

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

E. Roy Hawkens, Chairman
Dr. Michael F. Kennedy
Dr. William C. Burnett

In the Matter of
FLORIDA POWER & LIGHT COMPANY
(Turkey Point Units 6 and 7)

Docket Nos. 52-040-COL
and 52-041-COL

ASLBP No. 10-903-02-COL-BD01

July 11, 2017

NOTICE

(Transmission Of Proposed Questions To Office Of The Secretary)

On July 10, 2017, this Licensing Board issued an Initial Decision, LBP-17-05, rejecting Joint Intervenors' environmental challenge (Contention 2.1) to Florida Light & Power Company's application for a combined license for Turkey Point Units 6 and 7. Prior to that, the parties and interested government entities had submitted proposed questions for this Board to consider propounding during the May 2-3, 2017 evidentiary hearing. See 10 C.F.R. § 2.1207(a)(3)(i) and (ii). Those questions are appended to this Notice as Attachment A. In accord with 10 C.F.R. § 2.1207(a)(3)(iii), Attachment A is hereby provided to the Commission's Secretary for inclusion in the official record of this proceeding.¹

It is so ORDERED.

FOR THE ATOMIC SAFETY
AND LICENSING BOARD

/RA/

E. Roy Hawkens, Chairman
ADMINISTRATIVE JUDGE

Rockville, Maryland
July 11, 2017

¹ Joint Intervenors attached to their proposed questions a June 2003 document issued by the United States Environmental Protection Agency (EPA) concerning water treatment technology. That document is not included in Attachment A because (1) it is not a proposed question; (2) it was not submitted to the Board as a pre-filed exhibit; and (3) it is not otherwise part of the record in this case. That document is digitally available, however, through the EPA's website at <https://www.epa.gov/sites/production/files/2014-12/documents/815r03004.pdf>.

ATTACHMENT A

April 9, 2017

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
)
FLORIDA POWER & LIGHT CO.) Docket Nos. 52-040 & 52-041
)
(Turkey Point Units 6 and 7))

NRC STAFF PROPOSED QUESTIONS FOR
EVIDENTIARY HEARING REGARDING CONTENTION 2.1
(Impacts of Deep Well Injection of Four Constituents in Cooling Tower Blowdown)

INTRODUCTION

In accordance with 10 C.F.R. § 2.1207(a)(3) and the Atomic Safety and Licensing Board (Board) Orders dated October 5, 2016, and November 22, 2016, in this proceeding,¹ the U.S. Nuclear Regulatory Commission staff (NRC Staff) hereby submits, in camera, its proposed questions for the Board's consideration for use at the evidentiary hearings on Contention 2.1 (Impacts of Deep Well Injection of Four Constituents in Cooling Tower Blowdown). The Staff-proposed Board questions for Contention 2.1 are directed to the "Prefiled Initial Testimony of Mark A. Quarles Regarding Joint Intervenors' Contention 2.1" dated March 1, 2017 (Quarles Direct Testimony) (ADAMS Accession No. ML17060A815), and the "Pre-Filed Rebuttal Testimony of Mark A. Quarles Regarding Joint Intervenors' Contention 2.1" dated March 23, 2017 (Quarles Rebuttal Testimony) (ADAMS Accession No. ML17082A721), both of which were

¹ Memorandum and Order (Prehearing Conference Call Summary, Case Management Directives, and Scheduling Order) (October 5, 2016) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16279A219); Order (Amending Final Scheduling Order) (November 22, 2016) (ADAMS Accession No. ML16327A189).

**Confidential Filing, Pending Release by the Atomic Safety and
Licensing Board in Accordance with 10 C.F.R. § 2.1207(a)(3)(iii)**

filed by Mark Oncavage, Dan Kipnis, the Southern Alliance for Clean Energy, and the National Parks Conservation Association (collectively, Joint Intervenors).

As set forth below, the Staff suggests questions for the Board to ask Mr. Quarles. For each line of questioning the Staff suggests, the Staff briefly describes the issue that needs further examination, the objective of the examination, and proposed questions that may logically lead to achieving each stated objective.

PROPOSED QUESTIONS

I. The EPA Maximum Contaminant Level Goals are Met for Toluene and Ethylbenzene.

Brief Description of the Issue:

In his testimony, Mr. Quarles claims that the impacts of heptachlor, ethylbenzene, toluene, and tetrachloroethylene, the four constituents identified in Contention 2.1 and at issue in this proceeding (the Constituents), should have been measured by comparison to the Environmental Protection Agency (EPA) Maximum Contaminant Level Goals. Quarles Direct Testimony, A21. The Joint Intervenors do not dispute that the concentrations reported in FEIS (NRC-008A) are conservative and reliable. Joint List of Undisputed Facts, ¶ 41. Since the concentrations of toluene and ethylbenzene in the cooling-tower blowdown stated in FEIS (NRC-008A) Table 3-5 are below the EPA Maximum Contaminant Level Goals for those two chemicals, according to Mr. Quarles's testimony, injection of toluene and ethylbenzene does not pose any hazard to human health.

Objective of the Examination:

To clarify that the Staff analysis in the FEIS (NRC-008A-D) satisfies the Joint Intervenors' criteria for the acceptability of injecting toluene and ethylbenzene in cooling-tower blowdown into the Boulder Zone or even an Underground Source of Drinking Water, and Contention 2.1 no longer raises any issue in regard to either toluene or ethylbenzene.

**Confidential Filing, Pending Release by the Atomic Safety and
Licensing Board in Accordance with 10 C.F.R. § 2.1207(a)(3)(iii)**

Proposed Line of Questioning:

Q1: Mr. Quarles, you testified that the EPA Maximum Contaminant Level Goal is the level of a chemical “in drinking water at which no known or anticipated adverse effect on the health of persons would occur, and which allows an adequate margin of safety[.]” correct?

Q2: Since the EPA Maximum Contaminant Level Goal for toluene set in 40 C.F.R. § 141.50(b) is 1 milligram per liter (mg/l), the concentration set forth in FEIS (NRC-008A) Table 3-5 for toluene in the water FPL proposes to inject into the Boulder Zone is 0.00174 mg/l, and the Joint Intervenors have agreed that the concentrations in Table 3-5 are conservative and reliable, then isn't the toluene concentration of 0.00174 mg/l in the cooling-tower blowdown to be injected below the EPA Maximum Contaminant Level Goal for toluene?

Q3: Since the concentration set forth in FEIS (NRC-008A) Table 3-5 for ethylbenzene in the water FPL proposes to inject into the Boulder Zone is below the method detection limit, isn't that concentration below the EPA Maximum Contaminant Level Goal for ethylbenzene of 0.7 mg/l set in 40 C.F.R. § 141.50(b)?

Q4: According to your testimony then, the concentrations of toluene and ethylbenzene in the cooling-tower blowdown FPL proposes to inject meet the EPA Maximum Contaminant Level Goals for those two chemicals, and they will not pose any hazard to human health, correct?

II. The EPA Maximum Contaminant Level Goals for Heptachlor and Tetrachloroethylene Cannot be Met Using Current Detection Technology.

Brief Description of the Issue:

In his testimony, Mr. Quarles claims that the impacts of tetrachloroethylene and heptachlor should have been measured by comparison to the Environmental Protection Agency (EPA) Maximum Contaminant Level Goals. Quarles Direct Testimony, A21. Current detection technology, however, cannot measure zero concentrations of tetrachloroethylene and heptachlor in water. Accordingly, the Joint Intervenors are asking the Staff to verify a

**Confidential Filing, Pending Release by the Atomic Safety and
Licensing Board in Accordance with 10 C.F.R. § 2.1207(a)(3)(iii)**

concentration that cannot currently be verified, *i.e.*, measure concentrations of zero, which is not required under by NEPA under the “rule of reason.” *See, e.g., Long Island Lighting Co.* (Shoreham Nuclear Power Station, Unit 1), ALAB-156, 6 AEC 831, 836 (1973); *Louisiana Energy Servs. (National Enrichment Facility)*, CLI-05-20, 62 NRC 523, 536 (2005).

Objective of the Examination:

To clarify that the Joint Intervenors’ criteria for the acceptability of injecting heptachlor and tetrachloroethylene in cooling-tower blowdown into the Boulder Zone, the Maximum Contaminant Level Goal of zero, cannot be met with current technology and is unreasonable.

Proposed Line of Questioning:

Q5: Given that the EPA Maximum Contaminant Level Goals for heptachlor and tetrachloroethylene set in 40 C.F.R. § 141.50(a) are zero, and the method detection limits for heptachlor and tetrachloroethylene using current technology are above zero, current technology cannot provide verification that the Maximum Contaminant Level Goals are satisfied, correct?

Q6: In your testimony, you did not identify any method for determining that the concentration of either heptachlor or tetrachloroethylene in water is zero, did you?

III. High-level Disinfection Can Remove the Constituents from Reclaimed Wastewater, Even if not Designed to do so.

Brief Description of the Issue:

In his testimony, Mr. Quarles claims that “the high-level disinfection process installed at the South District Plant in 2013 is designed to remove pathogens[, not other contaminants], and EPA does not vouch for it for any purpose other than removal of pathogens.” Quarles Rebuttal Testimony, A16. Mr. Quarles, however, does not acknowledge that the process may remove the Constituents, even though the process is not designed to do so. Accordingly, the Joint Intervenors disregard the actual impact of high-level disinfection, including associated filtering, on the concentrations of the Constituents.

**Confidential Filing, Pending Release by the Atomic Safety and
Licensing Board in Accordance with 10 C.F.R. § 2.1207(a)(3)(iii)**

Objective of the Examination:

To show that high-level disinfection will reduce the concentrations of the Constituents even if not designed to do so.

Proposed Line of Questioning:

Q7: You make the point in your rebuttal testimony that the high-level disinfection process implemented at the South District Plant in 2013 is not designed to remove contaminants other than pathogens, correct?

Q8: Do you agree that filtration and volatilization can remove ethylbenzene, toluene, and tetrachloroethylene, the volatile Constituents, from reclaimed wastewater?

Q9: Given that high-level disinfection includes filtration and rapid and uniform mixing under the State of Florida requirements stated in 40 C.F.R. §146.15, the Constituents in the reclaimed wastewater treated with high-level disinfection will be filtered and subject to volatilization, even if the process is directed to some other purpose, correct?

IV. EPA 2005 Rule Rationale Regarding Contaminants Other Than Microbial Pathogens

Brief Description of the Issue:

Mr. Quarles quotes the EPA final Notice of Rulemaking regarding contaminants other than microbial pathogens, including the Constituents. Quarles Rebuttal Testimony, A16-A17. However, Mr. Quarles does not acknowledge EPA's finding that Underground Sources of Drinking Water (USDWs) will not be endangered as a result of injection of contaminants other than pathogens, including the Constituents, since they meet EPA standards, with or without high level disinfection. Further, the Joint Intervenors ignore the 2005 EPA rulemaking insofar as it documents that EPA determined there was no need to require further action in regard to the four Constituents, among others, in order to find that Underground Sources of Drinking Water (USDWs) will not be endangered under the 2005 EPA rule's approach to microbial pathogens.

**Confidential Filing, Pending Release by the Atomic Safety and
Licensing Board in Accordance with 10 C.F.R. § 2.1207(a)(3)(iii)**

Objective of the Examination:

To clarify that the EPA found in the 2005 final rule notice (NRC-021 at 70,525-26) that there was no basis to establish additional requirements to govern the injection of contaminants other than pathogens in wastewater, including the four Constituents.

Proposed Line of Questioning:

Q10: In your rebuttal testimony, you did acknowledge that EPA considered contaminants other than microbial pathogens in the 2005 EPA final rule notice and set forth a rationale for not requiring the removal of such contaminants, correct?

Q11: It's also true, isn't it, that the EPA considered the Relative Risk Assessment (NRC-010), including its evaluation of tetrachloroethylene, in the 2005 EPA final rule, and EPA stated that "the Relative Risk Assessment found that the only contaminants that posed a potential threat were pathogenic microorganisms"?²

Q12: Given that EPA did not address contaminants other than pathogens in the 2005 Rule for the following reasons:

(1) The Relative Risk Assessment found that the only contaminants that posed a potential threat were pathogenic microorganisms; (2) Class I municipal disposal wells are precluded from injecting listed or characteristically hazardous waste streams; (3) Class I municipal disposal wells are allowed to inject only wastewater that has received a level of treatment, specified in individual permits, deemed necessary by the Director^[3] to prevent endangerment; and (4) many other contaminants are addressed through EPA's existing pretreatment regulations . . . If the Director finds that any other contaminants pose a threat to USDWs, that threat can be addressed on a site-specific basis under existing authorities[.]

isn't it true that EPA declined to impose additional requirements on contaminants other than microbial pathogens, including the four Constituents, and all the reasons EPA stated in the 2005

² NRC-021 at 70,525-26.

³ The "Director" means the Secretary of the Florida Department of Environmental Protection. NRC-021 at 70,516.

**Confidential Filing, Pending Release by the Atomic Safety and
Licensing Board in Accordance with 10 C.F.R. § 2.1207(a)(3)(iii)**

Rule for declining to impose additional requirements stated above apply to the four
Constituents?

Respectfully submitted,

/Signed (electronically) by/

Robert Weisman
Counsel for NRC Staff
U.S. Nuclear Regulatory Commission
Mail Stop O-14A44
Washington, DC 20555-0001
(301) 287-9177
Robert.Weisman@nrc.gov

Executed in accord with 10 C.F.R. § 2.304(d)

Anthony C. Wilson
Counsel for NRC Staff
U.S. Nuclear Regulatory Commission
Mail Stop O-114A44
Washington, DC 20555-0001
(301) 287-9124
Anthony.Wilson@nrc.gov

Dated at Rockville, Maryland
this 9th day of April, 2017

April 9, 2017

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
)
FLORIDA POWER & LIGHT COMPANY) Docket Nos. 52-040 & 52-041
)
(Turkey Point Units 6 and 7))

CERTIFICATE OF SERVICE

I hereby certify that the “NRC STAFF PROPOSED QUESTIONS FOR EVIDENTIARY HEARING REGARDING CONTENTION 2.1 (Impacts of Deep Well Injection of Four Constituents in Cooling Tower Blowdown)” has been filed through the E-Filing system this 9th day of April, 2017.

/Signed (electronically) by/

Robert M. Weisman
Counsel for the NRC Staff
U.S. Nuclear Regulatory
Commission Mail Stop O-16 F3
Washington, DC 20555-0001
(301) 287-9177
Robert.Weisman@nrc.gov

**UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION**

Before the Atomic Safety and Licensing Board

In the Matter of)		
)		
Florida Power & Light Company	)	Docket Nos.	52-040-COL
	)		52-041-COL
)		
Turkey Point Units 6 and 7	)	ASLBP No.	10-903-02-COL
(Combined License Application))		

**FLORIDA POWER & LIGHT CO.’S PROPOSED
QUESTIONS FOR THE BOARD TO PROPOUND**

Florida Power & Light Company hereby submits to the Atomic Safety and Licensing Board (the “Board”), in accordance with 10 C.F.R. § 2.1207(a)(3)(i) and (ii), the Board’s Initial Scheduling Order dated March 30, 2011,¹ and the Board’s Prehearing Conference Call Summary, Case Management Directives, and Scheduling Order dated October 5, 2016,² as revised by the Board’s November 15, 2016 Final Scheduling Order,³ the following proposed questions for use at the evidentiary hearing to be held by the Board in the above-captioned proceeding.

I. Proposed Questions for Mark Quarles

A. Questions regarding Mr. Quarles’ relevant qualifications and experience, showing that his testimony exceeds his qualifications

1. Are you a registered professional geologist in the State of Florida?
2. Do you have any prior experience conducting seismic-reflection analysis in the field? If so, what is that experience?
3. You state that you are an expert “in the field of planned and accidental releases of environmental pollutants into the environment” and “hydrogeology and groundwater contamination.” Quarles

¹ *Florida Power & Light Co.* (Turkey Point Units 6 and 7), Order (Initial Scheduling Order and Administrative Directives) (Mar. 30, 2011) (unpublished) (ML110890768).

² *Florida Power & Light Co.* (Turkey Point Units 6 and 7), Memorandum and Order (Prehearing Conference Call Summary, Case Management Directives, and Scheduling Order) (Oct. 5, 2016) (unpublished) (ML16279A219).

³ *Florida Power & Light Co.* (Turkey Point Units 6 and 7), Order (Final Scheduling Order) (Nov. 15, 2016) (unpublished) (ML16320A248).

Prefiled Initial Testimony at A2. Are you also an expert in the field of toxicology? If so, on what do you contend that expertise is based?

4. Do you have a degree in the field of toxicology? Do you hold any independent certifications in the field of toxicology? Do you hold any independent certifications in the field of human health risk assessment? (If yes to any of these, why were those degrees or certifications not listed in your CV in this case?)
5. What papers have you published in the scientific literature that relate to the discipline of toxicology? What papers have you published in the scientific literature that relate to the discipline of potential exposure to chemicals with adverse effects on human health? (If any, why were they not listed in your CV in this case?)

B. Questions regarding Mr. Quarles' failure to challenge data demonstrating that there will be adequate confinement, showing that he has not addressed the full NRC Staff analysis of confinement

6. In your Prefiled Initial Testimony, you note that the NRC Staff based their analysis of upward migration in the Final Environmental Impact Statement ("FEIS") on the following:

To evaluate the impacts of deep well injection at the Turkey Point site, the review team 1) reviewed studies that characterized the confining ability of the [Middle Confining Unit] and the causes and extent of upwelling at other deep well injection sites, 2) compared hydrogeological conditions and parameters at the sites at which upwelling occurred to conditions and parameters at the proposed site, 3) evaluated numerical modeling of flow of injected wastewater presented by the applicant and performed confirmatory calculations, and 4) considered the injection well testing and groundwater monitoring requirements of the [Florida Department of Environmental Protection Underground Injection Control ("FDEP UIC")] program.

Quarles Prefiled Initial Testimony at A6 (quoting NRC-008A (FEIS) at 5-21).

- a. Regarding point (1) above, have you reviewed all of the studies relied on by the NRC Staff in characterizing the confining unit? In this proceeding, have you responded to all of the information in those studies that support a finding that there is an adequate confining unit? If yes, where? If not, why not?
- b. Regarding point (2) above, have you compared the hydrogeological conditions and parameters at the sites where upwelling has previously occurred with the conditions and parameters at the Turkey Point site? Is it your testimony that the conditions and parameters at sites where upwelling has previously occurred are identical to those at Turkey Point? If so, what is the basis of that testimony? If not, have you addressed in this proceeding the differences between the sites where upwelling has occurred and the Turkey Point site? If yes, where? If not, why not?

- c. Regarding point (3) above, have you evaluated the numerical groundwater migration modeling performed by the Applicant and the confirmatory modeling performed by the NRC Staff? *See, e.g.*, Maliva Pre-Filed Direct Testimony (FPL-003) at ¶¶ 37-45; NRC-008C (FEIS) at G-48 to G-50. In this proceeding, have you addressed why these models do not support a conclusion that an adequate confining unit exists? If yes, where? If not, why not? You do not appear to have performed your own modeling to challenge the modeling performed by the Applicant and the NRC Staff, is that correct? Why didn't you perform your own modeling?
- d. Are you familiar with all of the injection well testing and groundwater monitoring requirements of the FDEP UIC program that FPL testifies are in place to ensure adequate confinement? *See, e.g.*, Maliva Pre-Filed Direct Testimony (FPL-003) at ¶¶ 10, 18, 21; McNabb Pre-Filed Direct Testimony (FPL-002) at ¶¶ 8-11, 34, 44-45. In this proceeding, have you established why each of the requirements, or the sum of those requirements, is insufficient to ensure adequate confinement? If yes, where? If not, why not?

C. Questions regarding Mr. Quarles' claim that there will be leakage from the injection wells, showing that he overstates the risk of leakage

- 7. In A27 of your initial testimony, you state that "seals and well casings can fail at any time," including those approved by the FDEP. Is it your position that the FDEP permit conditions are insufficient to prevent these failures from occurring?
- 8. Have you reviewed the cement bond log on the final casing of EW-1? Do you agree with Mr. McNabb that this log demonstrated the presence of cement behind the final casing throughout the entire confining zone? *See* McNabb Pre-Filed Direct Testimony (FPL-002) at ¶ 43. Doesn't this indicate that cement is in contact with bedrock formations and all outer steel casings? If not, why not?
- 9. In A27 of your initial testimony, you opine that a formation pressure test should have been conducted on EW-1. Mr. McNabb, however, noted in his direct testimony that a formation pressure test was unnecessary because it "is something that occurs in the oil industry when drilling in formations that are suspected to be under very high pressure, and it is completely inapplicable to drilling for deep injection wells in Florida." McNabb Pre-Filed Direct Testimony (FPL-002) at ¶ 42. You did not respond to this statement in your rebuttal testimony. Is Mr. McNabb correct that formation pressure tests are done in the oil industry when formations are suspected to be under high pressure? If not, how exactly does a formation pressure test "monitor leakage," as you say in your Initial Testimony? Quarles Initial Testimony at A27. If so, how would that testing be applicable to drilling for deep injection wells? Does anything in the record indicate that the Boulder Zone is a formation that is under high pressure?
- 10. In his rebuttal testimony, Mr. McNabb notes that if "a leak in the well were to develop, there would be an immediate loss of pressure in the annular monitoring system, which would serve to notify FPL of the leak." McNabb Rebuttal Testimony (FPL-060) at ¶ 18. Do you agree with Mr. McNabb that a leak would be immediately known to FPL? If not, why not?

11. In A29 of your initial testimony, you state that the process for drilling an injection well through an aquifer and multiple layers of bedrock is “risky.” Mr. McNabb replies that “current construction techniques remove all risk of creating a vertical conduit during construction by backplugging all pilot holes that go through the confining unit with cement and careful cementing of casings in place.” McNabb Rebuttal Testimony (FPL-060) at ¶ 21. He adds that “[t]he few injection well systems that have leaked... were constructed more than 25 years ago.” McNabb Rebuttal Testimony (FPL-060) at ¶ 21. Do you agree with Mr. McNabb that the systems that have leaked were constructed more than 25 years ago? Doesn’t that fact indicate that current construction techniques have eliminated, or at least significantly reduced, the risk of creating a vertical conduit during construction?

D. Question regarding Mr. Quarles’ claim that the monitoring wells will be insufficient to detect leakage, showing that he has incorrectly stated the frequency with which the monitoring that will take place

12. In A28 of your initial testimony, you state that “sampling will not be frequent enough due to possibility of a rapid rate of migration,” noting that sampling will take place quarterly or semi-annually. In response, Mr. McNabb has explained that the sampling initially will occur much more frequently, and never less frequently than on a monthly basis. McNabb Rebuttal Testimony (FPL-060) at ¶ 20. Isn’t Mr. McNabb correct that testing will take place more frequently than quarterly or semi-annually as you stated in your initial testimony?

E. Questions regarding Mr. Quarles’ lack of familiarity with site characterization standards and practices, showing that contrary to his claims the site characterization of Turkey Point is adequate to demonstrate a confining layer

13. Dr. Maliva testifies that more than one exploratory well has never been drilled for any Class I injection well system in the State of Florida. Maliva Pre-Filed Direct Testimony (FPL-003) at ¶ 19. Do you disagree? Are you aware of any site in Florida at which more than one exploratory well has been used to obtain a permit for a Class I injection well?

14. You testify that one exploratory well is not sufficient. *See* Quarles Prefiled Initial Testimony at A14. In your opinion, how many exploratory wells are needed? On what analyses or facts is your estimate based?

15. FPL’s witnesses have testified that FPL has followed standard practice in Florida for permitting Class I injection wells. *See, e.g.*, Maliva Pre-Filed Direct Testimony (FPL-003) at ¶ 18; McNabb Pre-Filed Direct Testimony (FPL-002) at ¶ 12. Do you agree that FPL has followed standard practice? If not, how has FPL departed from standard practice? Is it your testimony that the NRC should impose higher standards on FPL than those imposed on other projects by the regulatory authority in Florida that permits Class I injection well systems?

16. Does the well construction, testing, and monitoring program that was implemented or proposed for well EW-1 and the planned full-scale injection well system at Turkey Point meet the FDEP

regulatory requirements? If you believe that it does not, then what specific regulatory requirement(s) does the project not meet?

17. You state that low percent core recovery from EW-1 is indicative to you of a lack of confinement, and that “‘percent recovery’ is a measurement of how much of the bedrock core sample from a specified sample interval actually contains bedrock rather than voids.” Quarles Prefiled Initial Testimony at A10, A11. When drilling through a confining unit, what is a typical value for core recovery? How does your opinion take into account the possibility of core material falling out of the barrel? Are you asserting that core material never falls out of the barrel during recovery of the core? Are you asserting that the core barrel never becomes clogged during drilling, preventing the collection of additional core pieces?
18. If there were voids present in the bedrock, wouldn't you expect a “bit drop,” as both Dr. Maliva and Mr. McNabb testify? Maliva Pre-Filed Direct Testimony (FPL-003) at ¶ 23; McNabb Pre-Filed Direct Testimony (FPL-002) at ¶ 35. Both Dr. Maliva and Mr. McNabb testify that there was no evidence of a bit drop. Maliva Pre-Filed Direct Testimony (FPL-003) at ¶ 23; McNabb Pre-Filed Direct Testimony (FPL-002) at ¶ 35. Do you disagree?
19. You state that high percent porosity from EW-1 is indicative of a lack of confinement, and that “the higher the percent porosity, the greater the quantity of voids contained in the bedrock, and therefore the less effective the confinement.” Quarles Prefiled Initial Testimony at A10, A12. Is porosity a function of the type of bedrock, as Dr. Maliva testifies? Maliva Rebuttal Testimony (FPL-061) at ¶ 15. At what percent porosity is bedrock no longer confining, in your opinion? If I have a glass of water, it may be 90% porous (where the water exists in the glass), with a 10% solid glass bottom. How would you reconcile the high percent porosity of my glass of water with the fact that the glass is clearly confining, preventing leaks? Wouldn't the pores need to be interconnected for my glass to lack an adequate confining layer?
20. You state that straddle packer test results from EW-1 are indicative of a lack of confinement, as they often failed to isolate the test section. Quarles Prefiled Initial Testimony at A10, A13. Mr. McNabb has explained that this is because sleeves were placed on the inflatable packers, decreasing the ability of the packers to seal against the large diameter borehole wall. McNabb Pre-Filed Direct Testimony (FPL-002) at ¶ 37. Do you have any prior experience using sleeves on inflatable packers? If so, what is the rate at which such sleeves fail to seal against large diameter borehole walls? If the failed straddle packer tests are indicative of a lack of confining strata, why did small differences in depth result in successful tests? *See* McNabb Pre-Filed Direct Testimony (FPL-002) at ¶ 38 (explaining that shifting one test two feet allowed for a successful test).
21. You assert that “McNabb documented such highly weathered bedrock conditions with voids during the installation of well EW-1.” Quarles Prefiled Initial Testimony at A29. Where did Mr. McNabb discuss these “highly weathered bedrock conditions” in the EW-1 report (INT-010)?

F. Questions regarding Mr. Quarles' proposal to use seismic-reflection analysis, showing that such analysis is unnecessary at Turkey Point

22. As a matter of standard practice in Florida, is seismic-reflection analysis used when characterizing the hydrogeology of a site that is to be used for Class I injection wells? Are you aware of any site in Florida at which seismic-reflection analysis has been used to characterize a site to obtain a permit for a Class I injection well?
23. Does the FDEP require the use of seismic-reflection analysis when characterizing a Class I injection well site?
24. Isn't Dr. Maliva correct when he says that seismic-reflection analysis only shows *the presence* of subsurface features such as faults or karst collapse structures? Maliva Pre-Filed Direct Testimony (FPL-003) at ¶ 74. Is there a study that proves that faults, if they exist, have an impact on groundwater flow? Where and what specifically does that study say? Can you cite to any evidence in the record in this matter supporting the idea that a fault or karst collapse structure has been responsible for upward migration of water through a confining unit in South Florida? If any, how was the upward migration of water through that fault or karst collapse structure identified? Does a seismic-reflection analysis identify the upward migration of water?

G. Questions regarding Mr. Quarles' incorrect interpretation of the Cunningham studies, showing that those studies do not support his claim that seismic-reflection analysis should be used at Turkey Point

25. In your initial testimony you claim that seismic-reflection analysis is a tool "favored by the USGS" to determine whether wastewater "is likely to migrate into the drinking water supply above." Quarles Prefiled Initial Testimony at A15. Can you provide specific examples where the USGS has used seismic-reflection analysis data to determine that wastewater "*is likely to*" or *will* migrate upwards? Did any of the Cunningham papers reach that conclusion? If so, where?
26. In any of his papers, did Cunningham identify any specific faults or karst collapse features that were responsible for the upward migration of water at the South District Plant? If so, where? Did Cunningham provide any actual data on the hydraulic properties of the subsurface structures that he identified?
27. You stated that the "Cunningham 2012 study [INT-006] demonstrated that widespread fractures and faults exist in the area near Turkey Point, and those bedrock conditions render bedrock layers ineffective as confining layers. The USGS concluded that two types of subsurface geological structure systems have the potential for producing a breach in confining layers of bedrock in the Floridan aquifer system: 1) tectonic faults and 2) karst collapse structures." Quarles Prefiled Initial Testimony at A15.
 - a. Where does the Cunningham 2012 article (INT-006) demonstrate the existence of "widespread fractures?"

- b. If Cunningham identified faults and karst collapse structures, where are they located? How far from Turkey Point? How old are these subsurface features? Where are they identified in the Cunningham article?
 - c. Where in the Cunningham article (INT-006) does it say that these features “render bedrock layers ineffective as confining layers?”
28. You also stated that the Cunningham 2015 (INT-009) study “confirmed the presence of subsurface geologic faults and karst collapse structures that can transmit injected wastewater upwards into the Upper Floridan Aquifer.” Quarles Prefiled Initial Testimony at A15. Where in the Cunningham article does he identify structures that “*can* transmit injected wastewater upwards?”
29. You have asserted that “Cunningham demonstrated that tectonic faults and karst collapse structures – where present in bedrock beneath the Biscayne Bay – cause fractures in multiple layers of bedrock that were originally thought to be ‘confining layers.’” Quarles Prefiled Initial Testimony at A15. Where does Cunningham make this claim? Is he asserting that *all* faults and karst collapse structures lead to fractures? If faults and karst collapse structures cause fracturing, wouldn’t that fracturing be identifiable using means other than a seismic-reflection analysis, such as geophysical log data? *See* Maliva Pre-Filed Direct Testimony (FPL-003) at ¶ 36. In fact, in Cunningham’s 2015 article (INT-009) doesn’t it state that geophysical log data was able to identify a buried karst collapse structure (by identifying the fractured strata), while seismic-reflection analysis identified nothing? INT-009 at 23 (PDF page 33) (bottom of first column leading into second column).
30. You assert that the Cunningham 2015 article makes the following finding: “The Middle Confining Unit of the of the [sic] Florida [sic] Aquifer system, characterized in the FEIS as ‘less permeable’ (FEIS 2-53) and having ‘low-permeability’ (FEIS 2-54) is now characterized as consisting of two ‘*semi*-confining’ units because of their tendency to leak. [INT-009] at 5, Figure 4 (emphasis added).” Quarles Prefiled Initial Testimony at A15. The cited figure (Figure 4) makes no reference to a tendency to leak. Where does the Cunningham article state that the Middle Confining Unit has a tendency to leak?
31. Can you cite to any examples where the results of a seismic-reflection analysis were relied on to place wells, as A6 of your rebuttal testimony implies could happen here?

H. Questions regarding Mr. Quarles’ use of scholarly articles, showing that his interpretation of the scholarly literature is incorrect and the prior experience at the South District Plant is not applicable to Turkey Point

32. You state that the “USGS studies provide important clues to subsurface conditions that might also exist at the Turkey Point site, because the Turkey Point [sic] is located just 9 miles south of the South District Plant in the same geologic conditions.” Quarles Prefiled Initial Testimony at A15. Are you asserting that, contrary to the testimony of Dr. Maliva (Maliva Pre-Filed Direct Testimony (FPL-003) at ¶ 59), the geology at the Turkey Point site does not vary much from the

South District Plant? If yes, how is Dr. Maliva's analysis of the geological differences incorrect? If no, why are the findings from the South District Plant relevant to the Turkey Point site if the geology is different?

33. You state that the Dausman study (INT-017) is inapplicable to Turkey Point because it "was not performed specifically for the Turkey Point site – it was performed for the South District Plant site where contamination has already occurred." Quarles Prefiled Initial Testimony at A23. How do you reconcile your arguments that Cunningham's analysis of the South District Plant is applicable to Turkey Point, while Dausman's study of the South District Plant is not?
34. You also assert that Bloetscher's study is inapplicable as it "was not designed or performed specific to Turkey Point (or even the South District Plant)." Quarles Prefiled Initial Testimony at A23. Yet later in your testimony you rely on both Dausman and Bloetscher. Quarles Prefiled Initial Testimony at A26. Are studies that are not specific to Turkey Point applicable, or are they not?
35. You also assert that conclusions from Cunningham (2015) and Starr (2001) undermine the assertions in the FEIS that the Middle Confining Unit acts as a "competent confining unit." *See* Quarles Prefiled Initial Testimony at A16. What conclusion in Cunningham (2015) [INT-009] undermines those assertions? What conclusion in Starr (2001) [INT-013] undermines those assertions?
36. You also claim that Cunningham (2015) and Starr (2001) undermine Dr. Maliva's 2007 study. Quarles Prefiled Initial Testimony at A16. How is it that Starr's study, now 16 years old, undermines Dr. Maliva's more recent conclusions?
37. In your rebuttal testimony at A13, you assert that Dr. Maliva's 2007 paper contradicts his testimony in this case that well construction issues were the cause of upward migration at the South District Plant. However, doesn't Dr. Maliva's present testimony rely on an investigation by Walsh and Price (2010) that was published after Dr. Maliva's 2007 paper was written? Maliva Pre-Filed Direct Testimony (FPL-003) at ¶¶ 65-66. Is it unreasonable for Dr. Maliva to have updated his conclusions from 2007 based on data from a subsequent investigation?
38. In your rebuttal testimony at A13, you assert that "Dr. Maliva's opinion that the past cause of upward movement of injectate was a leaky well rather than a leaking confining layer amounts to mere speculation, because he has not provided proof that bedrock fractures, like those he evaluated in 2007, are not the main cause of movement." What about the evidence provided by Dr. Maliva in ¶ 29 of his Rebuttal Testimony? Have you provided any evidence to establish that bedrock fractures are at fault at the South District Plant? Aren't you simply speculating that faults or karst collapse structures are at fault?

I. Questions regarding Mr. Quarles' incorrect interpretation of other prior experience, showing that he improperly characterizes and applies such experience to Turkey Point

39. You now state that there are “18 documented instances where deep well injection of wastewater has unintentionally migrated upward from the injection zone,” including three with fluid movement into USDWs. Quarles Prefiled Rebuttal Testimony at A17. This contradicts your repeated prior testimony that “18 deep well injection well sites in Florida have already contaminated USDWs.” INT-002 at ¶ 17 (Quarles First Affidavit); *see also* INT-003 at ¶ 41 (Quarles Second Affidavit); INT-005 at ¶ 40 (Quarles Third Affidavit). Which is correct? Why did you change your testimony?
40. You describe a variety of studies regarding the South District Plant, ultimately concluding that the groundwater in the Upper Floridan Aquifer is contaminated. Quarles Prefiled Initial Testimony at A16. To assert that the Upper Floridan Aquifer was contaminated, you rely in part on the “Walsh & Price study, conducted by the Miami-Dade Water and Sewer Department for the South District Plant, [which] concluded that deep well injection into the Boulder Zone contaminated the Floridan Aquifer.” Quarles Prefiled Initial Testimony at A17. On the contrary, didn't Walsh & Price (2009) (INT-012), determine that the Upper Floridan Aquifer was *not* contaminated? INT-012 at 15 (noting that “[t]he rapid vertical pathways did not appear to extend up to the UFA”).
41. Is there any study that has found that the upward migration at the South District Plant was the result of flow through faults or karst collapse structures? If so, which study and where does it state that conclusion? On the other hand, Walsh & Price determined that at least some of the upward migration was clearly the result of well construction issues, correct? INT-012 at 4 (describing a “leak due to corrosion of the casing”).
42. Is it your testimony that the EPA was incorrect when it concluded that injection well systems in South Florida pose low or no risk? *See* INT-015C at 8-22.

J. Questions regarding Mr. Quarles' analysis of the EPA Rule on Underground Injection Control Programs from 2005, showing that he misinterprets the rule in an attempt to support more stringent requirements

43. In your rebuttal testimony, you repeatedly rely on the 2005 EPA rule on Underground Injection Control Programs. *See* Quarles Pre-filed Rebuttal Testimony at A10, A11, A12, A14, A15, and A22 (referencing NRC-021). Didn't the 2005 EPA rule ultimately require that the South District Plant use high-level disinfection to compensate for the upward migration occurring at that site? *See* Quarles Pre-filed Rebuttal Testimony at A11. Isn't Turkey Point in compliance with this rule already by receiving water that has undergone high-level disinfection at the South District Plant? *See* NRC-008A (FEIS) at 5-20 to 5-21; Jacobs Pre-Filed Direct Testimony (FPL-001) at ¶ 9. Didn't the EPA say that this level of treatment “provide[s] an equivalent level of protection to USDWs” as provided by the existing no-fluid-migration requirement? NRC-021 at 70513.

44. You state in A18 of your rebuttal testimony that the NPDES permit for the South District Plant that was issued in 2012 “contains no monitoring requirements for any of the VOC and SVOC constituents listed in Contention 2.1.” Why not? If these constituents were of concern, wouldn’t there be such requirements?
45. You testify that the EPA concluded that “a more in-depth model ‘would require[] information on the location and extent of fissures, cracks, voids, and channels which is impossible, using current technologies, to obtain with any certainty.’” Quarles Pre-filed Rebuttal Testimony at A15. But didn’t the EPA reject the use of such an “in-depth model” in favor of implementing high-level disinfection? See NRC-021 at 70526.

K. Questions regarding Mr. Quarles’ analysis of the human health impacts of heptachlor in the concentration at issue, showing that he fundamentally misunderstands the human health impacts

46. Isn’t it true that the maximum concentration of heptachlor at issue in this proceeding is 0.000023 mg/L? NRC-008A (FEIS) at Table 3-5. Isn’t it true that the Federal Maximum Contaminant Level (MCL) for heptachlor is 0.0004 mg/L? Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 20. Since the maximum concentration of heptachlor at issue in this proceeding is less than its MCL, what “greater than small” health effects do you believe could be associated with heptachlor in this case? What information in the record supports your opinion on that subject?
47. Can you point to any study where heptachlor in a concentration of 0.000023 mg/L or less was found to have “greater than small” adverse human health effects? Can you point to any study at which a 0.000023 mg/L concentration of heptachlor was associated with *any* adverse health effects?
48. Citing to an ATSDR Tox FAQ document (INT-016), you state that heptachlor “can negatively affect the immune and nervous systems.” Quarles Prefiled Initial Testimony at A21. Where in INT-016 does it say that heptachlor can negatively affect the immune and nervous system in the concentration at issue here? Doesn’t that document say that “little is known about [heptachlor’s] health effects in humans” and that at “high levels” heptachlor “may cause damage to your liver and nervous system?” INT-016 at p. 5. Is it your testimony that a heptachlor concentration of 0.000023 mg/L, which is well below the protective Federal drinking water standard, is a “high level?”
49. Given your testimony that heptachlor can negatively affect the immune and nervous systems (Quarles Prefiled Initial Testimony at A21), at what doses do you think those effects occur? What is the basis for your conclusion?
50. Dr. Teaf cites a study which he testifies shows that the “Lowest Observed Adverse Effect Level” for heptachlor occurred in animals at a dose that is more than 49,500 times greater than the dose for heptachlor that could occur at the concentration set forth in Table 3-5. Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 19. Do you disagree with Dr. Teaf’s testimony regarding that study? If so, what is your basis for that disagreement? Are you aware of any study that shows adverse

health effects attributable to heptachlor concentrations that are lower than the dose in the study referenced by Dr. Teaf?

51. In your declaration dated August 23, 2012, you stated that heptachlor damages the liver and fertility of animals. INT-004-R at ¶ 18. Is it your opinion that these effects also have been reported or shown to occur in humans? If your answer is yes, what information in the record supports your opinion? If your answer is yes, at what doses were those effects observed?

L. Questions regarding Mr. Quarles' analysis of the human health impacts of ethylbenzene in the concentration at issue, showing that he fundamentally misunderstands the human health impacts

52. Isn't it true that the assumed concentration of ethylbenzene (if any) at issue in this proceeding is below the Method Detection Limit? NRC-008A (FEIS) at Table 3-5; Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 17. Isn't it true that the Method Detection Limit is an amount so small that levels less than it cannot be measured reliably? Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 17, n.3? Isn't it true that the Federal MCL for ethylbenzene is 0.7 mg/L? Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 23. Since the ethylbenzene concentration at issue here is less than the Federal MCL, and in fact is so small as to not be capable of reliable measurement, what adverse health effects do you believe could be associated with ethylbenzene in this case? What information in the record supports your opinion?
53. Can you point to any study where ethylbenzene, in a concentration below the Method Detection Limit, was found to have "greater than small" adverse health effects? Can you point to any study where ethylbenzene, in a concentration below the Method Detection Limit, was found to have *any* adverse health effects?
54. Dr. Teaf cites a study which he testifies showed "some indication that acute inhalation exposures to ethylbenzene" can result in adverse effects at concentrations of 1,000 parts per million or greater. Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 22. Do you disagree with Dr. Teaf's testimony regarding that study? Are you aware of any study that shows adverse health effects attributable to inhaled ethylbenzene concentrations that are lower than the dose in the study referenced by Dr. Teaf? Is potential inhaled exposure to ethylbenzene of any relevance at all when the ethylbenzene concentration in water is less than the Method Detection Limit?
55. You have testified that ethylbenzene is a "possible human carcinogen." Quarles Prefiled Initial Testimony at A21; see also INT-002-R at ¶ 31. Isn't it true, as Dr. Teaf testifies, that ethylbenzene has *not* been judged to be a carcinogen by the EPA or the Florida Department of Environmental Protection? Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 46 (citing FPL-050 at 014; FPL-040 at 170).
56. You have stated that "any concentration of the constituents [including ethylbenzene] above zero could cause adverse impacts." Quarles Prefiled Initial Testimony at A21. So is it your testimony that a level of ethylbenzene that is greater than zero but less than the MCL and MCLG of 0.7 mg/L could cause adverse impacts? If yes, why did the EPA set the MCL and MCLG for

ethylbenzene at a concentration greater than zero? Teaf Pre-Filed Rebuttal Testimony (FPL-062) at ¶ 11?

M. Questions regarding Mr. Quarles' analysis of the human health impacts of toluene in the concentration at issue, showing that he fundamentally misunderstands the human health impacts

57. Isn't it true that the maximum concentration of toluene at issue in this case is 0.00174 mg/L? NRC-008A (FEIS) at Table 3-5. Isn't it true that the Federal MCL for toluene is 1 mg/L? Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 26. Since the toluene concentration at issue in this case is less than its protective Federal MCL, what "greater than small" health effects do you believe could be associated with toluene at the 0.00174 mg/L maximum concentration? What information in the record supports your opinion?
58. Dr. Teaf cites a study which he testifies found that "[s]ome health effects" were reported in animals exposed to toluene at doses 87,000 times greater than the dose that would be associated with exposure at the concentration set forth in FEIS Table 3-5 (NRC-008A). Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 25. Do you disagree with Dr. Teaf's testimony regarding that study? Are you aware of any study that shows health effects attributable to toluene at doses from concentrations lower than the dose in the study referenced by Dr. Teaf?
59. Can you point to any study where toluene, in a concentration of 0.00174 mg/L (*see* NRC-008A (FEIS) at Table 3-5) or less, was found to have "greater than small" adverse health effects? Can you point to any study where toluene, in a concentration of 0.00174 mg/L (*see* NRC-008A (FEIS) Table 3-5) or less, was found to have *any* adverse health effects?
60. You have stated that "any concentration of the constituents [including toluene] above zero could cause adverse impacts." Quarles Prefiled Initial Testimony at A21. So is it your testimony that a level of toluene that is greater than zero but less than the MCLG and MCL (1 mg/L) (Teaf Pre-Filed Rebuttal Testimony (FPL-062) at ¶ 11) could cause adverse impacts? If yes, why did the EPA set the MCLG and MCL for toluene at greater than zero?
61. Did you address the negative impact of toluene in either your initial or rebuttal testimony? Are you abandoning your claim regarding the negative impact of toluene? If no, then why did you fail to affirmatively state a claim as to the negative impacts of toluene?

N. Questions regarding Mr. Quarles' analysis of the human health impacts of tetrachloroethylene in the concentration at issue, showing that he fundamentally misunderstands the human health impacts

62. Isn't it true that the maximum concentration of tetrachloroethylene at issue in this proceeding is 0.00359 mg/L? NRC-008A (FEIS) at Table 3-5. Isn't it true that the Federal MCL for tetrachloroethylene is 0.005 mg/L? Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 29. Since the maximum concentration of tetrachloroethylene at issue in this case is less than its protective MCL, what "greater than small" health effects do you believe could be associated with tetrachloroethylene? What information in the record supports your opinion?

63. Even though the concentration of tetrachloroethylene slightly exceeds the Florida MCL (0.003 mg/L), can you point to any study where tetrachloroethylene, in a concentration of 0.00359 or less (*see* NRC-008A (FEIS) at Table 3-5), was found to have adverse health effects?
64. Dr. Teaf cites a study which he testifies found that negative impacts were seen in an infant exposed to tetrachloroethylene at a concentration nearly 2,800 times the concentration set forth in FEIS Table 3-5. Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 28. Do you disagree with Dr. Teaf's testimony regarding that study? Are you aware of any study that shows health effects attributable to tetrachloroethylene at a concentration lower than in the study referenced by Dr. Teaf?
65. Citing to an ATSDR Tox FAQ document (INT-016), you state that "[e]ven at minute concentrations, tetrachloroethylene can cause nausea, liver damage, impaired heart function, and death." Quarles Prefiled Initial Testimony at A21. Where in INT-016 does it say that such health impacts can result from "minute concentrations?" What quantities are you referring to when you say "minute concentrations?" In the quoted statement, are you saying that ingestion of "minute concentrations" of tetrachloroethylene can cause death? If so, what information supports that conclusion? Doesn't INT-016 at page 3 say that certain adverse health effects come from exposure to "very high concentrations" of tetrachloroethylene? Is it your testimony that a concentration of 0.00359 mg/L (which is below the Federal MCL and only slightly above the Florida MCL) is a "very high concentration?"
66. If concentrations of tetrachloroethylene above zero have "greater than small" environmental impacts as you testify (Quarles Prefiled Initial Testimony at A21), why would the EPA and the FDEP set the MCL for that chemical at above zero?
67. Dr. Teaf testifies that "the public health in this case will be even further protected due to dilution. Given the geological features described in the FEIS and the Testimony of Dr. Robert Maliva and Mr. David McNabb, it is reasonable to assume that wastewater injected into the Boulder Zone would be substantially diluted by the time it may migrate, if at all, to the UFA." Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 34. To what extent does your claim regarding the potential "greater than small" adverse impacts of tetrachloroethylene (and the other constituents) take into account dilution during the time period in which the constituents would migrate into a USDW? Is it your testimony that dilution will not occur during such migration? If so, what is the basis for that testimony?
68. Did you review the EPA groundwater transport modeling analysis conducted for tetrachloroethylene ("Relative Risk Assessment of Management Options for Treated Wastewater in South Florida" (FPL-027)) cited by Dr. Teaf (Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 30)? Do you disagree with Dr. Teaf that the EPA transport analysis determined that tetrachloroethylene at a concentration of 0.00466 mg/L (that is injected to a depth of 2900 feet in Dade County) would be reduced to "0.00001 to 0.00002 mg/L at the hypothetical well or at the base of the nearest USDW, respectively?" Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 30 (citing FPL-027 at 132). Do you agree with Dr. Teaf's conclusion that wastewater injected with a tetrachloroethylene concentration of 0.00359 mg/L as in FEIS Table 3-5 would yield even lower

projected concentrations than were projected in the EPA transport analysis? If you disagree with Dr. Teaf, what is the basis for that disagreement? Did you consider the analysis in FPL-027 when you prepared your testimony regarding tetrachloroethylene? If so, on what basis did you find that the results in FPL-027 were not applicable to your opinion?

69. Does the EPA consider its standards for tetrachloroethylene to be protective for drinking water, even though Florida has elected to adopt a lower level? To your knowledge, has the EPA made any effort to reduce the Federal MCLs based upon consideration of Florida standards?
70. Did you read in Dr. Teaf's testimony that in May 2016 the EPA issued an update to health-based screening levels indicating that the protective default tapwater concentration for tetrachloroethylene should be 0.011 mg/L, which is even higher than the current EPA MCL? Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 29. Do you disagree with Dr. Teaf's interpretation of that update? Do you know why the EPA adjusted that tap water standard? If concentrations of tetrachloroethylene above zero could have "greater than small" environmental impacts (as you testify), why would the EPA recently have found that the protective default concentration should be 0.011 mg/L? Did you consider this update when you formed your opinions?
71. Do you agree with Dr. Teaf that tetrachloroethylene is volatile? Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 27? If not, what is your basis for that disagreement? If so, isn't Dr. Teaf correct that, when the wastewater at Turkey Point is heated and agitated (as would be the case when it is used for cooling purposes at Turkey Point), tetrachloroethylene would be released from the wastewater, thereby reducing its concentration below the calculated concentration of 0.00359 mg/L?

O. Questions regarding Mr. Quarles' position that the NRC Staff should have used MCLGs, rather than MCLs, to determine the potential environmental impacts in this case, for the purpose of showing that such a position is indefensible and that MCLs are the appropriate criteria

72. What is your understanding of what an MCL represents? Dr. Teaf testifies that the EPA takes into consideration the potential carcinogenic nature of chemicals such as heptachlor and tetrachloroethylene when it establishes MCLs. Teaf Pre-Filed Rebuttal Testimony (FPL-062) at ¶ 10. Do you disagree with that testimony? If so, what is your basis for that disagreement?
73. Dr. Teaf testifies that the EPA has concluded that MCLs (not MCLGs) for carcinogens (such as heptachlor and tetrachloroethylene) protect human health because they fall within the applicable EPA target cancer risk range. Teaf Pre-Filed Rebuttal Testimony (FPL-062) at ¶ 10. Do you disagree with that testimony? If so, what is your basis for that disagreement?
74. Your testimony states that MCLGs should have been used to determine whether the environmental impacts of the constituents would be "small." Quarles Prefiled Initial Testimony at A21. Can you cite any injection well system in the United States (including the South District Plant) where MCLGs have been used as the regulatory standard for that system? Does the

approval of wastewater injection at the South District Plant support your opinion that the MCLG is the appropriate standard for determining health effects?

75. Your testimony states that MCLGs should have been used to determine whether the environmental impacts of the constituents would be “small.” Quarles Prefiled Initial Testimony at A21. Do you agree with Dr. Teaf that the MCLG for ethylbenzene is 0.7 mg/L? Teaf Pre-Filed Rebuttal Testimony (FPL-062) at ¶ 11. Do you agree with Dr. Teaf that the MCLG for toluene is 1 mg/L? Teaf Pre-Filed Rebuttal Testimony (FPL-062) at ¶ 11. Do you agree that the concentrations at issue in this matter for those two chemicals are below their respective MCLGs? Since the concentrations at issue for ethylbenzene and toluene are below their respective MCLGs, doesn’t that mean that, applying the standard *which you suggest*, those chemicals pose no “greater than small” environmental impacts here?
76. You testify that the FEIS bases its conclusion that the impacts from wastewater will be “small” on the “incorrect conclusion that there is a safe concentration of the constituents” and that “any concentration of the constituents above zero could cause adverse impacts.” Quarles Prefiled Initial Testimony at A19, A21. Doesn’t the fact that the EPA has set drinking water standards (MCLs) above zero for each of the constituents at issue mean that the Federal government has determined that these chemicals are safe in drinking water at *some* concentrations? Is it your testimony that, by establishing MCLs greater than MCLGs, the EPA is allowing drinking water to contain unsafe concentrations of the constituents?
77. You testify that heptachlor and tetrachloroethylene may have an impact “greater than small” in this case because the concentrations at issue are above their MCLG of zero. Quarles Prefiled Initial Testimony at A21. If that is true, why does the EPA MCL allow drinking water to have concentrations for those chemicals above zero? Are you saying that the EPA permits drinking water to contain heptachlor and tetrachloroethylene in concentrations that could have a “greater than small” environmental impact or impact on drinking water consumers? Why would the EPA do that?
78. Dr. Teaf quotes from an EPA document (from which you also quote), which states that “MCLGs are non-enforceable public health goals.” Teaf Pre-Filed Rebuttal Testimony (FPL-062) at ¶ 12 (citing FPL-057 at 004). Do you agree with the EPA that the MCLGs it sets are non-enforceable goals? Are local and municipal water systems required by law to meet MCLGs of zero for heptachlor and tetrachloroethylene?
79. Is it your testimony that wastewater injected by Turkey Point into the Boulder Zone should meet chemical concentration requirements that are more stringent than what the Federal government requires for actual drinking water distribution systems? Why would such a requirement be reasonable?

P. Question regarding Mr. Quarles' criticism of Dr. Teaf and the NRC Staff's analysis of the high level disinfection process used at the South District Plant, showing that the South District Plant will comply with UIC requirements

80. Do you agree that the South District Plant is complying with the process approved by the UIC Rulemaking that you quote for the proposition that high-level disinfection “may not” remove a large variety of contaminants? Quarles Pre-filed Rebuttal Testimony at A11, A18. If so, is the FDEP endangering human health and the environment by allowing the South District Plant to dispose of wastewater in the Boulder Zone?

Q. Questions regarding Mr. Quarles' failure to apply standard practices of qualified toxicologists, showing that he has not applied the practices of a qualified toxicologist

81. Do you agree with Dr. Teaf's statement that the applicable standards that would be used by qualified professionals in the field of toxicology and human health impacts to assess environmental impacts from the constituents would be MCLs, not MCLGs? Teaf Pre-Filed Rebuttal Testimony (FPL-062) at ¶ 14. If you disagree with his statement, what is your basis? Do you think Dr. Teaf is qualified to testify as to what standards professionals in the field of toxicology would typically apply?
82. Do you agree with Dr. Teaf that “[a] generally accepted principle in the discipline of toxicology is that the simple presence of an agent, including these four substances, in an environmental medium such as water is not sufficient to assess exposure or significance of potential exposure?” Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 56. If you disagree with his statement, what is your basis? If you agree, did you follow that principle here? Do you think Dr. Teaf is qualified to testify as to generally accepted principles in the discipline of toxicology?
83. Do you agree with Dr. Teaf that, in order to assess the significance of potential exposure to the chemicals at issue here, one must consider chemical concentrations and intake rates compared with health-based risk guidelines? Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 56. If you disagree with his statement, what is your basis? If you agree, did you follow that principle here? Do you think Dr. Teaf is qualified to testify as to how professionals in the field of toxicology would assess the significance of potential exposures?
84. In reaching your conclusions regarding the potential adverse impacts of the four chemicals at issue, what exposure scenario did you use? Did you assume direct consumption of the wastewater at a certain level, such as Dr. Teaf testifies is used in the industry to calculate doses and potential risks from drinking water exposures? Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 56?
85. In reaching your conclusions regarding the environmental impacts of the four constituents, did you take into account the fact that, due to the salinity of water in the UFA in the Turkey Point region, water taken from the UFA for drinking purposes would be (and is now) subject to post-withdrawal treatment that would further reduce their chemical concentrations? Teaf Pre-Filed Direct Testimony (FPL-004) at ¶ 35. If not, why not?

Respectfully submitted,

/Signed electronically by Anne R. Leidich/

William S. Blair
FLORIDA POWER & LIGHT COMPANY
700 Universe Blvd.
Juno Beach, FL 33408
Telephone: 561-304-5238
Facsimile: 561-691-7135
william.blair@fpl.com

Steven Hamrick
FLORIDA POWER & LIGHT COMPANY
801 Pennsylvania Avenue, N.W. Suite 220
Washington, DC 20004
Telephone: 202-349-3496
Facsimile: 202-347-7076
steven.hamrick@fpl.com

Michael G. Lepre
Anne R. Leidich
PILLSBURY WINTHROP SHAW PITTMAN LLP
1200 Seventeenth Street, NW
Washington, DC 20036
Telephone: 202-663-8707
Facsimile: 202-663-8007
michael.lepre@pillsburylaw.com
anne.leidich@pillsburylaw.com

Counsel for FLORIDA POWER & LIGHT COMPANY

April 10, 2017

April 10, 2017

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
Before the Atomic Safety and Licensing Board

In the Matter of)		
	)	Docket Nos.	52-040-COL
Florida Power & Light Company	)		52-041-COL
)		
Turkey Point Units 6 and 7	)	AS- No.	10-903-02-COL
(Combined License Application))		

CERTIFICATE OF SERVICE

I hereby certify that a copy of Florida Power * Light, Co.'s Proposed Questions for the Board to Propound has been served, *in camera*, on the members of the Atomic Safety and Licensing Board, as required by the October 5, 2016 Initial Scheduling Order, as revised by the November 15, 2016 Final Scheduling Order, in this proceeding, this 10th day of April, 2017.

/signed electronically by Anne R. Leidich/

Anne R. Leidich
PILLSBURY WINTHROP SHAW PITTMAN LLP
1200 Seventeenth Street, NW
Washington, DC 20036
Telephone: 202-663-8707
Facsimile: 202-663-8007
anne.leidich@pillsburylaw.com

Counsel for FLORIDA POWER & LIGHT COMPANY

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before the Licensing Board:

E. Roy Hawkens, Chair

Dr. Michael F. Kennedy

Dr. William C. Burnett

In the Matter of)
)
Florida Power & Light Company) Docket Nos. 52-040 and 52-041
) ASLBP No. 10-903-02-COL-BD01
Turkey Point,)
Units 6 and 7)
_____)

JOINT INTERVENORS' PROPOSED QUESTIONS FOR WITNESSES
REGARDING REBUTTAL TESTIMONY FOR CONTENTION 2.1
Submitted *in camera* on April 10, 2017

Pursuant to 10 C.F.R § 2.1207(a)(3)(i) and the Atomic Safety and Licensing Board's ("the Board's" or "ASLB's") November 22, 2016 Order (Amending the Final Scheduling Order), Southern Alliance for Clean Energy, National Parks Conservation Association, Dan Kipnis, and Mark Oncavage (collectively "Joint Intervenors") hereby submit proposed questions for the ASLB to propound to witnesses during the upcoming hearing regarding their rebuttal testimony. These questions are directed to witnesses for Joint Intervenors, the U.S. Nuclear Regulatory Commission ("NRC") Staff and Florida Power and Light Co. ("FPL"). As a preface to each set of questions, Joint Intervenors provide background information in order to inform the ASLB regarding the reasons the questions should be asked for purposes of ensuring that the record of the proceeding is complete and therefore allows the ASLB to make a meaningful decision.

I. POTENTIAL FOR VERTICAL MIGRATION OF INJECTATE

A. Borehole testing.

Background. The NRC Staff disputes Mr. Quarles testimony that the FEIS “relies on a ‘single deep borehole test’” to characterize the Turkey Point site. NRC Staff Rebuttal Testimony, A11. According to the Staff, “[d]uring characterization activities at the Turkey Point site two, not one, wells were drilled.” The ASLB should question NRC Staff witnesses to clarify the nature of the second well and the type and value of information it yielded in comparison to Exploratory Well-1, the principal well discussed in the FEIS.

Questions for NRC Staff witnesses Thorne and Barnhurst (who are responsible for A11 in the NRC Staff Rebuttal Testimony):

1. Please identify, in the FEIS, the second well (*i.e.*, in addition to EW-1) that you are referring to.
2. Please compare the depth of the second well to EW-1.
3. Please provide the lateral distance between the second well and EW-1.
4. Did the second well provide sufficient data to fully characterize geologic confining layers and the groundwater quality as it relates to the USDW at Turkey Point? Please explain your answer.
5. Please identify the documents that discuss the test results from the second well.

Question for Mr. Quarles:

1. Please comment on the information (or lack thereof) provided in the Staff’s answers to these questions.

B. Adequacy of consideration of data.

Background. The NRC Staff testifies that Mr. Quarles “omit[ted]” some of the “data collected at EW-1 and considered by the Staff that supported the Staff conclusion that vertical migration of wastewater is unlikely.” NRC Staff Rebuttal Testimony, A12. In support of this claim, the Staff provides a table of tests recommended by Staff et al. in Exhibit NRC-044 and endorsed by Mr. Quarles in his Second Affidavit (Exhibit INT-003). The implication of the Staff’s testimony is that FPL performed all the tests Mr. Quarles asked for in his Second Affidavit, and the only reason he is not satisfied is that he didn’t consider the results of those tests. This implication is not correct. Mr. Quarles should be allowed to confirm that he did consider the information yielded by the tests, and that the information was not sufficient to satisfy his concerns about the potential for vertical migration of injectate. Mr. Quarles’ primary concern, as stated in testimony and his Second Affidavit, is that FPL and NRC have relied on only one test well. While the Staff claims to have addressed his concerns, it did not add any more exploratory wells. Instead, the Staff proposes that 12 injection and 6 monitoring wells “will be installed,” *i.e.*, after licensing. NRC Staff Rebuttal Testimony, A12 (at page 8). Thus, the deficiency identified by Mr. Quarles was not cured.

In addition, in his rebuttal testimony, Dr. Maliva ruled out gathering additional test well data, testifying that additional testing “cannot be seriously contemplated for an injection well system in which the constituents of concern are present at concentrations below drinking water

standards.” Maliva Rebuttal Testimony, ¶ 13. In fact, however, the concentration of tetrachloroethylene, as represented in Table 3-5 of the FEIS, is *above* the Florida standard. Quarles Rebuttal Testimony, A21. Thus, Turkey Point fails Dr. Maliva’s own test for the reasonableness of limiting the investigation to a single well. Mr. Quarles should be asked to comment on this discrepancy.

Questions:

1. Ask Mr. Quarles whether, in fact, he considered all of the test results described in the table in A12 at pages 8-9 of the NRC Staff Rebuttal Testimony.
2. Ask Mr. Quarles whether and how the results described in the Staff’s table in A12 were insufficient to satisfy his concerns about the potential for upward migration.
3. Ask Mr. Quarles to comment on Dr. Maliva’s asserted justification for failing to install additional test wells.

C. Need for seismic-reflection testing

Background. The parties dispute the necessity of seismic-reflection testing for the Turkey Point site. In his initial testimony, Mr. Quarles asserted that: “Only by conducting a comprehensive, site-specific investigation that includes, among other analyses, seismic-reflection tests, could the NRC rule out vertical transport of injected wastewater into the drinking water aquifer.” Quarles Pre-Filed Initial Testimony, A9. On rebuttal, Mr. Quarles further testified that: “FPL should have used the reasonable and feasible technique of seismic stratigraphy (*i.e.*, seismic-reflection investigations) to investigate the potential for vertical flow through geologic pathways on the Turkey Point site.” Quarles Pre-Filed Rebuttal Testimony, A4.

Both NRC Staff and FPL testify on rebuttal that seismic-reflection testing is not necessary to characterize the Turkey Point site. NRC Staff Rebuttal Testimony, A18; Maliva Rebuttal Testimony, ¶ 21 (asserting that seismic-reflection testing “does not help identify whether or not wastewater will migrate.”); McNabb Testimony, ¶ 16. But their testimony is contradicted by FPL Exhibit FPL-0063, submitted on rebuttal by Dr. Maliva. Exhibit FPL-063 is the Ph.D. dissertation of Dr. Virginia Walsh, who currently serves as Chief of the Hydrogeology Section of the Miami-Dade Water and Sewer Department.¹ Dr. Walsh recommends seismic-reflection testing, without qualification, for “any” future wastewater injection sites:

Reflection seismic surveying is being used to test for the presence of fractures, faults, and karst features. The seismic data may be able to locate possible confinement bypass pathways in the vicinity of existing injection sites, and possibly confirm that these structures do not extend into the Upper Floridan Aquifer. *Seismic data acquisition is recommended for any future injection sites, as it may be able to optimize location of future injection sites in areas where these subsurface features are not found.*

¹ Walsh, V. M. (2012). Geochemical determination of the fate and transport of injected fresh wastewater to a deep saline aquifer. Ph.D. Dissertation, Florida International University, Miami, Florida. *FIU Electronic Theses and Dissertations*. Paper 692, available at <http://digitalcommons.fiu.edu/etd/692> (as cited in Maliva Rebuttal Testimony, ¶ 35 n.3) (hereinafter “Dr. Walsh’s dissertation”).

Id. at 161-62 (emphasis added).

As a senior geologist with responsibility for evaluating and overseeing the Miami-Dade wastewater injection program, and as a geologist whose work has been cited with approval by all parties,² Dr. Walsh's endorsement of seismic-reflection testing is significant. In addition, the wastewater to be injected at the Turkey Point site will come from the Miami-Dade wastewater injection program. Thus, Dr. Walsh's recommendation applies to the Turkey Point site. It is also consistent with the recommendations of USGS scientist Kevin Cunningham that are cited in Mr. Quarles' testimony and rebuttal testimony. *See* Quarles Pre-Filed Initial Testimony, A15, A16; Quarles Pre-Filed Rebuttal Testimony, A5, A6, A8. Therefore, all of the witnesses should be questioned on the significance of her recommendation.

Questions:

1. Ask FPL witnesses Maliva and McNabb and NRC witnesses Thorne and Barnhurst to confirm that Dr. Walsh recommends seismic-reflection studies, for all proposed injection wells, including Turkey Point, in order to rule out the presence of pathways for potential upward migration of injected wastewater.
2. Ask FPL witnesses Maliva and McNabb and NRC witnesses Thorne and Barnhurst: Do seismic-reflection tests reveal faults and fractures that may not be identified with traditional/existing downhole methods?
3. When did FPL witnesses Maliva and McNabb and NRC witnesses Thorne and Barnhurst become aware of Dr. Walsh's Ph.D. dissertation?
4. In ¶ 35 of his rebuttal testimony, Dr. Maliva describes Dr. Walsh's Ph.D. dissertation as "a detailed investigation of both the North and South District Wastewater Treatment Plant sites." Are there any other investigations of either the North or South District Wastewater Plant sites that have an equivalent level of detail? If so, what are they, when were they written, and what are their principal findings?
5. Ask Mr. Quarles to comment on the significance of Dr. Walsh's opinion in conjunction with the statements of Kevin Cunningham as cited in Mr. Quarles' testimony.

D. Cost of seismic-reflection testing

Background. In his rebuttal testimony, Dr. Maliva rules out seismic-reflection testing for the Turkey Point site, in part based on its expense. Maliva Rebuttal Testimony, ¶ 7. But he does not give any cost estimates or discuss the cost-effectiveness of seismic-reflection testing, and thus he does not provide a basis for evaluating his claim of unreasonableness.

² In addition to FPL's reliance on Dr. Walsh's Ph.D. dissertation, all parties have attached as exhibits Dr. Walsh's previous report, Virginia Walsh & René M. Price, *Determination of Vertical and Horizontal Pathways of Injected Fresh Wastewater Into a Deep Saline Aquifer (Florida, USA) Using Natural Chemical Tracers*, Hydrogeology Journal, 18(4): 1027-1042 (2009) (hereinafter Walsh & Price study). *See* Exhibit INT-012, Exhibit FPL-028, Exhibit NRC046.

Questions for Dr. Maliva:

1. In ¶ 7 of your rebuttal testimony, you state that seismic-reflection analyses “are extremely expensive.” Have you performed any cost analyses for performing a seismic-reflection test at the Turkey Point site? Do you have any experience in conducting seismic-reflection testing? On what is your assertion regarding the high expense of seismic-reflection testing based?
2. Do you agree with Dr. Walsh that seismic-reflection testing “may be able to optimize location of future injection sites in areas where these subsurface features are not found?” (Exhibit FPL-063 at 161-62).
3. How much money could seismic-reflection testing save if it optimizes the placement and number of injection wells?

Question for Mr. Quarles:

1. Please comment on the value of seismic-reflection testing to optimize the number and placement of injection wells.
2. Would seismic-reflection testing also optimize the number and placement of monitoring wells?

E. Potential contamination of Underground Source of Drinking Water

Background. FPL’s testimony creates confusion about whether upward migration of wastewater has contaminated any underground source of drinking water (“USDW”) at the South District Wastewater Treatment plant. Dr. Maliva asserts:

Mr. Quarles also claims that the upwards migration experience at the South District Plant portends migration into the drinking water supply at the Turkey Point site. However, even at the South District Plant wastewater did not migrate into the Upper Floridan Aquifer. Based on a detailed investigation of both the North and South District Wastewater Treatment Plant sites, Walsh (2012) concluded that “[n]o evidence was observed at either site of injected wastewater migration to the Upper Floridan aquifer, which is used as a municipal water supply and for aquifer storage and recovery.” Walsh (2012) (FPL-063 at 009).

Maliva Rebuttal Testimony, ¶ 35 (citing Exhibit FPL-063). Questions should clarify that wastewater has contaminated the Avon Park Permeable Zone (“APPZ”), which formerly was considered part of the Upper Floridan Aquifer (“UFA”). *See* FEIS at 5-23:

As a result of more recent characterization of the Floridan aquifer in south Florida (such as Reese and Richardson 2008-TN3436), it is now understood that the APPZ is separated from the Upper Floridan aquifer in south Florida by the upper confining unit of the MCU. Results from characterization at EW-1 indicate that the upper confining unit of the MCU may separate the APPZ from the Upper Floridan by approximately 250 ft. Also, the base of the USDW is defined by the depth at which TDS exceeds 10,000 mg/L. The depth at which groundwater TDS exceeds 10,000 mg/L may occur beneath the base of the Upper Floridan Aquifer as it does at the SDWWTP. Therefore, upwelling into the USDW does

not necessarily indicate that upwelling has reached the Upper Floridan aquifer. However, review of data from well EW-1 indicate that the base of the USDW and Upper Floridan aquifer occur around the same depth at the Turkey Point site.

In addition, questions should clarify that while no wastewater has been detected in any wells in the Upper Floridan Aquifer, it remains uncertain whether this “is the result of the confinement bypass pathways not extending into the UFA, or may be that wells in the UFA are not located in areas of injectate plume migration.” Walsh, FPL-0063 at 159-60. While Dr. Walsh believes it “may be more likely” that confinement bypass pathways do not extend into the UFA, the reason remains unconfirmed.

Questions to Dr. Maliva and Mr. Quarles:

1. Has groundwater in the Avon Park Permeable Zone ever been considered to be part of the Upper Floridan Aquifer?
2. Is the APPZ the same as the Avon Park Formation?
3. Is the APPZ at Turkey Point a USDW?
4. If so, is the APPZ at Turkey Point protected for all future uses?
5. Is it correct that the APPZ and UFA are separated by only a portion of the Middle Confining Unit?
6. Would seismic-reflection studies provide useful information to determine the potential existence and characteristics of confinement bypass pathways into the Upper Floridan Aquifer exist?

F. Potential causes of vertical migration – faulty wells or natural features?

Background. On rebuttal, Dr. Maliva testified that:

[M]ultiple separate plumes of wastewater, the presence of wastewater in upper monitoring zones but not lower zones in the same well, and the absence of significant fracturing in the confining zone strata in the injection wells, all suggest that well construction issues were the likely cause of the vertical migration.

Maliva Rebuttal Testimony, ¶ 24. However, Dr. Walsh’s Ph.D. dissertation, on which Dr. Maliva relies, contains multiple statements attributing vertical migration at the South District site to natural pathways. Dr. Walsh also discusses the combined role of horizontal and vertical migration. Dr. Walsh’s statements confirm conclusions by USGS scientist Kevin Cunningham regarding the potential for transport of injectate through natural pathways. *See* Quarles Rebuttal Testimony, A5. Dr. Maliva and Mr. Quarles should be asked to comment on these statements in Dr. Walsh’s dissertation.

Questions for witnesses Maliva, McNabb, Barnhurst, Thorne, and Quarles:

1. Ask the witnesses to address comparisons between the South District and North District at pages 87-88, especially the italicized language. Doesn’t Dr. Walsh make the case that there is a likelihood of natural pathways for vertical migration at both the South District site and the North District site, and that it is even stronger at the South District site? And

isn't it correct that she relies in part on the work of others for her views, *i.e.*, Walker, Cunningham, and King, thus undermining Dr. Maliva's previous testimony that "[t]he prevailing opinion is that this upward movement was likely due to well construction issues rather than hydrogeological issues (e.g., breaches in the confining layer)? Maliva Initial Testimony, ¶ 57.

The MDWASD [Miami-Dade Water and Sewer District] concluded ammonia present at the ND (North District) was a result of construction problems (MDWASD, 2005), however, this study does not support that hypothesis. Samples collected for the 2008 sampling event show that NH₄⁺ concentrations have remained persistent in the MC1, which would not be the expected case if a one-time pulse of injectate was introduced into the aquifer. There is very little variance in all data sets for the APPZ wells at the ND, and data has been remarkably homogenous for all parameters analyzed in this study. Data show injectate as the source of the NH₄⁺ in the APPZ, and also show no mixing trends with the lower saline zones. The homogeneity of the data (of the North District Plant) may indicate there is no on-site or nearby vertical pathway (*as is evident at the SD*), but does not disprove the existence of an off-site source of NH₄⁺, that then migrates to the site with the groundwater flow. Work done by King et al. (2009) at the ND (North District) used analytical models to test various injectate flow paths, and concluded at the ND an off-site confinement bypass source was the most likely. Work by Cunningham and Walker has indicated fractures, faults and seismic-sag structural systems in the rocks of the FAS from seismic-reflection data acquired in Biscayne Bay in south Florida, nearby the two study sites, and these structures may also provide transport pathways for the injectate (Cunningham and Walker, 2009). Walsh and Price (2010) analyzed the aquifer geochemistry at both sites and their conclusions were that the geochemistry indicated multiple pathways for migration.

2. Also, please comment on the following statements at page 88. Isn't it true that an offsite vertical bypass feature cannot be a faulty well?

There is evidence of multiple vertical bypass features at the SD, however no evidence of these features were (sic) observed in the data at the ND. Confinement bypass features were observed in different locations at the SD, suggesting several plumes may exist on site, consistent with previous findings. Data suggest injectate present in the APPZ at the ND may be the result of an *offsite* vertical bypass feature.

3. Ask the witnesses to address the potential for horizontal migration through natural pathways, as discussed at pages 158-59 of Dr. Walsh's dissertation:

Two transport mechanisms were identified at the SD: density-driven buoyant vertical flow and slower horizontal advective flow. At the SD, the injectate may first have migrated upwards through vertical pathways from the Boulder Zone to

the MC1, bypassing the underlying MC2, with the freshwater injectate migrating upwards through the saline MC2 as a chemically distinct water body. The four plumes identified at the SD appear to have originated via this confinement bypass pathway. Once introduced in the higher aquifer intervals, the transport mechanism appeared to be horizontal advective flow with mixing of ambient waters. Evidence of confinement bypass pathways were observed in the MC1 and MC2 wells at the South District. Wells thought to lie in the vicinity of these pathways had concentrations of ions, isotope values, and dissolved gas concentrations similar to injectate. Binary plots of ions and stable isotopes show mixing trends in the MC1 back to injectate, with no trends towards the lower MC2.

G. Assumptions for groundwater modeling

Background. In ¶ 15 of his rebuttal testimony, Dr. Maliva testified that:

The key variables controlling permeability are pore size (more particularly, pore throat diameters) and the amount of interconnected porosity. The effects of porosity on confinement were incorporated into my groundwater model (Maliva Direct Testimony (FPL-003) - Confinement Analysis 2: Groundwater Model). Simulations using actual porosity data from EW-1 indicate that very effective confinement is likely present.

Dr. Walsh's dissertation, on which Dr. Maliva relies, identifies an additional factor affecting porosity: the chemistry of injectate. Questions to Dr. Maliva should determine whether he considered this factor; and Mr. Quarles should also be asked to comment on the significance of injectate chemistry.

Questions:

1. Dr. Maliva and Mr. Quarles should be asked to address the following statements in Dr. Walsh's dissertation (Exhibit FPL-063). In particular, Dr. Maliva should be asked how the following information regarding the chemistry of injectate was incorporated into his model:

At page viii: "Geochemical modeling indicated that CO₂ -enriched injected wastewater allowed for carbonate dissolution along the vertical pathways, enhancing permeability along these flowpaths."

At page 75: "As a result of the cryogenic process, the injectate is enriched in CO₂ and the heavier gases."

At page 130:

The undersaturated state for carbonate minerals in the injectate would suggest that there is porosity enhancement along the vertical flowpaths over time. If enhanced porosity was occurring along vertical flow paths, the f_{inj} over time should increase in wells considered close to these vertical flowpaths, as increasing porosity would allow greater buoyant injectate migration. Chloride concentrations in wells 6U and 14U decrease over

time, and the calculated f_{inj} therefore increases with time (Figure 4.13), consistent with the interpretation of porosity enhancement along the vertical flowpaths in the vicinity of these wells.

At page 132:

This study suggests a possible geochemical scenario for upward fluid migration. Injectate migrates upwards as a result of buoyant density flow along fractures, either natural or anthropogenic, enhancing porosity along the vertical pathway, as suggested by the high CO₂ concentrations and the saturation indices of the injectate (Figure 4.14).

At page 134:

Porosity enhancement is predicted as injectate migrates through the vertical bypass pathways, allowing for greater upward buoyant flow over time, and may provide for dissolution of the aquifer matrix once introduced into overlaying aquifers in the vicinity of the bypass pathways.

At page 160:

Geochemical modeling suggests that porosity enhancement may occur as injectate migrates through the confinement bypass pathways, allowing for greater upward buoyant flow over time, and may provide for dissolution of the aquifer matrix once introduced into overlaying aquifers in the vicinity of the bypass pathways. This would allow for increased injectate flow through the pathways as a result of increased porosity.

H. Dilution of injected wastewater

Background. In ¶ 33 of his rebuttal testimony, Dr. Maliva concedes that “[i]f the wastewater migrated upwards through a small diameter conduit (*e.g.*, unplugged borehole or open fracture) then minimal dilution might occur during vertical migration once the conduit was been [sic] flushed of native groundwater.” But he qualifies that statement by saying that “dilution of wastewater that would occur once the wastewater reached a pumped production well located miles from the conduit would be enormous” because a “pumped well draws in water from all directions (360 degrees).” *Id.* Questions to Dr. Maliva should clarify that he is assuming there will be no drinking water wells at the Turkey Point site, and all drinking water wells will be miles away.

Questions for Dr. Maliva:

1. Please clarify your answer in ¶ 33 of your rebuttal testimony that dilution of injected wastewater would be ‘enormous’ as a result of groundwater pumping. Is it correct that your answer assumes a groundwater drinking well would always be away from the Turkey Point site, and therefore never close to a conduit?

Questions for Mr. Quarles:

1. Please comment on Dr. Maliva's response to the question above.

II. EFFECTIVENESS OF MONITORING AND TREATMENT OF INJECTATE

A. Removal of contaminants by reverse-osmosis

Background. In ¶ 24 of his rebuttal testimony, Dr. Maliva asserts that:

One additional barrier I have not previously described is that the Floridan Aquifer System USDW is FPL-061-015 brackish (not directly potable) and has to be treated by a reverse-osmosis desalination facility before it can be used as potable water, which would remove the contaminants of concern.

Questions to Dr. Maliva should clarify the basis for his statement that reverse-osmosis will remove the contaminants of concern. An EPA document that lists Best Available Technology ("BAT") treatments for toluene, trichloroethylene, and heptachlor, Water Treatment Technology Feasibility Support Document for Chemical Contaminants; In Support of EPA Six-Year Review of National Primary Drinking Water Regulations at pages 16, 21 (EPA 815-R-03-004, www.epa.gov/safewater, June 2003) (attached) does not include reverse-osmosis.

Questions for Dr. Maliva:

1. On what do you base your assertion that reverse-osmosis will remove the contaminants of concern?
2. Are you aware of Water Treatment Technology Feasibility Support Document for Chemical Contaminants; In Support of EPA Six-Year Review of National Primary Drinking Water Regulations (EPA 815-R-03-004, www.epa.gov/safewater, June 2003)?
3. Are you aware that this Water Treatment Technology Feasibility Support Document discusses Best Available Technology ("BAT") treatments for toluene, tetrachloroethylene, and heptachlor (*id.* at 16, 21) but does not mention reverse-osmosis as BAT?

Questions for Mr. Quarles:

1. Please comment on Dr. Maliva's responses to the above questions.

B. Monitoring of Wastewater

Background. On rebuttal, Mr. McNabb testifies that monitor wells at the Turkey Point site will be sampled weekly for the first six months to two years of operation, and subsequently monthly. McNabb Rebuttal Testimony, ¶ 20. But he does not discuss any requirements to sample wastewater from the South District Plant for the four constituents of concern *before* it is injected into the ground. Questions to Mr. McNabb should clarify this, because it is much harder to clean up contaminated water than to prevent the injection of contaminated water.

Questions for Mr. McNabb:

1. How often will the injectate from South District Plant be sampled specifically for the four constituents of concern in Contention 2.1: toluene, heptachlor, trichloroethylene, and ethylbenzene?

2. How often does FPL plan to sample the injectate received from the South District Plant for the four constituents of concern in Contention 2.1: toluene, heptachlor, trichloroethylene, and ethylbenzene?
3. Once a sample is taken, how long does it take to analyze that sample? How many millions of gallons of wastewater will be injected while FPL does that analysis?
4. As a general matter, how often do Florida public water systems that use groundwater have to test for the four constituents of concern?

Questions for Mr. Quarles:

1. Mr. Quarles should be asked to comment on Mr. McNabb's responses to the questions above.

Respectfully submitted,

 /signed electronically by/
Mindy Goldstein
Turner Environmental Law Clinic
Emory University School of Law
1301 Clifton Road
Atlanta, GA 30322
Phone: (404) 727-3432
Email: magolds@emory.edu

 /signed electronically by/
Diane Curran
Harmon, Curran, Spielberg, & Eisenberg, L.L.P.
1725 DeSales Street N.W., Suite 500
Washington, D.C. 20036
240-393-9285
dcurran@harmoncurran.com

April 10, 2017

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of)
)
Florida Power & Light Company) Docket Nos. 52-040 and 52-041
) ASLBP No. 10-903-02-COL-BD01
Turkey Point,)
Units 6 and 7)
_____)

CERTIFICATE OF SERVICE

I hereby certify that on April 10, 2017, JOINT INTERVENORS' PROPOSED QUESTIONS FOR WITNESSES REGARDING REBUTTAL TESTIMONY FOR CONTENTION 2.1 and the attached Water Treatment Technology Feasibility Support Document for Chemical Contaminants; In Support of EPA Six-Year Review of National Primary Drinking Water Regulations at pages 16, 21 (EPA 815-R-03-004, www.epa.gov/safewater, June 2003) were posted on the NRC's Electronic Information Exchange System.

 /signed electronically by/

Diane Curran
Harmon, Curran, Spielberg, & Eisenberg, L.L.P.
1725 DeSales Street N.W., Suite 500
Washington, D.C. 20036
240-393-9285
dcurran@harmoncurran.com

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before the Licensing Board:

E. Roy Hawkens, Chair
Dr. Michael F. Kennedy
Dr. William C. Burnett

In the Matter of)
)
Florida Power & Light Company) Docket Nos. 52-040 and 52-041
) ASLBP No. 10-903-02-COL-BD01
Turkey Point,)
Units 6 and 7)
_____)

JOINT INTERVENORS' ADDITIONAL PROPOSED QUESTIONS FOR WITNESSES
REGARDING REBUTTAL TESTIMONY FOR CONTENTION 2.1
Submitted *in camera* on May 2, 2017

Pursuant to the Atomic Safety and Licensing Board's ("the Board's" or "ASLB's") oral directions during the adjudicatory hearing on May 2, 2017, Southern Alliance for Clean Energy, National Parks Conservation Association, Dan Kipnis, and Mark Oncavage (collectively "Joint Intervenors") hereby submit proposed questions for the ASLB to propound to witnesses during the final day of the hearing. These questions are in addition to the questions submitted to the ASLB by Joint Intervenors on April 10, 2017. These questions are directed to witnesses for Joint Intervenors, the U.S. Nuclear Regulatory Commission ("NRC") Staff and Florida Power and Light Co. ("FPL"). As a preface to each set of questions, Joint Intervenors provide background information in order to inform the ASLB regarding the reasons the questions should be asked for purposes of ensuring that the record of the proceeding is complete and therefore allows the ASLB to make a meaningful decision.

POTENTIAL FOR VERTICAL MIGRATION OF INJECTATE

Questions regarding Exhibit INT-014

Background. The first panel of witnesses, who testified on the potential for vertical migration of injectate, included FPL's witness Dr. Maliva. Dr. Maliva made a number of statements that contradicted statements he had made in a 2007 article in Hydrogeology Journal, "Vertical migration of municipal wastewater in deep injection well systems, South Florida, USA" (hereinafter "Maliva 2007"). Maliva 2007 is Exhibit INT-014 to Mr. Quarles' testimony. It is also an exhibit to FPL's testimony. Joint Intervenors request the ASLB to question Dr. Maliva regarding the basis for the inconsistencies between his 2007 paper and his testimony in this proceeding. They also request the ASLB to give Mr. Quarles an opportunity to comment on his answers.

Questions for Dr. Maliva:

1. Please confirm that in Maliva 2007, you stated that: "The greatest potential risk to public health associated with deep injection wells in South Florida is vertical migration of wastewater, containing pathogenic micro-organisms and pollutants, into brackish-water aquifer zones that are being used for alternative water-supply projects such as aquifer storage and recovery." Maliva 2007 at 1.
2. Please confirm that in Maliva 2007, you reported that:
Upward migration of municipal wastewater into USDWs has been documented at eight Florida injection well sites, and injected fluid movement has been detected in deep monitor wells completed below the deepest USDW in at least nine other injection well systems.
Maliva 2007 at 2.
3. Please confirm that in Maliva 2007, you asserted that "The upward migration of reclaimed water at the 17 sites occurred at a much more rapid rate than expected at the times of both the design and construction of the injection wells." Maliva 2007.
4. Please confirm that in Maliva 2007, you concluded that modeling of core plug data erred in estimating the rate of upward migration of wastewater by approximately four orders of magnitude. As you stated:

Wastewater at the Palm Beach County SRWWTP migrated approximately 200 m in 2.5 years. Modeling results indicate that the average vertical hydraulic conductivity would need to be approximately 1×10^{-3} cm/s to obtain the documented SRWWTP migration rate (Fig. 5b). The vertical hydraulic conductivity obtained by calibration against measured migration rates is approximately four orders of magnitude greater than core-plug data.

Maliva at 7.

5. Please confirm that you attributed the apparent cause of this rapid vertical migration of wastewater to fracturing rather than faulty well construction. As you stated:

The rapid vertical migration that has occurred in some injection-well systems requires that the equivalent vertical hydraulic conductivity of strata above the injection zone be roughly four orders of magnitude greater than the values indicated by the core plug data. The enhanced vertical hydraulic conductivity appears to be due to fracturing, which is evident in the geophysical logs of wells that experienced rapid vertical fluid migration. From a modeling perspective, the fracturing increased the bulk vertical hydraulic conductivity of the equivalent porous media.

6. Please confirm your conclusion in Maliva 2007 (page 7) that: “The fracture zones may have a limited horizontal extent, creating chimneys that were conduits for vertical fluid migration.”
7. Please describe what you mean by “limited horizontal extent.”
8. At page 8 of Maliva 2007, you observed that:

In southern Palm Beach County and northern Broward County, wastewater has reached the deep monitoring zone of some injection well systems, but has not reached the base of the USDW. Monitoring data and modeling results indicate that unfractured dolostones with low hydraulic conductivities (main confining units) can locally provide sufficient effective confinement to prevent wastewater from reaching the deepest USDW, irrespective of the fracturing of the underlying rock.

Based on this observation, you concluded that:

The focus of confinement analyses should, therefore, be on the extent and distribution of fracturing rather than analyses of the properties of the rock matrix.

How would you study the extent and distribution of fracturing with respect to the 12 individual borings that will be turned into injection wells at the Turkey Point site?

Please explain what rock/core data was used to develop your groundwater flow model at Turkey Point.

Please explain whether and how your groundwater flow model incorporated your conclusions in Maliva 2007 regarding “chimneys” and the extent and distribution of fracturing.

9. In Maliva 2007 (at page 9), you also stated that:

Another suspected explanation for upwards migration at some sites is well construction problems. If the reamed hole for a casing string diverged from the pilot hole, then the pilot hole may become a conduit for vertical fluid migration. However, well construction problems as a cause for vertical fluid migration have not yet been conclusively confirmed at any injection site.

Have you since conclusively confirmed well construction as a cause of vertical migration of wastewater at any injection site? If so, which site(s)?

10. In Maliva 2007 (page 9), you attributed rapid vertical migration, at roughly four orders of magnitude greater than the values indicated by the core plug data, to be “likely due to fracturing.” You also stated that confinement is effective “[w]here fracturing is not significantly developed.” *Id.* Therefore you recommended that “Confinement analyses should, therefore, focus on characterizing the distribution and properties of fracture systems, which may have been caused by regional tectonism.”

Has your conclusion changed since then?

Question for Mr. Quarles:

1. Please comment on Dr. Maliva’s responses to the questions above.

Respectfully submitted,

/signed electronically by/
Mindy Goldstein
Turner Environmental Law Clinic
Emory University School of Law
1301 Clifton Road
Atlanta, GA 30322
Phone: (404) 727-3432
Email: magolds@emory.edu

/signed electronically by/

Diane Curran

Harmon, Curran, Spielberg, & Eisenberg, L.L.P.

1725 DeSales Street N.W., Suite 500

Washington, D.C. 20036

240-393-9285

dcurran@harmoncurran.com

May 3, 2017

**UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE
ATOMIC SAFETY AND LICENSING BOARD**

In the Matter of)	
)	
Florida Power & Light Co.	)	Docket Nos. 52-040-COL
Turkey Point Units 6 & 7	)	52-041-COL
)	
Combined Construction and License)	
Application	)	April 10, 2017
_____)	

**THE CITY OF MIAMI’S (“CITY”) PROPOSED QUESTIONS FOR THE
BOARD TO PROPOUND TO WITNESSES FOR CONTENTION 2.1**

NOW BEFORE THE UNITED STATES NUCLEAR REGULATORY COMMISSION’S ATOMIC SAFETY AND LICENSING BOARD, through undersigned counsel, comes the CITY OF MIAMI (“City”), pursuant to 10 C.F.R. Section 2.1207(a)(3)(i), hereby submits the City’s Proposed Questions for the Board to Propound to Witnesses for Contention 2.1.

Proposed questions for NRC Staff Witnesses

Questions for Witness Ann L. Miracle

1. In Question 6 of the “Pre-filed Direct Testimony of Daniel O. Barnhurst, Ann L. Miracle, Paul D. Thorne, and Alicia Williamson-Dickerson Regarding Contention 2.1” (hereinafter, “NRC Staff Testimony”), you were asked the hypothetical question “If . . . the Constituents at the concentrations listed in FEIS Table 3-5 were injected directly into the Upper Floridan aquifer, which is an Underground Source of Drinking Water (USDW), what, in your professional opinion, would be the effect on human health?” Part of your response that the concentrations of constituents would not affect human health

was qualified by the following statement “if the Upper Floridan aquifer was used for drinking in the region of the site”

- a. Do you believe that the Upper Floridan Aquifer will not be used as a source of drinking water in the region?
 - b. Are you aware that municipalities in the region, such as Hialeah, currently are using the Upper Floridan Aquifer as a source of drinking water?
 - c. Was your original testimony based on the assumption that the Upper Floridan Aquifer is not being used as drinking water in the region?
 - d. Would your original testimony be different knowing that the Upper Floridan Aquifer is currently being used as a source of drinking water?
2. In Question 6 of NRC Staff testimony, you stated that , “there would be no adverse human health impact as the concentrations do not exceed the EPA Maximum Contaminant Levels (often referred to as MCLs) for safe drinking water.”
- a. How many active well did you consider would be injecting the constituents directly into the Upper Floridan Aquifer?
 - b. FPL anticipates to operate as many as thirteen (13) deep injections wells. If all thirteen (13) wells were directly injecting these constituents into the Upper Floridan Aquifer, do you still be live there would be no adverse human health impact? What if ten wells (10) were operating at the same time? What if five (5) wells were operating at the same time?
3. Throughout your testimony you note that the four (4) constituents that are the subject of Contention 2.1 are below EPA Maximum Contaminant Levels.

- a. Would your testimony still be the same if all thirteen (13) deep injection wells that FPL contemplates on operating were all pumping injectate at once? In other words, would the four (4) constituents still be below the EPA Maximum Contaminant Levels if all four (4) constituents were simultaneously pumping injectate into the ground?
- b. What if ten wells (10) were operating at the same time?
- c. What if five (5) wells were operating at the same time?

Questions for Witness Daniel O. Barnhurst

1. Throughout your testimony you note that the four (4) constituents that are the subject of Contention 2.1 are below EPA Maximum Contaminant Levels.
 - a. Would your testimony still be the same if all thirteen (13) deep injection wells that FPL contemplates on operating were all pumping injectate at once? In other words, would the four (4) constituents still be below the EPA Maximum Contaminant Levels if all four (4) constituents were simultaneously pumping injectate into the ground?
 - b. What if ten wells (10) were operating at the same time?
 - c. What if five (5) wells were operating at the same time?
2. In A.86 you stated that “The FPL evaluation of injectate behavior in regard to horizontal migration, which was independently verified by the Staff, indicated that Injected wastewater was not predicted to extend horizontally more than around 4 mi beyond the point of injection over the modeled timeframe. This indicates that risk would be low because the plume is not expected to migrate horizontally beyond the 5 miles indicated in the Bloetscher risk assessment.” You also state in A124 that “Injected wastewater was

not predicted to extend more than around 4 mi beyond the point of injection over the modeled timeframe.” However, the FEIS relied on studies that estimated that the injectate can spread horizontally four (4) miles on the low-end and thirteen (13) miles on the high-end.

- a. Is this horizontal estimate based on the operations of only one (1) deep injection well?
 - b. Would this horizontal estimate change if all thirteen (13) injection wells contemplated by FPL were operating at the same time?
 - c. Would this horizontal estimate change if ten (10) injection wells were operating at the same time?
 - d. Would this horizontal estimate change if five (5) injection wells were operating at the same time?
3. In A105 you state “In the most recent study, karst collapse features have been identified in the vicinity of the North and South District Wastewater Treatment Plants as well as locations beneath Biscayne Bay, and have been found to extend from the Middle Confining Unit to above the Upper Floridan aquifer.”
- a. Are any of these karst collapses within four (4) miles of the deep well injection sites contemplated by FPL?
 - b. Are any of these karst collapses within ten (10) miles of the deep well injection sites contemplated by FPL?
 - c. Are any of these karst collapses within thirteen (13) miles of the deep well injection sites contemplated by FPL?

- d. What is the distance of the nearest identified karst collapse to the deep well injection sites contemplated by FPL?
 - e. How quickly could injectate migrate horizontally to the nearest identified karst collapse and then how quickly could the injectate migrate vertically after it arrived to the nearest karst collapse?
4. FPL's witness, David McNabb, stated in his testimony that "The high permeability of the Boulder Zone prevents significant pressure from building up during injection by allowing the wastewater to preferentially move laterally, instead of upwards where the low permeability rock impedes movement." He further states that, "If water pumped into the highly permeable Boulder Zone encounters a confining zone, the water preferentially spreads in the direction of least resistance, which is laterally rather than vertically through the confining zone."
- a. Assuming there is an adequate confining layer, would you agree that Mr. McNabb's testimony confirms that there is high probability of horizontal migration of the injectate given that the choice of location to place the injectate is in an area where the intent is for the injectate to spread horizontally?
 - b. If the intent is for the injectate to spread horizontally, is it safe to assume that the horizontal spread of the injectate will be on the low end of only four (4) miles beyond the point of injection?

Questions for Witness Paul D. Thorne

1. In A.86 you stated that "The FPL evaluation of injectate behavior in regard to horizontal migration, which was independently verified by the Staff, indicated that Injected wastewater was not predicted to extend horizontally more than around 4 mi beyond the

point of injection over the modeled timeframe. This indicates that risk would be low because the plume is not expected to migrate horizontally beyond the 5 miles indicated in the Bloetscher risk assessment.” You also state in A124 that “Injected wastewater was not predicted to extend more than around 4 mi beyond the point of injection over the modeled timeframe.” However, the FEIS relied on studies that estimated that the injectate can spread horizontally four (4) miles on the low-end and thirteen (13) miles on the high-end.

- a. Is this horizontal estimate based on the operations of only one (1) deep injection well?
 - b. Would this horizontal estimate change if all thirteen (13) injection wells contemplated by FPL were operating at the same time?
 - c. Would this horizontal estimate change if ten (10) injection wells were operating at the same time?
 - d. Would this horizontal estimate change if five (5) injection wells were operating at the same time?
2. In A105 you state “In the most recent study, karst collapse features have been identified in the vicinity of the North and South District Wastewater Treatment Plants as well as locations beneath Biscayne Bay, and have been found to extend from the Middle Confining Unit to above the Upper Floridan aquifer.”
- a. Are any of these karst collapses within four (4) miles of the deep well injection sites contemplated by FPL?
 - b. Are any of these karst collapses within ten (10) miles of the deep well injection sites contemplated by FPL?

- c. Are any of these karst collapses within thirteen (13) miles of the deep well injection sites contemplated by FPL?
 - d. What is the distance of the nearest identified karst collapse to the deep well injection sites contemplated by FPL?
 - e. How quickly could injectate migrate horizontally to the nearest identified karst collapse and then how quickly could the injectate migrate vertically after it arrived to the nearest karst collapse?
3. FPL's witness, David McNabb, stated in his testimony that "The high permeability of the Boulder Zone prevents significant pressure from building up during injection by allowing the wastewater to preferentially move laterally, instead of upwards where the low permeability rock impedes movement." He further states that, "If water pumped into the highly permeable Boulder Zone encounters a confining zone, the water preferentially spreads in the direction of least resistance, which is laterally rather than vertically through the confining zone."
- a. Assuming there is an adequate confining layer, would you agree that Mr. McNabb's testimony confirms that there is high probability of horizontal migration of the injectate given that the choice of location to place the injectate is in an area where the intent is for the injectate to spread horizontally?
 - b. If the intent is for the injectate to spread horizontally, is it safe to assume that the horizontal spread of the injectate will be on the low end of only four (4) miles beyond the point of injection?

Proposed Questions for FPL Witnesses

Questions for Witness David McNabb

1. In Paragraphs 29 and 30 you explain that the purpose of injecting the wastewater into the Boulder Zone is so that the wastewater move horizontally instead of vertically. Was the purpose of designing these deep injection wells to facilitate or promote the horizontal movement of wastewater over the vertical movement of the wastewater?
2. In Paragraphs 31 through 38, you argue that there is vertical confinement in the Middle Confining Unit and that “the geology in that area lacks variability over short (less than a few miles) distances.”
 - a. What constitutes a few miles?
 - b. If four (4) miles a few miles?
 - c. Have you analyzed what the horizontal migration of the wastewater will be based on the information gathered from EW-1?
 - d. Have you analyzed what the horizontal migration of the wastewater will be if thirteen (13) wells similar to EW-1 were operating all at once?
 - e. Have you analyzed what the horizontal migration of the wastewater will be if ten (10) wells similar to EW-1 were operating all at once?
 - f. Have you analyzed what the horizontal migration of the wastewater will be if five (5) wells similar to EW-1 were operating all at once?

Questions for Witness Robert G. Maliva

1. In Paragraph 51 of your testimony you note that there may be horizontal movement of the injectate in the Boulder Zone.
 - a. Do you agree with the testimony of Paul D. Thorne that one of the reasons for injecting the wastewater into the Boulder Zone was to facilitate or promote the horizontal movement of wastewater over the vertical movement of the wastewater?
 - b. Do you know if the horizontal flow analysis conducted by FPL based on the operation of only one (1) deep injection well?
 - c. Would the horizontal flow analysis, including the rate of horizontal flow rate, be different if he analysis assumed the operation of thirteen (13) deep injection wells?
 - d. Would the horizontal flow analysis, including the rate of horizontal flow rate, be different if he analysis assumed the operation of thirteen (13) deep injection wells?
 - e. Would the horizontal flow analysis, including the rate of horizontal flow rate, be different if he analysis assumed the operation of ten (10) deep injection wells?
 - f. Would the horizontal flow analysis, including the rate of horizontal flow rate, be different if he analysis assumed the operation of five (5) deep injection wells?

Questions for Witness Christopher M. Teaf

1. Throughout your testimony you note that the four (4) constituents that are the subject of Contention 2.1 are below federal drinking water standards.
 - a. Would your testimony still be the same if all thirteen (13) deep injection wells that FPL contemplates on operating were all pumping injectate at once? In other words, would the four (4) constituents still be below federal drinking water standards if all four (4) constituents were simultaneously pumping injectate into the ground?
 - b. What if ten wells (10) were operating at the same time?
 - c. What if five (5) wells were operating at the same time?

Conclusion

The City of Miami respectfully requests that the aforementioned proposed questions be propounded to the persons sponsoring the testimony.

Respectfully Submitted,

Signed electronically by: /s/ Xavier E. Albán
Xavier E. Albán
(Fla. Bar No. 113224)
Assistant City Attorney,
The City of Miami
444 SW 2nd Avenue
Miami, FL 33130
(305) 416-1800
(305) 416-1801 (facsimile)
xealban@miamigov.com

Certificate of Service

I hereby certify that on April 10, 2017, I electronically filed *in camera* the foregoing Proposed Questions for the Board to Propound to Witnesses for Contention 2.1 with the electronic filing system of the U.S. Nuclear Regulatory Commission and that persons and parties of record were electronically served a notice of the City of Miami's *in camera* filing.

Below please find the **City of Miami's** additional proposed questions. If the Board chooses to propound the questions, the City of Miami has identified who the questions should be directed to in the parentheses following the question.

1. Has anyone used seismic reflection to map the South Florida aquifer system, generally, such that the sweeping statements that some of the experts have made about the rarity or infrequency of faults or defects in the rock structures are accurate? Can any expert point to any exhibit in the record supporting their statement? **(Dr. Maliva, Mr. Barnhurst, Mr. Quarles)**
2. Dr. Maliva noted in his testimony that faults can or have the ability to “heal.” Does the fact that faults can or have the ability to heal mean that “healed” faults can never be active or permeable? **(Dr. Maliva)**
3. FPL witnesses continue referencing that there is nothing dangerous about the injected wastewater, and that it meets drinking water standards. If the injected wastewater meets “drinking water standards” then why is it being deep injected? What is the purpose of deep injecting wastewater that meets “drinking water standards”? Assuming that this water were to be injected directly into Upper Floridan Aquifer, could the water drawn from the Upper Floridan Aquifer still be used for drinking water? **(Dr. Maliva, Dr. Teaf, Mr. Barnhurst, Mr. Thorne, Dr. Miracle)**
4. Please refer to the Figure 3-7, on page 3-12 of NRC Exhibit NRC-007A. To the west of the proposed site for Turkey Point Units 6 & 7 there is a cooling canal system for Turkey Point Nuclear Units 3 & 4 (a map (Figure 2-23) can be found on page 2-72 of NRC Exhibit NRC-007A depicting the cooling canals west of the proposed site). Currently,

FPL is remediating a hypersaline plume that formed in and has polluted the Biscayne Aquifer, a USDW and the main source of potable water for the area, due to FPL's operation of Turkey Point Units 3 and 4. As part of that remediation process, FPL has or will install several pumps to extract the hypersaline plume that has formed in the Biscayne Aquifer. Will FPL's remediation activities and extraction wells have any effect on the migration of the wastewater being deep injected for Turkey Point proposed Units 6 & 7? Will these extraction wells have any effect on the groundwater flow? Is there any exhibit or evidence in the record definitively showing that the extraction wells do or do not have an effect on the migration of the deep injected wastewater or on the groundwater flow? **(Dr. Maliva, Mr. McNaab, Mr. Barnhurst, Mr. Thorne)**

5. As part of the remediation process of the hypersaline plume, it is our understanding that after hypersaline water is extracted from the Biscayne Aquifer, the extracted hypersaline water will then be deep injected into the ground. Will the deep injection of this water have any effect on the groundwater flow or the horizontal migration of the deep injection wells for Units 6 & 7? Is there any exhibit or evidence in the record definitively showing that the deep injection wells for the hypersaline water drawn from the Biscayne Aquifer do or do not have an effect on the migration of the deep injected wastewater from Units 6 & 7 or on the groundwater flow? **(Dr. Maliva, Mr. McNaab, Mr. Barnhurst, Mr. Thorne)**

6. As part of the remediation process of the hypersaline plume, it is our understanding that after hypersaline water is extracted from the Biscayne Aquifer, the extracted hypersaline water will then be deep injected into the ground. Is there a possibility of the deep injected wastewater from Units 6 & 7 mixing with the deep injected hypersaline water? If there is

a mixing of the water and the water were to migrate vertically, would FPL be able to identify or differentiate whether the deep injected water is hypersaline water, water from Units 6 & 7, or mixture of the two? **(Dr. Maliva, Mr. McNaab, Mr. Barnhurst, Mr. Thorne)**

7. The findings in the FEIS and of NRC Staff is that injected wastewater will migrate upward no more than 300 feet. Is this assumption based on the assumption that the injected wastewater will not find any faults, karst collapse structures, or any other vertical pathways? What would happen if the wastewater found a vertical pathway within the 300 feet it has migrated vertically? If it found a vertical pathway, would the injected wastewater contaminate the Upper Floridan Aquifer? **(Dr. Maliva, Mr. McNaab, Mr. Barnhurst, Mr. Thorne)**
8. FPL witnesses have noted that in approximately 25 years there have been no reports of Class I wells failing and therefore it is reasonable to assume FPL's Class I wells will not fail. Additionally, in 20 years of using new well construction techniques, there have been no well failures. Is 25 years of no Class I failures statistically significant? Is 20 years of new well construction techniques without any failures statistically significant? Is 25 or 20 years a sufficient amount of time to state with reasonable assurance that FPL's Class I wells will not fail? **(Mr. McNaab)**
9. If the Upper Floridan Aquifer were contaminated by injected wastewater, would the water treatment techniques currently being used to treat the water prior to consumption be able to remove the contaminants identified in the Contention? **(Dr. Teaf, Dr. Miracle)**

Additional Question – City of Miami (05.03.2017):

- 1) (Mr. Jacobs) [From panel 5 discussion] – With regard to the large reservoir mentioned where the wastewater would go before being injected (and that Mr. Jacobs said would be subject to dilution by rainwater), if the waste water is subject to dilution by precipitation, isn't it also subject to becoming MORE concentrated through evaporation? Haven't you had similar problems with your cooling canal system during hot or dry months, where the water in that system has become very concentrated and hypersaline? How might this potential issue impact the calculations of the concentrations of the constituents discussed today? Has anyone analyzed this issue in the application process? Has wastewater that has sat in this reservoir during hot or dry months been tested?

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of)
)
FLORIDA POWER & LIGHT COMPANY) Docket Nos. 52-040 and 52-041-COL
(Juno Beach, Florida))
)
(Turkey Point, Units 6 & 7))

CERTIFICATE OF SERVICE

I hereby certify that copies of the **NOTICE (Transmission of Proposed Questions to Office of the Secretary)** have been served upon the following persons by Electronic Information Exchange.

U.S. Nuclear Regulatory Commission
Office of Commission Appellate Adjudication
Mail Stop: O-7H4
Washington, DC 20555-0001
ocaamail@nrc.gov

U.S. Nuclear Regulatory Commission
Office of the Secretary of the Commission
Mail Stop: O-16C1
Washington, DC 20555-0001
hearingdocket@nrc.gov

U.S. Nuclear Regulatory Commission
Atomic Safety and Licensing Board Panel
Mail Stop: T-3 F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

U.S. Nuclear Regulatory Commission
Office of the General Counsel
Mail Stop: O-15 D21
Washington, DC 20555-0001

E. Roy Hawkens
Administrative Judge, Chair
roy.hawkens@nrc.gov

Sara Kirkwood, Esq.
sara.kirkwood@nrc.gov
Patrick Moulding, Esq.
patrick.moulding@nrc.gov

Dr. Michael F. Kennedy
Administrative Judge
michael.kennedy@nrc.gov

Michael Spencer, Esq.
michael.spencer@nrc.gov
Robert Weisman, Esq.
robert.weisman@nrc.gov

Dr. William C. Burnett
Administrative Judge
william.burnett2@nrc.gov

Christina England, Esq.
christina.england@nrc.gov
Anthony C. Wilson, Esq.
anthony.wilson@nrc.gov

Jennifer E. Scro, Law Clerk
Jennifer.Scro@nrc.gov

Maxine Segarnick
Maxine.Segarnick@nrc.gov

Kimberly Hsu, Law Clerk
kimberly.hsu@nrc.gov

OGC Mail Center: Members of this office have received a copy of this filing by EIE service.

Turkey Point, Units 6 and 7, Docket Nos. 52-040 and 52-041-COL

NOTICE (Transmission of Proposed Questions to Office of the Secretary)

Florida Power & Light Company
700 Universe Blvd.
Juno Beach, Florida 33408
Nextera Energy Resources
William Blair, Esq.
william.blair@fpl.com

Florida Power & Light Company
801 Pennsylvania Ave. NW Suite 220
Washington, DC 20004
Steven C. Hamrick, Esq.
steven.hamrick@fpl.com

Pillsbury, Winthrop, Shaw, Pittman, LLP
1200 Seventeenth Street, N.W.
Washington, DC 20036-3006
Michael G. Lepre, Esq.
michael.lepre@pillsburylaw.com
John H. O'Neill, Esq.
john.oneill@pillsburylaw.com
David R. Lewis, Esq.
david.lewis@pillsburylaw.com
Timothy J. V. Walsh, Esq.
timothy.walsh@pillsburylaw.com
Anne Leidich, Esq.
ann.leidich@pillsburylaw.com

Counsel for Mark Oncavage, Dan Kipnis,
Southern Alliance for Clean Energy (SACE),
and National Parks Conservation Association
Everglades Law Center, Inc.
3305 College Avenue
Ft. Lauderdale, Florida 33314
Jason Totoiu, Esq.
jason@evergladeslaw.org

Counsel for Mark Oncavage, Dan Kipnis,
Southern Alliance for Clean Energy (SACE),
and National Parks Conservation
Association
Turner Environmental Law Clinic
Emory University School of Law
1301 Clifton Rd. SE
Atlanta, GA 30322
Mindy Goldstein, Esq.
magolds@emory.edu

Counsel for Mark Oncavage, Dan Kipnis,
Southern Alliance for Clean Energy (SACE),
and National Parks Conservation
Association
Harmon, Curran, Spielberg, & Eisenberg, LLP
1725 DeSales Street NW, Ste. 500
Washington, DC 20036
Diane Curran, Esq.
dcurran@harmoncurran.com

Counsel for the Village of Pinecrest
Nabors, Giblin & Nickerson, P.A.
1500 Mahan Drive, Suite 200
Tallahassee, FL 32308
William C. Garner, Esq.
bgarner@ngn-tally.com
Gregory T. Stewart, Esq.
gstewart@ngnlaw.com

Matthew Haber, Esq., Assistant City Attorney
Kerri McNulty, Esq.
Xavier Alban, Esq.
The City of Miami
444 SW 2nd Avenue
Miami, FL 33130
mshaber@miamigov.com
Klmcnulty@miamigov.com
xealban@miamigov.com

[Original signed by Clara Sola _____]
Office of the Secretary of the Commission

Dated at Rockville, Maryland,
this 11th day of July, 2017