NRC RAI Letter No. PTN-RAI-LTR-040

SRP Section: 02.05.04 - Stability of Subsurface Materials and Foundations

QUESTIONS from Geosciences and Geotechnical Engineering Branch 1 (RGS1)

NRC RAI Number: 02.05.04-3 (eRAI 6006)

FSAR Subsection 2.5.4.2.2 indicates that adjustments are made to the subsurface investigation including changes to the field testing locations and to the types. Also, the applicant made adjustments to depths and frequencies of sampling. In accordance with NUREG-0800, Standard Review Plan, Chapter 2.5.4, "Stability of Subsurface Materials and Foundations," and Regulatory Guide (RG) 1.132, "Site Investigations for Foundations of Nuclear Power Plants," please provide further information on how and to what extent these adjustments vary from the recommendations provided in RG 1.132 and justify its acceptance for characterizing site subsurface conditions.

FPL RESPONSE:

Regulatory Guide (RG) 1.132 (Revision 2) provides guidance on conducting subsurface explorations including investigation methods, location and depth of exploration points, and in-situ tests. Section C.1 of the guide states that the "…site investigation program will be site dependent; such a program should be tailored to the specific conditions of the site using sound professional judgment." The guide also acknowledges that the program should be flexible and adjusted as the investigation proceeds.

As indicated in FSAR Subsection 2.5.4.2.2.1, the guidance in RG 1.132 was used as the basis for planning the site-specific subsurface investigation for Turkey Point Units 6 & 7. Local geologic information from the subsurface investigation for Turkey Point Units 3 & 4 was used in planning the investigation. In the powerblock, the boring layout included a minimum of one boring or cone penetration test (CPT) per structure and one boring or CPT per 10,000 square feet of structure plan area. Planned drilling methods included mud rotary for geotechnical boreholes. Triple-tube wire-line coring was used to sample rock. Overall, the subsurface investigation program as summarized in FSAR Subsection 2.5.4.2.2 included 88 geotechnical borings, 22 groundwater observation wells, 4 CPTs, and 2 test pits. The supplemental response to RAI 02.05.04-10 compares the numbers and depths of borings, CPTs, etc. performed for Turkey Point Units 6 & 7 with those performed at other planned two unit AP1000 sites (Levy County, Vogtle and V.C. Summer) and concludes that there is no typical amount of exploration — the amount depends on the site conditions. Surface and downhole geophysical surveys (as described in Subsection 2.5.4.4) were also conducted. These surveys included borehole logging (natural gamma, long and short normal resistivity, spontaneous potential, caliper, and deviation), P-S suspension velocity logging, downhole seismic velocity logging, and an integrated surface geophysical survey for evaluation of potential dissolution features.

After the start of field work, adjustments to the subsurface investigation program were made to account for site specific conditions, for both accessibility and subsurface issues. These adjustments included exploration methods, borehole locations, borehole deletions, sampling frequencies, and exploration depths. All changes to the exploration program

were documented with either a revision to the specification or through the submission, by the subcontractor, of a Supplier Deviation Disposition Request (SDDR) form. This form, and its use, was provided in the subsurface investigation specification. A summary of adjustments reported with the SDDR process is presented in Table 1. All adjustments made were consistent with RG 1.132 guidance.

During the initial drilling activities, the Tamiami Formation underlying the Fort Thompson Formation was found to be less dense than anticipated from review of previous subsurface data. For this reason, CPT soundings were added to the exploration program with a revision to the specification. The CPTs were advanced into the Tamiami and Peace River Formations to aid in characterizing these materials. Execution of the CPT program necessitated coring the overlying Key Largo and Fort Thompson at these locations. Additionally, one boring, B-701, was extended into the underlying Arcadia Formation to confirm the characterization of this material.

The depth of exploration utilized the guidance in RG 1.132. As stated in FSAR Subsection 2.5.4.2.2.3, the borings beneath the reactors and key structures extended to 250 feet with one boring beneath each reactor to at least 400 feet. The deepest boring (B-701) was extended to a depth of 615.5 feet. The supplemental response to RAI 02.05.04-10 notes that the maximum required boring depth at the site based on RG 1.132 guidelines is about 285 ft.

RG 1.132 Section 4.3.1 states that at least one continuously sampled boring should be used for each safety-related structure. Generally, soil was sampled at 2.5-foot intervals to 15 feet and then 5-foot intervals until rock coring began (when SPT refusal was encountered) or at a depth of about 35 feet. The Key Largo and Fort Thompson Formation limestones were then cored continuously. SPT sampling was conducted at approximately 10-foot intervals in the sands and silts of the underlying Tamiami and Peace River Formations. In the deepest boring, where the Arcadia Formation was encountered, the rock was cored continuously. In summary, the rock formations were sampled continuously. The soil was sampled at close intervals near the surface and then at an increased interval at greater depths, reflecting the lessening variability of soils with increasing depth. The selected sampling intervals enabled satisfactory characterization of the materials encountered.

RG 1.132 Section 4.3.1.2 states that boreholes with depths greater than 100 feet should be surveyed for deviation. As stated in FSAR Subsection 2.5.4.4.3, deviation measurements were conducted in the 10 uncased boreholes in which borehole geophysical logging was performed. The depths of these deviation data in the boreholes ranged from approximately 157 to 610 feet as provided in Table 5 of Appendix D – Geovision Downhole and P-S Logging Report in Volume 2 of FSAR Subsection 2.5.4, Reference 257. The deviation of the borehole from the vertical does not impact the characterization of the materials encountered.

Adjustments made during field work accounted for differing surface and subsurface conditions. These changes provided enhancements to the original exploration program to

supplement characterization of site conditions. None of the adjustments made to the field testing locations, test methods, testing frequencies and test depths vary from the recommendations in RG 1.132. The exploration program met the intent of RG 1.132 and met the guidelines of the RG except, as previously discussed in this response, no boring was continuously sampled in the deeper soils, and only the borings used for borehole geophysical logging were surveyed for deviation.

Table 1 - Summary of SDDR Issues Related to Adjustments in Subsurface Exploration Program

SDDR NO. (25409-102-YD4-CY00-XXXXX)	Subject	Cause of Adjustment	Associated with Safety-Related Structures
00007	Drilling fluids permitted while rock coring, except in association with wells	Improve sample recovery and integrity	yes
00008	PS velocity logging modified to eliminate the upper 20 to 30 feet	Soft ground conditions required casing which precluded obtaining P-S logging data	yes
00015	Relocate borings B-613, B-614, and B-615	Minimize environmental impact	no
00017	Relocate borings B-734, B-735, B-736, and B-737 and wells OW-735U, OW-735L	Minimize environmental impact	no
00018	Relocate borings B-806 and B-807, wells OW-636U, OW-636L	Minimize environmental impact	no
00019	Relocate boring B-621, wells OW-621U and OW-621L	Minimize environmental impact	no
00020	Relocate boring B-805, wells OW-805U and OW-805L	Location inaccessible, submerged land	no
00024	Relocate borings B-634, B-635, B-636, and B-637	Minimize environmental impact	no
00025	Delete boring B-801, relocate borings B-812, B-813, and B-814, and wells OW-802U, OW-802L, OW-812U and OW-812L	Deleted boring due to inaccessibility (submerged land), relocated borings to minimize environmental impact	no
00026	Delete borings B-638, B-803 and B-804	Deleted borings due to inaccessibility (submerged land)	no
00027	Relocate boring B-802, wells OW-802U and OW-802L	Minimize environmental impact	no
00028	Install wells OW-802L and OW-805L in geotechnical boreholes instead of separate borings	Soft ground conditions restricted access to original well locations	no
00030	Relocate test pits TP-601 and TP-701	Minimize environmental impact	no
00032	Relocate boring B-813	Minimize environmental impact	no
00033	Change secondary seismic method from crosshole to downhole	More appropriate method for site-specific geology	yes
00039	Install 2 additional wells OW-606D and OW-706D, conduct slug tests	Evaluate hydrogeologic properties of Tamiami Formation	no

This response is PLANT SPECIFIC.

References:

None

ASSOCIATED COLA REVISIONS:

None

ASSOCIATED ENCLOSURES:

None