DEC 2 0 2016

10 CFR 50.54f
L-2016-226

FPL

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

Re: Turkey Point Unit 3 and Unit 4
Docket Nos. 50-250 and 50-251
NEI 12-06, Revision 2, Appendix G, G.4.2, Mitigating Strategies Assessment (MSA) for FLEX Strategies report for the New Flood Hazard Information

References:

1. NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendations 2.1, 2.3 and 9.3 of the Near Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated March 12, 2012, ADAMS Accession Number ML12056A046.
2. FPL Letter, L-2014-087, Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding the Flood Hazard Reevaluations for Recommendation 2.1, dated March 11, 2013, ADAMS Accession Number ML13095A216.
3. NRC Letter, Turkey Point Nuclear Generating, Unit Nos. 3 and 4 - Staff Assessment of Response to Title 10 CFR 50.54(f), Information Request –Flood Causing Mechanism Reevaluation (TAC NOS MF1114 and MF1115)," dated December 4, 2014, ADAMS Accession Number ML14324A816.
4. NRC Letter, Turkey Point Nuclear Generating, Unit Nos. 3 and 4 –Supplement to Staff Assessment of Response to 10 CFR 50.54(f) Information Request-Flood-Causing Mechanisms Reevaluation (CAC Nos. MF114 and MF115), dated November 4, 2015, ADAMS Accession Number ML15301A200.
5. NRC Staff Requirements Memoranda to COMSECY-14-0037, " Integration of Mitigating Strategies for Beyond Design-Basis External Events and Reevaluation of Flooding Hazards, " dated March 30, 2015.
6. NRC Letter, Coordination of Requests for Information Regarding Flooding Hazard Reevaluations and Mitigating Strategies for Beyond-Design-Basis External Events, dated September 1, 2015.
7. NEI 12-06, Revision 2, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, December 2015, ADAMS Accession Number ML16005A625.
8. 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, dated February 2016, ADAMS Accession Number ML15357A163.

On March 12, 2012, the NRC issued Reference 1 to request information associated with Near Term Task Force (NTTF) Recommendation 2.1 for Flooding. Enclosure 2 of Reference 1, requested that licensees reevaluate flood hazards using present day methods and regulatory guidance and to submit the Flood Hazard Reevaluation Report (FHRR). For Turkey Point Units

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3 and 4, the FHRR was submitted on March 11, 2013, Reference 2, and supplemented by FPL letters dated January 31, 2014, February 26, 2014, and April 25, 2014, and August 7, 2014, ADAMS Accession Numbers ML14055A365, ML14073A065, ML14149A479 and ML14234A085, respectively. The NRC Staff completed its review as documented in the Staff Assessment, Reference 3, and in the Supplement of the Staff Assessment, Reference 4.

Concurrent to the flood hazard reevaluation, Turkey Point Units 3 and 4, developed and implemented 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." In Reference 4, the NRC Staff concluded that the reevaluated flood hazard information for Turkey Point Units 3 and 4 is suitable for the assessment of mitigation strategies developed in response to Order EA-12-049 (i.e., the mitigating strategies flood hazard information (MSFHI).

In Reference 5, the NRC affirmed that licensees need to address the reevaluated flooding hazards within the mitigating strategies for beyond-design-basis (BDB) external events, including the reevaluated flood hazards. This requirement was confirmed by the NRC in Reference 6. Guidance for performing mitigating strategies flood hazard assessments (MSFHAs) is contained in Appendix G of Reference 7, endorsed by the NRC in Reference 8.

Reference 7, describes the MSFHA for flooding. Consistent with Section G.4 of Reference 7, Evaluation of Mitigating Strategies for the Mitigating Strategies Flood Hazard Information (MSFHI), it was concluded that the FLEX strategies for Turkey Point Units 3 and 4 can be implemented without additional changes. The details of the Mitigating Strategies Assessment (MSA) are found in the enclosure.

This letter contains no new regulatory commitments and no revisions to existing regulatory commitments.

Should you have any questions regarding this submittal, please contact Mr. Mitch Guth, Turkey Point Licensing Manager, at 305-246-6698.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on December 20, 2016.

Sincerely,

Thomas Summers
Site Vice President
Turkey Point Nuclear Plant

Enclosure

cc: USNRC Regional Administrator, Region II
USNRC Project Manager, Turkey Point Nuclear Plant
USNRC Senior Resident Inspector, Turkey Point Nuclear Plant

2016 MITIGATING STRATEGIES ASSESSMENT FOR FLOODING DOCUMENTATION REQUIREMENTS AT THE TURKEY POINT NUCLEAR SITE

TABLE OF CONTENTS

2016 MITIGATING STRATEGIES ASSESSMENT FOR FLOODING DOCUMENTATION REQUIREMENTS AT THE TURKEY POINT NUCLEAR SITE

Acronyms:

- APM – Available Physical Margin
- CDB – Current Design Basis
- FESB – FLEX Equipment Storage Building
- FHRR – Flood Hazard Reevaluation Report
- FIP – Final Integrated Plan
- FLEX DB – FLEX Design Basis (flood hazard)
- LIP – Local Intense Precipitation
- MSFHI – Mitigating Strategies Flood Hazard Information (from the FHRR and MSFHI letter)
- NTWC – National Tsunami Warning Center
- MLW – Mean Low Water
- NGVD88 – National Geodetic Vertical Datum of 1988
- NHC – National Hurricane Center
- NWS – National Weather Service
- PMH – Probable Maximum Hurricane
- PMSS – Probable Maximum Storm Surge
- PMT – Probable Maximum Tsunami
- PTN – Turkey Point Nuclear Site
- QPF – Quantitative Precipitation Forecast
- WPC – Weather Prediction Center of the NWS

Definitions:

Design Bases*:* the information which identifies the specific functions to be performed by a structure, system, or component of a facility, and the specific values or ranges of values chosen for controlling parameters as reference bounds for the current design.

FLEX Design Bases: the information which identifies the specific functions to be performed by a structure, system, or component of a facility to accomplish the FLEX strategies.

FLEX Design Basis Flood Hazard: the controlling flood parameters used to develop the FLEX flood strategies.

NGVD88: the elevations presented in the PTN Updated Final Safety Analysis Report (UFSAR) are referenced to the site MLW vertical datum. The FHRR study results are referenced to North American Vertical Datum of 1988 (NAVD88). Site datum (MLW) is 2.307 ft. below NAVD88 datum (NAVD88, ft. = MLW, ft. - 2.307 ft.).

1.0 *Summary*

The MSFHI developed in the PTN FHRR (Ref. 2.4.1) demonstrated that the Local Intense Precipitation (LIP), hurricane induced Probable Maximum Storm Surge (PMSS), and Probable Maximum Tsunami (PMT) exceed the plant's current design basis. The results of this assessment conclude that the current FLEX mitigation strategy described in the Final Integrated Plan (FIP) (Ref. 2.4.14) can be implemented without additional changes other than those previously identified for enhancing plant barriers for the reevaluated PMSS. The previously identified modifications require action to strengthen three sections of the north and south barriers and to increase the height of the same three barrier sections to address the projected 20 year sea-rise for the projected remaining period of plant operation. The height of the PMSS barrier is acceptable for the current sea elevation.

2.0 *Documentation*

2.1. *NEI 12-06, Rev. 2, Section G.2 – Characterization of the MSFHI*

The PTN FHRR (Ref. 2.4.1) evaluated various flood-causing mechanisms and the combined event flood and concluded that the current design basis floods do not bound all reevaluated flood-causing mechanisms at the plant site. The FHRR determined the following flood-causing mechanisms are not bounded by the current licensing basis:

1. Local Intense Precipitation (LIP)
2. Probable Maximum Storm Surge (PMSS)
3. Probable Maximum Tsunami (PMT)
4. Seiche
5. Combined Events Flooding

The reevaluated flooding results due to the LIP, PMSS, and PMT exceed the corresponding flooding hazards in the current licensing basis. The tsunami event is applicable to PTN and was not included or bounded by the current design basis.

Seiche and combined events flood hazards are not addressed in the current licensing basis and are thus not bounded. It is determined that PTN is not affected by seiche flooding and seiche flooding is eliminated from further evaluation (Ref. 2.4.1). The combination of events required for the combined events flooding reevaluation for sites along the coast are included in the reevaluations performed for the PMSS and PMT events. Therefore, the PMSS and PMT floods include the combined event mechanisms and combined events are not considered separately (Ref. 2.4.1).

The flooding of streams and rivers, dam breaches and failures, ice induced flooding, and channel diversion and migration flooding mechanisms are not applicable to PTN (Ref. 2.4.1).

The flood parameters and associated effects discussed in this report are obtained from the PTN FHRR (Ref. 2.4.1), supplemental studies performed in response to the request for additional information (RAI) and submitted to the NRC in April 2014 (Ref. 2.4.2), and subsequent studies performed to support the plant's flooding response (Refs. 2.4.8, 2.4.9, 2.4.10, and 2.4.11). The NRC review of the PTN FHRR and subsequent RAI responses is documented in the NRC staff assessment (Ref. 2.4.12) and supplement (Ref. 2.4.13).

2.1.1. Local Intense Precipitation

Two LIP scenarios are addressed; the first LIP scenario assumes normal plant operations and the second LIP scenario occurs when the plant is under Hurricane Season Readiness Procedures where flood barriers are installed.

The PTN Turbine Building area and Component Cooling Water (CCW) area are open-air structures. During normal operating conditions, rainwater is evacuated through floor drains, open pathways, and doorways (current licensing basis). The LIP reevaluation study conservatively assumed that all floor drains would be clogged during the LIP event. Therefore, the runoff can discharge only through open pathways and doorways.

For both LIP scenarios, the runoff from the Turbine Building areas would drain to and accumulate in the Units 3 and 4 Condenser Pits. During the LIP event, the volume of water accumulated in the Condenser Pits is lower than the capacity of the pits. However, water levels will accumulate at various locations prior to the volume draining to the pits.

For the CCW area during the normal operations LIP, the rainwater is evacuated through open pathways and doorways, and drains away from the CCW area. During the hurricane preparations LIP, the CCW doorways are sealed and the drains are plugged. In this configuration drainage of the CCW area will not occur. Portable pumps are provided to evacuate rainwater from the CCW area.

2.1.2. Probable Maximum Storm Surge

The PMSS is postulated to be caused by a Probable Maximum Hurricane (PMH). A PMH is a hypothetical hurricane with a combination of characteristics that make it the most severe that can reasonably occur in the particular region in question. The meteorological parameters are selected in such a way that the PMH makes landfall near PTN and maximizes the effects of the PMSS. The computer model used to compute the storm surge effects is calibrated to the largest historical event observed near the Turkey Point plant. The probable maximum storm surge with wind-wave activity in combination with an antecedent 10 percent exceedance tide are the combined effects considered with the PMH. Additionally, higher water level in the ocean is expected over the next 20 years, nominally the remaining lifespan of the plant. The expected sea level rise is added to the PMSS maximum water level.

The wind-wave activity includes the wave setup and wave run-up, which are also added to the PMSS maximum still-water elevation. There will be no wave run-up along the west side of the power block during the PMSS event because wave propagation is from the east. However, wave oscillations are expected on the west side of the power block. Therefore, a depth-limited wave height is calculated and added to the PMSS maximum still-water elevation. Wave run-up on the north and south varies depending on the presence of intervening structures and equipment. The PMSS elevation at the plant flood barrier is shown in Table 2.1-1 (Refs. 2.4.8).

Table 2.1-1 – Summary of Wave Heights and Wave Run-up at PTN PMSS Flood Barrier

Side of PTN Power Block	PMSS Elevation - (ft.-NAVD88)	Maximum Wave Amplitude above PMSS - (ft.)	Wave Run-up on a Vertical Wall - (ft.)	Total Water Level - (ft.-NAVD88)
North Barrier Security Wall	17.3	---[1]	0.7	18.0
Unit 3 Switchgear Room	17.3	---[1]	1.1	18.4
North Barrier – Segment A[2]	17.3	0	0	17.3
North Barrier – Segment B	17.3	---[1]	0.7	18.0
Unit 3 EDG Room	17.3	---[1]	0.7	18.0
East Barrier	17.3	---[1]	1.8	19.1
South Barrier – Segment A	17.3	---[1]	0.6	17.9
South Barrier – Segment B[3]	17.3	0	0	17.3
Condensate Storage Tank	17.3	---[1]	0.6	17.9
West Barrier	17.3	0.2	---[4]	17.5

[1]Wave height is component of wave run-up.
[2]No wave action or run-up at North Barrier Segment A due to North Barrier Security Wall
[3]No wave action or run-up assumed at South Barrier Segment B due to Condensate Storage Tank
[4]Zero wave run-up determined due to direction of wave propagation.

The plant condition when the PMSS occurs will have hurricane procedure preparations in place with flood barriers in place and the reactor in one of the following conditions:

- If initially in Modes 1-4, place the plant in Mode 5 with AFW aligned in standby.
- If initially in Mode 5, fill and vent the RCS, draw a pressurizer bubble, align AFW and place into standby.
- If initially in Mode 6, terminate all fuel transfer operations, secure fuel transfer equipment, and close tube gate valve. Maintain the RCS and Spent Fuel Pit temperatures as low as possible and maintain the refuel cavity and Spent Fuel Pit levels in the normal band.

2.1.3. Probable Maximum Tsunami

The tsunami event was analyzed for the Turkey Point Units 6 and 7 COLA SAR (Ref. 2.4.3) and is applicable to Turkey Point Units 3 and 4. The tsunami is combined with wind wave activity and antecedent 10 percent exceedance tide.

The antecedent tide water level is included in the tsunami stillwater elevation. The wind-wave activity, or wave run-up, is not determined in the SAR for Turkey Point Units 6 and 7. Therefore, for PTN Units 3 and 4, the PMSS wave run-up is conservatively added to the maximum tsunami water level. The maximum water surface elevation was determined to be 13.9 ft. NAVD88) (Ref. 2.4.1 and 2.4.8). The maximum water level due to tsunami is assumed to be the same everywhere around the power block and remains below plant grade.

2.2. *NEI 12-06, Rev. 2, Section G.3 – Comparison of the MSFHI and FLEX DB Flood*

A complete comparison of the CDB, the FLEX DB and reevaluated flood hazards is provided in the tables listed below:

- Table 2.2-1 reflects data from the MSFHI for the LIP during normal plant operation (LIP Scenario A).
- Table 2.2-2 reflects data from the MSFHI for the LIP when the plant is under hurricane season readiness procedures (LIP Scenario B).
- Table 2.2-3 reflects data from the MSFHI for PMSS with wind-wave activity postulated to be caused by a PMH combined with antecedent 10 percent exceedance tide.
- Table 2.2-4 reflects data from the MSFHI for PMT with wind-wave activity combined with antecedent 10 percent exceedance tide.

Table 2.2-1 – Local Intense Precipitation (LIP Scenario A) Parameters

Flood Scenario Parameter		Plant Current Design Basis Flood Hazard	FLEX Design Basis Flood Hazard	MSFHI LIP Scenario A	Bounded (B) or Not Bounded (NB) by FLEX DB
Flood Level and Associated Effects	1. Max Stillwater Elevation	N/I See Note 1	N/A See Note 1	17.24 ft. (NAVD88) See Note 2	NB
	2. Max Wave Run-up Elevation	N/I	N/A	N/A See Note 3	B
	3. Max Hydrodynamic/ Debris Loading	N/I	N/A	N/A See Note 4	B
	4. Effects of Sediment Deposition/Erosion	N/I	N/A	N/A See Note 5	B
	5. Concurrent Site Conditions	N/I	N/A	High velocity winds See Note 6	NB
	6. Effects on Groundwater	N/I	N/A	N/A See Note 7	B
Flood Event Duration	7. Warning Time	N/I	N/A	12 hours See Note 8	B
	8. Period of Site Preparation	N/I	N/A See Note 8	12 hours See Note 9	B
	9. Period of Inundation	N/I	N/A	30 minutes See Note 10	NB
	10. Period of Recession	N/I	N/A	45 minutes See Note 11	NB
Other	11. Plant Mode of Operations	Modes 1-6	Modes 1-6	Modes 1-6	B
	12. Other Factors	N/A	N/A	N/A	B

Notes:

1. The UFSAR provides a statement that flooding from rainwater is prevented by an elaborate system of storm drains, catch basins, and sump pumps, but it does not report the water elevation value.
2. Maximum LIP flood elevation at CCW Unit 3 for LIP Scenario A (plant is operating under normal operation). There are no appreciable flood elevation differences between the two LIP scenarios at any location other than the component cooling water (CCW) areas (Ref. 2.4.8).
3. Consideration of wind-wave action for the LIP event is not explicitly required by NUREG/CR-7046 and is judged to be negligible because of the low flow depths.
4. The hydrodynamic and hydrostatic loads due to LIP flooding are negligible because water velocities are very low, not exceeding 2.7 ft./sec., and water depths are below 2 ft. for most of the areas at the plant. The debris loads are negligible because water velocity and depth are not significant enough to generate any impact force.
5. Erosion and sedimentation are not expected due to low flood water velocities and paved surfaces around the power block.
6. LIP Scenario A assumes a localized intense precipitation event during normal operations. The localized intense precipitation event may be coincident with high velocity winds, however, the localized intense precipitation event winds will be less severe than PMH winds assumed for the PMSS and the duration of the winds is limited to the period of time the thunderstorm is present at the site. The localized intense precipitation event high velocity winds will not adversely impact the implementation of the FLEX procedures (Ref. 2.4.8)
7. Groundwater ingress is not expected during the LIP event as the surface around the power block is impervious (asphalt or concrete pavement) and the LIP event occurs over a very short timeframe (rainfall duration is one hour).
8. For non-tropical events, the Weather Prediction Center (WPC) of the National Weather

Flood Scenario Parameter		Plant Current Design Basis Flood Hazard	FLEX Design Basis Flood Hazard	MSFHI LIP Scenario A	Bounded (B) or Not Bounded (NB) by FLEX DB
	Service (NWS) provides Quantitative Precipitation Forecasts (QPFs) with lead times of 6 hours to 7 days, three times daily (Ref. 2.4.72.4.7). The QPF provides an estimate of the precipitation that may occur in the near future. The WPC also offers Probabilistic Precipitation Guidance for days 1-3 and for every 6-hour and 24-hour period with different levels of probability of exceedance, including probability of precipitation of at least a specific amount and precipitation amount by percentile probability (Ref. 2.4.7). The Storm Prediction Center (SPC) of the NWS issues thunderstorm outlooks with a lead time of approximately 4 to 8 hours, but the forecasts do not include quantitative precipitation estimates. When conditions become favorable for organized severe thunderstorms and tornadoes to develop, the SPC issues a severe thunderstorm watch or a tornado watch. Watches are usually issued at least one hour prior to the onset of severe weather (Ref. 2.4.6). PTN Operations monitor the WPC and SPC to address weather conditions at the site in a timely manner. Based on the varying warning times provided by the NWS, a mid-range site preparation period of 12 hours is chosen (Ref. 2.4.8). 9. No site preparation is credited for protecting doors subject to leakage for non-tropical LIP events as the flood elevation remains below the available physical margin. Actions may be implemented to enhance the barriers during the site preparation period to further reduce potential leakage. 10. The inundation duration for the 1-hour LIP event begins nearly instantaneously from the onset of rainfall and is approximately 30 minutes (time to peak levels vary by minutes depending on the specific location of interest). 11. The recession from the peak level lasts the remainder of the LIP event and for an additional 15 minutes afterwards, for a total recession time of 45 minutes.				

Table 2.2-2 - Local Intense Precipitation (LIP Scenario B) Parameters

Flood Scenario Parameter		Plant Current Design Basis Flood Hazard	FLEX Design Basis Flood Hazard	MSFHI LIP Scenario B	Bounded (B) or Not Bounded (NB) by FLEX DB
Flood Level and Associated Effects	1. Max Stillwater Elevation	N/I See Note 1	N/A See Note 1	16.57 ft. NAVD88 See Note 2	NB
	2. Max Wave Run-up Elevation	N/I	N/A	N/A See Note 3	B
	3. Max Hydrodynamic/ Debris Loading	N/I	N/A	N/A See Note 4	B
	4. Effects of Sediment Deposition/Erosion	N/I	N/A	N/A See Note 5	B
	5. Concurrent Site Conditions	N/I	N/A	High velocity winds See Note 6	NB
	6. Effects on Groundwater	N/I	N/A	N/A See Note 7	B
Flood Event Duration	7. Warning Time	N/I	72 hours See Note 8	72 hours See Note 8	B
	8. Period of Site Preparation	N/I	72 hours See Note 8	72 hours See Note 9	B
	9. Period of Inundation	N/I	N/A	30 minutes See Note 10	NB
	10. Period of Recession	N/I	N/A	45 minutes See Note 11	NB
Other	11. Plant Mode of Operations	Mode 1-6	Mode 1-6	Mode 1-6	B
	12. Other Factors	N/A	N/A	N/A	B

Notes:

1. The UFSAR provides a statement that flooding from rainwater is prevented by an elaborate system of storm drains, catch basins, and sump pumps, but it does not report the water elevation value.
2. Maximum LIP flood elevation at CCW Unit 3 for LIP Scenario B (plant is operating under Hurricane Season Readiness Procedures with modifications that have been completed). There are no appreciable flood elevation differences between the two LIP scenarios at any location other than the component cooling water (CCW) areas (Ref. 2.4.8).
3. Consideration of wind-wave action for the LIP event is not explicitly required by NUREG/CR-7046 and is judged to be negligible because of the low flow depths.
4. The hydrodynamic and hydrostatic loads due to LIP flooding are negligible because water velocities are very low, not exceeding 2.7 ft./sec. Additionally, water depths are below 2 ft. for most of the areas at the plant. The debris loads are negligible because water velocity and depth are not significant enough to generate any impact force.
5. Erosion and sedimentation are not expected due to low flood water velocities and paved surfaces around the power block.
6. LIP Scenario B assumes hurricane preparations have been implemented due to the approach of a tropical cyclone accompanied by the threat of significant flooding from storm surge. The magnitude and warning time for the LIP high velocity winds is bounded by the PMH winds assumed in the PMSS. Therefore, the high velocity winds assumed with LIP scenario B will not adversely impact the implementation of the FLEX procedures (Ref. 2.4.8)
7. Groundwater ingress is not expected during the LIP event as the surface around the power block is impervious (asphalt or concrete pavement) and the LIP event occurs over a very short timeframe (rainfall duration is one hour).
8. A LIP resulting from a tropical cyclone will have approximately the same warning/ preparation time as the hurricane force winds warning time (72 hours). Preparation for a

Flood Scenario Parameter		Plant Current Design Basis Flood Hazard	FLEX Design Basis Flood Hazard	MSFHI LIP Scenario B	Bounded (B) or Not Bounded (NB) by FLEX DB
	hurricane or tropical storm event is incorporated within the Turkey Point Procedure for Hurricane Season Readiness. 9. Severe weather preparations are initiated 72 hours prior to the projection of hurricane force winds arriving onsite. Hurricane watches are issued 48 hours in advance of the anticipated hurricane force winds by the National Hurricane Center (NHC); hurricane warnings are issued 36 hours in advance (Ref. 2.4.4). PTN Operations monitor the NHC to ensure severe weather conditions generated by a tropical cyclone are addressed at the site in a timely manner. 10. The inundation duration for the 1-hour LIP event begins nearly instantaneously to the onset of rainfall and is approximately 30 minutes (time to peak levels vary by minutes depending on the specific location of interest). 11. The recession from the peak level lasts the remainder of the LIP event and for an additional 15 minutes afterwards, for a total recession time of 45 minutes.				

Table 2.2-3- Probable Maximum Storm Surge (Including 20 Year Sea Rise) Parameters

Flood Scenario Parameter		Plant Current Design Basis Flood Hazard	FLEX Design Basis Flood Hazard	MSFHI PMSS (Ref. 2.4.10	Bounded (B) or Not Bounded (NB) by FLEX DB
Flood Level and Associated Effects	1. Max Stillwater Elevation	16.0 ft. NAVD88	16.0 ft. NAVD88	17.3 ft. NAVD88	NB
	2. Max Wave Run-up Elevation	18.7 ft. NAVD88 (Maximum East Barrier)	18.7 ft. NAVD88 (Maximum East Barrier)	East Flood Barrier – 19.1 ft. NAVD88 North Flood Barrier – 18.0 ft. NAVD88 South Flood Barrier – 17.9 ft. NAVD88 West Flood Barrier – 17.5 ft. NAVD88 Unit 3 Switchgear Rm 18.4 ft. NAVD88 Unit 3 EDG Room – 18.0 ft. NAVD88	NB
	3. Max Hydrodynamic/ Debris Loading	N/I	N/A	375 lbs./ft^2/ 19,536 lbs.	NB
	4. Effects of Sediment Deposition/Erosion	N/I	N/A	142 lbs./ft^2 (horizontal) 244 lbs./ft^2 (vertical) Scour up to 2 ft. at plant grade structures	NB
	5. Concurrent Site Conditions	N/I	N/A	High velocity winds High intensity rainfall See Note 1	NB
	6. Effects on Groundwater	N/I	N/A	N/A See Note 2	B
Flood Event Duration	7. Warning Time	N/I	48 hours See Note 3	48 hours See Note 3	B
	8. Period of Site Preparation	N/I	48 hours See Note 4	48 hours See Note 4	B
	9. Period of Inundation	N/I	N/I	3 hours See Note 5	NB
	10. Period of Recession	N/I	N/I	5 hours See Note 6	NB
Other	11. Plant Mode of Operations	Mode 5 & 6 Note 7	Mode 5 & 6 Note 7	Mode 5 & 6 Note 7	B
	12. Other Factors	N/A	N/A	6,048 ft-lb (on Intake Structure) See Note 8	B

Notes:

1. The PMSS is based on a postulated PMH. The PMH includes high winds and intense rainfall; however, no outdoor actions are required during the time when high winds provide a personnel hazard. For a Category 4 or 5 hurricane the reactor is shutdown and cooled down early to reduce decay heat load and small generators are prestaged to support the

Flood Scenario Parameter	Plant Current Design Basis Flood Hazard	FLEX Design Basis Flood Hazard	MSFHI PMSS (Ref. 2.4.10	Bounded (B) or Not Bounded (NB) by FLEX DB

120V electrical distribution. With the exception of refueling the small generators prestaged in the Turbine Building, no outside operations actions are required until the severe winds abate. The prestaged generators staged in Turbine Building are sufficiently protected from hurricanes winds to allow starting, operating, and refueling to be performed.

2. Groundwater ingress is not expected during the storm surge event as the surface around the power block is impervious (asphalt or concrete pavement) and the surge elevation is only above site grade for a short timeframe of 8 hours.
3. Storm surge probabilities, based on the National Hurricane Center (NHC) official advisory, are available approximately 48 hours in advance of hurricane force winds (Ref. 2.4.4). The NHC produces a set of updated storm surge probability graphics for every active hurricane watch or warning along any portion of the Gulf of Mexico or Atlantic coasts of the continental United States. These graphics are updated on the NHC website approximately 30 minutes following the issuance of NHC tropical cyclone advisories at 1:00 a.m. eastern standard time (EST), 7:00 a.m. EST, 1:00 p.m. EST, and 7:00 p.m. EST. PTN Operations monitor the NHC to ensure severe weather conditions and storm surge generated by a tropical cyclone are addressed at the site in a timely manner.
4. Since the storm surge elevation is likely to be below the plant grade at the onset of hurricane force winds, 48 hours provides the lower bound of the possible preparation time. The PTN Hurricane Season Preparation Procedure also directs storm surge preparation activities to start at 48 hours prior to arrival of hurricane force winds.
5. For the PMSS produced by the PMH, the period of inundation of the storm surge water levels above plant grade is 2 hours for surge levels to reach a maximum of +17.3 ft. NAVD88. Additionally, wave run-up may reach the plant grade 1 hour prior to the arrival of the storm surge to the plant grade making the period of inundation 3 hours (Ref. 2.4.8).
6. For the PMSS produced by the PMH, flood waters would recede for the following 3 hours from the maximum surge water level +17.3 ft. NAVD88 until the storm surge level is below the plant grade. Additionally, wave run-up may remain for an additional 2 hours following the storm surge recession from plant grade making the period of recession 5 hours.
7. For Category 4 and 5 hurricanes, plant procedures require the plant to be in cold shutdown 2 hours prior to onset of hurricane force winds onsite. Therefore, Modes 1 through 4 are not applicable to severe storm surge events.
8. Because the site is located on the coastline, waterborne projectiles such as small recreational boats are also considered as additional debris loads. Only the Intake Structure would be subject to an impact from a boat because the rest of the safety-related structures are located at the plant grade of 15.7 ft. NAVD88, where the water depth is limited to less than 2 ft. The FLEX strategy is not affected as no SSCs in the Intake Structure are credited.

Table 2.2-4- Probable Maximum Tsunami Parameters

Flood Scenario Parameter		Plant Current Design Basis Flood Hazard	FLEX Design Basis Flood Hazard	MSFHI PMT (Ref. 2.4.8)	Bounded (B) or Not Bounded (NB) by FLEX DB
Flood Level and Associated Effects	1. Max Stillwater Elevation	N/I	N/A	12.1 ft. NAVD88	NB
	2. Max Wave Run-up Elevation	N/I	N/A	13.9 ft. NAVD88 See Note 1	NB
	3. Max Hydrodynamic/ Debris Loading	N/I	N/A	N/A See Notes 2 & 3	NB
	4. Effects of Sediment Deposition/Erosion	N/I	N/A	N/A See Note 3	B
	5. Concurrent Site Conditions	N/I	N/A	None	B
	6. Effects on Groundwater	N/I	N/A	N/A See Note 4	B
Flood Event Duration	7. Warning Time	N/I	N/A	2 hours See Note 5	B
	8. Period of Site Preparation	N/I	N/A	2 hours See Note 5	B
	9. Period of Inundation	N/I	N/A	N/A See Note 2	B
	10. Period of Recession	N/I	N/A	N/A See Note 2	B
Other	11. Plant Mode of Operations	Modes 1-6	Modes 1-6	Modes 1-6	B
	12. Other Factors	N/A	N/A	N/A	B

Notes:

1. Wave run-up for PMT is not determined in the reevaluation study. The PMSS wave run-up is applied instead. This approach is consistent with the COLA for Units 6 and 7 (Ref. 2.4.3).
2. The maximum run-up associated with the PMT does not reach site grade. Thus, no hydrodynamic, debris, or waterborne projectile loadings are expected on the plant grade power block structures. The Intake Structure will experience hydrostatic and hydrodynamic loadings from the PMT. The hydrostatic loads are bounded by the PMSS hydrostatic loads because hydrostatic loads are directly proportional to water depth, which is significantly larger for the PMSS event. The hydrodynamic loads depend on wave properties which are unknown for the PMT event because detailed modeling was not performed. However, the majority of the hydrodynamic forces from the PMT flood propagation will be taken by the ISFSI pad located between the ocean and the Intake Structure. The ISFSI pad is above the PMT flood level thus protecting the Intake Structure from the largest hydrodynamic impact, i.e. due to the waves propagating from the ocean side east to west. It is possible that a tsunami wave will propagate in various directions, including along the intake channel. However, due to the torturous geometry of the intake channel, the wave height and velocities are expected to be significantly lower compared to unobstructed wave propagation from the ocean. The intake channel makes two 90-degrees turns which would lower velocities and break the waves before reaching the Intake Structure, which would limit the hydrodynamic impact loads on the structure as they are directly proportional to both wave height and velocity. Therefore, it is justifiable to conclude that the PMT hydrodynamic loads will be bounded by PMSS hydrodynámic loads for the Intake Structure.
3. No significant sedimentation or debris loadings are expected at the Intake Structure during the PMT due to the influence of the ISFSI pad above the maximum tsunami run-up level equal to 13.9 ft. NAVD88 and the tortuous Intake Canal path around the ISFSI to the

Flood Scenario Parameter		Plant Current Design Basis Flood Hazard	FLEX Design Basis Flood Hazard	MSFHI PMT (Ref. 2.4.8)	Bounded (B) or Not Bounded (NB) by FLEX DB
	Intake Structure. It is highly improbable that a significant volume of sediment or debris would be deposited at the Intake Structure because the majority of sediment would be deposited at the turns inside the canal where the velocities are lower compared to the center of the canal allowing for sediment deposition. 4. Groundwater ingress is not expected at the at-grade plant structures during the PMT because the maximum tsunami still-water elevation (12.1 ft. NAVD88) is below the plant grade elevation. The groundwater ingress is also not expected for the below-grade plant structures because sustained tsunami water levels have a short duration which would not be sufficient to induce a hydraulic groundwater gradient through the compacted fill between the Biscayne Bay and the plant structures. 5. No reliable method exists for predicting the occurrence of tsunamigenic events, such as earthquakes or submarine landslides. The minimum travel time of a tsunami wave to the Turkey Point plant would be slightly greater than 2 hours for an earthquake event along the Hispaniola or Puerto Rican Trench and greater for other sources. NOAA National Tsunami Warning Center (NTWC) provides notifications for all U.S. coastal states alerting of tsunamigenic events in the Atlantic Ocean or Caribbean Sea (Ref. 2.4.5).				

2.3. *NEI 12-06, Rev. 2, Section G.4 – Evaluation of Mitigating Strategies for the MSFHI*

2.3.1. *NEI 12-06, Rev. 2, Section G.4.1 – Assessment of Current FLEX Strategies*

2.3.1.1. *Local Intense Precipitation*

The only point-of-interest (POI) that has significantly different water elevations between the LIP scenarios is the CCW area. The hurricane preparations LIP is approximately 8 inches lower than a LIP that could occur during normal operations even with the doors sealed and drains plugged due to the presence of a portable diesel pump. The level in the CCW area does not affect the FLEX strategy as no equipment or connections required for FLEX are present in that area. In the Turbine Building the AFW pumps are at grade level; however, the critical AFW SSC remains above the peak water elevation at this POI by approximately 7.5 inches. No other initial (Phase 1) FLEX SSCs are potentially affected by the LIP water elevations at the various POIs identified. However, to prevent affecting SSCs that may be used in subsequent phases of the FLEX strategy after the LIP flood has receded, the maximum water elevation in each fire zone was compared with its corresponding critical SSC elevation. All fire zones have available physical margin (APM) greater than or equal to zero (Ref. 2.4.8).

The LIP flood recedes within 75 minutes and Phase 2 actions to utilize the portable equipment stored onsite (Phase 2) are not adversely affected. The initial portable equipment required is the FLEX 480V DG and the FLEX Well Pump. Both the FLEX 480V DG and the FLEX Well Pump are staged at or near grade level that has no standing water after 75 minutes. Staging of the FLEX 480V DG is schedule to commence at 3 hours and the FLEX Well Pump is scheduled to begin at 2 hours, well after the LIP flood has receded (Ref. 2.4.14).

For Phase 3, the NSRC's ability to transport equipment to Staging Area B (site location where equipment will be pre-staged, parked, or placed prior to movement into the final location) is discussed in the SAFER Response Plan for Turkey Point Nuclear Generating Station, which includes multiple means and pathways of transporting NSRC equipment to the site, including aerial transportation by helicopter. Since deployment of NSRC equipment occurs later in the event the LIP inundation will have receded.

2.3.1.2. *Probable Maximum Storm Surge*

FLEX preparations ensure prestaging of small portable diesel generators and fuel is completed prior to the arrival of tropical storm wind from a Category 4 or 5 hurricane predicted to impact the plant site to provide temporary support for the electrical power system. This action, coupled with the existing actions prescribed in the hurricane preparation procedures to shutdown and cool down the reactor, extends the FLEX coping times and reduces the number of required FLEX activities during the event.

The components and equipment utilized for the FLEX Phase 1 strategy are protected by the site's flood protection design (i.e., the stop logs are installed in the flood barrier for the PMSS event). Note that the Intake Structure is not relied upon for the FLEX strategies. With the exception of refueling the small generators prestaged in the Turbine Building, no outside operations actions are required until the severe winds abate.

No activities outside the flood wall are required until 18 hours after the maximum storm surge elevation occurs. The storm surge and associated wave run-up will be below plant grade 5 hours after the maximum storm surge elevation occurs; therefore, the transport and use of portable FLEX equipment stored onsite in the FESB is not affected. The FESB is located above the PMSS so the FLEX Phase 2 equipment is protected and available when needed.

For Phase 3, the NSRC's ability to transport equipment to Staging Area B (site location where equipment will be pre-staged, parked, or placed prior to movement into the final location) is discussed in the SAFER Response Plan for Turkey Point Nuclear Generating Station, which includes multiple means and pathways of transporting NSRC equipment to the site, including aerial transportation by helicopter. Since deployment of NSRC equipment occurs later in the event the storm surge will have receded.

The CLB PMSS stillwater and maximum wave run-up elevations are not bounded by the reevaluation, however, the actual height of the flood barrier is above the current PMSS elevations assuming wave run-up. Three flood barrier segments; 1) North Barrier – Segment B, 2) North Flood Wall Section DG-18-G, and 3) South Barrier – Segment A are adequate for the current sea-level; however, they are not sufficient when the projected 20 year sea-level rise of 0.39 inches is included and require modification to increase the height of the flood barrier. Other flood barriers and segments are sufficient to provide flood protection for PMSS wave run-up and the 20 year sea-level rise. The CLB hydrostatic, hydrodynamic, and debris impacts are not bounded by the reevaluation.

Assessment have determined that the three flood barrier segments will withstand the hydrostatic and hydrodynamic forces of the reevaluated PMSS and that APM is maintained with a reduced safety factor. Although there is margin to withstand the hydrostatic and hydrodynamic forces, modifications to increase the safety factor to values recommended by industry standards should be pursued for the three flood barrier segments with a reduced safety factor; 1) North Barrier – Segment B, 2) North Flood Wall Section DG-18-G, and 3) South Barrier – Segment A. In addition, the same three flood barrier segments are not bounded for potential debris loading determined in calculation FPL-062-CALC-021 (Ref. 2.4.15). However, a qualitative assessment with a conclusion that, "...although the debris loading that was determined would be conservative for a new design or the modifications that are planned due to the sea level rise, there is not a credible combination of debris, weight, path and velocity that could cause the impact load given under the current plant configuration...;" therefore the APM determined for other loads associated with the PMSS are bounding. Modification of these three flood barrier segments; 1) North Barrier – Segment B, 2) North Flood Wall Section DG-18-G, and 3) South Barrier – Segment A, is required to reestablish the desired safety factors and margin considering the reevaluated PMSS hydrostatic, hydrodynamic, and debris loading.

APM is currently available and will be maintained/enhanced by plant modification as required. Since the PMSS/FLEX actions and timing of the actions is consistent with the current FLEX strategy, there is no adverse effect on any phase of the FLEX strategy.

2.3.1.3. *<u>Probable Maximum Tsunami</u>*

The hydrostatic and hydrodynamic force of the tsunami only impacts the Intake Structure and these loads are not bounded by the CLB. Note that the Intake Structure is not relied upon for the FLEX strategies. Since the maximum tsunami water elevation of 13.9 ft. NAVD88 remains below plant grade at 15.7 ft. NAVD88, there is no adverse effect on any phase of the FLEX strategy.

2.3.2. NEI 12-06, Revision 2, Section G.4.2 – Assessment for Modified FLEX Strategies

The existing FLEX strategies can be implemented as written with no modifications to the physical plant other than those already completed. In the longer term, sea level rise may result in wave run-up overtopping the north and south barriers in the turbine building. When these barriers are modified to prevent overtopping, they should also be strengthened to withstand the full PMSS hydrostatic, hydrodynamic, and debris loading with safety factors recommended by industry standards.

Operation of Phase 1 FLEX equipment is unaffected by LIP water elevations. While some LIP water levels exceed some critical door thresholds, available physical margin for critical SSC elevations is greater than or equal to zero. The current FLEX mitigation strategy timeline contains sufficient margin for local floodwaters to recede prior to the required deployment of FLEX equipment.

Hurricane preparation activities as described in the FLEX strategy and EC288571 (Ref. 2.4.14) are unchanged. Hurricane warning times allow ample time for event preparation which includes maximizing inventories and resources. Existing procedures also require the reactor to be shutdown and potentially cooled down depending on hurricane strength prior to tropical storms arriving onsite. This shutdown and cooldown for Category 4 and 5 hurricanes extend the FLEX coping times and reduce the number of required FLEX activities during the event. The current FLEX mitigation strategy timeline contains sufficient margin for the storm surge to recede below plant grade prior to the required deployment of FLEX equipment.

Tsunami water elevation does not exceed plant grade and thus has no effect on the FLEX mitigation strategy.

Based on this assessment, the current FLEX mitigation strategy described in the Final Integrated Plan (FIP) (Ref. 2.4.14) can be implemented with no additional strategy modifications required.

2.4. *References*

2.4.1. Flood Hazard Reevaluation Report In Response to 50.54(f) Information Request Regarding Near-Term Task Force Recommendation 2.1 (PTN-ENG-SECS-13-012). Florida Power and Light Company (FPL) dated March 11, 2013, ADAMS Accession No. ML 130950216.

2.4.2. Revised Response to Request for Additional Information Question Six Regarding Supplemental Response to NRC Request for Additional Information Pursuant to 10 CFR 50.54(f) Regarding the Flooding Aspects of Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident. Florida Power and Light Company (FPL) dated April 25, 2014, ADAMS Accession No. ML 14149A479

2.4.3. Turkey Point Units 6 and 7 Combined Operating License Application (COLA), Part 2 –Safety Analysis Report (SAR), Florida Power and Light Company (FPL), Revision 7, December 28, 2015.

2.4.4. National Oceanic and Atmospheric Administration (NOAA), NOAA National Weather Service (NWS), National Hurricane Center, available at: http://www.nhc.noaa.gov/

2.4.5. National Oceanic and Atmospheric Administration (NOAA), NOAA National Weather Service (NWS), National Tsunami Warning Center, available at: http://wcatwc.arh.noaa.gov/?page=productRetrieval

2.4.6. National Oceanic and Atmospheric Administration (NOAA), NOAA National Weather Service (NWS), Storm Prediction Center (SPC), available at: http://www.spc.noaa.gov/products/outlook/

2.4.7. National Oceanic and Atmospheric Administration (NOAA), NOAA National Weather Service (NWS), Weather Prediction Center (WPC), available at: http://www.hpc.ncep.noaa.gov/pqpf/conus_hpc_pqpf.php?fpd=6

2.4.8. Integrated Assessment Report NEE016-PR-001, in Response to the 50.54(t) Information Request Regarding the Near-Term Task Force Recommendation 2.1: Flooding for Turkey Point Nuclear Generating Station Units 3 and 4 (PTN-ENG-SECS-15-025). Not Docketed. Submittal pending revised guidance concerning Flooding Integrated Assessments.

2.4.9. Calculation FPL062-CALC-004, Effects of Local Intense Precipitation

2.4.10. Calculation FPL-062-CALC-014, PMSS Wave Run-up Evaluation

2.4.11. Calculation FPL-062-CALC-017, Hydrostatic and Hydrodynamic Loads Evaluation

2.4.12. U.S. Nuclear Regulatory Commission, Turkey Point Nuclear Generating, Unit Nos. 3 and 4 - Staff Assessment of Response to 10 CFR 50.54(f) Information Request-Flood-Causing Mechanism Reevaluation (TAC Nos. MF1114 and MF1115), December 4, 2014

2.4.13. U.S. Nuclear Regulatory Commission, Turkey Point Nuclear Generating, Unit Nos. 3 and 4 – Supplement to Staff Assessment of Response to 10 CFR 50.54(f) Information Request - Flood-Causing Mechanism Reevaluation (TAC Nos. MF1114 and MF1115), November 4, 2015

2.4.14. EC 288571, PTN-SEMS-16-003, Final Integrated Plan

2.4.15. Calculation FPL-062-CALC-021, Debris and Sediment Loading Calculation