FPL.

L-2012-352
10 CFR 52.3

September 19, 2012

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 to NRC Request for Additional Information Letter No. 64 (eRAI 6544)
Related to SRP Section 03.05.03 – Barrier Design Procedures

References:

1. NRC Letter to FPL dated July 11, 2012, Request for Additional Information Letter No. 64 Related to SRP Section 03.05.03 Barrier Design Procedures for the Turkey Point Nuclear Plant Units 6 and 7 Combined License Application

2. FPL Letter to NRC dated August 23, 2012, Schedule for Response to NRC Request for Additional Information Letter No. 64 (eRAI 6544) Related to SRP Section 03.05.03 – Barrier Design Procedures

Florida Power & Light Company (FPL) provides, as an attachment to this letter, its responses to the Nuclear Regulatory Commission's (NRC) request for additional information (RAI) 03.05.03-34 provided in the referenced letter. 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). Reference 2 provided a schedule for the response.

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 September 19, 2012.

Sincerely,

William Maher
Senior Licensing Director – New Nuclear Projects

WDM/ETC

Attachment: FPL Response to NRC RAI No. 03.05.03-34 (eRAI 6544)

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-064 Dated July 11, 2012

SRP Section: 03.05.03 – Barrier Design Procedures

Questions from Hydrologic Engineering Branch (RHEB)

NRC RAI Number: 03.05.03-34 (eRAI 6544)

This is a follow-up to RAI No. 6251 (for FSAR Section 2.3.1).

The staff reviewed the response to RAI No. 6251. In the area pertaining to the local and global analysis of the Auxiliary Building concrete walls, the staff requests the following information:

1 - The staff request clarification on the use of the hurricane wind and missile impact load as it relates to Section 3.8.4.3.1.3 of the AP1000 DCD, where extreme environmental loads are defined. Given that the information in RG 1.221 indicates that the Turkey Point site may be prone to hurricane missile velocities higher than tornado missile velocities, structural demands from tornado missile loads may not bound those from hurricane missile loads. The staff requests the applicant to explain how the hurricane wind and missile impact loads (from the automobile missile) are considered (or not) as extreme environmental loads described in the AP1000 DCD. If hurricane loads (wind and missiles) are not considered in the structural analysis, provide a technical basis for not considering the hurricane wind and missile loads.

2 - The consideration given to opening of protective barriers, as explained in Section 3.5.2 of the AP1000 DCD. The missile spectrum in both RG 1.76 and RG 1.221 includes a 1-inch diameter steel sphere to test the configuration of openings in the protective barriers. Given that the information in RG 1.221 indicates that the Turkey Point site may be prone to hurricane missile velocities higher than tornado missile velocities, the staff is concerned that the higher missile velocity of the steel sphere could generate greater damage than previously estimated for tornado. The response to RAI No. 6251 does not provide information to address this issue. The applicant is requested to address the impact of the increased velocity of the 1-in diameter steel sphere on the openings of protective barriers.

Please provide sufficient detail in your responses to demonstrate that the design of protective barriers (including openings) adequately address site-specific hurricane wind and missile speeds. Responses should provide reasonable assurance that the barrier design is adequate for the Turkey Point site.

FPL RESPONSE:

The responses to each RAI question are discussed in the paragraphs below.

Question 1.

Load Combinations

The analysis for the automobile hurricane missile impact was performed on Seismic Category I reinforced concrete walls. Therefore, the applicable load combination is load case 4 given in DCD Table 3.8.4-2. The hurricane loads and associated missiles are considered extreme environmental loads. The hurricane is treated the same as the tornado. The hurricane automobile missile exceeds the tornado velocity only in the horizontal direction (180 mph for

the hurricane and 105 mph for the tornado). Therefore, the dead and live loads are zero, and since the critical area of the walls are above grade the liquid and earth loads are zero. In DCD section 3.3.2.2 the tornado load, W_t (see below), is defined further. The hurricane wind and missile loads are used in place of the tornado loads.

$$W_t = W_w$$
$$W_t = W_p$$
$$W_t = W_m$$
$$W_t = W_w + 0.5\ W_p$$
$$W_t = W_w + W_m$$
$$W_t = W_w + 0.5\ W_p + W_m$$

where:

W_t = total tornado load
W_w = total wind load
W_p = total differential pressure load
W_m = total missile load

The governing load combination is $W_w + W_m$.

Structures Evaluated

Selection of Wall Segments for Analysis

Five typical walls of the Auxiliary Building are selected for evaluation. The wall segments and location are identified in Table 1. All of these locations are associated with the Auxiliary Building. The walls are reinforced concrete design having a concrete compressive stress of 4,000 pounds per square inch (psi), and the reinforcement meeting ASTM 615, Grade 60 (yield stress of 60 kips per square inch [ksi]).

The Shield Building wall is thicker than the Auxiliary Building walls (3 feet versus 2 feet) and has more reinforcement. Therefore, the Shield Building is shown to be adequate by demonstrating that the Auxiliary Building structural integrity is maintained for the automobile hurricane missile. An automobile missile generated within a half mile of the plant structures is considered to impact all altitudes less than 30 feet above all grades and therefore will not reach the elevation of the PCS tank. This criterion is provided in Regulatory Guide 1.221 (October 2011).

Shear Capacity Automobile Missile Impact

The shear stress in the concrete caused by the impact of the automobile on the structural segment is checked against the allowable shear stress defined by the ACI 349 code (Section 11.3). The allowable shear stress per code is 112.77 psi.

The shear stress that the impact of the automobile imparts to the wall is determined using the effective parameter about the zone of impact. When performing equivalent static analyses for the automobile impact, a dynamic load factor is used to reflect the dynamic amplification effect of the forcing function of the automobile impact. For calculating the shear, it is conservatively assumed that the impact load is amplified by a dynamic load factor of 2 which is the maximum

that it can be. In addition to the missile impact load, the wind and differential pressure inward on the walls act over the area within the shear perimeter.

Table 1 contains a summary of the calculated shear stresses. As shown, the shear stresses on the walls caused by the automobile impact are under the allowable stress of 112.77 psi.

Table 1 – Shear in Walls Due to Automobile Impact

Wall ID Number	Wall Segment[1]	Elevation	Shear psi
1W	Along wall 1 between walls N & I	135' 3" to 180' 0"	91.8
2W	Along wall N between walls 1 & 4	135' 3" to 180' 0"	109.1
3W	Along wall I between 1 & 4	153' 0" to 180' 0"	106.2
4W	Along wall Q between walls 9.1 & 11	117' 6" to 153' 0"	105.9
5W	Along wall 1 between N & K2	100' to 135' 3"	91.8

[1] Location of wall segment is shown in Westinghouse Design Control Document, Revision 19, Appendix 3H

Ductility Due to Flexure from Automobile Missile Impact

Based on ACI 349 Appendix C, a ductility factor of 10 can be used as the allowable value. A dynamic analysis is performed using a one-mass dynamic model and the time history forcing function defined below.

The automobile is defined as a massive high kinetic energy missile for the tornado event. The AP1000 Civil/Structural Design Criteria defines this missile as "a massive high kinetic energy missile which deforms on impact, assumed to be a 4000 lb automobile impacting the structure at normal incidence". For Turkey Point Units 6 & 7, the automobile has a maximum horizontal velocity of 180 mph for the hurricane which is larger than the tornado velocity of 105 mph. The vertical velocity associated with the hurricane is smaller (58 mph for hurricane versus 74 mph for tornado).

The forcing function for the automobile missile is defined in Reference 1. The forcing function associated with the impact of the automobile onto the structure is defined as a quarter sine wave. The basis of this formulation is that "the automobile is considered as a deformable missile and the structure as a rigid target." This formulation is given below:

$F_t = 0.625\ V_c\ W\ \sin(20t)$ $\quad 0 < t \leq 0.0785$ sec
$F_t = 0$ $\quad t > 0.0785$ sec

where:

V_c = impact velocity during impact (fps)
V_c = 264 fps for horizontal impact based on the horizontal velocity of 180 mph
W = weight of automobile = 4000 lbs
F_t = 660 Sin (20t), kips for horizontal impact
t = time (sec)

The plot of this forcing function considering horizontal impact is shown in Figure 1. The frontal impact is 6.6 feet x 4.3 feet as per Regulatory Guide 1.221, Revision 0, October 2011.

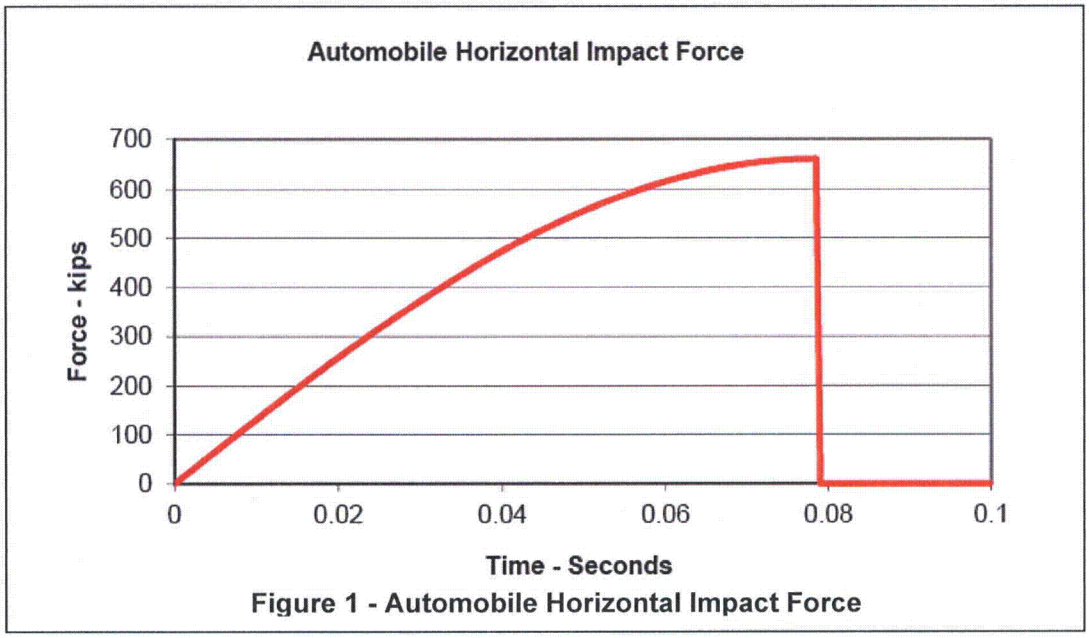
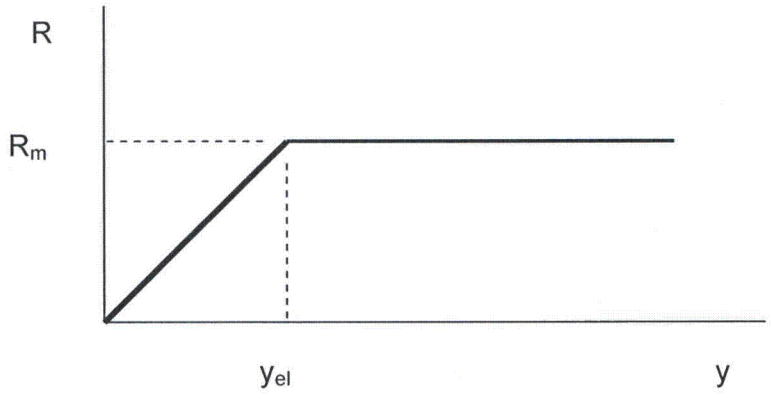


Figure 1 - Automobile Horizontal Impact Force

The resistance associated with each of the walls identified in Table 1 is determined, and time history analyses are performed that allow the wall to deform in an elastic-perfectly plastic manner as shown in Figure 2. It was determined that for the walls, the largest ductility factor is 1.10, which is well below the allowable of 10. Further, the ductility factors are adjusted for the added deflection due to the hurricane induced pressures. The ductility factors are shown in Table 2.



where:

R = Applied load
y_e = Deflection of structure at yield
R_m = Maximum resistance of structure
y = Deflection of structure

Figure 2 – Elastic Perfectly Plastic Resistance Function

Table 2 – Ductility of Walls Due to Automobile Impact

Wall ID Number	Ductility
1W	1.04
2W	0.61
3W	1.03
4W	0.88
5W	1.10

In conclusion, the hurricane missiles are treated the same as the tornado missiles. The load combinations are the same. The analysis methodology and structures evaluated are the same as the tornado evaluation.

Question 2.

The solid steel sphere has been considered for the tornado extreme environmental event for the AP1000. The velocity of this missile is 105 mph for any direction. The openings in the AP1000 that were a concern where entry of the steel sphere could potentially result in damage to safety related equipment are located on the Auxiliary Building roof in Areas 1 and 2 which are above the MSIV compartment. These openings are steam vents for the MSIV area. The steel sphere would have to pass vertically through two levels of grating acting as barriers before it could potentially impact the MSIV. Above the grating is a panel made of aluminum frame sandwich panel with 2.75" thick foam with 0.04" aluminum skin on top and bottom. An evaluation was made to determine if the steel sphere would penetrate this panel using nonlinear analysis (LS-DYNA). It was determined that the steel sphere at a velocity of 105 mph would not penetrate this panel.

The velocities of the solid steel sphere for Turkey Point Unit 6 & 7 are 128.5 mph for the horizontal direction, and vertically 58 mph. The critical direction is vertical where the steel sphere would have to pass through the grating before potentially damaging the MSIV. Horizontally, the steel sphere would not impact any safety related equipment, or be stopped by the grating.

In conclusion, the barrier design has sufficient strength for the Turkey Point site since the solid steel sphere vertical kinetic energy under the design tornado condition is larger than that for the Turkey Point hurricane condition (650 lb-in vs. 198 lb-in respectively; missile weight of 0.147 lb).

This response is PLANT SPECIFIC.

References:

1. Linderman, R. B, J. V. Rotz, and G. C. K. Yeh, 1974. Design of Structures for Missile Impact, BC-TOP-9-A., Rev. 2, Bechtel Power Corporation, San Francisco, California, September 1974.

ASSOCIATED COLA REVISIONS:

Table 2.0-201 will be revised as follows in a future revision to the COLA.

Table 2.0-201 (Sheet 6 of 8)
Comparison of DCD Site Parameters and Turkey Point Units 6 & 7 Site Characteristics

	AP 1000 DCD Site Parameters[a]	Units 6 & 7 Site Characteristics	Units 6 & 7 Site Characteristic Reference	Bounding Yes/No
Soil (cont.)				
Limits of Acceptable Settlement Without Additional Evaluation[k]	Differential Across Nuclear Island Foundation Mat 1/2 inch in 50 ft	<0.1 inch in 50 ft (projected)	Subsection 2.5.4.10	Yes (projected)
	Total for Nuclear Island Foundation Mat 6 inches	2.5 inches (projected)		
	Differential Between Nuclear Island and Turbine Building[l] 3 inches	0.3–2 inches (projected)		
	Differential Between Nuclear Island and Other Buildings[l] 3 inches	0.3–2.3 inches (projected)		
Liquefaction Potential	No liquefaction considered beneath the seismic Category I and seismic Category II structures and immediate surrounding area. The immediate surrounding area includes the effective soil supporting media associated with the seismic Category I and seismic Category II structures.	None at the site-specific SSE.	Subsection 2.5.4.10	Yes

Minimum Soil Angle of Internal Friction	Minimum soil angle of internal friction is greater than or equal to 35 degrees below the footprint of nuclear island at its excavation depth. If the minimum soil angle of internal friction is below 35 degrees, a site specific analysis shall be performed using the site specific soil properties to demonstrate stability.	Nuclear island excavations are backfilled with lean concrete up to the foundation level of the structures.	Subsection 2.5.4.10 Table 2.5.4-215	Not Applicable
Missiles[(n)]				
Tornado	4000-lb automobile at 105 mph horizontal, 74 mph vertical	4000-lb automobile at 105 mph horizontal, 74 mph vertical	APP-GW-GLR-020, "Wind and Tornado Site Interface Criteria," Westinghouse Electric Company, LLC.[(i)] Subsection 3.5.1.5	Yes
	275-lb, 8-in. shell at 105 mph horizontal, 74 mph vertical	275-lb, 8-in. shell at 105 mph horizontal, 74 mph vertical		Yes
	1-in.-diameter steel ball at 105 mph in the most damaging direction	1-in.-diameter steel ball at 105 mph in the most damaging direction		Yes

(Add note as follows):

(n) The effects of hurricane missiles are discussed in FSAR Subsection 3.5.2.

ASSOCIATED ENCLOSURES:

None.