Progress Energy

Serial: NPD-NRC-2009-202
September 3, 2009

10CFR52.79

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

LEVY NUCLEAR PLANT, UNITS 1 AND 2
DOCKET NOS. 52-029 AND 52-030
SUPPLEMENT 2 TO RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 030 RELATED TO STABILITY OF SUBSURFACE MATERIALS AND FOUNDATIONS

References:

1. Letter from Brian C. Anderson (NRC) to Garry Miller (PEF), dated May 8, 2009, "Request for Additional Information Letter No. 030 Related to SRP Section 2.5.4 for the Levy County Nuclear Plant, Units 1 and 2 Combined License Application"
2. Letter from Garry D. Miller (PEF) to U. S. Nuclear Regulatory Commission (NRC), dated June 9, 2009, "Response to Request for Additional Information Letter No. 030 Related to Stability of Subsurface Materials and Foundations," Serial: NPD-NRC-2009-104
3. Letter from Garry D. Miller (PEF) to U. S. Nuclear Regulatory Commission (NRC), dated June 23, 2009, "Supplement 1 to Response to Request for Additional Information Letter No. 030 Related to Stability of Subsurface Materials and Foundations," Serial: NPD-NRC-2009-123

Ladies and Gentlemen:

Progress Energy Florida, Inc. (PEF) hereby submits a supplemental response to the Nuclear Regulatory Commission's (NRC) request for additional information provided in Reference 1.

Revised responses to two of the NRC questions (02.05.04-19 and 02.05.04-22) are provided in the enclosure. The enclosure also identifies changes that will be made in a future revision of the Levy Nuclear Plant Units 1 and 2 application.

If you have any further questions, or need additional information, please contact Bob Kitchen at (919) 546-6992, or me at (919) 546-6107.

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

Executed on September 3, 2009.

Sincerely,

Garry D. Miller
General Manager
Nuclear Plant Development

Progress Energy Carolinas, Inc.
P.O. Box 1551
Raleigh, NC 27602

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NRO

Enclosure

cc : U.S. NRC Region II, Regional Administrator
Mr. Brian C. Anderson, U.S. NRC Project Manager

Levy Nuclear Plant Units 1 and 2
Supplement 2 to Response to NRC Request for Additional Information Letter No. 030 Related to SRP Section 2.5.4 for the Combined License Application, Dated May 8, 2009

NRC RAI #	Progress Energy RAI #	Progress Energy Response
02.05.04-15	L-0198	NPD-NRC-2009-123; June 23, 2009
02.05.04-16	L-0199	NPD-NRC-2009-104; June 9, 2009
02.05.04-17	L-0200	NPD-NRC-2009-104; June 9, 2009
02.05.04-18	L-0201	NPD-NRC-2009-104; June 9, 2009
02.05.04-19	L-0528	Revised response enclosed – see following pages
02.05.04-20	L-0204	NPD-NRC-2009-104; June 9, 2009
02.05.04-21	L-0205	NPD-NRC-2009-104; June 9, 2009
02.05.04-22	L-0530	Revised response enclosed – see following pages

NRC Letter No.: LNP-RAI-LTR-030

NRC Letter Date: May 8, 2009

NRC Review of Final Safety Analysis Report

NRC RAI NUMBER: 02.05.04-19

Text of NRC RAI:

FSAR Section 2.5.4.8.5 states that liquefiable zones are isolated, not continuous, and not within the passive wedge of the nuclear island considering sliding. Insufficient information is available in the FSAR to determine the accuracy of these statements.

Please provide sufficient information for the staff to confirm that the zones are isolated, not continuous, and outside of the passive wedge zone around the nuclear island.

PGN RAI ID #: L-0528

PGN Response to NRC RAI:

In FSAR Section 2.5.4.8.5, it is stated that the random zones of soil with a low factor of safety against liquefaction will not affect the development of passive pressure resistance to sliding of the AP1000 basemat because the zones are isolated, not continuous, and negligible; not within the passive wedge on any side of the nuclear island; excavated and replaced with non-liquefiable material; or because detailed analysis for nuclear island sliding demonstrates adequate margin of safety without credit for passive wedge resistance.

Westinghouse has performed non-linear analyses with sliding friction elements using a 2D ANSYS model in the East-West direction. The coefficient of friction used in this analysis was 0.55 and yielded a maximum deflection at elevation 60'5", the base of the nuclear island basemat, of 0.03". The results of this analysis have led to changes in TR-85 Rev. 1 Section 2.9, which can be found in Westinghouse RAI-TR85-SEB1-10R2, which states that "it can be concluded that the Nuclear Island is stable against sliding, and there is no quality requirement for the backfill material adjacent to the NI (side soil) to remain stable against sliding. Also, as noted in Revision 1 of this response, there is no passive pressure required to maintain stability against overturning.".

With no quality requirement for soils adjacent to the nuclear island (since the nuclear island is stable against sliding during a seismic event), then sliding of the nuclear island is not impacted by the potential liquefaction of adjacent soils. As such, the properties of the random liquefiable zones, such as their isolation, continuity, negligibility, or location with the passive wedge, are no longer relevant to the discussion of nuclear island sliding.

References:

1) Westinghouse RAI Response RAI-TR85-SEB1-10R2

Associated LNP COL Application Revisions:

The following changes will be made to the LNP COLA in a future revision:

1) The following text will be modified in FSAR Subsection 2.5.4.5.4 from:

Based on a nominal site grade elevation of 15.5 m (51 ft.) NAVD88, the elevation of each nuclear island basemat will be 3.5 m (11 ft. 6 in.) NAVD88. A 15.2-cm (6-in.) mudmat will be located beneath each nuclear island basemat at elevation 3.4 m (11 ft.) NAVD88. Structural fill between the excavation bottom (elevation -7.3 m [-24 ft.] NAVD88) and the nuclear island mudmat (elevation 3.4 m [11 ft.] NAVD88) will consist of an RCC bridging mat, as shown on Figures 2.5.4.5-201B and 2.5.4.5-202B. A waterproofing membrane will be located between the RCC and the mudmat, meeting AP1000 DCD requirements of 0.7 static coefficient of friction between horizontal membrane and concrete.

to:

Based on a nominal site grade elevation of 15.5 m (51 ft.) NAVD88, the elevation of each nuclear island basemat will be 3.5 m (11 ft. 6 in.) NAVD88. A 15.2-cm (6-in.) mudmat will be located beneath each nuclear island basemat at elevation 3.4 m (11 ft.) NAVD88. Structural fill between the excavation bottom (elevation -7.3 m [-24 ft.] NAVD88) and the nuclear island mudmat (elevation 3.4 m [11 ft.] NAVD88) will consist of an RCC bridging mat, as shown on Figures 2.5.4.5-201B and 2.5.4.5-202B. A waterproofing membrane will be located between the RCC and the mudmat, meeting AP1000 DCD requirements of 0.55 static coefficient of friction between horizontal membrane and concrete. For buildings adjacent to the nuclear islands, the nominal site grade will be raised to elevation 15.5 m (51 ft.) NAVD88 using engineered fill.

2) Revise the following text in FSAR Table 2.0-201 (Sheet 5 of 8) from:

A waterproofing membrane will be located between the RCC and the mudmat, meeting AP1000 DCD requirements of ≥0.7 static coefficient of friction.

to:

A waterproofing membrane will be located between the RCC and the mudmat, meeting AP1000 DCD requirements of ≥0.55 static coefficient of friction.

3) Revise the following text in FSAR Section 2.5.4.8.5 from:

The random zones of soil with low FS will not affect the development of passive pressure resistance to sliding of the AP1000 basemat because of any of the following:

- The zones are isolated, not continuous, and negligible.
- The zone is not in the passive wedge on any side of the nuclear island.

- The zone will be specifically excavated and replaced with non-liquefiable material, or detailed analysis for nuclear island sliding demonstrates adequate margin of safety without credit for passive wedge resistance.

to:

Westinghouse has performed non-linear analyses with sliding friction elements using a 2D ANSYS model in the East-West direction, which concluded that the Nuclear Island is stable against sliding, that there is no quality requirement for the backfill material adjacent to the NI (side soil) to remain stable against sliding, and that there is no passive pressure required to maintain stability against overturning. Since the seismic loading conditions used in the Westinghouse analysis are larger than those required at the LNP site, if the soil within the passive wedge of the nuclear island structures were to completely liquefy, the nuclear island would not slide under seismic loads.

4) Revise the following text in LNP COLA Part 10, Appendix B, Table 3.8-2 from:

Table 3.8-2

Waterproof Membrane Inspections, Tests, Analyses, and Acceptance Criteria (Sheet 1 of 1)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
The friction coefficient to resist sliding is ≥ 0.7.	Testing will be performed to confirm that the mudmat-waterproofing-RCC interface beneath the Nuclear Island basemat has a coefficient of friction to resist sliding of ≥ 0.7.	A report exists and documents that the as-built waterproof system (mudmat-waterproofing-RCC interface) has a coefficient of friction of ≥ 0.7 as demonstrated through material qualification testing.

to:

Table 3.8-2

Waterproof Membrane Inspections, Tests, Analyses, and Acceptance Criteria (Sheet 1 of 1)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
The friction coefficient to resist sliding is ≥ 0.55.	Testing will be performed to confirm that the mudmat-waterproofing-RCC interface beneath the Nuclear Island basemat has a coefficient of friction to resist sliding of ≥ 0.55.	A report exists and documents that the as-built waterproof system (mudmat-waterproofing-RCC interface) has a coefficient of friction of ≥ 0.55 as demonstrated through material qualification testing.

Attachments/Enclosures:

None.

NRC Letter No.: LNP-RAI-LTR-030

NRC Letter Date: May 8, 2009

NRC Review of Final Safety Analysis Report

NRC RAI NUMBER: 02.05.04-22

Text of NRC RAI:

FSAR Section 2.5.4.5.4, "Properties of Backfill Beneath and Adjacent to Nuclear Island" states that you propose to use a "concrete-type" fill material adjacent to the sidewalls of the nuclear islands. Table 2.5.4.5-201 summarizes the anticipated engineering properties as having a 28-day compressive strength of 500 psi and a shear wave velocity of 1000 feet per second. No design criteria or standards were given for this low-strength "concrete-type" material. Since the fill material will be placed adjacent to the nuclear island, the appropriate standard is the Code Requirements for Nuclear Safety Related Concrete Structures (ACI 349). The proposed low strength concrete is currently not addressed by the ACI standard for use in construction of nuclear safety related structures. Additionally, there is a scarity of data to confirm the long term stability of the low strength concrete type backfill, and concern that the materials might degrade with time due to leaching of constituents.

Please provide justification for the use of the low strength concrete-type backfill, and address the issue of long term stability. Please include in your submittal the static and dynamic engineering properties. Please also include the standards that will be used for design and discuss your construction quality control plans for ensuring uniformity of the placement and meeting of applicable design standards.

PGN RAI ID #: L-0530

PGN Response to NRC RAI:

As described in the response to RAI 02.05.04-19, Westinghouse has performed non-linear analyses with sliding friction elements using a 2D ANSYS model, which concluded that "the Nuclear Island is stable against sliding, and there is no quality requirement for the backfill material adjacent to the NI (side soil) to remain stable against sliding" and "there is no passive pressure required to maintain stability against overturning."

Thus, the low-strength concrete-type backfill, installed adjacent to but not beneath the nuclear islands, requires no shear capacity and is therefore not subject to the same long-term stability concerns of other backfill applications.

Nonetheless, there are numerous advantages to the use of low-strength concrete type backfill, also widely known as Controlled Low-Strength Materials (CLSM). These advantages are described in Table RAI 02.05.04-22-1, as summarized below from ACI 229R-99.

TABLE RAI 02.05.04-22-1

Easy to place	Depending on type and location of void to be filled, CLSM can be placed by chute, conveyor, pump, or bucket. Because CLSM is self-leveling, it needs little or no spreading or compacting. This speeds construction and reduces labor requirements.
Versatile	CLSM mixtures can be adjusted to meet specific fill requirements. Mixes can be adjusted to improve flowability. More cement or fly ash can be added to increase strength. Admixtures can be added to adjust setting times and other performance characteristics. Adding foaming agents to CLSM produces lightweight, insulating fill.
Strong and durable	Load-carrying capacities of CLSM are typically higher than those of compacted soil or granular fill. CLSM is also less permeable, thus more resistant to erosion. For use as permanent structural fill, CLSM can be designed to achieve 28-day compressive strength as high as 8.3 MPa (1200 psi).
Will not settle	CLSM does not form voids during placement and will not settle or rut under loading. This advantage is especially significant if backfill is to be covered by pavement patch. Soil or granular fill, if not consolidated properly, may settle after a pavement patch is placed and forms cracks or dips in the road.
Allows all-weather construction	CLSM will typically displace any standing water left in a trench from rain or melting snow, reducing need for dewatering pumps. To place CLSM in cold weather, materials can be heated using same methods for heating ready-mixed concrete.

ADVANTAGES OF CLSM

The typical engineering properties of CLSM are described in Chapter 4 of ACI 229R-99, including flowability, segregation, subsidence, hardening time, pumping, unconfined compressive strength, density, settlement, thermal insulation/conductivity, permeability, shrinkage, excavatability, shear modulus, potential for corrosion, and compatibility with plastics. The CLSM mix design program will be performed prior to construction with the target parameter values described in ACI 229R-99.

Design Standards that can be applied to the CLSM for use as a volumetric backfill are the same that are applied to soil used in the same application. Concerning a standard mix design, CLSM contains the common concrete components to include a fine to coarse sand as an aggregate, typical Type I Portland Cement as an cementitious reaction binder, fly ash derived as a by-product of coal combustion as a pozzolan, and some volume of water.

Chapter 7 of ACI 229R-99 describes the quality control program, ASTM sampling procedures, and ASTM consistency/uniformity testing procedures to be used to ensure adequate placement of the CLSM, meeting applicable design standards.

References:

1) American Concrete Institute, Committee 229, Controlled Low-Strength Materials (CLSM), ACI-229R-99 Report, 1999.

Associated LNP COL Application Revisions:

The following change will be made to the LNP FSAR in a future revision:

The second note (b) on LNP FSAR Table 2.5.4.5-201 will be revised in a future amendment from:

> b) Values are typical for concrete backfill, conservatively based on engineering judgment.

to:

> b) Values are typical for concrete backfill, conservatively based on ACI-229R-99.

Attachments/Enclosures:

None.