UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	Docket Nos. 52-029-COL
Progress Energy Florida, Inc.	)	52-030-COL
	)	
(Combined License Application for	)	
Levy County Nuclear Plant, Units 1 and 2)	)	ASLBP No. 09-879-04-COL

PRE-FILED REBUTTAL TESTIMONY OF PAUL C. RIZZO, PH.D. ADDRESSING INTERVENORS' TESTIMONY ASSERTING INADEQUATE TREATMENT OF KARST FEATURES BY THE NRC STAFF IN THE FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE LEVY COUNTY NUCLEAR PLANT, UNITS 1 AND 2

I. BACKGROUND –WITNESS

Q1: Please state your name and business address.

A1: My name is Paul C. Rizzo. My business address is 500 Penn Center Blvd., Penn Center East, Suite 100, Pittsburgh, PA, 15235.

Q2: Please state your employer and position.

A2: I am employed by Paul C. Rizzo Associates, Inc., ("PCR")[1] a 300-person international consulting engineering firm that works heavily in the global nuclear industry sector. I founded PCR about 30 years ago and we specialize in the "-ologies" related to major project sites and site investigations, including geotechnical features and groundwater hydrology. PCR and its subsidiaries have 6 offices in the United States, 4 in South America, 2 in Europe, 2 in Africa, and one each in the Middle East and Australia. Our clients include U.S. and foreign nuclear utilities, U.S. government agencies, overseas

[1] A list of acronyms and their meanings is found in PEF701.

governments, U.S. water management districts and authorities, contractors, architect/engineers, mining companies and large industrial water users. I am the President and Chairman of the firm. I personally advise our clients on matters related to nuclear plant siting, geology/seismic matters and matters related to groundwater and surface water hydrology.

Q3: Please describe your professional qualifications and experience.

A3: My professional and educational experience is summarized in the curriculum vitae provided in PEF702. I hold a Bachelor of Science, Master of Science and Ph.D., all in civil engineering, from Carnegie Institute of Technology (now Carnegie Mellon University). I am a registered Professional Engineer in 36 states including Florida. I am a member of the American Society of Civil Engineers, Society of Mining Engineers, the United States Committee for Dams, the International Committee of Large Dams, the Australia-New Zealand Committee for Large Dams, the American Nuclear Society, and the Engineers Society of Western Pennsylvania.

I have worked directly on siting issues for nuclear power projects around the world and specifically including nuclear plants and proposed nuclear plants in Florida, such as Turkey Point, Crystal River Unit 3, the Levy Nuclear Plant, Units 1 and 2 ("LNP"), a Florida state-wide nuclear site selection study, and a proposed nuclear facility at Jacksonville. I recently worked on a water storage reservoir owned by the Tampa Bay Water Authority, a dam near Panama City, the Brunswick Steam Electric Plant in North Carolina, the U.S. Department of Energy ("DOE") Savannah River Plant in South Carolina, and the new Vogtle Nuclear Plant in Georgia—all of which are underlain by limestone. Geotechnical engineering considerations for these projects are directly relevant to the issues and conditions at the LNP, as this is a nuclear site underlain by

limestone within the state of Florida. We are currently working on the Panama Canal Expansion Project and on twenty other nuclear plants around the world. I am an Outside Expert to the Defense Nuclear Facilities Safety Board and regularly work for the Board on matters related to geology, hydrology, groundwater and seismic issues at DOE facilities. I have served as a consultant to the Nuclear Regulatory Commission ("NRC"), the Advisory Committee on Reactor Safeguards ("ACRS"), the Federal Energy Regulatory Commission and the International Atomic Energy Commission.

Q4: Please describe your experience with technical issues before the NRC.

A4: I have given multiple presentations on technical issues to the NRC regarding the LNP Site, including two formal public presentations to the NRC Staff and one formal public presentation to a subcommittee of the ACRS, and supported another presentation to an ACRS subcommittee given by Progress Energy Florida ("PEF") personnel. In addition, I have given multiple presentations to the NRC regarding other proposed nuclear sites. Technical topics have included nuclear island foundations, karst, groundwater modeling, subsurface conditions and investigations, and other geotechnical topics.

II. PRC EXPERIENCE WITH LNP SITE

Q5: What work have you done in connection with the LNP project?

A5: Our firm was contracted by PEF through their engineer for preparing the LNP Combined License Application ("COLA"), a Joint Venture of Sargent & Lundy, Worley-Parsons, and CH2M HILL, to assess the geologic and geotechnical conditions at the LNP Site and to develop a plan for designing and constructing the foundations while minimizing the impact on the environment, particularly the groundwater environment and the wetlands. This work involved a detailed review and assessment of earlier work performed by others, supplemental test borings and field tests, a grout take test program, preliminary

design of the primary foundation elements to support the nuclear reactors and the turbine buildings, radwaste buildings and the annex buildings, the preliminary design of the temporary construction dewatering program and the design of the rock grouting program. This included authoring relevant sections of the LNP Final Safety Evaluation Report ("FSAR"), primarily in FSAR Section 2.5.4 and associated subsections.

I am responsible for the design of the concrete mat, called a roller compacted concrete ("RCC") Bridging Mat, which will support the nuclear reactors; the design of the excavation for the LNP foundation; the design of the foundation improvement program; the temporary dewatering system, including the slurry wall, groundwater cut-off wall and construction dewatering wells; and the design of the foundations for the other major structures at the LNP Site.[2] This effort required a detailed and exhaustive study over a two-year period of the potential for karst development in the Avon Park Formation[3] that will support the LNP. This study addressed (1) the impact of the transmissivity and the storativity[4] of the Avon Park Formation on dewatering and the excavation, (2) the postulation that dissolution activity in the Avon Park Formation could activate or change over the lifetime of the LNP, (3) the impact of the LNP on the flow of groundwater around and beneath the foundation and (4) the assessment of the behavior of the LNP Site under postulated extreme seismic events. I personally serve as the principal investigator and Engineer-of-Record for all work at the LNP Site.

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[2] "LNP Site" refers to both the north property (where the LNP will be located) and the south property (where the production wells will be located) as outlined in yellow and blue on BRD001, p.2.

[3] The Avon Park Formation is described in the Final Environmental Impact Statement ("FEIS") (NRC001, p. 2-177) and the NRC Staff Testimony (at pp. 41 and 124) and will be discussed in more detail later in this testimony.

[4] Storativity (also called "storage coefficient") is defined as the volume of water that an aquifer releases from or takes into storage per unit area of the aquifer per unit change in its head. It is equal to the product of specific storage and aquifer thickness. (C.W. Fetter, Applied Hydrogeology, Fourth Edition Prentice-Hall, 2001).

III. PURPOSE OF REBUTTAL TESTIMONY

Q6: In addition to the work performed for PEF that you just described, what have you done to prepare this rebuttal testimony?

A6: I have reviewed our previous reports prepared as part of the licensing effort for the LNP Site including relevant sections of the FSAR (PEF703), as well as our reports previously introduced as exhibits by Dr. Mitchell Griffin, PEF013 and PEF015. In addition, I reviewed relevant sections of the FEIS (NRC001), the Pre-Filed Direct Testimonies of Dr. Mitchell L. Griffin (PEF001), Jeffrey D. Lehnen (PEF200), Gareth J. Davies (INT001R), Dr. Sydney Bacchus (INT301R), David Still (INT201R), and the NRC Staff.

Q7: What is the purpose of your testimony?

A7: The purpose of my testimony is to address the Initial Pre-Filed Testimony of Gareth Davies (INT001R), and certain portions of the Initial Pre-Filed Testimonies of Dr. Sydney Bacchus (INT301R) and David Still (INT201R), which allege inadequacies in the FEIS regarding the treatment of karstic features of the LNP Site. Intervenors challenge the modeling of the drawdown from active pumping during LNP operations because of "the assumption that the geologic medium through which groundwater flows is evenly porous." Intervenors' Initial Written Statement of Position Regarding Contention 4, p. 9. Intervenors argue that due to the karstic features of the LNP Site, the groundwater flow is instead through "preferential path-ways" and therefore "because of the nature of the flow paths, impacts from LNP on the flow of water could be more severe and occur further away than predicted, impacts could occur faster than expected, and freshwater springs could be cut-off. In addition, salinity levels could be affected." Intervenors' Initial Written Statement of Position Regarding Contention 4, pp. 9-10. My testimony will demonstrate that (a) Intervenors are incorrect in their characterization of the condition of the limestone underlying the LNP Site, (b) they are incorrect in their understanding of the

impacts on groundwater flow through the dolomitic Avon Park Formation limestone underlying the LNP Site, and (c) they consequentially overstate potential impacts of the projected withdrawal of water from the LNP production wells.

Q8: Please describe your specific education, training and experience that qualify you to address these issues.

A8: As stated earlier I have conducted a detailed and exhaustive analysis of the Avon Park Formation as part of my work to develop a foundation design that is compatible with the geologic conditions at the LNP Site. I have been doing this type of assessment for power plants and large industrial facilities and dams over my entire professional career of 48 years, including work at numerous sites (unlike the LNP Site) where limestone has been subjected to dissolution activity due to a karstic condition.

IV. GEOTECHNICAL AND GEOLOGIC CONDITIONS OF THE LNP SITE

Q9: Please describe the geotechnical and geologic conditions of the LNP Site.

A9: The geotechnical/geologic conditions at the LNP Site are described in FSAR Section 2.5 (PEF703) and are illustrated on PEF704. The existing ground surface is about El. 43.[5] The upper most overburden soils are Quaternary[6] Soils and the weathered Avon Park Formation, a Mid-Eocene[7] limestone, implying an age greater than 40 million years. The interface zone between these two different material types is about 67 feet deep and it is an erosion surface, meaning that at one time the surface was exposed to the atmosphere and was eroded by waters flowing, probably to the west.

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[5] "El." refers to elevation above mean sea level; EL. 43 is 43 feet above mean sea level.

[6] The Quaternary Period encompasses approximately the most recent 3 million years.

[7] The Mid-Eocene Period was approximately 40 to 49 million years ago.

It is important to note that the Avon Park Formation is a dolomitic limestone, meaning that it has a relatively high percentage of magnesium. The presence of the magnesium impedes dissolution activity of the carbonate constituents that comprise limestone; thus dolomitic limestone, unlike pure limestone, is not subject to dissolution activity to the degree that would result in significant karst features. There is evidence of limited minor karst activity on the LNP Site and this has been taken into account in the design for foundations and other features on the LNP Site.

The LNP Site is underlain by the Avon Park Formation, and not the Ocala Formation, found elsewhere throughout Florida. The Ocala limestone is absent at the LNP Site. It is the Ocala limestone, not the Avon Park limestone, which has developed karstic conditions in Florida. The Ocala limestone, not the Avon Park limestone, can be likened in a limited fashion to the karstic features such as the Big Dismal sink and the Wakulla Spring cited by Mr. Davies. INT001R, pp. 3, 18. Mr. Davies would appear to be confusing the Avon Park limestone with the Ocala limestone.

In the FSAR Section 2.5 (PEF703) PEF reported the result of our detailed and comprehensive investigation of vertical fractures that were thought to cross the LNP Site as suggested by aerial lineament studies. We studied the vertical fracture patterns, fracture widths and spacing, and verticality of the fractures and the material on the fracture surfaces looking for evidence of significant flaws that would result in (a) conduit flow, or (b) the development of major dissolution features or karst feature, or (c) would impact on foundation design or temporary dewatering required for excavation. We found that that the vertical fractures are widely spaced on a definable pattern and that they are filled with weathered limestone. We did not find evidence of conduit flow or preferential flow paths that would challenge the validity of groundwater analyses performed with conventional porous media codes or methodologies.

V. RESPONSES TO CERTAIN ASSERTIONS IN DIRECT TESTIMONY OF JOINT INTERVENORS

Q10: Mr. Davies admits that the FEIS recognizes and describes the presence of karst in the area of the LNP Site, but claims that there is "no clear distinction between a well-developed karst setting and any other." INT001R, p. 10. He compares Mammoth Cave at greater than 700 km as "obviously a very well-developed karst, and the Florida karst." INT001R, p. 10. Do you agree with Mr. Davies that the well-developed karst identified by you in the FSAR and the NRC Staff in the FEIS could have significant conduit flow?

A10: The FEIS recognizes and describes the presence of karst features in the area of the LNP Site. However, there is a clear and obvious distinction between the dissolution activity at the LNP Site and that of world famous limestone caves, and even between the conditions at the LNP Site and other parts of Florida where sinkholes occasionally garner news headlines. The LNP Site is underlain by the Avon Park Formation, not the Ocala Formation as locations elsewhere in Florida where dissolution activity resulting in significant karst features are known. The Avon Park is an older dolomitic limestone, whereas the Ocala has relatively higher carbonate content. The dolomite, which implies a higher percentage of magnesium, is very much less prone to dissolution activity than pure limestone. This is a primary reason why the Avon Park is not to be compared with sites where karst development is more advanced. It is well known that dolomites and dolomitic limestone do not behave the same as pure or near pure limestone as regards dissolution activity and degradation to significant karst conditions.

Groundwater flow in the Avon Park Formation can be modeled as a flow through porous media enhanced by vertical fractures and flow along some bedding planes within the Avon Park. The fractures are too narrow in width, as evidenced by the core samples

extracted from the Avon Park Formation at the LNP Site, and from the Grout Test Program conducted at the site, to be considered as continuous conduits or preferential flow paths. Furthermore, the vertical fractures having a spacing on the order of 19 feet are too far apart to dictate a need to deviate from the industry practice of considering the groundwater flow as flow through porous media. Pumping tests and related analyses provide adequate transmissivity and storativity parameters suitable for analysis codes that are based on the principles of flow through porous media.

Q11: Mr. Davies claims that the FSAR contradicts the FEIS in the description of the LNP Site surface morphology. INT001R, pp. 9 – 11. Do you agree?

A11: No, I do not agree. The FSAR does not contradict the FEIS. The FEIS and the FSAR both reflect the actual conditions at the LNP Site in a consistent manner, with the former directed at environmental issues and the latter directed at plant safety issues. The FSAR recognizes the limited karstic features, particularly at the top of the Avon Park Formation, which is an erosion surface that has been covered by Quaternary sediments as mentioned above in my testimony. Consistent with erosion surfaces around the world, it is somewhat undulatory and the thickness of the Quaternary sediments is somewhat variable – an issue that is addressed in the foundation design and temporary construction dewatering design. The FEIS also includes a discussion of karst, focusing on the impact of potential groundwater flow and wetlands. There is no contradiction between the two.

Q12: Mr. Davies argues that it was inappropriate to use the "porous medium model' to predict groundwater flow and drawdown. INT001R, p. 2, 9, 11 – 13. Do you have an opinion on this criticism?

A12: Yes, it is my professional opinion that the use of a porous media model is appropriate for the LNP Site, as there is no evidence of continuous conduit flow or significant flow along

preferential pathways and the transmissivity is reasonable for porous media applications. It is not appropriate to consider the groundwater flow in the Avon Park Formation as preferential flow through pathways or conduits in fractured rock. Rather, a model based on flow through porous media is most appropriate for analyzing the conditions at the LNP Site.

Q13: Mr. Davies outlines his opinion of how karst aquifers should be properly investigated and criticizes the number of geotechnical borings (118) to characterize subsurface conditions at the LNP Site. INT001R, p. 14. Mr. Davies cites approvingly to a paper (not an exhibit) that suggested "1,000 3-cm drill holes per acre (404 per hectare) [would] have a 90% probability of intersecting a 1-meter solid elliptical object." INT001R, p. 14. He compares this number with 118 borings on the 3,105 acres on the northern parcel of the LNP Site. INT001R, pp. 13 – 15. Mr. Still asserts the FEIS is "deficient because it fails to map the conduit system." INT201R, p. 6. How do you respond to Mr. Davies' suggestion of how to investigate the subsurface conditions and Mr. Still's criticism of the FEIS for its failure to map the conduits at the LNP Site?

A13: The test borings drilled at the LNP Site were designed to characterize the subsurface conditions for the design and construction of the LNP, including an assessment of the impact of the LNP on the groundwater regime during construction and during operation. Mr. Davies appears to be implying that 1,000 boreholes per acre is a more appropriate number. Depending on the sample size that he might have in mind, this would translate to over tens of thousands or hundreds of thousands of boreholes, which is completely impractical and unrealistic. The number, spacing, diameter, type, and depth of boreholes drilled are consistent with, and indeed exceed, the requirements of NRC Regulatory Guides and the general practice of the industry. In addition to the test borings, considerable effort was expended in a geologic mapping, investigation and documentation of fracture patterns in the Avon Park Formation outside the LNP Site,

including quarry faces, stream banks, surface manifestations, aerial lineaments and road cuts. In no case, did the borings or fracture investigation provide evidence of conduit flow or preferential flow pathways. Indeed vertical fractures were investigated and mapped, but none of these fractures had degraded to the point that conduit flow or preferred pathways had developed. The vertical fractures were generally found to be filled with weathered rock or residual soil. Mr. Davies' implication that additional boreholes would supply more information about the LNP Site is not accurate. The boring program was more than sufficient to accurately characterize the subsurface properties. The geographic scope of the geotechnical / geologic field investigation and desk research summarized in the FSAR encompasses the entirety of the LNP Site. The investigation methodology is more than sufficient to adequately characterize the subsurface conditions, and is much more practical than the investigation scope that Mr. Davies is suggesting.

In addition to the test borings, a Grout Test Program was undertaken at the LNP Site. The intent of this program was to determine the requirements of the Dewatering Grouting Program to be performed as part of the dewatering at the LNP Site. Several important conclusions may be drawn from the data collected during this work regarding the fracture patterns and void spaces of the Avon Park Formation. This information is based on grout takes, measurements taken before, during, and after grouting, and verification drilling, and field observations.

First, no indications of cavernous limestone or extensively open geologic features were encountered in the Grout Test Program. This is consistent with the FSAR and FEIS characterization of the LNP Site.

Second, ungrouted vertical fractures encountered in the verification borings of the Grout Test Program indicate that the horizontal beds and fractures are not continuously open. This prevented grout from traveling significant distances to fill vertical fractures not

intercepted directly by a grout hole. This is further proof that the continuous flow paths (conduits) postulated by the Interveners are not present at the LNP Site.

Q14: Would you expect the groundwater withdrawals and pumping rates associated with the construction and operation of the LNP to contribute to additional karst development of the LNP Site and the surrounding area?

A14: No. Let us first distinguish between (1) groundwater withdrawals and pumping rates associated with construction dewatering and (2) withdrawals and pumping rates associated with LNP operations.

For construction dewatering, refer to PEF705. This Exhibit is a cross-section through one of the LNP units. The reactor building, shown in the cross-section, is founded on a basemat about 40 feet below plant grade, which is set at El. 51 or about 67 feet below the existing grade. Note that the LNP Site grade will be raised about 8 feet to El. 51. The reactor building's 8-foot-thick basemat rests on a 35-foot-thick concrete mat—about 3-1/2 stories of concrete, which, in turn, bears on the Avon Park Formation. We call the 35 feet of concrete here an RCC Bridging Mat. RCC stands for roller-compacted concrete because of the way it is densified at placement. The Avon Park Formation beneath the 35-foot-thick concrete mat will be grouted to a depth of 75 feet. In order to excavate to a total depth of ~75 feet below Plant Grade (67 feet below existing grade), we will install a vertical cut-off wall around the perimeter (a) to prevent the horizontal flow of groundwater to the excavation and (b) to support the vertical sides of the excavation. Upward vertical flow into the excavation will be prevented by the 75-foot-thick grouted zone in the Avon Park. In this manner we will build a "bathtub" such that water will not be able to enter into the "bathtub" from either the sides or the bottom. Prior to commencing excavation, we simply pump the water out of the "bathtub" on a one time

basis. Construction dewatering is therefore temporary and confined to the limits of the slurry wall cut-offs. During construction over about 24 months, we will pump out any water from rainfall, runoff and minor leakage through the cut-off wall, if any occurs. Therefore, construction dewatering is a not a consideration as regards the impact on the groundwater regime or the nearby wetlands as the pumping rate is low and the duration is short—perhaps lasting less than a month when we drain the "bathtub." [8] By inhibiting groundwater flow in the immediate vicinity of the nuclear island, construction dewatering will reduce the potential for dissolution activity.

Groundwater withdrawal during operation of the plant (from the production wells) will not cause additional karst development. As regards groundwater withdrawals and pumping during operation, the design of the LNP includes the installation of permanent wells that will be pumped to provide service water for the Plant Operation—not cooling water, but a relatively small quantity necessary for certain operations in the Plant including sanitary water, makeup for component cooling water systems and the like. These permanent wells are designed and operated like typical industrial user wells. The relatively low withdrawals from these wells will not cause additional dissolution activity.

Q15: Dr. Bacchus refers to karsts creating "preferential flow paths connecting wetlands in the vicinity of the LNP," which she alleges "have not been considered and accurately identified." INT301R, p. 24. Dr. Bacchus asserts, "[a]s a result, the FEIS does not properly address passive and active dewatering and aquifer flow issues that affect natural hydroperiods," which could lead to the "premature decline and death" of cypress depressional wetlands. INT301R, pp. 24, 26. Is this a concern that has not been adequately addressed in the FEIS?

[8] The design of the excavation dewatering system is described in PEF015, prepared by PCR

A15: No. Dr. Bacchus's concern might be applicable in a situation where the karst development might be more advanced in a pure limestone, but not at the LNP Site where the limestone is dolomitic. At the LNP Site, preferred flow paths, called conduits by some in the profession, were not found in spite of a diligent and comprehensive investigation of vertical fractures and overall fracture patterns at the LNP Site and off-site in quarries, stream banks and road cuts.

As the Floridan aquifer is a prolific aquifer, the impact of dewatering is SMALL to MODERATE (as defined in the FEIS) and certainly will not significantly impact the wetlands or the hydroperiods at the LNP Site. Our analysis has shown that there is negligible impact to the groundwater flow regime in the Avon Park Formation due to the grouted foundation of the LNP Reactors. During both construction and the long-term operation of the LNP Reactors, the groundwater has been modeled to be within the range of the groundwater's natural seasonal fluctuation. The potential for increased solution activity or sediment entrainment from voids due to changes in the subsurface flow velocity is judged to be negligible. Nearby wetlands will therefore not be impacted by these drawdowns.

Furthermore, as described in the FEIS, if adverse environmental impacts are predicted through environmental monitoring of wetlands, PEF would either take measures to mitigate the adverse impacts or implement an approved alternative water-supply project. PEF has performed an analysis of alternative sources of water that demonstrates that alternative sources of water are technically feasible if this is necessary.

This concern is therefore adequately addressed in the FEIS.

Q16: Mr. Davies described quarrying operations in Great Britain and suggests the LNP foundation design "can have significant effects on the flow system." INT001R, p. 20. Mr. Still asserts the "construction of the very large 100 feet deep pits for the nuclear islands could intercept

preferential flow paths" and "could cause a large change in the amount of water available in other parts of the system." INT201R, p. 6. Will the foundation design for the LNP reactors adversely affect groundwater flow?

A16: No. The foundation design for the LNP Reactors will not adversely affect the groundwater flow. But first, I need to clarify that the excavations are about 67 feet deep below existing grade as shown on PEF704, not 100 feet deep as suggested by Mr. Still. As discussed earlier, there is no evidence for the existence of flow paths or conduits for groundwater flow. Groundwater will simply flow under and around the structures just as it would for any industrial structure with foundations below grade. Groundwater flow in the vicinity was modeled both before and after the construction of the LNP foundation using a three-dimensional finite element model. Results indicate that the change in the groundwater flow regime of the Avon Park Formation due to grouting is insignificant. In addition, an analysis considering the normal forces on a soil particle (i.e., drag force and self-weight of the particle) indicate that the increase in groundwater flow due to LNP construction is not large enough to move the particles out of any infilled zones, and therefore additional erosion activity is negligible.

Q17: Mr. Davies warns that blasting in a quarry can "significantly increase [] the hydraulic conductivity in the quarry floor." INT001R, p. 20. Will there be any quarry on the LNP Site? Will the excavation for the LNP reactors require blasting?

A17: No. I am responsible for the design of the excavations for the LNP. We will not be performing any blasting or developing any quarries at the LNP Site.

Q18: Dr. Bacchus expresses the opinion that the FEIS does not adequately analyze the potential effects of sinkholes caused by dewatering and refers to page 2.5-72 of the FSAR (INT388) in support of her concern. INT301R, pp. 32 – 33. Do you agree with Dr. Bacchus's assessment that sinkholes at the LNP Site will occur and should have been addressed in the FEIS?

A18: No, I do not agree with Dr. Bacchus. The LNP Site has been comprehensively investigated in detail and no evidence of past or present sinkholes has been found. The assertion that sinkholes will be induced by future groundwater withdrawals at LNP is without merit. Construction dewatering will dewater only the areas of the nuclear islands, as they will have been isolated from the surrounding areas by the diaphragm wall (on the sides) and grouted Avon Park Formation (on the bottom). Operation of the permanent production wells, which are similar to industrial use water wells, will be sporadic and will withdraw a relatively small quantity of water. In addition, the production wells are located at least 3,700 feet away from the LNP units. Finally, the nuclear island is supported on the RCC Bridging Mat, as discussed earlier, and the surrounding buildings are supported on drilled shafts socketed into rock. The stresses imparted to the overburden soils from the main structures are therefore negligible, further reducing the possibility of sinkhole formation. Even if one were to postulate that a sinkhole would develop in the ungrouted Avon Park Formation beneath the LNP reactors -- 150 feet below final plant grade -- the 35-foot-thick concrete mat that will span over the sinkhole would prevent any impact on the LNP or the local hydro-geologic regime.

Q19: Do you share Dr. Bacchus's concern that the LNP stormwater retention ponds could cause sinkhole collapse? INT301R, p. 32; INT381.

A19: No, I do not share Dr. Bacchus's concern that the stormwater retention ponds could cause sinkhole collapse. The ponds will have a surface water level consistent with the LNP Site-wide groundwater level and the connection to the Avon Park Formation will not be impacted. Dr. Bacchus also makes reference to the increased weight of the water in the retention ponds. In fact, the water in the ponds will weigh less than the overburden soil that presently exists in the ponds and the effective vertical stress in the geologic materials directly beneath the ponds will be diminished compared to the stress that now exists.

VI. COMMENTS ON THE NRC STAFF'S FEIS AND DIRECT TESTIMONY

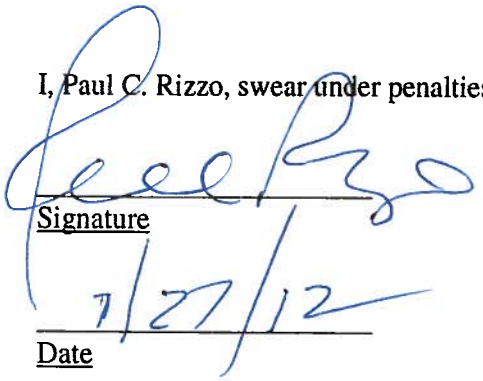
Q20: In your professional opinion, has the NRC Staff in the FEIS and in their testimony in this proceeding accurately described the geotechnical and geologic conditions of the LNP Site, including karst and the underlying aquifers?

A20: Yes, the NRC Staff has accurately described the geotechnical, geological and hydro-geological conditions at the LNP Site.

Q21: In your professional opinion, has the NRC Staff in the FEIS or in their testimony in this proceeding failed to take into account the potential impacts on groundwater flow of the geotechnical or geologic conditions of the LNP Site?

A21: No, the NRC Staff has properly taken into account in the FEIS the impacts on groundwater flow around and under the LNP Site and has addressed all of the pertinent issues related to geotechnical engineering and geology.

I, Paul C. Rizzo, swear under penalties of perjury that this document is my true and accurate testimony.



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Date