

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
)
Turkey Point,) ASLBP No. 10-903-02-COL-BD01
Units 6 and 7)
_____)

JOINT INTERVENORS' INITIAL WRITTEN STATEMENT OF POSITION
ON NEPA CONTENTION 2.1 (INADEQUATE EVALUATION OF
GROUNDWATER IMPACTS)

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GROUNDWATER IMPACTS)**

Pursuant to 10 C.F.R § 2.1207(a)(1) and the Atomic Safety and Licensing Board's ("the Board's or ASLB's") October 5, 2016 Memorandum and Order (Prehearing Conference Call Summary, Case Management Directives, and Scheduling Order) and 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 their initial written statement of position and prefiled direct testimony on NEPA Contention 2.1.

I. INTRODUCTION

In this case, Joint Intervenors challenge the adequacy of the U.S. Nuclear Regulatory Commission Staff's ("NRC Staff's" or "NRC's") Final Environmental Impact Statement ("FEIS") for the proposed Turkey Point Units 6 and 7 nuclear power plant (**Exhibit NRC001**) to comply with the requirements of the National Environmental Policy Act of 1969 ("NEPA"). NUREG-2176, Final

Environmental Impact Statement for Combined Licenses for Turkey Point Units 6 and 7 (2016). Joint Intervenor contend that the NRC has failed to adequately analyze the potentially significant impacts of license applicant Florida Power & Light's ("FPL's") proposal to inject municipal wastewater into the aquifer underlying the twin reactors proposed for the Turkey Point site after using it to cool the reactors.

The potential environmental impacts of the wastewater are of great concern to Joint Intervenor because the proposed reactors lie between two national parks and above an aquifer that has been designated by the U.S. Environmental Protection Agency ("EPA") as an underground source of drinking water ("USDW"). Furthermore, the wastewater to be injected into the Turkey Point site contains probable and possible human carcinogens, for which federal guidance recommends complete elimination from human drinking water.

Joint Intervenor contend that the FEIS lacks a valid technical basis for its assertion that injected wastewater is "extremely unlikely" to migrate upwards into the drinking water aquifer, or cause environmental harm if it does reach the drinking water aquifer. FEIS at 5-26. In fact, pollution of the drinking water supply by wastewater injection is now a serious and urgent concern for nearby municipal water authorities, leading local governments and the state to collaborate with the U.S. Geological Survey ("USGS"), as an independent federal research agency, on geologic investigations using seismic-reflective technology that can provide a more comprehensive and sophisticated view of the local hydrogeology than provided by previous technologies. These studies demonstrate that the geology in the region is much more complex than previously thought, and that pathways do indeed exist for vertical transport of pollutants into the drinking water aquifer.

Instead of applying the same seismic-reflection techniques to the Turkey Point site for a thorough understanding of the transport risks posed by its hydrogeology, the NRC has given its

blissing to FPL's proposal to inject municipal wastewater in a new location: beneath Turkey Point. To rationalize the transfer of these pollutants from one neighboring location to another, the NRC has relied on a seriously inadequate environmental investigation by FPL, buttressing it with generalizations about the impermeability of the geologic strata that are no longer supportable, if they ever were. This is worse than the usual ill-informed decision-making NEPA was designed to prevent, because the NRC already has a substantial amount of information and experience counseling against it: the repeated instances of vertical migration of the same wastewater it proposes to inject only a few miles away, and the information provided by the USGS' multiple studies confirming the existence of geologic pathways for vertical transport. The FEIS is unsupportable, and the proposal to inject wastewater into the Turkey Point site is environmental folly.

Joint Intervenors' position on Contention 2.1 is supported by the attached testimony of Mark Quarles, an expert in the field of planned and accidental releases of environmental pollutants into the environment.

II. LEGAL STANDARDS

A. National Environmental Policy Act

Joint Intervenors' Contention 2.1 arises under NEPA, the NRC's implementing regulations in 10 C.F.R. Part 51, and Council on Environmental Quality ("CEQ") regulations in 10 C.F.R. Part 40. NEPA is America's "basic national charter for protection of the environment."¹ NEPA ensures that federal agencies "will have available, and will carefully consider, detailed information concerning significant environmental impacts" and that such information "will be made available to the larger [public] audience."²

¹ 40 C.F.R. § 1500.1(a).

² *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 349 (1989).

To this end, NEPA requires federal agencies to prepare a detailed Environmental Impact Statement (“EIS”) for any “major federal action significantly affecting the quality of the human environment.”³ The principal goals of an EIS are twofold: to compel agencies to take a “*hard look*” at the environmental consequences of a proposed project, and to permit the public a role in the agency’s decision-making process.”⁴ As the court in *Lands Council v. Powell* explained:

Congress wanted each federal agency spearheading a major federal project to put on the table, for the deciding agency’s and for the public’s view, a sufficiently detailed statement of environmental impacts and alternatives so as to permit informed decision making. The purpose of NEPA is to require disclosure of relevant environmental considerations that were given a “hard look” by the agency, and thereby to permit informed public comment on the proposed action and any choices or alternatives that might be pursued with less environmental harm.⁵

An EIS must describe (1) the “environmental impact of the proposed action,” (2) any “adverse environmental effects which cannot be avoided should the proposal be implemented,” (3) alternatives to the proposed action, (4) “the relationship between local short-term uses of man’s environment and the maintenance and enhancement of long-term productivity,” and (5) any “irreversible or irretrievable commitment of resources which would be involved in the proposed action should it be implemented.”⁶

NEPA requires the consideration of reasonably foreseeable direct, indirect, and cumulative impacts to the natural and physical environment.⁷ Direct effects are those caused by the action and occur at the same time and place.⁸ Indirect effects are effects caused by the action and are later in time

³ 42 U.S.C. § 4332(C) (2017).

⁴ *La. Energy Servs., L.P.* (Claiborne Enrichment Center), CLI-98-3, 47 N.R.C. 77, 87 (1998) (emphasis added).

⁵ 395 F.3d 1019, 1027 (9th Cir. 2005).

⁶ 42 U.S.C. § 4332(C)(i)–(v).

⁷ *See* 40 C.F.R. §§ 1508.7, 1508.8

⁸ 40 C.F.R. § 1508.8(a).

or farther removed in distance, but are still reasonably foreseeable.⁹ They may include related effects on air and water and other natural systems, including ecosystems.¹⁰ Cumulative impacts are impacts that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.¹¹

As part of the EIS, each federal agency also must “study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources.”¹² An agency must “rigorously explore and objectively evaluate all reasonable alternatives.”¹³ In addition, an agency “shall state how alternatives . . . will or will not achieve the requirements of section 101 and 102(1) of the Act”¹⁴ which requires agencies to “use all practicable means” to “assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings” and to “preserve important historic, cultural, and natural aspects of national heritage.”¹⁵ Until an agency issues a Record of Decision pursuant to NEPA, no action concerning a proposal may be taken that would have an adverse environmental impact, or limit the choice of reasonable alternatives.¹⁶

⁹ 40 C.F.R. § 1508.8(b).

¹⁰ *Id.*

¹¹ 40 C.F.R. § 1508.7.

¹² 42 U.S.C. § 4332(E).

¹³ 40 C.F.R. § 1502.14(a).

¹⁴ 40 C.F.R. § 1502.2(d).

¹⁵ 42 U.S.C. § 4331(b)(2), (4)

¹⁶ 40 C.F.R. § 1506.1(a).

In taking a “hard look” at the environmental impacts of a proposed action and its alternatives, an agency must be governed by the “rule of reason.” *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), CLI-02-25, 56 NRC 340, 348 (2002). In accordance with this mandate, an EIS “must utiliz[e] public comment and the best available scientific information.”¹⁷ The EIS must also disclose and analyze “the costs of uncertainty [and] the costs of proceeding without more and better information.”¹⁸ CEQ regulation 40 C.F.R. § 1502.22 “clearly contemplates original research if necessary” and “NEPA law requires research whenever the information is significant. As long as the information is . . . essential or significant, it must be provided when the costs are not exorbitant in light of the size of the project and the possible harm to the environment.”¹⁹

B. Burden of Proof

As the federal agency charged with preparing the FEIS for this project, the NRC Staff has the burden of complying with NEPA.²⁰ The NRC Staff must prove by a preponderance of the evidence that Joint Intervenors’ claims are without merit.²¹

¹⁷ *Colorado Environmental Coalition v. Dombeck*, 185 F.3d 1162, 1171-72 (10th Cir. 1999).

¹⁸ *S. Oregon Citizens Against Toxic Sprays, Inc. v. Clark*, 720 F.2d 1475, 1478 (9th Cir. 1983).

¹⁹ *Save Our Ecosystems v. Clark*, 747 F.2d 1240, 1249, 1244 n.5 (9th Cir. 1984).

²⁰ 10 C.F.R. § 2.325 (stating that “unless the presiding officer otherwise orders, the applicant or the proponent of an order has the burden of proof.”). *See also La. Energy Servs., L.P.* (Claiborne Enrichment Center), CLI-98-3, 47 NRC at 89.

²¹ *See Pacific Gas and Electric Co.* (Diablo Canyon Nuclear Power Plant, Units 1 and 2), ALAB- 763, 19 NRC 571, 577 (1984) (“[T]o prevail on . . . factual issues, the . . . position must be supported by a preponderance of the evidence”); *Tennessee Valley Authority* (Hartsville Nuclear Plant, Units 1A, 2A, 1B, and 2B), ALAB-463, 7 NRC 341, 360 (1978), *reconsideration denied*, ALAB-467, 7 NRC 459 (1978) (“Absent some special statutory standard of proof, factual issues . . . are determined by a preponderance of the evidence.”).

III. JOINT INTERVENORS' WITNESSES

Joint Intervenors present the testimony of Mark Quarles, P.G. Mr. Quarles is a licensed Professional Geologist in the State of Tennessee and environmental consultant with approximately 30 years of experience in a number of technical specialties including hazardous waste management and permitting; hydrogeologic investigations; multi-media environmental auditing; waste and wastewater permitting; and soil/groundwater remediation. He has performed a number of environmental investigations involving volatile organic compounds, heavy metals, and other contaminants in groundwater and has developed remedial action plans following contamination events throughout the United States. He has previously testified in federal court and state administrative court cases. He holds a Bachelor of Science in Environmental Engineering Technology from Western Kentucky University and a Masters' Degree in Business Administration from Vanderbilt University. Quarles Testimony, A2.

Over the past five years, Mr. Quarles has followed and responded to the development of FPL's Environmental Report, and the Draft and Final EISs. Documents he previously submitted in this proceeding consist of the following: (1) First Affidavit of Mark A. Quarles (Jan. 23, 2012) (filed in response to the Environmental Report, Turkey Point Plant, Units 6 and 7, Revision 3 (ER) prepared by FPL (attached as **Exhibit INT002** to Mr. Quarles' testimony); (2) Second Affidavit of Mark. A. Quarles (Feb. 17, 2012) (filed in response to FPL's Response to Joint Intervenor's Motion to Amend Contention 2.1 (February 10, 2012)) (attached as **Exhibit INT003** to Mr. Quarles' testimony); (3) Declaration in Support of Joint Intervenors' Answer to FPL's Motion for Summary Disposition of Joint Intervenors' Amended Contention 2.1 (August 3, 2012) (attached as **Exhibit INT004** to Mr. Quarles' testimony); and (4) Third Affidavit of Mark A. Quarles (Feb. 2, 2016) (filed in response to FPL's Statement of Material Facts As To Which No Genuine Issue Exists, in support of FPL's Motion for Summary Disposition (December 15, 2015)) (attached as **Exhibit INT005** to Mr. Quarles' testimony).

Quarles Testimony, A5.

IV. FACTUAL AND PROCEDURAL BACKGROUND

A. Factual Background

On June 30, 2009, FPL submitted an application for a combined license (“COL”) for two new AP1000 nuclear reactors (“Units 6 and 7”) at its Turkey Point site near Homestead, Florida. FPL proposes to inject municipal wastewater into the Boulder Zone, a cavernous limestone bedrock formation that is located beneath the Lower Floridan Aquifer underlying the site, after using it to cool the reactors. Intervenors are concerned that the injected wastewater, which contains potential or probable carcinogenic constituents, may migrate upwards from the Boulder Zone into the Upper Floridan Aquifer, a designated USDW, causing the Upper Floridan Aquifer to become contaminated. Quarles Testimony, A3. In particular, as stated in Contention 2.1, Joint Intervenors are concerned that chemicals in the wastewater injectate, including ethylbenzene, heptachlor, tetrachloroethylene, and toluene, may migrate upward into the USDW aquifer, contaminating it. While the FEIS predicts that the concentrations of these chemicals will be below EPA drinking water standards, EPA has issued guidance advising that any concentration above zero could cause harm, especially to vulnerable populations such as the elderly and infants. EPA also counsels that drinking water should be free of contaminants that are carcinogens. Tetrachloroethylene and heptachlor, constituents of the injectate here, are probable or possible carcinogens. Quarles Testimony, A21.

As described in the FEIS, the Floridan aquifer system – which lies beneath the Turkey Point site -- consists of three units, which are, from shallowest to deepest, the Upper Floridan Aquifer, the Middle Confining Unit (“MCU”), and the Lower Floridan Aquifer. FEIS 2-53. The Upper Floridan Aquifer is an important source of freshwater in Florida and is a designated USDW at the Turkey Point site. FEIS 2-54. The Lower Floridan Aquifer contains the Boulder Zone, the high-permeability geologic zone that

has been identified for deep-well injection of water from proposed Turkey Point Units 6 and 7. FEIS 2-54. According to the FEIS, “the low-permeability dolomite and limestones of the MCU limits (sic) the upward migration of water from the Boulder Zone.” *Id.* Therefore, the FEIS deems upward migration of wastewater into the drinking water supply to be “extremely unlikely.” FEIS 5-26, Quarles Testimony, A8.

Despite asserting that the MCU has low permeability, the FEIS acknowledges a number of cases in which injected wastewater has migrated into the drinking water supply in South Florida. Quarles Testimony, A17. The FEIS also acknowledges that “[s]eismic-reflection studies performed by the USGS in southeastern Florida have identified both linear tectonic faults and “karst collapse” structures up to about 2 mi in diameter that may result in areas of increased vertical flow through the Floridan aquifer confining units such as the MCU. . .” FEIS 2-55, Quarles Testimony, A8. These upward excursions of injected wastewater have posed an increasing concern and alarm to the State and municipal authorities, and caused the USGS to declare an “immediate need for a subsurface assessment.”²² The USGS conducted seismic-reflection investigations that spanned a ten-year period, and resulted in the issuance of four reports.²³ Quarles Testimony, A9. These reports emphasized the

²² Cunningham et al 2012-TN4576: Cunningham, K.J., C. Walker and R.L. Westcott. 2012. “Near-Surface Marine Seismic-Reflection Data Define Potential Hydrogeologic Confinement Bypass in the Carbonate Floridan Aquifer System, Southeastern Florida,” page 1. In *SEG Technical Program Expanded Abstracts 2012*, <http://library.seg.org/dol/abs/10.1190/segam2012-0638.1> (hereinafter “Cunningham 2012”, attached to Quarles Testimony as **Exhibit INT006**).

²³ In addition to Cunningham 2012, these reports are:

- Cunningham 2013-TN4573: Integrating Seismic-Reflection and Sequence-Stratigraphic Methods to Characterize the Hydrogeology of the Floridan Aquifer System in Southeast Florida. U.S. Geological Survey Open File Report 2013-1181, Reston, Virginia. (ADAMS No. ML16172A124) (hereinafter “Cunningham 2013”, attached to Quarles Testimony as **Exhibit INT007**).
- Cunningham 2014-TN4051: *Integration of Seismic-Reflection and Well Data to Assess the Potential Impact of Stratigraphic and Structural Features on Sustainable Water Supply from*

importance and usefulness of seismic stratigraphy for understanding the hydrogeology of the region and the behavior of contaminants injected into lower aquifers. In Cunningham 2014 (**Exhibit INT008**), for example, the USGS observed that seismic stratigraphy “allows, for the first time in southeastern Florida, a level of resolution in mapping of hydrogeologic units never before accomplished using well data alone.” *Id.* at 3. In Cunningham 2015 (**Exhibit INT009**), the USGS further asserted that “[t]he relations between seismic-sequence stratigraphy and hydrostratigraphy allow for detailed mapping of permeable zones and semiconfining units of the Floridan aquifer system at a level of resolution never before accomplished using well data alone.” *Id.* The USGS observed that use of high resolution seismic-reflection technologies “can be used to plan the development of future effluent-injection-well sites in other areas of southeastern Florida.” *Id.* at 5. *See also* Quarles Testimony, A15.

The USGS investigation culminated in a 2015 report that made the following critical findings:

- Seismic-reflection data determined that both karst collapse structures and faults occur beneath the South District Plant. Karst collapse structures were present at three locations. Cunningham 2015 at 1 and 24.
- Tectonic faults (one strike-slip and multiple reverse faults) exist in the area.
- The strike-slip fault and karst collapse structures “span confining units of the Floridan aquifer system and could provide high permeability passageways for groundwater movement.” *Id.* at 24.
- Faults and karst collapse structures “represent a plausible physical system for the upward migration of effluent injected into the Boulder Zone to overlying US EPA designated underground sources of drinking water in the upper part of the Floridan aquifer system.” *Id.* at 24.
- The Middle Confining Unit of the of the Florida Aquifer system, characterized in the

the Floridan Aquifer System. Open-File Report 2014–1136, U.S. Geological Survey, Davie, Florida (hereinafter “Cunningham 2014”, attached to Quarles Testimony as **Exhibit INT800**).

- Cunningham 2015-TN-4574: *Seismic-Sequence Stratigraphy and Geologic Structure of the Floridan Aquifer System Near "Boulder Zone" Deep Wells in Miami-Dade County, Florida*. U.S. Geological Survey Scientific Investigations Report 2015-5013, Reston, Virginia. (ADAMS No. ML16172A125) (hereinafter “Cunningham 2015”, attached to Quarles Testimony as **Exhibit INT009**).

See Quarles Testimony, A8.

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. *Id.* at 5, Figure 4 (emphasis added).

See also Quarles Testimony, A15. Thus, the most recent and up-to-date geologic studies conducted in South Florida recognize the existence of multiple types of geologic pathways for vertical migration of injected wastewater. Given the existence of these pathways and the repeated excursions of chemical pollutants from lower aquifers into drinking water aquifers in South Florida, injection of municipal wastewater into the aquifer underlying the Turkey Point site poses a risk that toxic chemicals found in the injectate, including ethylbenzene, heptachlor, tetrachloroethylene, and toluene, may migrate upward into the drinking water aquifer that lies near the surface.

B. Procedural Background

On June 12, 2010, the NRC issued a Notice of Hearing and Opportunity to Petition for Leave to Intervene, which provided members of the public sixty days from the date of publication for leave to intervene in this proceeding.

Joint Intervenors filed a timely petition to intervene. On February 18, 2011, the Board ruled that Joint Intervenors had standing to participate in the proceeding and admitted the following contention (“NEPA Contention 2.1”):

[T]he ER fails to analyze and discuss the potential impacts on groundwater quality of injecting into the Floridan Aquifer via underground injection wells heptachlor, ethylbenzene, toluene, selenium, thallium, and tetrachloroethylene, which have been found in injection wells in Florida but are not listed in FPL’s ER as wastewater constituent chemicals.²⁴

In admitting Contention 2.1, the Board stated that Joint Intervenors had “asserted (with adequate supporting information . . .) that these ‘specified chemicals might be in the wastewater discharged via deep well injection wells into the Boulder Zone of the Lower Floridan Aquifer, and that the wastewater

²⁴ Memorandum and Order (Ruling on Petitions to Intervene), LBP-11-06, 73 NRC 149, 190 (2011).

could possibly migrate into the Upper Floridan Aquifer, contaminating the groundwater (including potential drinking water) with these chemicals.”²⁵

On December 16, 2011, FPL submitted to the NRC Revision 3 of its COL application. FPL followed this submittal with a Motion to Dismiss Contention 2.1 on January 3, 2012. Joint Intervenors filed an answer opposing FPL’s motion on January 23, 2012, and alternatively moved the Board to admit an amended version of Contention 2.1. The Board dismissed Contention 2.1 on January 26, 2012 as moot, finding that the original ER had listed two of the six chemicals named in the contention and that an amendment to the ER had provided information regarding the other four chemicals.²⁶ The Board, however, later granted in part Joint Intervenor’s Motion to amend Contention 2.1 on May 2, 2012.²⁷ Amended Contention 2.1 reads:

The ER is deficient in concluding that the environmental impacts from FPL’s proposed deep injection wells will be “small” because the ER fails to identify the source data of the chemical concentrations in ER Rev. 3 Table 3.6-2 for ethylbenzene, heptachlor, tetrachloroethylene, and toluene. Such information is necessary to ensure the accuracy and reliability of those concentrations, so it might reasonably be concluded that those chemicals will not adversely impact the groundwater by migrating from the Boulder Zone to the Upper Floridan Aquifer.²⁸

On July 19, 2012, FPL filed a Motion for Summary Disposition of amended Contention 2.1 and Joint Intervenors filed an answer on August 6, 2012. The Board issued an order on August 30, 2012 granting in part and denying in part FPL’s Motion for Summary Disposition of Amended Contention 2.1. The Board reformulated Amended Contention 2.1 to read as follows:

The ER is deficient in concluding that the environmental impacts from FPL’s proposed deep injection wells will be “small” because the chemical concentrations in ER Rev. 3 Table 3.6-2

²⁵ *Id.*, 73 NRC at 191.

²⁶ Licensing Board Memorandum and Order (Granting FPL’s Motion to Dismiss Joint Intervenors’ Contention 2.1 and CASE’s Contention 6 as Moot) (Jan. 26, 2012).

²⁷ Memorandum and Order (Granting, In Part, Joint Intervenors’ Motion to Admit Amended Contention NEPA 2.1), LBP-12-09 (May 2, 2012) (unpublished).

²⁸ *Id.* at 16.

for ethylbenzene, heptachlor, tetrachloroethylene, and toluene may be inaccurate and unreliable. Accurate and reliable calculations of the concentrations of those chemicals in the wastewater are necessary so it might reasonably be concluded that those chemicals will not adversely impact the groundwater should they migrate from the Boulder Zone to the Upper Floridan Aquifer.²⁹

In February 2015, the NRC Staff published the Draft Environmental Impact Statement (“DEIS”) for Turkey Point Units 6 and 7.

On December 15, 2015, FPL filed a motion for summary disposition. NRC Staff filed an Answer on February 3, 2016. Joint Intervenors also filed an Answer on February 3, 2016. The Board granted in part, and denied in part, FPL’s motion for summary disposition. The Board concluded:

In sum, Joint Intervenors have proffered an expert opinion that raises credible disagreements with the following factual assertions advanced by FPL’s and the NRC Staff’s experts: (1) the wastewater will be confined in, or near, the Boulder Zone; (2) the injection wells’ design and testing will prevent leaks; and (3) if wastewater were to migrate from the Boulder Zone or leak from an injection well, it would be detected and its effects would be mitigated before reaching the Upper Floridan Aquifer and adversely impacting an Underground Source of Drinking Water.³⁰

The Board reformulated the contention to read as follows:

The DEIS is deficient in concluding that the environmental impacts from FPL’s proposed deep injection wells will be “small.” The chemicals ethylbenzene, heptachlor, tetrachloroethylene, and toluene in the wastewater injections at concentrations listed in DEIS Table 3-5 may adversely impact the groundwater should they migrate from the Boulder Zone to the Upper Floridan Aquifer.³¹

The Board further determined that an evidentiary hearing must be conducted so that the Board could “question the experts, assess their credibility, and weigh their testimony and the evidence.”³²

²⁹ Memorandum and Order (Granting in Part and Denying in Part Motion for Summary Disposition of Amended Contention 2.1) at 10 (Aug. 30, 2012) (unpublished).

³⁰ Memorandum and Order (Granting in part and Denying in Part FPL’s Motion for Summary Disposition), LBP-16-03, 83 NRC 169, 185 (2016).

³¹ *Id.*, 83 NRC at 186.

³² *Id.*

On October 5, 2016 the Board issued a Memorandum and Order summarizing a prehearing conference call, providing case management directives and setting a scheduling order for the evidentiary hearing.³³ The Board amended its Final Scheduling Order on November 22, 2016.³⁴

V. LEGAL ISSUES IN CONTROVERSY

As discussed above in Section II, NEPA requires an EIS to take a “hard look” at the environmental consequences of a proposed project, and to permit the public a role in the agency’s decision-making process.³⁵ Here, as demonstrated in the testimony of Mark Quarles, the required “hard look” analysis is absent from the FEIS. In Mr. Quarles’ expert opinion, the NRC has failed to provide a reasonable amount of technical support for the conclusions in the FEIS that (1) upward migration is “extremely unlikely” to occur from the underground injection of wastewater at the Turkey Point site, and that (2) the environmental impacts of the upward migration of injected wastewater containing tetrachloroethylene, ethylbenzene, heptachlor, and toluene (constituents) will be “SMALL.”

Not only are the NRC’s conclusions unsupported by the necessary data, they are contradicted by some of the documents on which the NRC relies. This inconsistency between the NRC’s conclusions and the factual record violate the “rule of reason” and therefore is fatal to the FEIS.³⁶ Given the uncertainty that a competent confining layer can prevent vertical migration of contaminants into the drinking water supply, NEPA imposes three mandatory obligations on the NRC Staff to address that uncertainty: (1) a duty to disclose the scientific uncertainty; (2) a duty to complete independent

³³ Memorandum and Order (Prehearing Conference Call Summary, Case Management Directives, and Scheduling Order) (Oct. 5, 2016).

³⁴ Order (Amending Final Scheduling Order) (Nov. 22, 2016).

³⁵ *La. Energy Servs., L.P.*, CLI-98-3, 47 N.R.C. at 77.

³⁶ *Private Fuel Storage, L.L.C.*, CLI-02-25, 56 NRC at 348.

research and gather information if no adequate information exists (unless the costs are exorbitant or the means of obtaining the information are not known); and (3) a duty to evaluate the potential, reasonable foreseeable impacts in the absence of relevant information.³⁷ The FEIS has utterly failed to satisfy these obligations.

The FEIS also violates NEPA by failing to base its risk evaluation on seismic-reflection analysis and data or justifying its failure to do so. An EIS “must utiliz[e] public comment and the best available scientific information”³⁸ and disclose and analyze “the costs of uncertainty [and] the costs of proceeding without more and better information.”³⁹ CEQ regulation 40 C.F.R. § 1502.22 “clearly contemplates original research if necessary” and “NEPA law requires research whenever the information is significant. As long as the information is . . . essential or significant, it must be provided when the costs are not exorbitant in light of the size of the project and the possible harm to the environment.”⁴⁰ As demonstrated in Mr. Quarles’ testimony, seismic stratigraphy is a reasonable and feasible investigative method, which has been used for the past five years by the USGS for the very same purpose as the FEIS, *i.e.*, to evaluate the risk that wastewater injected into the aquifers of South Florida will migrate upward and contaminate drinking water supplies. The USGS has established that these seismic tests provide far greater and more accurate information than the outdated borehole testing relied on in the FEIS. *See Quarles Testimony*, A15.

The NRC acknowledged in the FEIS that “deep seismic data has not been collected at the Turkey Point site” (FEIS 5-25), but failed to justify its omission or seek the information. And even if

³⁷ 40 C.F.R. § 1502.22.

³⁸ *Colorado Environmental Coalition v. Dombeck*, 185 F.3d 1162, 1171-72 (10th Cir. 1999).

³⁹ *S. Oregon Citizens Against Toxic Sprays, Inc. v. Clark*, 720 F.2d 1475, 1478 (9th Cir. 1983).

⁴⁰ *Save Our Ecosystems v. Clark*, 747 F.2d 1240, 1249, 1244 n.5 (9th Cir. 1984).

the NRC could rely on the single borehole investigation conducted by FPL, the results of that investigation contradict, rather than support, NRC's conclusion that vertical migration of contaminated injectate is extremely unlikely. Quarles Testimony, A10 – A14. The NRC's conclusion is also contradicted by the technical studies of other sites cited in the FEIS. Quarles Testimony, A15 – A18. These defects render the FEIS completely inadequate to satisfy NEPA's rule of reason.

As demonstrated in Mr. Quarles testimony (A19 – A32), NRC has also failed to satisfy the rule of reason with respect to its assertion that environmental impacts of wastewater will be detected and mitigated if they do reach the drinking water aquifer. According to the FEIS, the impact of injectate that enters the drinking water supply will be "SMALL" because the concentration of any migration of the constituents would be low enough not to cause adverse impacts. FEIS 5-42. But the NRC bases this conclusion on the incorrect assumption that there is a safe concentration of the constituents and any migration will sufficiently dilute the constituents to this low concentration. In fact, federal guidance advises that the constituents at issue in Contention 2.1 pose potential health risks at *any* concentration. The FEIS also incorrectly concludes the impacts will be "SMALL" because the design and testing of the injection well will prevent any leaks, and the monitoring will identify any leaks before adverse impacts can occur. FEIS 5-41 to 5-42. But the FEIS fails to support these conclusions. Quarles Testimony, A19. Having failed to show the effectiveness of these alleged mitigation measures, the NRC lacks a lawful basis for asserting that the environmental impacts of injecting wastewater into the aquifer below the Turkey Point site will be "SMALL."

Finally, the fact that concentrations of contaminants are predicted to be below maximum contaminant levels ("MCLs") does not render their environmental impacts insignificant. The concerns of NEPA are not circumscribed by other statutes. *Limerick Ecology Action v. NRC*, 869 F.2d 719, 729 (3rd Cir. 1989). As discussed in Mr. Quarles' testimony and Section VI below, constituents such as

tetrachloroethylene, heptachlor, ethylbenzene, and toluene are just a few of the many constituents that are in the wastewater. Quarles Testimony, A24. Those constituents are commonly associated with industrial or agricultural wastewater streams that are discharged into the sewerage system prior to reaching the treatment plant. The mere presence of these and other similar indicator constituents in the municipal wastewater effluent reported by FPL in the FEIS after treatment demonstrates that the municipal wastewater treatment plant is ineffective at removing all such constituents from the wastewater. Furthermore, the concentrations of these chemicals is above the maximum contaminant level goal (“MCLG”) set by EPA as “the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, allowing an adequate margin of safety.”⁴¹ As further explained by EPA:

MCLGs are non-enforceable public health goals. MCLGs consider only public health and not the limits of detection and treatment technology effectiveness. Therefore, they sometimes are set at levels which water systems cannot meet because of technological limitations.

When determining an MCLG, EPA considers the adverse health risk to sensitive subpopulations:

- Infants
- Children
- The elderly
- Those with compromised immune systems and chronic diseases⁴²

EPA further explains that:

For **chemical contaminants that are carcinogens**, EPA sets the MCLG at zero if both of these are the case:

- there is evidence that a chemical may cause cancer
- there is no dose below which the chemical is considered safe.

If a chemical is carcinogenic and a safe dose can be determined, EPA sets the MCLG at a level above zero that is safe.

⁴¹ See <https://www.epa.gov/dwregdev/how-epa-regulates-drinking-water-contaminants>.

⁴² *Id.*

For **chemical contaminants that are non-carcinogens but that can cause adverse non-cancer health effects** (for example, reproductive effects), the MCLG is based on the reference dose. A **reference dose (RfD)** is an estimate of the amount of a chemical that a person can be exposed to on a daily basis that is not anticipated to cause adverse health effects over a lifetime.⁴³

Thus, the chemical constituents of injected wastewater may pose significant health risks to sensitive individuals, including the sick, the elderly, and infants, even at the relatively low concentrations predicted here. Therefore, Joint Intervenors respectfully submit that the environmental risk they pose is significant.

VI. SUMMARY OF KEY POINTS TO BE MADE IN THE TESTIMONY

As discussed above in Section V, in Mr. Quarles' expert opinion, the NRC has failed to provide a reasonable amount of technical support for the conclusions in the FEIS that (1) upward migration is "extremely unlikely" to occur from the underground injection of wastewater at the Turkey Point site, and that (2) the environmental impacts of the upward migration of injected wastewater containing tetrachloroethylene, ethylbenzene, heptachlor, and toluene (constituents) will be "SMALL."

A. Upward Migration of Wastewater Containing Contaminants

As testified by Mr. Quarles, there are four key problems with the NRC's analytical approach and conclusions. Quarles Testimony, A9 and A10-A18.

First, while the FEIS claims it can draw conclusions about the Turkey Point site by comparing it to "hydrogeological conditions and parameters at the sites at which upwelling occurred" (FEIS 5-21), the NRC did not obtain nearly enough information about the specific characteristics of the Turkey Point site to make such comparisons. Quarles Testimony, A10-A14. The FEIS relies on a single deep borehole test that provides very little information about the Turkey Point site characteristics. What little

⁴³ *Id.* (emphasis in original).

information *is* provided by the borehole test indicates that the layers of bedrock that were believed to be confining layers were actually quite permeable. *Id.*

The FEIS also unreasonably fails to employ, or discuss the implications of its failure to employ, seismic-reflection in making its evaluation of the Turkey Point site. Seismic stratigraphy is the investigative tool favored by USGS, and used by USGS over the past five years, to study the very question raised in the FEIS and Contention 1.2 – i.e., whether wastewater injected into the Boulder Zone below the proposed Turkey Point reactors is likely to migrate into the drinking water supply above. Quarles Testimony, A15. 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. However, no seismic study was performed for the Turkey Point site. *Id.*

Second, the FEIS incorrectly relies on broad generalizations about the “low-permeability” of the “confining units” that supposedly will contain the injected contaminants (*e.g.*, FEIS at 2-47). Quarles Testimony, A16. Time and again, unexpected vertical intrusions of contaminated water into the drinking water supply in South Florida have proved that generalization to be dead wrong. In fact, these recurring excursions impelled the USGS to begin conducting the seismic-reflection studies that now show the presence of faults and karst collapse structures that may provide pathways for rapid upward migration of contaminated wastewater. The NRC has no reasonable basis to make such sweeping claims, having failed to support them with a seismic-reflection combined with other analyses of the Turkey Point site. *Id.*

Third, the FEIS incorrectly minimizes the significance of known instances of upward migration of contaminated wastewater in the area of the Turkey Point site. Quarles Testimony, A17. There can be no doubt that contamination of drinking water sources with injected wastewater is a significant problem

in South Florida, warranting a three-and-a-half year investigation. *See* Quarles Testimony, A15 and **Exhibit INT007**. The FEIS should have acknowledged that the number of occurrences of upward migration of wastewater through “confining layers” in the vicinity of the Turkey Point site is the appropriate indicator of its significance, not a general statewide survey. Quarles Testimony, A17.

Finally, the FEIS incorrectly attributes the known instances of vertical migration of contaminated wastewater to faulty wells, rather than geologic conduits such as faults and karst collapse structures. Quarles Testimony, A18. The studies on which the FEIS relies do not support this proposition. Instead, these studies acknowledge that geologic characteristics of a given site are just as likely to be the cause of vertical migration. *Id.*

B. Adverse Impacts to Drinking Water Supply

Mr. Quarles also challenges the FEIS’ failure to support its assertion that if injectate migrates into the drinking water supply, its environmental impacts will be “SMALL.” Quarles Testimony, A19-32. The FEIS concludes that the impact will be “SMALL” because the concentration of any migration of the constituents would be low enough not to cause adverse impacts. FEIS 5-42. However, this is based on the incorrect conclusion that there is a safe concentration of the constituents and any migration will sufficiently dilute the constituents to this low concentration. The FEIS also incorrectly concludes the impacts will be “SMALL” because the design and testing of the injection well will prevent any leaks, and the monitoring will identify any leaks before adverse impacts can occur. FEIS 5-41 to 5-42. Again, the FEIS fails to support these conclusions. Quarles Testimony, A19.

As Mr. Quarles testifies, the constituents in the injected wastewater could cause potential adverse harms to the groundwater in the Upper Floridan Aquifer. Quarles Testimony, A20. Any concentration of the constituents above zero could cause adverse impacts, because of the high toxicity of the chemicals in the injectate. Quarles Testimony, A21. There is a risk of widespread contamination

of drinking water aquifers with the constituents that could last long into the foreseeable future due to the sheer volume of water to be injected. Up to 40 percent of FPL's injected fluids could contaminate the Upper Floridan Aquifer. *Id.* Additionally, the process of investigating and remediating the contaminated groundwater can be very long and costly. Moreover, the FEIS relied in part for its conclusion that impacts will be "SMALL" on studies that incorrectly suggest that the wastewater would be sufficiently diluted such that the constituents would only be in low concentrations and there would be no human health impact. Quarles Testimony, A22. These studies failed to address the specific characteristics of the Turkey Point site, including the potentially high rate of vertical migration of wastewater into the drinking water aquifer. In addition, the studies were not specifically designed to address human health impacts of migrated contaminants. Quarles Testimony, A23.

In his testimony, Mr. Quarles also observes that constituents such as tetrachloroethylene, heptachlor, ethylbenzene, and toluene are just a few of the many constituents that are in the wastewater. Quarles Testimony, A24. Those constituents are commonly associated with industrial or agricultural wastewater streams that are discharged into the sewerage system prior to reaching the treatment plant. The mere presence of these and other similar indicator constituents in the municipal wastewater effluent reported by FPL in the FEIS after treatment demonstrates that the municipal wastewater treatment plant is ineffective at removing all such constituents from the wastewater.

As Mr. Quarles testifies, the dilution of chemicals in wastewater can be affected by the speed of vertical migration. Quarles Testimony, A25. Vertical migration of wastewater from the Boulder Zone and into the Upper Floridan aquifer can be caused by a leaking geologic confining layer, the absence of a geologic confining layer, by faulty well construction, and by a well construction that deteriorates over time to allow leakage. This potential for rapid vertical migration of wastewater into the drinking water aquifer has been demonstrated at other sites in South Florida. *Id.* Groundwater may also migrate great

distances horizontally. Quarles Testimony, A26.

While the FEIS asserts that contamination of the drinking water can be detected if it occurs (FEIS 5-26), Mr. Quarles testifies that design and testing of injection wells will prevent leakage, and that seals and well casings can fail at any time and contaminate the groundwater before FPL is made aware. Quarles Testimony, A27. As a result, even a wastewater injection well application that is reviewed and approved by the Florida Department of Environmental Protection (“FDEP”) and constructed to FDEP standards can fail. Drilling an injection well to the near 3,000-foot depth of the Boulder Zone results in plenty of opportunities for human error and unknowns associated with voids in the bedrock and sealing multiple casings, for example. *Id.*

Moreover, as Mr. Quarles observes, the FEIS relies on the lower injection rates planned for the proposed site relative to the South District Plant to limit formation pressures and ensure the integrity of the constructed well. Quarles Testimony, A27; FEIS 5-40. However, no formation pressure test was ever conducted on FPL’s well to monitor leakage between the concrete that is in contact with bedrock formations and all outer steel casings. The contact between the bedrock and outer casing must be sealed for the entire depth of the well to prevent upward migration of wastewater along this pathway. This is especially critical where the bedrock is significantly fractured or where voids are present. Without these tests, it is not possible to document whether cement coverage and seal would prevent leakage. Furthermore, the FEIS fails to provide sufficient support that mechanical integrity tests performed every five years will be sufficient enough to detect stresses and strains on the injection wells that would allow for leakage. Quarles Testimony, A27.

Mr. Quarles also raises the concern that FPL’s groundwater monitoring system is likely unable to detect upward migration in time because (1) sampling will not be frequent enough due to possibility of a rapid rate of migration and (2) the constituents may migrate horizontally before they migrate

upward. Quarles Testimony, A28. Upward migration of wastewater along vertical pathways can occur in a matter of days. Given the potentially rapid rate of vertical migration, contaminants are likely to reach the Upper Floridan Aquifer before FPL's monitoring system detects the contamination. *Id.*

Moreover, the wastewater may migrate horizontally within the Boulder Zone prior to migrating vertically. Quarles Testimony, A28. FPL's intent to use a "dual-zone" groundwater monitoring well ("DZMW") to detect upward migration of wastewater may not provide an early indication of groundwater contamination because the DZMW is located 75 feet from the injection well. Experience shows that discrete vertical migration of wastewater can also bypass shallower monitoring wells through discrete vertical fractures in the upper-lying bedrock. As a result, the FEIS failed to provide sufficient evidence that the DZMWs that FPL intends to construct will detect upward migration of wastewater. *Id.*

Mr. Quarles' testimony further demonstrates that a leaking injection well that was presumably properly installed can allow vertical leakage of wastewater upward through bedrock layers and into the Floridan Aquifer. Quarles Testimony, A29. He cites two studies that have documented that possibility. While regulations and well installation protocols must be followed when drilling an injection well through an aquifer and multiple layers of bedrock, geologic conditions can make that process difficult to accomplish properly. *Id.*

In Mr. Quarles' expert opinion, the FEIS does not provide sufficient support for the proposition that any upward migration of the constituents from the injection well would be "SMALL" because leaks would be detected or mitigated before reaching the Upper Floridan Aquifer. Quarles Testimony, A30. The data relied on in the FEIS for this conclusion is flawed, and the FEIS fails to provide sufficient support that FPL's monitoring programs, although in line with FDEP requirements, will detect leakage and prevent constituents from reaching the Upper Floridan Aquifer. The FEIS also fails

to consider mitigation strategies in light of these deficiencies and past documented contaminations. As a result, the FEIS fails to provide sufficient support for its conclusion that the environmental impacts of the constituents to the Upper Floridan Aquifer would be “SMALL.” *Id.* According to Mr. Quarles, in making any determination on the environmental impact of upward migration of constituents into the Upper Floridan Aquifer, the FEIS should have evaluated the nature and extent of a potential contamination; the impact of such a contamination to the wastewater treatment plant; the cost and economic impact of the contamination; and the cost to modify treatment and effluent distribution methods. Quarles Testimony, A31.

VII. CONCLUSION

For the foregoing reasons, the ASLB should find that the FEIS for the Turkey Point COL is inadequate to comply with NEPA or to justify the licensing of Turkey Point Units 6 and 7.

Respectfully submitted this first day of March, 2017.

 /signed electronically by/

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