FPL

L-2014-355
10 CFR 52.3

December 11, 2014

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-001

Re: Florida Power & Light Company
Proposed Turkey Point Units 6 and 7
Docket Nos. 52-040 and 52-041
Voluntary Revised Response to NRC Request for Additional Information Letter No. 61
(eRAI 6432) Related to SRP Section 03.07.01 - Seismic Design Parameters

References:

1. NRC Letter to FPL dated May 17, 2012, Request for Additional Information Letter No. 61 Related to SRP Section 03.07.01 Seismic Design Parameters for the Turkey Point Units 6 and 7 Combined License Application
2. FPL Letter L-2014-285 to NRC dated October 3, 2014, Voluntary Revised Response to NRC Request for Additional Information Letter No. 040 (eRAI 6006) – Standard Review Plan Section 02.05.04 Stability of Subsurface Materials and Foundations
3. FPL Letter L-2014-314 to NRC dated October 29, 2014, Submittal of the Annual Update of the COL Application – Revision 6 and the Semi-Annual Update of the Departures Report

Florida Power & Light Company (FPL) provides, as an attachment to this letter, its revised response to the Nuclear Regulatory Commission's (NRC) request for additional information (RAI) 03.07.01-19 provided in Reference 1. This revision resulted from the supplemental site investigation testing and analyses performed to support the revised responses for FSAR Subsection 2.5.4 submitted in Reference 2.

The voluntary revised responses do not provide any associated COLA changes as any COLA revisions resulting from the revised responses were incorporated in Revision 6 of the Turkey Point 6 & 7 COL Application submitted in Reference 3.

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

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NRO

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

Executed on December 11, 2014.

Sincerely,

William Maher
Senior Licensing Director – New Nuclear Projects

WDM/RFB

Attachment: FPL Revised Response to NRC RAI No. 03.07.01-19 (eRAI 6432)

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

NRC RAI Letter No. PTN-RAI-LTR-061 Dated May 17, 2012

SRP Section: 03.07.01 – Seismic Design Parameters

Questions from Structural Engineering Branch 1

NRC RAI Number: 03.07.01-19 (eRAI 6432)

In Revision 3 of the applicant's FSAR, (aka. TPG-1000-S2R-802, "Turkey Point Site-Specific Seismic Evaluation Report") the third paragraph in Section 2.5.4.7.3.3, "Shear modulus and Damping for Rock," states that the damping for rock is taken as 1%. The damping shown in Figure 2.5.2-249 which describes the soil properties used to develop the GMRS indicates that a damping value of ½% was used in the analyses. The applicant is requested to provide clarification as to the actual level of damping used in the analyses, including the SSI analyses, and provide basis for selection considering the large variability in RQD shown in Figure 2.5.4-215.

FPL RESPONSE:

This RAI is very similar to RAI 02.05.04-16 and thus the response given here follows closely the response to RAI 02.05.04-16 with some additional information. Proposed changes to the FSAR are given in the response to RAI 02.05.04-16.

FSAR Figure 2.5.2-249 (Sheet 2 of 2) is reproduced in this response for illustrative purposes. This figure represents the full soil and rock column that includes approximately 30 ft of structural fill (with surface at El. +25.5 ft NAVD 88) above approximately 25 ft of Miami Limestone, overlying about 90 ft of rock consisting of the Key Largo and Fort Thompson Formations. The rock is underlain by soil of the Tamiami and Peace River Formations to about 475 ft depth. The Arcadia Formation, consisting of very weak rock mixed with some soil extends to about 640 ft depth, the limiting depth of the site subsurface investigation. The actual levels of damping used in the analyses are the values shown in FSAR Figure 2.5.2-249 (Sheet 2 of 2). The basis for selecting the value for each formation is described in the following paragraphs.

FSAR Subsection 2.5.4.7.3.3 indicates that the Miami Limestone is considered sufficiently weak to have strain-dependent modulus and damping values. FSAR Table 2.5.4-216 shows the damping ratio (D, percent) versus shear strain values. D remains constant at 0.6 percent from 0.0001 to 0.03 percent strain. In the SHAKE analysis, shear strain did not exceed 0.03 percent, and so D is constant at 0.6 percent in FSAR Figure 2.5.2-249 (Sheet 2 of 2).

D = 1 percent at all strain levels for the Key Largo and Fort Thompson Formations (Strata 3 and 4). As Part of the supplemental field investigation as discussed in the revised response to RAI 02.05.04-3 (Reference 1), four resonant column torsional shear tests (RCTS) were conducted on the Key Largo and Fort Thompson formations. The RCTS results, as obtained from the supplemental field investigation testing, are used to create the best fit damping curve labeled "Key Largo and Fort Thompson" in FSAR Figure 2.5.4-235. The maximum shear strain that these strata experience is much smaller than 0.005 percent (FSAR Figure 2.5.2-248). For this strain interval, the

damping ratio is first constant around 0.8 percent, and then increases towards 1 percent as the shear strain approaches 0.005 percent. Even though the assumed damping ratio of 1 percent is slightly higher than the measured value, the test results can be considered in good agreement with the assumptions made for this layer and the difference is within the uncertainty involved in determining the damping ratio from the test results.

The only other rock formation noted in FSAR Subsection 2.5.4.7.3 is Stratum 8, the Arcadia Formation. The Arcadia Formation is much weaker than the Key Largo and Fort Thompson Formations. FSAR Table 2.5.4-209 indicates an unconfined compressive strength of about 140 psi compared with about 2700 and about 2300 psi for the Key Largo and Fort Thompson Formations, respectively. Even the strain-dependent Miami Limestone has higher strength than that of the Arcadia Formation. Thus, for the Arcadia Formation, consideration was given to using the D versus shear strain values of the Miami Limestone (Oolite) given in FSAR Table 2.5.4-216. However, since the Arcadia Formation is the lower portion of the Hawthorn Group, with the overlying Peace River Formation (FSAR Subsection 2.5.1.1.1.2.1.1) forming the upper portion, it was considered more appropriate to use the D versus shear strain values of the Peace River Formation for the Arcadia Formation.

The constant damping ratio of the material below the Arcadia Formation, (i.e., below about 640-ft depth in FSAR Figure 2.5.2-249, Sheet 2 of 2), is 0.32 percent based on the median value of kappa and associated uncertainty.

The damping ratio versus shear strain relationship derived for mudstone was selected for the Miami Limestone, and the damping ratio versus shear strain relationship for natural soil measured from RCTS testing was selected for the Arcadia Formation (both relationships are shown on FSAR Figure 2.5.4-235). The strength and rigidity of the limestone in the Key Largo and Fort Thompson Formations indicated that damping ratio is essentially independent of strain level, and a value of 1 percent was selected, consistent with the damping ratio selected for other rock sites (e.g., North Anna Unit 3 and VC Summer Units 2 & 3). As mentioned earlier, this assumption was confirmed for strains less than about 0.005 percent based on RCTS results obtained during supplemental field investigation.

The following provides a basis for the selection of damping ratio values for the various rock strata considering the large variability in RQD shown in FSAR Figure 2.5.4-215. Each rock stratum is defined based on age, mineral composition, depositional mode, etc. Although there may be significant variability of a parameter (strength, shear wave velocity, RQD, etc.) within a stratum, a single damping ratio versus strain relationship is selected for each stratum. If the variability was clearly defined within the stratum (e.g., high RQD at the top of the stratum and low RQD at the bottom), the stratum could be sub-divided into separate strata and different damping ratio versus strain relationships assigned to each. However, with the Turkey Point rock strata, the variability is generally random, and the strata are not sub-divided.

The uncertainties and variation in the damping ratios (reflected in the variations in parameters such as RQD) were taken into account in the randomization process. FSAR Figure 2.5.2-238 shows the variation assumed in the randomization process for the damping ratio versus strain for the Arcadia Formation.

This response specifies the level of damping used in the generation of simulated (randomized) soil profiles, which are in turn used in seismic site response analysis. The SSI analyses use the strain-compatible damping ratios that result from the site response analysis of the simulated (randomized) profiles. FSAR Table 3.2-1 in Appendix 3KK provides the damping ratio values used in the SSI for the best estimate profile.

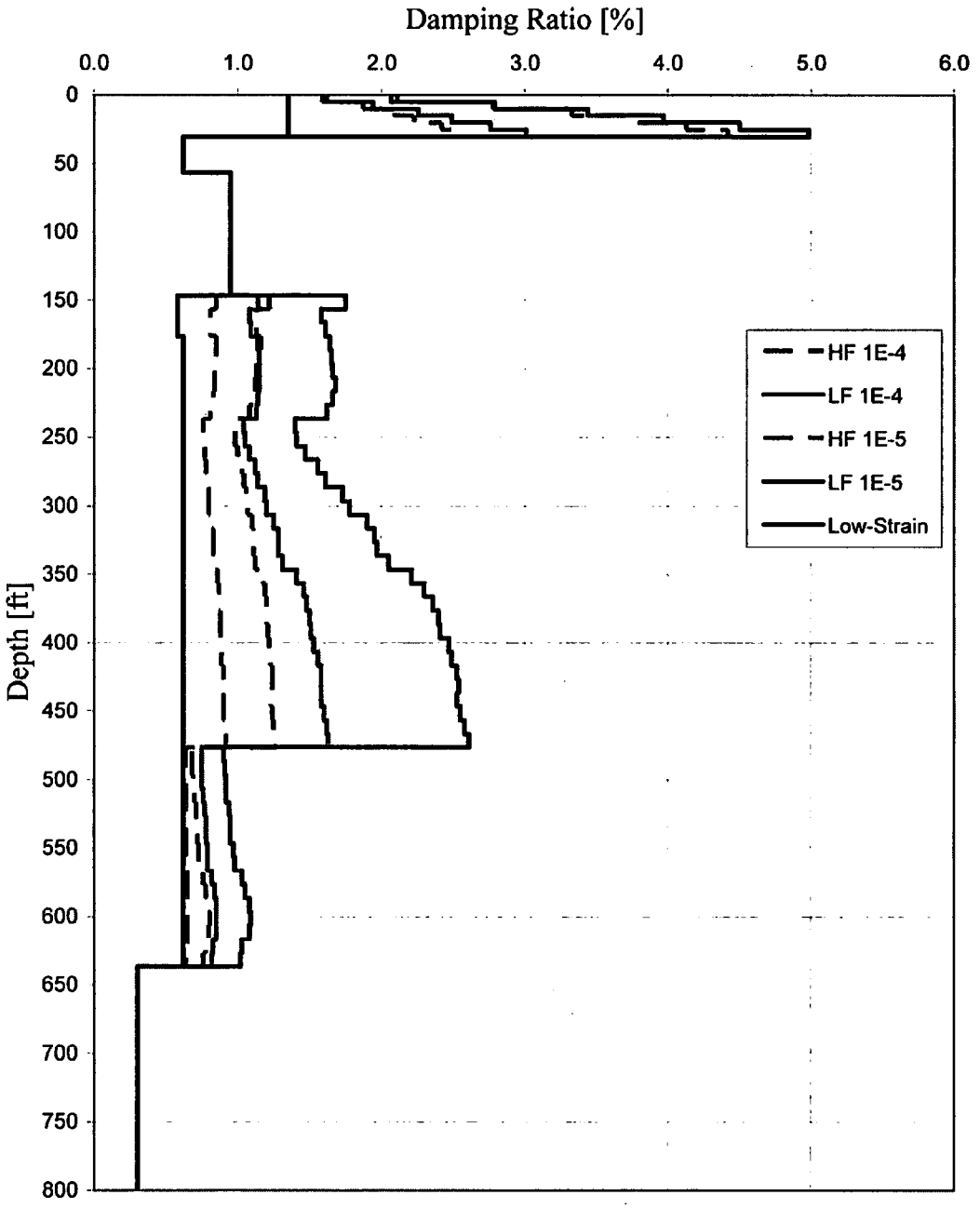

Figure 2.5.2-249 Median Profiles of Strain-Compatible Soil Damping (Upper 800 feet) (Sheet 2 of 2)

(FSAR Revision 6)

This response is PLANT SPECIFIC.

Reference:

1. FPL Letter L-2014-285 to NRC dated, October 3, 2014, Voluntary Revised Response to NRC Request for Additional Information Letter No. 040 (eRAI 6006) – Standard Review Plan Section 02.05.04 – Stability of Subsurface Materials and Foundations

ASSOCIATED COLA REVISIONS:

No additional changes to COLA Revision 6 have been identified as a result of this revised response.

ASSOCIATED ENCLOSURES:

None