the licensee appears to have adequately assessed the PMT flooding for the impact on the FLEX strategies and that the applicable FLEX strategies can be implemented as currently designed.

3.3 Confirmation of Flood Hazard Elevations in the MSA

The NRC staff reviewed the flood hazard parameters in the MSA for Turkey Point and found that, for the LIP and PMT flood-causing mechanisms, the licensee applied new maximum water surface elevations, which are lower than the values reported in the MSFHI letter. The NRC staff will commence a full review of the MSA's revised flood hazard levels following submittal of the licensee's Focused Evaluation/Integrated Assessment. As part of the staff's review of the Turkey Point MSA, the staff evaluated potential impacts to the FLEX strategies from the flood elevations reported in both the MSFHI letter and the MSA and concluded that applicable FLEX strategies can be implemented as currently designed. If modifications to these elevations are determined to be necessary based on the staff's review of the Focused Evaluation/Integrated Assessment, the staff will revisit the MSA and assess any potential impacts to Turkey Point's FLEX strategies.

3.4 Evaluation of Flood Event Duration

As part of the staff's review of the Turkey Point MSA, the staff evaluated potential impacts to the FLEX strategies from the flood event duration (FED) parameters reported in both the MSFHI letter and the MSA. Given these values, as reported, the staff concluded that applicable FLEX strategies can be implemented as currently designed. The NRC staff will commence a full review of the FED parameters following submittal of the licensee's Focused Evaluation/Integrated Assessment Report. If modifications to these parameters are determined to be necessary based on the staff's review of the Focused Evaluation/Integrated Assessment, the staff will revisit the MSA and assess any potential impacts to Turkey Point's FLEX strategies.

3.5 Evaluation of Flood Associated Effects

As part of the staff's review of the Turkey Point MSA, the staff evaluated potential impacts to the FLEX strategies from associated effects (AE) parameters reported in both the MSFHI letter and the MSA. Given these values, as reported, the staff concluded that applicable FLEX strategies can be implemented as currently designed. The NRC staff will commence a full review of the AE parameters following submittal of the licensee's Focused Evaluation/Integrated Assessment Report. If modifications to these parameters are determined to be necessary based on the staff's review of the Focused Evaluation/Integrated Assessment, the staff will revisit the MSA and assess any potential impacts to Turkey Point's FLEX strategies.

3.6 Conclusion

The NRC staff has reviewed the information provided in the Turkey Point MSA related to the FLEX strategies, as evaluated against the reevaluated hazards described in Section 3 of this staff assessment, and found that:

- The FLEX strategies are not affected by the impacts of the reevaluated flood levels;
- The deployment of the FLEX strategies is not affected by the reevaluated flood levels; and

- FLEX strategies appear to be reasonably protected against the flood hazard levels, AE, and FED parameters reported in the Turkey Point MSA. As stated in Sections 3.3, 3.4 and 3.5 of this assessment, flood hazard levels, AE, and FED parameters will be fully reviewed by the staff following submittal of the licensee's Focused Evaluation/Integrated Assessment Report and the staff will revisit the MSA conclusions, if necessary.

Therefore, the NRC staff concludes that the licensee has demonstrated the capability to implement the FLEX strategies, as designed, under the conditions associated with the reevaluated LIP, PMSS, and PMT, as described in NEI 12-06, Revision 2, and JLD-ISG-2012-01, Revision 1.

4.0 CONCLUSION

The NRC staff has reviewed the information presented by the licensee in its MSA for Turkey Point. The NRC staff confirmed that the licensee's flood hazard MSA for Turkey Point was performed consistent with the guidance in Appendix G of NEI 12-06, Revision 2, as endorsed by JLD-ISG-2012-01, Revision 1. Based on the licensee's use of the hazards characterized in the NRC staff's MSFHI letter, the methodology used in the Turkey Point MSA, and the description of its current FLEX strategy in the Turkey Point FIP and supporting documentation, the NRC staff concludes that the licensee has demonstrated that the mitigation strategies appear to be reasonably protected from reevaluated flood hazard conditions.

SUBJECT: TURKEY POINT NUCLEAR GENERATING, UNIT NOS. 3 AND 4 – FLOOD HAZARD MITIGATION STRATEGIES ASSESSMENT DATED JUNE 23, 2017

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