FPL.

L-2011-455
10 CFR 52.3

October 21, 2011

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

Re: Florida Power & Light Company
Proposed Turkey Point Units 6 and 7
Docket Nos. 52-040 and 52-041
Response and Response Schedule to NRC Request for Additional Information Letter No. 036 (eRAI 5860) SRP Section: 02.04.05
Probable Maximum Surge and Seiche Flooding

Reference:

1. NRC Letter to FPL dated September 21, 2011, Request for Additional Information Letter No.036 Related to SRP Section 02.04.05 - Probable Maximum Surge and Seiche Flooding for the Turkey Point Nuclear Plant Units 6 and 7 Combined License Application

Florida Power & Light Company (FPL) provides, as an attachment to this letter, its response to the Nuclear Regulatory Commission's (NRC) Request for Additional Information (RAI) 02.04.05-6 provided in Reference 1. The attachment identifies changes that will be made in a future revision of the Turkey Point Units 6 and 7 Combined License Application (if applicable).

Additionally, the Nuclear Regulatory Commission (NRC) requested Florida Power & Light Company (FPL) to respond to the Request for Additional Information (RAI) within 30 days of the date of the referenced letter. If FPL was unable to provide a response within 30 days, NRC requested FPL to provide a schedule to provide the responses. This letter also provides the FPL schedule to respond to the NRC Requests for Additional Information (RAI) 02.04.05-4 and 02.04.05-5 provided in the referenced letter.

The response to RAI 02.04.05-4 is scheduled to be provided by November 19, 2011, and the response to RAI 02.04.05-5 is scheduled to be provided by November 4, 2011.

If you have any questions, or need additional information, please contact me at 561-691-7490.

D097
NRO

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

Executed on October 21, 2011

Sincerely,

William Maher
Senior Licensing Director – New Nuclear Projects

WDM/RFB

Attachment: FPL Response to NRC RAI No. 02.04.05-6 (eRAI 5860)

cc:
PTN 6 & 7 Project Manager, AP1000 Projects Branch 1, USNRC DNRL/NRO
Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, Turkey Point Plant 3 & 4

NRC RAI Letter No. PTN-RAI-LTR-036

SRP Section: 02.04.05 - Probable Maximum Surge and Seiche Flooding

Question from Hydrologic Engineering Branch (RHEB)

NRC RAI Number: 02.04.05-6 (eRAI 5860)

The applicant's analysis of PMH-related storm surge includes an apparently limited analysis of the sensitivity of storm surge predictions to variations in input parameters, including radius of maximum winds.
The analysis for the effect of radius of maximum winds considered values (in nautical miles) of 4 (the lower end of the range indicated in NWS 23), 12, 20 (the upper end of the range in NWS 23), 25, 30, 40, and 100. Radius of maximum wind values of 25, 30, and 40 nautical miles all resulted in storm surge elevations higher than were determined for a radius of 20 nautical miles. The highest storm surge elevation found by the analysis resulted from a radius of 30 nautical miles, at which value the predicted surge elevation at Units 6 and 7 was approximately 2.6 percent (3.5 percent, as a percentage of the surge height) higher than predicted when the radius of maximum wind was specified as 20 nautical miles. The applicant did not determine whether other values between 25 and 35 nautical miles could result in a higher estimated storm surge elevation. The applicant used the surge elevation for a 20-n.m. radius in its analysis, stating that the effect of the larger storm radius on storm surge was encompassed within the 20 percent adjustment to surge height that the applicant made to account for empirically determined uncertainty in storm surge estimation.

Although NWS 23 identified 20 nautical miles as the upper bound value of radius of maximum winds for a PMH, some major hurricanes striking the continental U.S. in recent years have had a larger radius of maximum winds.

In regard to storm surge height, please explain how consideration of a 20 nautical mile radius of maximum wind accounts for the most severe wind radius reported for the site and surrounding area, with sufficient margin. Provide technical justification for the conclusion that the adjustment to storm surge height made to account for uncertainty in storm surge estimation is sufficient to account for the deterministically estimated effect on storm surge of a radius of maximum wind larger than 20 nautical miles.

FPL RESPONSE:

Many major hurricanes striking the continental U.S. in recent years have had radius of maximum winds (RMW) larger than the probable maximum hurricane (PMH) RMW. As discussed below, these hurricanes have been much less intense than the PMH, since the central pressures for these hurricanes are much higher than the PMH central pressure. Therefore the maximum storm surge elevation obtained using the combination of parameters for the PMH would be bounding. As indicated in NUREG-0800 (Subsection 2.4.5) the PMH as defined by the National Oceanic and Atmospheric Administration (NOAA) Technical Report NWS 23 (FSAR Subsection 2.4.5, Reference 201), should be estimated for coastal locations that may be exposed to these events. Since the analysis

uses the upper and lower bounds of the RMW given in NWS 23, no adjustment due to uncertainty in hurricane size is necessary.

NWS 23 defines the PMH as a fully developed, tightly wound hurricane whose RMW for any particular coastal point is less than the RMW of the standard project hurricane (SPH) which is a less intense hurricane than the PMH. Table 1 lists the central pressures and RMWs for category 3 or higher intensity hurricanes that struck the U.S. between 2001 and 2010 (Reference 1) and for Hurricane Andrew which struck near Turkey Point Units 6 & 7 site. As seen in Table 1, Hurricanes Katrina and Rita had RMWs of approximately 30 nautical miles. Hurricane Katrina had the lowest central pressure value of 920 millibars. The size and central pressure of Hurricane Katrina is similar to the SPH definition from NWS 23 near the site. As shown in Table 1, near the site, SPH has an upper bound RMW of about 29 nautical miles, higher than the PMH upper bound of 20 nautical miles. However, the central pressure for the SPH is 919 millibars, which is also higher than the PMH central pressure of 885 millibars.

NWS 23, Figure 2.5, shows that the PMH RMW increases with latitude. The highest PMH RMW is 38 nautical miles at Eastport, Maine. However, as shown in NWS 23, Figure 2.3, the PMH central pressure drop decreases with latitude and Eastport, Maine has the highest PMH central pressure value of about 930 millibars (NWS 23, Table 2.5).

Hurricanes with larger RMWs than the PMH can occur near the Turkey Point Units 6 & 7 site. However, these hurricanes would not be as intense as the PMH and maximum surge elevation obtained using the combination of parameters (from NWS 23) for the PMH would be bounding.

In FSAR Subsection 2.4.5, the effect of RMW on storm surge elevation is further investigated by artificially increasing the PMH size above the upper bound specified in NWS 23, keeping the central pressure drop constant. The purpose of this exercise was to better understand the impact of hurricane size on the maximum storm surge. However, hurricane sizes outside the range given in NWS 23 with the same central pressure drop are not realistic and therefore are not taken as bounding. Discussion related to hurricane sizes above the upper bound specified in NWS 23 will be modified to clarify that the purpose of this exercise is to better understand the hurricane size impact on storm surge and is not taken as bounding.

Table 1. Central Pressure and RMWs for Category 3 or Higher U.S. Hurricanes that Struck from 2001 to 2010 (Reference 1) and for Hurricane Andrew (1992), SPH and PMH.

Hurricane Name	Saffir-Simpson Hurricane Category at Landfall [1]	Central Pressure at Landfall (millibars) [1]	Radius of Maximum Winds (RMW) (nautical miles)	Landfall Location [11]
Andrew 1992	5	922	~8-11 [2]	Southeast Florida
Charley 2004	4	941	~6 [3]	Southwest Florida
Ivan 2004	3	946	~24 [4]	Alabama
Jeanne 2004	3	950	~20 [5]	Southeast Florida
Dennis 2005	3	946	~26 [6]	Northwest Florida
Katrina 2005	3	920	~25-30 [7]	Louisiana
Rita 2005	3	937	~30 [8]	Texas
Wilma 2005	3	950	~26 [9]	Southwest Florida
Standard Project Hurricane (SPH)	-	919 [10]	5-29 [10]	-
Probable Maximum Hurricane (PMH)	-	885 [10]	4-20 [10]	-

[1] FSAR Subsection 2.4.5, Table 2.4.5-202
[2] Reference 2
[3] Reference 3
[4] Reference 4
[5] Reference 5
[6] Reference 6
[7] Reference 7
[8] Reference 8, from Figure 4
[9] Reference 9
[10] FSAR Subsection 2.4.5, Reference 201
[11] Reference 10

This response is PLANT SPECIFIC.

References:

1) Blake, E.S., et al., *The Deadliest, Costliest, and Most Intense United States Tropical Cyclones from 1851 to 2010 (and Other Frequently Requested Hurricane Facts)*, NOAA Technical Memorandum NWS NHC-6, August 2011.

2) Landsea, C.W., et al., *A Reanalysis of Hurricane Andrew's Intensity*, American Meteorological Society, Volume 85, Issue 11, November 2004.

3) Wang, R., et al., *Hurricane Charley Characteristics and Storm Tide Evaluation*, Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems, April 2005.

4) Wang, R., et al., *Hurricane Ivan Characteristics and Storm Tide Evaluation*, Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems, April 2005.

5) Wang, R., et al., *Hurricane Jeanne Characteristics and Storm Tide Evaluation (DRAFT)*, Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems, May 2005.

6) NOAA, *SLOSH (Sea, Lake and Overland Surges from Hurricanes) Display Program*, Version 1.61 h, December 2009.

7) Knabb, R.D., et al., *Topical Cyclone Report, Hurricane Katrina*, NOAA National Hurricane Center, Updated September 2011.

8) Hasling, J.F., et al., *Freeman Hurricane Damage Potential Scale*, Weather Research Center, TX, March 2009.

9) Florida Department of Environmental Protection, *Hurricane Wilma, Post-Storm Beach Conditions and Coastal Impact Report*, Bureau of Beaches and Coastal Systems, January 2006.

10) NOAA, *North Atlantic Hurricane Tacking Charts*, National Weather Service, available at : http://www.aoml.noaa.gov/hrd/hurdat/DataByYearandStorm.htm, accessed 10/17/2011.

ASSOCIATED COLA REVISIONS:

The fourth paragraph of FSAR Subsection 2.4.5, Page 2.4.5-8 will be updated in a future revision as follows:

Figure 2.4.5-205 indicates that the surge elevation increases with increasing PMH size at the upper bound forward speed. This behavior is further investigated by varying the PMH size beyond the upper bound specified in NWS 23 for a PMH approaching at a direction of 270 degrees from the north. The hurricane track is assumed at a distance from Units 6 & 7 equal to the PMH radius of maximum wind. **The Δp is artificially kept constant for the hurricane sizes beyond the upper bound of 20 nautical miles (23 miles).** The resulting surge elevations are presented on Figure 2.4.5-207. For the selected set of parameters, Figure 2.4.5-207 shows that the surge elevation would be the maximum when the PMH size (radius of maximum wind) is 30 nautical miles (34.5 miles). **The maximum surge elevation is approximately 2.6 percent higher than the surge elevation from the PMH upper bound radius of maximum wind. Beyond 30 nautical miles (34.5 miles) surge elevation decreases.**

As discussed below, for larger hurricanes, the Δp should not be kept constant and it would be smaller and would generate lower surge elevations. Figure 2.5 of NWS 23 shows that PMH radius of maximum wind increases with latitude. The highest PMH radius of maximum wind is 38 nautical miles (44 miles) at Eastport, Maine. However, as shown in NWS 23, Figure 2.3, the PMH Δp decreases with latitude and Eastport, Maine has the lowest PMH Δp of 2.7 inch mercury lower than the PMH Δp of 4.0 inch mercury near the site. NWS 23 defines the PMH as a fully developed, tightly wound hurricane whose RMW for any particular coastal point is less than the RMW of the

standard project hurricane (SPH) which is a less intense hurricane than the PMH. Near the site, SPH has an upper bound RMW of about 29 nautical miles (33 miles), higher than the PMH upper bound of 20 nautical miles (23 miles). However, the Δp for the SPH is 2.6 inch mercury which is lower than PMH Δp of 4.0 inch mercury. This suggests that, for larger hurricane sizes than the PMH upper bound value given in NWS 23, the Δp would be smaller. The purpose of Figure 2.4.5-207 is to better understand the impact of hurricane sizes on storm surge elevation by artificially keeping the Δp constant. Therefore, surge elevations shown in Figure 2.4.5-207, for the hurricane sizes larger than the NWS 23 upper bound of 20 nautical miles (23 miles), are not taken as bounding. ~~This radius of maximum wind is larger than the upper bound radius of maximum wind for the PMH as described in the NOAA Technical Report NWS 23 (Reference 201). However, the difference in the resulting surge elevations at Units 6 & 7 for the two cases is small, approximately 2.6 percent of the surge elevation from the PMH upper bound radius of maximum wind. This difference in surge elevation caused by the hurricane size larger than the PMH upper bound radius of maximum wind is addressed as part of the overall uncertainties of the SLOSH model results in Subsection 2.4.5.2.2.5.~~

The first paragraph of FSAR Subsection 2.4.5, Page 2.4.5-10 will be updated in a future revision as follows:

would be approximately 17.5 feet. ~~This 20 percent adjustment to surge height is much greater than the 2.6 percent increase in surge elevation (which is approximately 3.5 percent in surge height) due to the PMH size, as described in Subsection 2.4.5.2.2.3. Therefore, no additional adjustment in surge height for the PMH size is considered necessary.~~

ASSOCIATED ENCLOSURES:

None