March 23, 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)	)	

NRC STAFF WRITTEN RESPONSE TO THE JOINT INTERVENOR AND CITY OF MIAMI INITIAL WRITTEN PRESENTATIONS AND TESTIMONY (NEPA CONTENTION 2.1)

INTRODUCTION

Pursuant to 10 C.F.R. § 2.1207(a)(2) and the Atomic Safety and Licensing Board (Board) November 22, 2016, and February 24, 2017, scheduling orders for the evidentiary hearing,[1] the United States Nuclear Regulatory Commission staff (NRC Staff) hereby presents its Written Response to the Initial Statements of Position and testimony filed by the City of Miami and the Joint Intervenors, respectively, regarding Contention 2.1.[2] For the reasons discussed below and

[1] Order (Amending Final Scheduling Order) (November 22, 2016) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16327A189); Order (Granting Unopposed Request for Extension of Time) (February 24, 2017) (ADAMS Accession No. ML17055C716).

[2] The initial statements of position filed by the parties are as follows: *Joint Intervenors' Initial Written Statement of Position on NEPA Contention 2.1 (Inadequate Evaluation of Groundwater Impacts)* (March 1, 2017 (ADAMS Accession No.ML17060A814) (Joint Intervenors' Statement of Position); *The City of Miami's (City) Initial Statement of Positions and Direct Testimony for Contention 2.1* (March 1, 2017) (ADAMS Accession No. ML17060A883) (City Initial Statement of Position); FPL's Initial Statement of Position in the Contested Hearing for Contention 2.1 (March 1, 2017) (ADAMS Accession No. ML17060B053) (FPL Initial Statement of Position); and *NRC Staff Initial Statement of Position* (March 1, 2017) (ADAMS Accession No. ML17060B051) (Staff Initial Statement of Position).

in the attached rebuttal testimony, Contention 2.1 is without merit, and the Board should rule in favor of the NRC Staff.

BACKGROUND

On March 1, 2017, the City of Miami, the Joint Intervenors, Florida Power and Light Company (FPL), and the NRC Staff filed their initial statements of position, testimony, and supporting exhibits on Contention 2.1. The Staff set forth the background of this proceeding before March 1, 2017, in the Staff's Initial Statement of Position, and that background need not be revisited here. Staff Initial Statement of Position at 4-7. Subsequently, the Board granted the "NRC Staff Motion in Limine to Exclude Portions of the City of Miami Prefiled Testimony or in the Alternative Strike Portions Thereof," dated March 8, 2017 (ADAMS Accession No. ML17067A559) and the "[FPL] Motion to Strike Portions of the City of Miami's Initial Statements of Position and Direct Testimony for Contention 2.1," dated March 8, 2017 (ADAMS Accession No. ML17067A570). "Memorandum and Order (Ruling on Motions to Strike or Exclude)" (unpublished) at 2 (March 15, 2017) (ADAMS Accession No. ML17074A581) (Board March 2017 Order).[3] The Board also granted in large measure the "NRC Staff Motion in Limine to Exclude Portions of the Joint Intervenor Exhibits or in the Alternative Strike Portions Thereof" dated March 8, 2017 (ADAMS Accession No. ML17067A564). Board March 2017 Order at 5-8. The Board March 2017 Order clarifies the

[3] In its Initial Statement of Position, the City of Miami does not adduce any evidence other than that offered by the Joint Intervenors to support its claims regarding the potential for upward migration of injected wastewater into an Underground Source of Drinking Water (USDW). City Initial Statement at 3-4, 6. Insofar as the City has incorporated by reference the evidence submitted by the Joint Intervenors, and has not adduced any other evidence on Contention 2.1, the Staff will not explicitly address the City's arguments in this response. The Staff requests the Board to consider the Staff response to the Joint Intervenors as also responding to the City. The City does, however, complain that NUREG-2176, "Environmental Impact Statement for Combined Licenses (COLs) for Turkey Point Nuclear Plant Units 6 and 7, Final Report" dated October 2016 (FEIS) (NRC-008A-D), "ignores the fact" that some municipalities in Miami-Dade County use the Upper Floridan aquifer as a source of drinking water. *Id*. at 3. The City, however, does not offer any evidence regarding how injection at the Turkey Point site might possibly affect such a source of drinking water.

portions of the Joint Intervenors' arguments that are outside the scope of Contention 2.1 and its bases, as admitted.

DISCUSSION

I. Legal and Regulatory Requirements

At issue in this proceeding is the narrow question of whether the FEIS adequately assessed impacts of the proposed deep injection wells as set forth in Contention 2.1. *See Florida Power & Light Co*. (Turkey Point Units 6 & 7), LBP-16-03, 81 NRC 169, 185-86 (2016). Through direct testimony and initial statements, the Joint Intervenors have made numerous claims regarding the adequacy of the FEIS. As detailed, discussed and rebutted in the following sections, Joint Intervenors fail to recognize prior decisions that establish that: 1) the NRC is free to select its own methodologies in evaluating environmental impacts, as long as they are reasonable. *Entergy Nuclear Generation Co.* (Pilgrim Nuclear Power Station), CLI-10-11, 71 NRC 287, 315-16 (2010); 2) NEPA must be construed "in the light of reason if it is not to demand virtually infinite study and resource." *Id*. (quoting *Natural Res. Def. Council* v. *Hodel*, 865 F.2d 288, 294 (D.C. Cir. 1988)); and, 3) in challenging the Staff's environmental review, Joint Intervenors must identify, with some specificity, the alleged deficiencies in the Staff's NEPA analysis. *See Hydro Resources, Inc.* (Albuquerque, NM), CLI-99-22, 50 NRC 3, 13 (1999).

For the reasons discussed herein and set forth in greater detail in the NRC Staff's Pre-filed Direct[4] and Rebuttal Testimony,[5] the FEIS adequately assesses impacts of the proposed deep injection wells within the range dictated by the nature and scope of the proposal and has

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[4] Revised NRC Staff Testimony of Ann L. Miracle, Daniel O. Barnhurst, Paul D. Thorne, and Alicia Williamson-Dickerson Concerning Contention 2.1 (Impacts of Deep Well Injection of Four Constituents in Cooling-Tower Blowdown), dated March 1, 2017, as corrected March 23, 2017 (NRC-002-R) (Staff Direct Testimony).

[5] NRC Staff Rebuttal Testimony of Ann L. Miracle, Daniel O. Barnhurst, and Paul D. Thorne Concerning Contention 2.1 (Impacts of Deep Well Injection of Four Constituents in Cooling-Tower Blowdown), dated March 23, 2017 (NRC-072) (Staff Rebuttal Testimony).

rigorously explored, objectively evaluated, and fully documented the Staff findings and conclusion. Accordingly, the Board should find in favor of the NRC Staff.

II. Witnesses

The Staff Rebuttal Testimony (NRC-072) presents the opinions of three qualified witnesses, Ann L. Miracle, Daniel O. Barnhurst, and Paul D. Thorne, on certain claims made in the "Pre-filed Initial Testimony of Mark A. Quarles Regarding Joint Intervenors' Contention 2.1," dated March 1, 2017 (Quarles Testimony). In rebutting the Joint Intervenors' positions on Contention 2.1, the NRC Staff is relying on three of the same four expert witnesses who authored the Staff's pre-filed direct testimony. *See* NRC Staff Direct Testimony; NRC-002-R at A107. The qualifications of these witnesses are discussed in the Staff's initial filings. *See* NRC Staff Initial Statement of Position at 9-10; Staff Direct Testimony at A1-A3; and Statements of Professional Qualifications (NRC-003, NRC-004, and NRC-005). Specifically, the NRC Staff Rebuttal Testimony (NRC-072) will rebut the Joint Intervenors' assertions that: (1) heptachlor, ethylbenzene, toluene, or tetrachloroethylene, the chemicals at issue in Contention 2.1 (the Constituents), at the concentrations listed in FEIS (NRC-008A) Table 3-5 have any effect on human health; (2) the data collected from Exploratory Well No. 1 (EW-1) at the Turkey Point site are insufficient to characterize the Turkey Point site; (3) seismic reflection tests are the only tests sufficient to characterize the Turkey Point site; (4) regional geological studies show that the Middle Confining Unit will not provide adequate confinement at the site; (5) migration at the site may result from well construction issues and if injection wells fail during operation, such failure may remain undetected for lengthy periods; and (6) the Staff conclusion regarding the impacts of upward migration in the FEIS are somehow unsupported.

III. The Joint Intervenors Have Not Shown That NEPA Contention 2.1 Has Merit

A. Joint Intervenors Incorrectly Seeks to Link the Four Constituents Concentrations to Toxicology and Adverse Impacts

The Quarles Testimony challenges several aspects of the FEIS discussion and analysis of impacts to the Upper Floridan aquifer. Quarles Testimony A19 – A30 at 17 – 24. Specifically, Joint Intervenors Witness Mark A. Quarles (Mr. Quarles) argues that: 1) the FEIS assumes that the concentrations of the constituents would not cause adverse impacts to the Upper Floridan aquifer based on an incorrect conclusion that there are safe concentrations of the constituents; 2) that any concentration of the constituents above zero could cause adverse impacts and, 3) that "even at minute concentrations," tetrachloroethylene and heptachlor can cause adverse health effects. Quarles Testimony A19 - A21 at 17.

The Joint Intervenors claim that the FEIS concludes that the concentrations of the constituents would not cause adverse impacts to the Upper Floridan Aquifer is incorrect. *See* Quarles Testimony A19 at 17. As first described in Staff Direct Testimony (NRC-002) A27,the NRC Staff relied upon an analysis of the EPA safe water drinking standards to support the conclusion that the Constituents would not cause adverse impacts to the Upper Floridan Aquifer. Staff Rebuttal Testimony (NRC-072) A5 at 3. Joint Intervenors' through Mr. Quarles have not presented any evidence either to support the statement or to demonstrate that the FEIS was incorrect or mistaken. Moreover, even if there was a mistake in the FEIS, mistakes that are not significant or material do not indicate that the Staff's NEPA review was inadequate. *See Exelon Generation Co.* (Early Site Permit (ESP) for Clinton Site), CLI-05-29, 62 NRC 801, 811 (2005) ("[I]n an NRC adjudication, it is Intervenors' burden to show the 'significance and materiality' of mistakes in the EIS"). Joint Intervenors have failed to support their assertion that the FEIS includes an "incorrect conclusion" or demonstrate the significance and materiality of any asserted mistake.

Next, Joint Intervenors incorrectly asserted that any concentration of the constituents above zero could cause adverse impacts. Quarles Testimony at A21. For the reasons discussed below, Joint Intervenors' statement regarding the concentration of the Constituents are factually incorrect and they provide no support for those statements. As discussed in Revised Staff Direct Testimony, the EPA set the Maximum Contaminant Level Goal for a contaminant as the concentration at which there is no known or anticipated adverse effect on the health of persons and which allows an adequate margin of safety. Staff Rebuttal Testimony (NRC-072) at A5 – A8 at 3 – 5. None of the South District Wastewater Treatment Plant water samples had concentrations of the toluene, ethylbenzene, tetrachloroethylene, or heptachlor—the four constituents that are the subject of the contention in this proceeding—that exceeded the Maximum Contaminant Levels for each constituent Revised Staff Direct Testimony (NRC-002-R) at A30, A33, A34, and A35; Staff Rebuttal Testimony (NRC-072) A5. Moreover, with additional treatment technology added in 2013, samples taken after that time show that none of the constituents had any detectable concentration. Revised NRC Staff Direct Testimony (NRC-002-R) at A29. The EPA Maximum Contaminant Levels for toluene and ethylbenzene are identical to the Maximum Contaminant Goal Levels for these chemicals. Staff Rebuttal Testimony (NRC-072) A5 at 3 – 4. The EPA set Maximum Contaminant Levels for both heptachlor and tetrachloroethylene at concentrations above zero that are considered protective of human health. *Id*.

Mr. Quarles lists health-related impairments for all of the constituents except toluene, and references fact sheets for ethylbenzene, tetrachloroethylene, and heptachlor. Quarles Testimony, A21 at 17-18. As set forth in Staff's Direct Testimony, ethylbenzene was not detected in the water samples at the South District Wastewater Treatment Plant. Staff Rebuttal Testimony (NRC-072) A7 at 4-5. The fact sheets specific to health effects for ethylbenzene (INT-016 at 2) state that EPA has determined that an acute drinking water concentration of 30 parts per million (30 milligrams per liter), and a 10 day drinking water exposure of 3 parts per

million (3.0 milligrams per liter) would not cause adverse effects in a child. The fact sheet goes on to explain that a lifetime exposure to ethylbenzene at 0.7 parts per million (0.7 milligrams per liter) is also not expected to cause adverse effects. *Id*. The 0.7 milligrams per liter is also the EPA Maximum Contaminant Level and Maximum Contaminant Level Goal. Joint Intervenors did not directly challenge or provide information to support a challenge of the EPA Maximum Contaminant Level and Maximum Contaminant Level Goal nor did Joint Intervenors provide information to support contesting the Staff reliance on the EPA Maximum Contaminant Level and Maximum Contaminant Level Goal.

Joint Intervenors' state that at minute concentrations, heptachlor impairs immune and nervous system functions. Quarles A21, pg. 18. Staff disagrees noting that Joint Intervenors' statement is both unsupported and contradicted by Joint Intervenors' INT-016. Staff Rebuttal Testimony (NRC-072) A8 at 5. INT-016 states that little is actually known about human health effects following exposure to heptachlor, and that nervous system damage may occur following exposure to high levels of heptachlor. *Id*. According to Joint Intervenors' exhibit, the Food and Drug Administration sets a limit of 0.01 parts per million (0.01 milligrams per liter) for heptachlor on raw food crops, and 0.3 parts per million (0.3 milligrams per liter) on edible seafood for human consumption. *Id*. citing INT-016, page 6. The EPA concentrations for safe drinking water are listed at 0.0004 milligrams per liter, which is the EPA Maximum Contaminant Level for heptachlor. Staff Rebuttal Testimony (NRC-072) at A8. The EPA Maximum Contaminant Level for heptachlor in drinking water is seven hundred fifty times less than the FDA limit for heptachlor ingestion on edible seafood and twenty-five times less than the FDA limit for ingestion from raw food crops. The FDA heptachlor limit for food sources represents a minute concentration that is considered safe for human consumption, and the more minute concentration of heptachlor set by EPA as the Maximum Contaminant Level is protective of human health and are not known to impair immune and nervous system functions. Staff

Rebuttal Testimony (NRC-072), A8-A10. Joint Intervenors fail to support the assertion that the exposure above zero could result in health-related impairments.

B. Joint Intervenors Witness Quarles Incorrectly Interprets and Challenges Data from the EW-1 Exploratory Well.

Joint Intervenors claim in their testimony that Staff's information about the geologic characteristics at the Turkey Point site is inadequate. First, they argue that the conclusions reached in the FEIS are based on a "single deep bore hole test." Joint Intervenors' Initial Statement at 18; Quarles Testimony A9 at 6. This claim, however, is not accurate. As noted in the FEIS and in Staff's Initial Testimony, not one, but two bore holes were drilled and more than one test was conducted to assess the geologic characteristics of the site. Staff Rebuttal Testimony (NRC-072), A11 at 7 (*see also* NRC-008A at 5-26 and NRC-002-R at A107). Staff also gathered data from a number of additional sources to support its analyses regarding the receiving capacity of the Boulder Zone and the confining capability of the Middle Confining Unit in the FEIS, which Joint Intervenors neither dispute nor even mention. *Id*., A12 at 7. These data, including hydrogeological testing, laboratory testing and data analysis, were collected at each location. *Id*. Indeed, the tests FPL performed included every test that Mr. Quarles testified needed to be conducted in his Second Affidavit (INT-003, ¶33, at 6-7), and even included additional testing beyond those which Mr. Quarles claimed were needed. These same tests will be performed at each of the 12 injection wells and 6 monitoring wells on the Turkey Point site. *Id*. Mr. Quarles appears to be saying, and Joint Intervenors appear to argue, that the information Mr. Quarles previously indicated was necessary and adequate to reach an appropriate conclusion regarding the Turkey Point site, is no longer enough. Except for seismic reflecting tests, which are discussed below, Joint Intervenors provide no additional testing that they contend must be completed for the FEIS analysis regarding the confining nature of the Middle Confining Unit to be well-founded and adequate.

Related to this first argument, Joint Intervenors also assert that the information gathered from the borehole test indicate that the confining layers of bedrock in the Middle Confining Unit are permeable. Joint Intervenors' Initial Statement of Position at 18-19; Quarles Testimony A9 at 6. However, the Staff based its conclusion regarding the confining nature of the Middle Confirmatory Unit on a wide range of data that Joint Intervenors do not recognize. *See* Staff Rebuttal Testimony (NRC-072), A12 at 7. Accordingly, Joint Intervenors' argument that the FEIS conclusion that the confinement capability of the Middle Confining Unit is inadequate is unfounded. Not only was data gathered from two exploratory wells instead of one, but the Staff also examined a number of different sources of data and studies to reach its conclusion that Joint Intervenors did not consider or correctly characterize.

Second, Mr. Quarles questions the methodology in the McNabb study, which Staff used in part as a basis for its conclusion about the likelihood of vertical migration. Quarles Testimony A14 at 10. Mr. Quarles claims that inspected pulverized drill cuttings from deep depths do not provide adequate information to determine bedrock conditions such as the presence of voids, fractures, faults, hydraulic capacity, or the confining nature of the bedrock and should be used for "qualitative, general evaluation[s] only." *Id.*, A14 at 10. He does not explain why. *Id*. Moreover, Mr. Quarles does not recognize that this consistent with how FPL and the NRC Staff used this information. Staff Rebuttal Testimony (NRC-072) A16. Drill cuttings provide useful information on rock type and, in combination with the known depths at which they are obtained, are adequate to differentiate individual geologic units. *Id*. Further, Mr. Quarles says the McNabb study did not consider a wide enough range of bedrock core samples. He says that the ten core samples taken from the bedrock only included 122 feet of the 3,230-foot well. Mr. Quarles argues that this represents only 4% of the total depth, leaving 96% of the bedrock conditions to be "generalized." Quarles Testimony, A14 at 10. Mr. Quarles's claim is incorrect. The purpose of the coring at EW-1 was to evaluate the Middle Confining Unit. As a result, the cores were purposefully selected for this interval, and not for the entire well depth, as Mr.

Quarles asserts. Core samples were evaluated through laboratory testing to determine key attributes affecting migration, such as porosity, permeability, hydraulic conductivity, specific gravity, etc. Bedrock conditions for the remaining portions of the core were not generalized but were evaluated through lithologic description of cuttings, lithologic logging and extensive geophysical logging. Staff Rebuttal Testimony (NRC-072), A16 at 11.

Finally, Mr. Quarles states in his testimony that certain tests performed by FPL indicate that the Middle Confining Unit has a low confinement capability and that there might be voids in the bedrock. Quarles Testimony A11 at 7; A13 at 9. Mr. Quarles claims that there was a low percentage of core samples recovered, as reported in the McNabb study cited by Staff in the FEIS. According to Mr. Quarles, this indicates that there are voids in the bedrock, thereby making the Middle Confining Unit a poor confining layer. *Id*., A11 at 7. However, a lack of core recovery does not indicate the presence of voids in the bedrock. There are many reasons for a low recovery percentage of core samples, such as mechanical stresses created by the drilling process, or the clogging of the core barrel during drilling. Staff Rebuttal Testimony (NRC-072), A16 at 11. As such, low recovery percentages do not by themselves indicate bedrock voids, and Joint Intervenors provide no evidence, besides Mr. Quarles's claims, that suggest the low core recovery in this case was due to voids being present in the bedrock. Mr. Quarles makes a similar claim regarding the packer test results. He argues that the failed packer tests results indicate that the bedrock strata above and below the packers in the confinement unit could be hydraulically connected. Quarles Testimony A13 at 9. However, as stated by Staff in its rebuttal testimony, the failed packer tests only mean that the test results are of no use. Packer tests can fail for any number of reasons, and their failure in this case does not indicate that there was permeable rock in or near the tested interval. Staff Rebuttal Testimony (NRC-072), A15 at 10. Mr. Quarles provides no evidence to conclude otherwise.

C. Seismic Reflections Tests are Unnecessary to Characterize the Geology of the Turkey Point Site.

In his testimony, Mr. Quarles claims that geologic features that would allow upwelling may be present at the Turkey Point site and that seismic reflection tests are necessary to rule out the existence of such features at the site. As explained below, however, there is no evidence of such features at the Turkey Point site, nor are seismic reflection tests the only means to explore that issue.

By way of background, seismic reflection data from a number of intersecting reflection survey lines can be interpreted to create a three-dimensional model, but there is still uncertainty in the modeled features, especially in areas between lines where seismic data has been collected. Staff Rebuttal Testimony (NRC-072) A19. Seismic data processing and interpretation is a complex process that uses stratigraphic thickness data and sonic velocities measured in boreholes to translate the seismic reflections to information on geologic stratigraphy and subsurface features such as faults. *Id*. Interpretations of seismic data are also not unique with different interpretations potentially fitting the same data set. *Id*. Seismic interpretations should be viewed as providing an approximation of subsurface features rather than a clear picture with precise depths and locations. *Id*. In addition, interpretations of seismic reflection data only show reflective subsurface structures and do not provide any information on the hydraulic flow properties of the structures. *Id*.

In his testimony, Mr. Quarles states that "seismic-reflection analysis is an investigative tool favored by USGS to study the very question raised in the FEIS and Contention 2.1." Quarles Testimony A15 at 10. While Mr. Quarles seems to acknowledge that seismic reflection data by itself is not sufficient to characterize the geology of a specific location (referring to information "that includes, among other analyses, seismic-reflection tests" *id.*, A9 at 6; "seismic-reflection combined with other analyses" *id*.), Mr. Quarles also seems to imply that seismic reflection tests can be used to characterize the geology of a site without reference

to other data. Seismic reflection surveys alone, however, would not be sufficient to characterize the site because they do not provide information on the hydraulic flow properties of the subsurface, or the properties of subsurface fluids. Staff Rebuttal Testimony (NRC-072) A20. In addition, data on the sonic velocities of materials in the subsurface are required for processing and interpreting seismic reflection data. *Id*. Knowledge of site geologic structure and geologic history is also required so that patterns seen in the seismic data can be interpreted. *Id*. This information can only be obtained from borehole data. In one of the studies cited by Mr. Quarles, Cunningham recognizes that seismic data must be correlated to actual hydrostratigraphic units using borehole data, such as drill-cutting samples and a suite of borehole geophysical logs (NRC-050 at 2). Staff Rebuttal Testimony (NRC-072) A20.

In his testimony, Mr. Quarles refers to U.S. Geological Survey (USGS) studies that used seismic reflection tests in south Florida (Quarles Testimony A15, A18), and indicates that "[t]he results of the Cunningham 2012 and 2015 [USGS] studies thereby strongly undermine the FEIS' conclusion that the Turkey Point area has an appropriate confining layer to prevent upward migration of injected wastewater." Quarles Testimony A15 at 13. Results of the referenced reports do not "undermine the FEIS' conclusion that the Turkey Point area has an appropriate confining layer to prevent upward migration of injected wastewater" because they do not identify features at the Turkey Point site that are likely to result in upward migration of injected wastewater. Staff Rebuttal Testimony (NRC-072) A21. The USGS conducted seismic reflection surveys with an objective to "improve current understanding of the relation between seismic sequence stratigraphy, imaged tectonic and karst structures, and the potential for vertical transport of injected effluent from the Boulder Zone upward into [Underground Sources of Drinking Water] USDWs in southeastern Florida" (NRC-053 at 6). Staff Rebuttal Testimony (NRC-072) A21. Most of the surveys were conducted from barges in canals and in Biscayne Bay, with a single ground-based seismic line. *Id*. The results of these surveys are

documented in the FEIS, along with the Staff evaluation of them (NRC-008A at 2-55, 2-56, and 5-25). Staff Rebuttal Testimony (NRC-072) A21.

Results from the seismic surveys are interpreted linear sections through the subsurface showing features based on the reflection of the shockwaves. *Id*. The USGS studies Mr. Quarles cites detail the use of seismic-reflection techniques to evaluate subsurface structure and identify faults and karst collapse features. *Id*. Kevin Cunningham is the primary author of these USGS studies, which were discussed in the FEIS. *Id*. These studies were conducted in locations throughout southeast Florida and did identify karst collapse structures and faults. *Id*. (Karst terrain is created when rocks composed of soluble minerals are dissolved by surface water or groundwater and results in the formation of solution channels, caves, and sinkholes. Karst collapse structures are formed when rock or sediment collapses into open cavities as result of continued dissolution.) *Id*. The USGS seismic reflection interpretation shows a possible geologic fault in Biscayne Bay oriented approximately parallel to the shoreline (NRC-053 at 2). Staff Rebuttal Testimony (NRC-072) A21. However, this fault is shown to terminate about five (5) miles north of the location of the proposed Turkey Point injection wells, and does not support Mr. Quarles's position that the study shows such a feature may exist at the Turkey Point site. *Id*.

In addition, the Cunningham (USGS) studies identified a karst collapse structure from borehole data at the North District wastewater injection site and interpreted to extend about 900 feet vertically from the upper part of the Boulder Zone to a section of the Lower Floridan aquifer, which overlies the Boulder Zone and is beneath the Middle Confining Unit at that location. *Id*. The karst collapse feature at the North District Plant did not extend above the Lower Floridan aquifer, which is below the Middle Floridan confining units. *Id*. And the feature did not extend into any overlying Underground Source of Drinking Water (USDW) aquifer. *Id*. Likewise, the existence of a karst collapse structure near the Turkey Point injection wells would not necessarily provide a pathway for injectate to migrate into the Underground Source of

Drinking Water (USDW) aquifer. *Id*. Moreover, the North District Plant is more than 34 miles from the Turkey Point site, and the existence of the karst collapse feature at the North District Plant does not imply that such a feature is likely to exist near the Turkey Point site. *Id*.

To support the asserted need for seismic reflection tests, Mr. Quarles states "[the Cunningham 2012 study demonstrated that widespread fractures and faults exist in the area near Turkey Point, and those bedrock conditions render bedrock layers ineffective as confining layers." Quarles Testimony A15, at 11. To the contrary, these studies were not conducted in the "area near Turkey Point." Staff Rebuttal Testimony (NRC-072) A22. The Cunningham 2012 and 2015 reports did identify faults and karst collapse features in the region. *Id*. However, these features are absent, or confined to the Lower Floridan aquifer in the seismic profiles nearest the Turkey Point site. *Id*. Karst collapse features confined to the Lower Floridan aquifer will not provide a pathway to the Upper Floridan aquifer or any Underground Source of Drinking Water (USDW). *Id*. The Cunningham 2015 report itself shows that such features are absent in profile EW-7 located two and one-half (2.5) miles northeast of the site offshore in Biscayne Bay (NRC-053 Figure 8). Staff Rebuttal Testimony (NRC-072) A22. Similarly, Cunningham (2015) obtained similar results near the South District Wastewater Treatment Plant, as shown in the nearest onshore data profile (C1) obtained south of that plant, which is nine (9) miles north of Turkey Point (NRC-053 Figure 6). Staff Rebuttal Testimony (NRC-072) A22. The only karst collapse feature identified in Cunningham (2015) is within the Lower Floridan aquifer and does not extend upward into the Middle Confining Unit. *Id*. Cunningham interprets the data to show a fault, but this fault is two (2) miles offshore and does not appear to extend through the Middle Confining Unit on the profile. NRC-053, Plate 1; Staff Rebuttal Testimony (NRC-072) A22. A reverse fault is also located 25 miles northeast of the Turkey Point site in Biscayne Bay. NRC-053, Figure 1; Staff Rebuttal Testimony (NRC-072) A22. As a result, Cunningham did not identify any potential pathways through the confining unit at or near the Turkey Point site. Staff Rebuttal Testimony (NRC-072) A22. The

faults and karst collapse features identified in the Cunningham studies (NRC-050, NRC-053) are shown on seismic reflection profiles that are further from the Turkey Point site than the EW-7 and C1 profiles described above, and it is not reasonable to infer that these features extend onto the Turkey Point site. *Id*.

In his testimony, Mr. Quarles states that "[o]nly 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 Testimony ¶ A9 at 6. The Staff agrees that survey interpretations conducted by the USGS in south Florida provide useful information to help understand the subsurface stratigraphy and tectonic features. Staff Rebuttal Testimony (NRC-072) A23. However, a similar seismic survey at the proposed Turkey Point injection site is not necessary to determine the ability of the Middle Confining Unit to prevent upward migration at the site because seismic data do not indicate the probability of fluid migration through faults or karst collapse features beneath a site. *Id*. The USGS has used seismic-reflection data to "provide useful evidence for the presence of faults and fractures that can plausibly function as permeable pathways" (NRC-052 at 3). Staff Rebuttal Testimony (NRC-072) A23. However, Mr. Quarles does not identify limitations of seismic-reflection techniques that are important to this discussion. *Id*. Seismic-reflection data can only identify structures that may be capable of transmitting fluid. *Id*. They do not provide any indication of the hydraulic capability of the structure. *Id*. A seismic survey would also not necessarily reveal the existence of a tectonic fault or karst collapse structure that could result in upward migration. *Id*. For example, the karst collapse structure that was identified based on borehole data at the North District wastewater injection site was not recognized on the seismic reflection profiles acquired in the nearby C–9 Canal, Oleta River, Maule Lake, and the Intracoastal Waterway. *Id*. Further, there is no evidence that tectonic faults or karst collapse structures exist within the area of the injection target zone for Turkey point. *Id*. And if such features did exist, they would not necessarily result in vertical flow of

injectate from the Boulder Zone because there is no evidence that such features might be hydraulically conductive. *Id*.

Accordingly, the Joint Intervenors are incorrect in their assertion that seismic reflections tests are necessary at the Turkey Point site to rule out upward migration of injectate, and this assertion provides no support for Contention 2.1.

D. The Joint Intervenors Misconstrue the Regional Studies of Stratigraphy

Joint Intervenors take issue with a number of studies Staff analyzed, evaluated, and referred to in the FEIS. In its rebuttal testimony, Staff responded to Mr. Quarles's opinions regarding the studies discussed in his initial testimony. These responses will be summarized below.

1. Cunningham Study

Mr. Quarles argues in his testimony that the 2012 and 2015 Cunningham studies conclude, or could be used to conclude, that upwelling of injected wastewater from the Boulder Zone into the Middle Confining Unit resulted from subsurface geological features, such as faults or karst collapse structures. Quarles Testimony A15 at 13. Quarles also argues that the Middle Confining Unit is "semi-confining" because of its "tendency to leak" in the vicinity of the site, a conclusion he says the Cunningham study supports. *Id.*

As the Staff states in its rebuttal testimony, the 2012 and 2015 Cunningham studies were conducted only to locate features which "represent a plausible physical system for upward migration" (Cunningham 2015 at 24), but do not measure the ability of the feature to transmit fluid. Staff Rebuttal Testimony (NRC-072), A25 at 19. Staff also asserts that no feature that could act as a potential pathway for vertical migration of wastewater was detected in the vicinity of the Turkey Point site, and that this conclusion is supported by a number of other studies (McNeill 2002 (at 3), Maliva et al 2007 (at 1395), Dausman et al 2010 (at 147) and Walsh and Price 2010 (at 15)). *Id*. Further, Staff testifies that these studies conclude that upwelling near

the Turkey Point site, when it had occurred, "was likely the result of well-related issues and had not reached the Upper Floridan aquifer." *Id.*

Staff also disagrees with Mr. Quarles's characterization of the Middle Confining Unit as "semi-confining" and subject to leaks. To support his assertion, Mr. Quarles cites to Cunningham 2015, which based its conclusion on language used by Reese and Richardson 2008. Quarles Testimony A15 at 13. However, Staff testifies that the Reese and Richardson report summarized regional information for the Middle Confining Unit to make this and other general statements, such as that the degree of confinement is "uncertain," a term Mr. Quarles repeats in his testimony. Staff Rebuttal Testimony (NRC-072), A24 at 18. Reese and Richardson are clear that the Middle Confining Unit is more confining in areas where it is thicker and where the lithology is low-permeability. *Id*. (citing NRC-040 at 57). In particular, Staff testifies that Reese and Richardson conclude that sufficient confinement "may also be provided by dense unfractured dolostone in some areas" *Id*. (citing NRC-040 at 58). This conclusion is consistent with conclusions in other studies, such as McNeill 2002 and Maliva et al 2007, which indicate that thin, unfractured dolostones with low hydraulic conductivity provide effective confinement of Boulder Zone water and injected effluent. *Id*. *See also* Staff Initial Testimony at A83 and A100.

The Staff disagrees with the conclusions Mr. Quarles draws in his testimony regarding the Cunningham study. While Cunningham seems to suggest that vertical pathways exist in the Middle Confining Unit, other studies, including one upon which Cunningham relies, establish that upwelling did not occur in the Middle Confining Unit due to geologic features and did not reach the Upper Floridan aquifer.

2. Walsh and Price Study

In his testimony, Mr. Quarles argues that the Staff's conclusion in the FEIS regarding vertical migration of injected wastewater is contradicted by the Walsh and Price study. Quarles Testimony A16 at 14. He says that this study "concluded that deep well injection into the

Boulder Zone contaminated the Floridan Aquifer as a result of unintended vertical and horizontal migration of municipal wastewater into the aquifer from wastewater injection wells." *Id*.

The Staff disagrees with Mr. Quarles's assertion. The Walsh and Price study is discussed repeatedly in the FEIS, and Staff based its findings in part on this study. Staff Rebuttal Testimony (NRC-072), A26 at 20; *see also, e.g.,* NRC-008A at 2-56 to 57, 5-23, 5-25, 5-28, 5-40. As Staff testifies, Walsh and Price concluded that vertical upwelling along "rapid pathways could be the result of construction related events such as drifting boreholes, or the result of structural anomalies such as fracturing or karst features...," but further stated that "no fracturing of the confining strata at either the North District Wastewater Treatment Plant or the South District Wastewater Treatment Plant has been reported." *Id*. (citing NRC-046 unnumbered at 13). Additionally, Mr. Quarles argues that the Floridan aquifer is "contaminated" by vertical migration of wastewater. Quarles Testimony A16 at 16. However, as Staff testifies in its rebuttal testimony, the Walsh and Price study does not provide support for Mr. Quarles's argument, and, in fact, undermines his argument. Staff Rebuttal Testimony (NRC-072), A26 at 20. Accordingly, Walsh and Price support staff's conclusion in the FEIS that the injected effluent "did not appear to extend up to the [Upper Floridan Aquifer] UFA." *Id*. (citing NRC-046 unnumbered at 15).

Contrary to Mr. Quarles's arguments, the conclusions in the Walsh and Price study are not at odds with Staff's conclusion in the FEIS. In fact, the Walsh and Price findings *support* the Staff conclusion because they establish that upwelling detected at the South District Wastewater Treatment Plant has not reached the Upper Floridan aquifer and that upwelling was likely the result of well-related issues and not fracturing. Staff Rebuttal Testimony (NRC-072) A25.

3. Starr et al. Study

Mr. Quarles argues that the Starr et al study found that "groundwater in the Upper Floridan Aquifer at the South District Plant is contaminated with treated wastewater." Quarles

Testimony A17 at 16. Mr. Quarles concludes that "[t]his finding implies that contaminants are migrating through the Middle Confining Unit. Starr at 38." *Id.* He says that the Starr report contradicts the Staff's conclusions regarding the Middle Confining Unit in the FEIS because the Starr et al. report indicates that the Middle Confining Unit is not a "competent, low hydraulic conductivity layer that is capable of preventing upward migrations of fluids from the Boulder Zone into the overlying underground source of drinking water." *Id.*, A16 at 15.

Staff testifies that, as explained in the FEIS, the Starr et al study does indeed indicate that upwelling at the South District Wastewater Treatment Plant had reached the Upper Floridan aquifer. Staff Rebuttal Testimony (NRC-072), A29 at 22; *see also* NRC-008A at 5-23. However, that conclusion, which was reached by a number of other studies conducted during the same time, was incorrect because it relied on an incorrect interpretation of the hydrostratigraphy beneath the site. This explanation was discussed a number of times in the FEIS. *See, e.g.,* NRC-008A at 5-23, E-112-E113. Further, as is explained throughout the body of the Starr et al report, the authors expressed significant and repeated concern regarding the quality of the data which had been provided to them for their review, and, therefore, their ability to draw meaningful results regarding the confining nature of the Middle Confining Unit at the South District Wastewater Treatment Plant from this data. Staff Rebuttal Testimony (NRC-072), A30 at 23. Contrary to Mr. Quarles's assertion, however, the Starr study *did not* conclude that the confining capability of the Middle Confining Unit was inadequate. In fact, as discussed in Staff's rebuttal testimony, the Starr report concluded that the Middle Confining Unit was more adequate as a confining layer than the unreliable data provided indicated. The study concluded that, overall, the spatial distribution of contaminants "suggests that isolated conduits, such as inadequately sealed wells or natural features, provide pathways for contaminated water to migrate upward from the Boulder Zone, but contaminants are not migrating upward through the Middle Confining Unit across a broad area." *Id*. (citing NRC-044 at 39 to 40; NRC-008A at 5-23 and 5-24.

Mr. Quarles's reliance on the Starr study is therefore misplaced. Mr. Quarles selects quotes from the Starr study that indicate a conclusion that was not ultimately reached by the researchers. As Staff explains in their rebuttal testimony and numerous times in the FEIS, the Starr study was based on a questionable data set that indicated the Middle Confining Unit was an inadequate as a confining layer.

4. EPA and Bloetscher Risk Assessments

In his testimony, Mr. Quarles states that the risk assessments performed by the EPA 2003 and Bloetscher et al (2005) do not support the Staff's impact determination because they fail to address "the potentially high rate of vertical migration of wastewater into the drinking water aquifer." Quarles Testimony A23 at 19-20. Mr. Quarles also states that the EPA risk assessment is limited due to uncertainties in the values for some model input parameters, and that the Bloetscher assessment was "not designed or performed specific to the Turkey Point (or even the South District Plant)" and that it "evaluated, generalized, and compared wastewater disposal alternatives in the southeast Florida region." *Id.* at 20.

Regarding the risk assessments supporting the Staff's impact determination, Staff testifies in rebuttal testimony that Mr. Quarles's statement that the determination is unsupported is incorrect. Staff Rebuttal Testimony (NRC-072), A32 at 25-27. As explained in the FEIS, the EPA risk assessment evaluated the impact to human health of "rapid flow through preferential flowpaths (such as a failed well or natural conduit)." *Id*. at 25 (citing NRC-008A at 5-40; NRC-010 at 4-44). The Bloetscher et al study also evaluated the impact of rapid vertical migration on human health by including scenarios of: 1) rapid migration of wastewater from Boulder Zone to drinking water well in Upper Floridan aquifer, and 2) direct release of wastewater into the Upper Floridan aquifer and flow to drinking water wells. *Id*. at 26 (citing NRC-011 at 484). These scenarios are conservative because they do not take into account the confinement expected to be provided by the Middle Confining Unit. The scenarios also assume that the water within the Upper Floridan aquifer is used for drinking within the area of the injection well, which is not true

at the Turkey Point site. *Id.* Mr. Quarles's argument that the risk assessments do not consider potentially high rates of vertical migration of wastewater into an Underground Source of Drinking Water (USDW) is incorrect. The risk assessments absolutely do consider this scenario. The conclusions of these risk assessments were used by the Staff to reach its impact finding.

Regarding the limitations of the EPA risk assessment, Staff disagrees with Mr. Quarles characterization. As Staff states in its rebuttal testimony, EPA performed an analysis as part of the risk assessment to evaluate the impact of uncertainty in transport parameters on the results of fate and transport modeling. Staff Rebuttal Testimony (NRC-072) A32. The fate and transport modeling also considered uncertainty through the use of a bounding scenario which assumed that rapid migration from the Boulder Zone to the Underground Source of Drinking Water (USDW) or to drinking water wells in the Upper Floridan aquifer would occur. *Id*. The risk assessment determined that rapid migration of treated wastewater to drinking water wells in the Upper Floridan aquifer posed a low risk to human health and that this risk was "significantly" reduced when wastewater was treated to high-level disinfection standards. *Id*. (citing NRC-010 at ES-24). The Staff used the results of this risk assessment to understand how concentrations of constituents within wastewater might be diluted along flowpaths and what impact to human health might occur if constituents within wastewater reached drinking water at concentrations below the EPA Maximum Contaminant Levels (MCLs). *Id*. at 26-27. This is further discussed in the Revised Staff Direct Testimony (NRC-002-R), A38 to A58. Accordingly, Mr. Quarles's objection to the EPA risk assessment as using uncertain values is misplaced, as uncertainty was factored into the risk assessment and therefore led to conservative conclusions.

In his testimony, Mr. Quarles objects to the Bloetscher risk assessment as not being specifically designed for the Turkey Point site, and therefore generalized in its conclusions. Quarles Testimony A23 at 19-20. However, Mr. Quarles offers no reason why generalized nature of the assessment precludes it from being used to draw conclusions related to the risk to human health from deep well injection, as was done in the FEIS. The purpose of this type of

generalized assessment was to enable a broad understanding of basic relationships that could be expected at sites in Florida. Staff Rebuttal Testimony (NRC-072), A32 at 27. Mr. Quarles identifies one such relationship when he states that, "The Bloetscher study concluded that risks to human health were the greatest nearest the wastewater injection site and that risks were reduced as the distance away from the site increases." Quarles Testimony A23 at 20. This relationship is one reason why injection at the Turkey Point site would not impact human health, even if rapid migration to the Upper Floridan aquifer occurred. Bloetscher et al indicate that risk at distances greater than 5 miles is negligible. There are no users of water from the Upper Floridan within this distance. Staff Rebuttal Testimony (NRC-072), A32 at 27. Mr. Quarles provides no reason to conclude that use of a generalized study to draw broad conclusions about impacts of wastewater injection on human health is objectionable. Mr. Quarles does not contest the findings in the Bloetscher study, which were used as part of the basis for Staff's findings in the FEIS. As such, Mr. Quarles has not persuasively established that Staff's use of the Bloetscher study was misplaced.

Mr. Quarles's issues with the EPA and Bloetscher risk assessments have no merit. Staff's conclusions in the FEIS were supported by an EPA risk assessment that factored uncertainty into its analysis and by the Bloetscher risk assessment, which provided general characteristics of migration that could be applied at all sites.

5. Dausman Study

Mr. Quarles claims in his testimony that the Dausman et al. (2008) study concluded that a rise in water levels and ammonia concentrations in the drinking water aquifer indicates that vertical migration has occurred. Quarles Testimony A23 at 19. He says that these findings demonstrate "connectivity of the drinking water aquifer with wastewater injection into the much deeper Boulder Zone due to the absence of a geologic confining layer." *Id.*

Staff discusses the 2008 and 2010 Dausman studies (NRC-012 and NRC-047, respectively) in its rebuttal testimony. Staff Rebuttal Testimony (NRC-072), A33 at 28-29. Staff

states that the more recent Dausman study, conducted in 2010, evaluated the increase in ammonia above the injection zone that was detected in the 2008 study. *Id*. Since ammonia is a component of injected wastewater, the presence of ammonia, and not elevated water levels, indicate that upwelling has occurred. *Id*. at 28. The more recent Dausman study (as well as the Walsh and Price 2010 study) concluded that ammonia has not been detected above the Avon Park Permeable Zone (APPZ) of the Middle Confining Unit. *Id*. Further, Staff's position is that there was nothing in either of the Dausman studies ((Dausman et al 2008 or Dausman et al 2010)) to suggest that the Middle Confining Unit was absent at the South District Wastewater Treatment Plant site, contrary to Mr. Quarles's assertions. *Id.* at 29.

6. Maliva Study

Mr. Quarles indicates that, due to the findings in the Starr and Cunningham studies, as he interprets them, the FEIS lacks a basis to rely on the Maliva study, because "Maliva's study fails to consider the more likely vertical transport mechanisms associated with vertical leakage - bedrock vertical fractures and faults that can extend hundreds and thousands of feet, and well failures recognized by the Starr, Walsh and Price, and Cunningham studies." Quarles Testimony A25 at 22.

Staff does not agree; Mr. Quarles's claim is both incorrect and unsupportable. Staff testifies that the Starr, Cunningham and Maliva studies, when properly understood, do not undermine each other or the FEIS. Staff Rebuttal Testimony (NRC-072), A34 at 28. Mr. Quarles finds fault with the study by Maliva et al 2007 by claiming that the study does not consider fractures, faults and well failure which may lead to upwelling. Quarles Testimony A25 at 22. The Maliva et al 2007 study indicated that while unfractured units with sufficiently low hydraulic conductivity could provide confinement, this would not be true for units that are fractured. Staff Rebuttal Testimony (NRC-072), A34 at 28. As a result, and contrary to Quarles assertion, Maliva stated that "[t]he distribution and cause of the development of fractures, and possibly other flow conduits, in the Floridan Aquifer System, is important for understanding

vertical fluid migration," and that "[c]onfinement analyses should, therefore, focus on characterizing the distribution and properties of fracture systems[.]" *Id*. (citing NRC-043 at 1395).

Therefore, contrary to Mr. Quarles's arguments, the Maliva study is supported, and not undermined, by the Starr and Cunningham studies.

E. Joint Intervenors Err in Describing the Impacts of Flows on the Upper Floridan Aquifer and in Summarizing NRC Staff's Conclusions in the FEIS

1. Mr. Quarles's Testimony Describing the Impacts of Flows and Dilution on the Upper Floridan Aquifer is Incorrect

Mr. Quarles states that 40 percent of FPL fluid could contaminate the Upper Floridan Aquifer. Quarles Testimony, A20 at 19. Next Mr. Quarles asserts that rapid transport along "isolated conduits" results in less dilution because the flow is concentrated along discrete vertical pathways" resulting in a higher percentage of injected wastewater reaching the "drinking water aquifer". Quarles Testimony, A25 at 21. Earlier, in A20 at 17, Mr. Quarles cites ¶36 in his 2nd Affidavit (INT-003) to assert that, "[a]ccording to the Starr study, up to 40 percent of FPL's injected fluids could contaminate the Upper Floridan Aquifer". Quarles Testimony, A20 at 17. As more fully explained below, NRC Staff disagrees, Mr. Quarles misstates or misinterprets the relevant calculations and studies cited in the FEIS in reaching his conclusions regarding the potential impacts of flows and dilution on the Upper Floridan Aquifer. Staff Rebuttal Testimony (NRC-072) A35 – 36 at 32-33.

The Staff disagrees with Mr. Quarles's characterization of the injected wastewater as reaching the "drinking water aquifer." *See* Quarles Testimony, A25 at 21. As more fully set forth in Staff' Rebuttal testimony: there are no users of groundwater within the Boulder Zone; there are no users of the Upper Floridan aquifer within the expected 4 mile migration distance; upwelling of injected effluent is not expected to occur; and, concentrations of constituents would be so low at the point of injection as to be undetectable or absent. *See* Staff Rebuttal Testimony (NRC-072) A21 at 15. Mr. Quarles mischaracterizes the use of the Upper Floridan aquifer by

repeatedly calling it the "drinking water aquifer." *Id*. It is an Underground Source of Drinking Water (USDW), but this does not mean that it is used for drinking near the site (it is not) or without further treatment (it is not). Staff Rebuttal Testimony (NRC-072) A39 at 35.

As discussed in FEIS Appendix G.3.3.2, Staff performed a more conservative analysis and determined that no impact would occur to the Upper Floridan aquifer even if more than 90 percent of the injected wastewater as rapidly migrated from the Boulder Zone through the Middle Confining Unit to the Upper Floridan aquifer. *See* Revised Staff Direct Testimony (NRC-002-R), A38 to A58. This conclusion is supported by risk assessments that determined that rapid migration and even direct release of treated wastewater to the Upper Floridan aquifer posed a low risk to human health which further decreased when wastewater was treated to high-level disinfection standards (EPA 2003 at ES-24) and as distance to receptors increased. (Bloetscher at 489).

Further, as documented in the FEIS, FPL performed (and NRC staff independently verified) a number of modeling scenarios. The first FPL modeling scenario used conservative parameters to evaluate the potential maximum extent of migration through a competent (non-fractured) Middle Confining Unit, as indicated by Mr. Quarles. The second scenario evaluated the impact that would occur to the Upper Floridan if rapid migration occurred along a connected pathway through the entire Middle Confining Unit. *See* FEIS (NRC-008C), Appendix G, § G.3.3.2. This is an extremely conservative analysis and, despite Mr. Quarles's assertion, is not representative of conditions at the South District Wastewater Treatment Plant site where upwelling has been attributed to well-related issues and did not extend out of the Middle Confining Unit. This is discussed in the FEIS Section 5.2.1.3 "Boulder Zone" subsection "Potential Causes of Upwelling of Injected Wastewater through the Middle Confining Unit" as well as McNeill 2002 (at 3), Maliva et al 2007 (at 1395), Dausman et al 2010 (at 147) and Walsh and Price 2010 (NRC-046, unnumbered at 15).

Joint Intevenors' assertion that 40 percent of FPL fluid could contaminate the Upper Floridan Aquifer" is not correct. Quarles A25. The vertical flux calculation used to determine the amount of potential upwelling at the South District Wastewater Treatment Plant, conservatively used the lowest values for hydraulic conductivity measured for each unit beneath the site. (Starr et al at 25). Starr et al determined that the hydraulic conductivity dataset was not accurate. They stated that the hydraulic conductivity dataset used in the calculation "does not adequately describe the vertical hydraulic conductivity of the Middle Confining Unit" because the calculated amount of upwelling did not match what was observed at the South District Wastewater Treatment Plant site (Starr et al at 25). They go on to state that, "If the true value of vertical hydraulic conductivity for the Middle Confining Unit is less than the measured value used in the calculations presented here, then the flux would be lower and the travel time would be longer than the values calculated here. Therefore, in order to build a better case that the Middle Confining Unit acts as an effective barrier to upward migration of fluids from the Boulder Zone, it must be shown that the effective vertical hydraulic conductivity of the Middle Confining Unit is less than the value used here." Starr et al at 26. As a result, the estimate provided by Mr. Quarles that 40 percent of FPL fluid could contaminate the Upper Floridan Aquifer" is not correct.

2. Mr. Quarles' Testimony on the Effectiveness of Treatment of Reclaimed Wastewater is Incorrect as it focused on the presence of constituents instead of concentrations of constituents

Mr. Quarles states that, "[t]he mere presence" of the constituents in the "municipal wastewater effluent reported by FPL in [Table 3-5 of] the FEIS after treatment demonstrates that the municipal wastewater treatment plant is ineffective at removing all such constituents from the wastewater." Quarles Testimony, A24 at 20. For the reasons set forth below, NRC Staff disagrees with Mr. Quarles on the effectiveness of treatment on reclaimed wastewater.

Mr. Quarles is incorrect. It is not the "mere presence" of constituents in the wastewater but rather the concentration of these constituents after treatment which is important. Staff

Rebuttal Testimony (NRC-072) A37. Even though the treatment process may not totally eliminate all contaminants from the wastewater, the fact that concentrations of the four Constituents measured at the South District Wastewater Treatment Plant after implementation of high-level disinfection are below detectable levels indicates that, contrary to Mr. Quarles assertion, the South District Wastewater Treatment Plant's wastewater treatment methods are effective. *Id*.

3. Mr. Quarles's Direct Testimony on Well Construction, Monitoring and Upwelling Ignores the Discussions and Conclusions of the FEIS

Mr. Quarles's Direct Testimony on well construction, monitoring and upwelling ignores the discussions and conclusions of the FEIS. Mr. Quarles created a table using a list from Starr et al and argued that this same type of data must be collected at the Turkey Point site. Quarles 2nd Aff. (INT-003) ¶ 33. This data has been collected at the Turkey Point site. *See* Comparison Spreadsheet, Staff Rebuttal Testimony (NRC-072) A12. As demonstrated by the Comparison Spreadsheet, FPL performed the additional data collection and that Mr. Quarles identified as adequate. *Id*. FPL will collect further data as requires as part of the UIC permitting process. Joint Intervenors fail to contest the results or provide any support for a different interpretation thereof. *Id.*

Next, Mr. Quarles states repeatedly that the Staff found upwelling to be "extremely unlikely." Quarles Testimony A7. To support his testimony, Mr. Quarles incorrectly summarizes the conclusion of the FEIS analysis as being that upward migration at the Turkey Point site is "extremely unlikely." Quarles Testimony, A7. He states:

> 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.

Quarles A7. Mr. Quarles repeats this conclusion 14 times (Quarles Testimony at 4, 5, 7, 8, 9, 10, 16, 25) and endeavors to show that it is unsupported by studies cited by him and cited within

the FEIS. The FEIS does not support Mr. Quarles's testimony; he has inaccurately paraphrased and selectively quoted Staff's conclusions.

Contrary to Mr. Quarles's statements as cited above, Staff in the FEIS acknowledged repeatedly that upward migration into the Middle Confining Unit is possible and even give a maximum expected migration extent in FEIS (NRC-008C) Appendix G.3.3. Rather, the Staff position in the FEIS is that upward migration through the Middle Confining Unit and into the Upper Floridan aquifer, which is the Underground Source of Drinking Water (USDW), is "extremely unlikely." Staff Rebuttal Testimony (NRC-072), A46; FEIS (NRC-008A) at 5-26. The full quote from the Staff conclusion within the FEIS is:

> The review team believes that enhanced vertical flow through the confining units to the Upper Floridan aquifer is extremely unlikely, and if leakage associated with an injection well did occur it could be detected and mitigated as required by the FDEP [Florida Department of Environmental Protection] UIC [Underground Injection Control] program.

See Staff Rebuttal Testimony (NRC-072) A46 at 39. When read or quoted in its full context the FEIS continues to support a finding in Staff's favor on contention 2.1.

To the extent Mr. Quarles asserts that well construction issues may lead to upward migration of water injected into the Boulder Zone, the FEIS (NRC-008A) explains why well construction issues that may have previously led to upward migration at other sites will be avoided. Staff Rebuttal Testimony (NRC-072) A62. The Joint Intervenors offer no reason why such well construction issues should recur in the construction of the injection wells proposed at Turkey Point Units 6 & 7. Further, well casing pressure is monitored continuously during operation, and this pressure indication would allow FPL to shut down the well and take corrective action if a well should fail during operation. *Id.* at A58.

F. Mr. Quarles Mischaracterizes the Staff's Development of the FEIS.

In his testimony (Quarles Testimony, A31), Mr. Quarles cites his Third Affidavit (INT-005) in concluding that, "[i]n 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; and, the cost to modify treatment and effluent distribution methods. Third Quarles Aff. (INT-005) ¶ 46. Staff disagrees noting extensive discussion of these factors throughout the FEIS. Staff Rebuttal Testimony (NRC-072) A47 at 40. Specifically, the FEIS evaluated the nature and extent of potential contamination" The staff discuss the incidents of upwelling in great detail in FEIS Section 5.2.1.3 Boulder Zone subsections entitled "Composition of Injected Wastewater" (FEIS (NRC-008A) at 5-20 to 5-21), "Evaluation of Confinement of Injected Wastewater in the Saline Lower Floridan Aquifer" (*id.* at 5-21 to 5-23), "Extent of Upwelling at Deep Well Injection Facilities" (*id*. at 5-23), "Potential Causes of Upwelling of Injected Wastewater through the Middle Confining Unit" (*id*. at 5-23 to 5-26) and "Extent of Injected Wastewater Migration at the Turkey Point Site" (*id*. at 5-26 to 5-29). It is further discussed in FEIS Section 5.2.3.2 "Groundwater-Quality Impacts" subsections "UIC Impacts" (*id*. at 5-39 to 5-42). Background information is provided in Section 2.3.1.2 "Groundwater Hydrology subsection "Floridan Aquifer System" (*id.* at 2-53 to 2-54), "Groundwater Flow Directions within the Floridan Aquifer" (*id*. at 2-55 to 2-57), "Hydraulic Properties of the Floridan Aquifer System at the Turkey Point Site" (*id*. at 2-57 to 2-58). Cumulative impacts are discussed in FEIS Section 7.2.2.2 "Groundwater-Quality Impacts" (FEIS (NRC-008B) at 7-17 to 7-18). FPL and staff modeling of the behavior of injected effluent is presented in Appendix G.3.3 "Confirmatory Calculations of Potential Upward Migration of Injectate from the Boulder Zone of the Lower Floridan Aquifer" (FEIS (NRC-008C) at G-48 to G-52). Finally, staff responded to numerous comments regarding the potential effects of deep

well injection including this specific contention in FEIS Appendix E (NRC-008D) at E-109 to E-115, E-190 to E-192, E-202 to E-203, E-210 to E-213. Joint Intervenors are incorrect in asserting that the Staff should have evaluated the nature and extent of a potential contamination; the impact of such a contamination to the wastewater treatment plant; and, the cost to modify treatment and effluent distribution methods. Joint Intervenors claims are unsupported and should be rejected.

CONCLUSION

For the reasons discussed above, the Contention2.1 is without merit, notwithstanding the arguments, testimony, and evidence the Intervenors present. The Staff's environmental review complies with the requirements of NEPA, and the Intervenors' contentions should be resolved in favor of the Staff.

Respectfully submitted,

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