UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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

DECLARATION OF DAVID MCNABB IN SUPPORT OF FLORIDA POWER & LIGHT COMPANY'S MOTION FOR SUMMARY DISPOSITION OF JOINT INTERVENORS' AMENDED CONTENTION 2.1

David McNabb states as follows under penalties of perjury:

I. PERSONAL BACKGROUND

1. My name is David McNabb. I am president of McNabb Hydrogeologic Consulting, Inc. and a licensed professional geologist in the state of Florida. I perform hydrogeologic consulting with a focus on underground injection control wells including design, permitting, and construction oversight services.

2. I am providing this Declaration in support of Applicant Florida Power & Light Company's ("FPL") motion for summary disposition of amended Contention 2.1, submitted by intervenors Mark Oncavage, Dan Kipnis, Southern Alliance for Clean Energy, and National Parks Conservation Association ("Joint Intervenors") in the above captioned proceeding.

3. I have worked as a geologist for 28 years, and began working with deep injection well construction and permitting in 1992 at the Florida Department of Environmental Protection ("FDEP"). Since that time, I have worked at CH2M Hill, Arcadis, Inc.,

LBFH, Inc. and now at McNabb Hydrogeologic Consulting Inc. My resume is included as Exhibit 7.

4. For nearly all of my professional career, I have focused on the siting, design, construction oversight, testing, and permitting of deep injection wells, specifically "Class I"[1] injection wells. During my career, I have obtained, on behalf of my clients, approximately 30 to 35 underground injection control permits from the FDEP.

5. With respect to this proceeding, I provided design, permitting and construction oversight services for a 3,230 foot deep exploratory well ("EW-1"), and a dual-zone monitor well, at the Turkey Point Units 6 & 7 ("Turkey Point") proposed site. I also am the author of the "Report on the Construction and Testing of Class V Exploratory Well EW-1 at the Florida Power & Light Company Turkey Point Units 6 &7" ("EW-1 Construction and Testing Report").

6. The EW-1 Construction and Testing Report is attached to this Declaration as Exhibit 8. FPL provided that Report to the NRC in this proceeding on October 1, 2012, and submitted to the NRC a revised version of it on February 20, 2013.

7. I have personal knowledge of the matters discussed in this Declaration, except as indicated herein.

[1] F.A.C. 62-528.300(1)(a) defines a Class I injection well as: (1) wells used by generators of hazardous wastes or owners or operators of hazardous waste management facilities to inject hazardous waste beneath the lowermost formation containing, within one quarter mile of the well bore, an underground source of drinking water; (2) other industrial and municipal (publicly or privately owned) disposal wells which inject fluids beneath the lowermost formation containing, within one quarter mile of the well bore, an underground source of drinking water; or (3) radioactive waste disposal wells that inject fluids below the lowermost formation containing an underground source of drinking water within one-quarter mile of the well bore.

II. INTRODUCTION and SUMMARY

8. FPL proposes to use a Class I deep injection well system for disposing non-hazardous operational industrial wastewater from Turkey Point. The Florida Department of Environmental Protection ("FDEP") administers the underground injection control program ("UIC") under which deep injection wells in Florida, including those contemplated at Turkey Point, are permitted. The primary objective of the UIC program is to protect the Underground Source of Drinking Water ("USDW").

9. Turkey Point's proposed deep well injection system will consist of 12 or 13 Class I deep injection wells and 6 or 7 dual-zone monitor wells. A pipeline will connect the injection wells to a pumping facility. Wastewater from the operation of Units 6 & 7 will be pumped from the pumping facility through a pipeline to the injection wells, which will inject the wastewater into the "Boulder Zone" at depths between approximately 2,900 and 3,500 feet (more than a half mile) below land surface.

10. For the reasons set forth below, I agree with the Nuclear Regulatory Commission's draft Environmental Impact Statement ("DEIS") in this proceeding that, due to the isolation of the Boulder Zone from the USDW, the groundwater-quality impacts from Turkey Point's proposed wastewater injection would be SMALL (see, e.g. DEIS at §5.2.3, p.5-29), if any. I also agree with the DEIS that the FDEP has sufficient testing and mitigation programs in place to minimize groundwater impacts, in the extremely unlikely event of a well leak or upward migration of wastewater through the approximately 985-foot thick confining unit overlying the wastewater's injection zone. *Id*. I understand that at issue in this proceeding is whether the concentrations of toluene, ethylbenzene, tetrachloroethylene, and heptachlor (collectively the "Constituents") presented in the

DEIS are accurate. However, the concentrations of the Constituents are irrelevant because the confining characteristics of the Boulder Zone, the well design, and the state required monitoring will ensure that the environmental impacts from Turkey Point's wastewater injectate will be SMALL, if any.

III. DISCUSSION

A. Wastewater From Turkey Point will be Confined within the Boulder Zone

11. The FDEP has comprehensive and detailed regulations requiring that an applicant for a Class I injection well demonstrate that the hydrogeologic environment is suitable for wastewater injection. FAC 62-528.405(1)(a). These regulations also require that the applicant demonstrate there is a confining zone with sufficient areal extent, thickness, lithological, and hydraulic characteristics to prevent fluid migration into underground sources of drinking water. FAC 62-528.405(2)(a). The injection well applicant is to provide sufficient data such as geophysical logs, lithologic cores, physical core analysis, borehole video television surveys, water samples, and drill stem tests (also known as packer tests) to adequately demonstrate the confining characteristics of the bed. FAC 62-528.405(2)(c).

12. FDEP's underground injection control regulations also provide general design considerations for the wells to prevent movement of fluids into or between underground sources of drinking water, and to maintain the ground water quality in the aquifers above the injection zone. FAC 62-528.410.

13. The Turkey Point injection wells cannot be constructed or operated without satisfying these FDEP requirements.

14. In order to satisfy these requirements by evaluating the site hydrogeology for appropriate confining intervals and to confirm the presence of a zone below the confining interval that is suitable to accept injected fluids from the proposed Turkey Point units, FPL sought and obtained a permit from the FDEP to construct EW-1. The geology of Southeast Florida does not vary much over short distances, i.e. within a few miles. Therefore, there is reasonable assurance that the data obtained from the EW-1 construction and testing is representative of the entire site with only minor fluctuations. I assisted FPL with the EW-1 design and with obtaining the EW-1 permit. I also oversaw the construction and testing of EW-1. The results of this testing are set forth in the EW-1 Construction and Testing Report.

15. As explained in that Report, under my direction the testing and sampling program was performed during construction of EW-1. The program was designed to achieve four goals: (1) determine the appropriate well casing setting depths; (2) determine the depth of the base of the lowermost USDW at the site; (3) confirm the presence of an injection zone at the site; and (4) evaluate the confining characteristics of intervals overlying the injection zone.

16. The sampling program included collection of drill cutting rock samples at intervals of 10 feet or less, while drilling downward to provide actual samples of the subsurface rocks. The samples were described for rock type, color, grain size, porosity, fossil content and consolidation. Ex. 8 at p.11. Collection of water samples began at a depth of 1,100 feet and were collected at 90-foot or less intervals to the total depth of the well. These samples were sent to a certified laboratory for analysis to provide water quality data. Ex. 8 at pp. 16-18.

17. A total of ten 4-inch diameter rock cores were collected during drilling. Portions of the cores were sent to a testing laboratory for analyses. Geophysical logs were performed to provide data about the physical properties of the subsurface. Data from the geophysical logs were used to select 10 intervals, which then underwent packer testing.[2] Ex. 8 at pp. 18-22.

18. Water level data and water samples were collected during each packer test to provide information on hydraulic characteristics and water quality data of the test intervals. A formation test was also performed to confirm the presence of the injection zone. Ex. 8 at pp. 19-22.

19. The data obtained from the drilling cutting samples and rock cores, packer tests, and geophysical logs were used to identify and characterize the geologic formations and hydrogeologic units penetrated by the well bore. Ex. 8 at pp. 23-25.

20. Data collected during the construction of EW-1 confirmed that the subsurface hydrogeology in the vicinity of the Turkey Point site consists of three main hydrogeologic units: the Biscayne Aquifer, the Intermediate Confining Unit, and the Florida Aquifer System. These are described in detail in Sections 2.3.1.2 and 2.8 of the DEIS, and are illustrated in DEIS Figures 2-17 and 2-40.

21. In summary, the Biscayne Aquifer occurs from just below land surface to a depth of approximately 140 feet. It consists primarily of layers of sand, shells, and limestone,

[2] Packer testing (also known as drill stem testing) is performed to determine hydraulic characteristics of the rock strata within the test interval and allows collection of water samples from the test interval. The test involves isolating the desired test interval by inflating an inflatable packer in the borehole at the top of the test interval and inflating another inflatable packer at the base of the test interval. Water is then pumped from the isolated test interval while recording the pumping rate and water level data from the test interval. This allows for a determination of hydraulic characteristics of the test interval to determine if the test interval has confining characteristics or is, instead, productive and non-confining. Water samples collected at the end of the test undergo laboratory analysis to provide water quality data for the groundwater within the test interval.

with the base of the aquifer identified by the presence of clay-rich silt. Ex. 8 at 14; DEIS §2.3.1.2 and Fig. 2-17; DEIS §2.8 and Fig. 2-40. The Biscayne Aquifer is used as a source of drinking water locally; however, it is not used as a source of drinking water at the Turkey Point site due to its relatively high salinity.

22. The intermediate Confining Zone separates the Biscayne Aquifer from the Floridan Aquifer System and is present throughout south Florida. It is present at the Turkey Point site over the interval from the base of the Biscayne Aquifer to a depth of 1,010 feet. The Intermediate Confining zone consists of interbedded clays, silt, sand, calcareous lime muds, and limestone. Ex. 8 at 14; DEIS §2.3.1.2 and Fig. 2-17; DEIS §2.8 and Fig. 2-40.

23. Below the Intermediate Confining Zone lies the Floridan Aquifer System. In south Florida, the Floridan Aquifer System is subdivided into three general hydrogeologic units – the Upper Floridan Aquifer, the middle Floridan Aquifer (also known as the Middle Floridan Confining Unit), and the Lower Floridan Aquifer. DEIS §2.3.1.2 and Fig. 2-17; DEIS §2.8 and Fig. 2-40.

24. The Upper Floridan Aquifer is a productive unit, contains water that is brackish in nature, and is used as a source of drinking water by some municipalities in south Florida. Water from the Upper Floridan Aquifer must be treated with membranes to remove salt from the water before it can be consumed. Rocks making up this unit consist of permeable limestone, dolomitic limestone, and dolomite. Ex. 8 at 14-15; DEIS §2.3.1.2 and Fig. 2-17; DEIS §2.8 and Fig. 2-40.

25. The Middle Floridan Confining Unit consists of fine grained and less permeable limestone, dolomitic limestone, and dolomite. Ex. 8 at 14-15; DEIS §2.3.1.2 and Fig. 2-17; DEIS §2.8 and Fig. 2-40. These fine grained, relatively low permeability rocks are

what one looks for when evaluating the confinement at a site, since they act as a barrier preventing fluids that are injected below this interval from escaping the injection zone.

26. The confinement for injectate at the Turkey Point site was identified to be present over the interval from approximately 1930 to 2915 feet. Ex. 8 at 29; DEIS §2.3.1.2 at p. 2-54 and Fig. 2-17; DEIS §2.8 and Fig. 2-40. The confinement layer, therefore, is approximately 985 feet thick. As the DEIS points out, these site-specific findings regarding the confinement layer are consistent with statewide mapping of the Floridan aquifer, and with characterization data and conclusions presented in studies of these same formations in South Florida and near the Turkey Point site. DEIS §2.3.1.2 at pp. 2-54 and 2-57.

27. Below the Middle Floridan Confining Unit lies the Lower Floridan Aquifer. The wells at Turkey Point will inject into the Lower Floridan Aquifer between the depths of approximately 2,900 and 3,500 feet below land surface. This unit consists of dolomite, dolomitic limestone, and limestone. The unit is permeable, with portions of the unit being extremely permeable. This extremely permeable zone is often referred to as the "Boulder Zone," and is targeted as the injection zone in south Florida for fluids disposal via underground injection. It is marked by cavernous and often highly fractured rock. Ex. 8 at 15; DEIS §2.3.1.2 at p. 2-54 and Fig. 2-17; DEIS §2.8 and Fig. 2-40. As the DEIS points out, these site-specific findings regarding the Boulder Zone also are consistent with statewide mapping of the Floridan aquifer and characterization data and conclusions presented in studies of these same formations in South Florida and near the Turkey Point site. DEIS §2.3.1.2 at pp. 2-54 and 2-57.

28. The extremely high permeability of the Boulder Zone prevents significant pressure buildup during injection, allowing the wastewater that is injected to move laterally within the Boulder Zone rather than vertically out of the Boulder Zone.

29. This zone is considered a "Confined Aquifer" under FDEP regulations, which means that it is an aquifer that is bounded above and below by impermeable beds or by beds of distinctly lower permeability than that of the aquifer itself. FAC 62-520.200(5). Water within the Boulder Zone is similar to seawater in nature and is *not* used as a source of drinking water. DEIS §2.3.1.2 at p. 2-53; DEIS §2.8 at p. 2-204 and Fig. 2-40.

30. This configuration of an extremely transmissive unit containing water that is similar to seawater, overlain by a thick layer of relatively low permeability rock that separates the Boulder Zone from underground sources of drinking water, is ideal for fluids disposal via underground injection.

31. Given the extremely high transmissivity of the injection zone and the low permeability of the confining layer, water will flow laterally within the highly transmissive rocks of the injection zone, and the confining layer will retard upward flow.

32. Accordingly, if wastewater from Turkey Point is injected into the injection zone as proposed, that wastewater is extremely unlikely to enter into underground sources of drinking water, cause a violation of any drinking water standards, and affect the health of individuals.

B. FDEP Regulations Require Testing and Monitoring of the Injection Wells to Ensure the Long-Term Effectiveness of the Confining Unit

33. I agree with the NRC review team's conclusion in the DEIS that "enhanced vertical flow through the confining units to the Upper Floridan aquifer is extremely unlikely, and if

leakage did occur it would be detected and mitigated as required by the FDEP UIC program." DEIS §5.2.1.3, p. 5-18.

34. Constructing, testing, and operating deep injection wells in accordance with FDEP regulations will ensure that the injection zone can receive, and that the Boulder Zone can confine, injectate from Turkey Point.

35. For example, before each proposed injection well becomes operational, the FDEP requires certain testing. FAC 62.528.410(7)(e). The EW-1 construction contractor, under the supervision of FPL, conducted that test on EW-1 by injecting water into the well for a 12 hour period, with a portion of that injection period being performed at a rate equal to the maximum injection rate at which the well will be operated. This test demonstrated: (1) the injection zone's ability to accept water at the intended injection rate; and (2) the absence of fluid connections from the injection zone through the confinement into the zones monitored.

36. FDEP regulations also require that the operator of a Class I injection system install and utilize monitor wells above the injection zone near an injection well to monitor for the absence of fluid movement adjacent to the well bore and the long term effectiveness of the confining unit. FAC 62-528.425(g).

37. FPL will rely on dual-zone monitor wells to meet this requirement for Turkey Point. A dual-zone monitor well is a well that allows sampling and monitoring from two different depths. A dual-zone monitor well was constructed approximately 75 feet south of EW-1 to meet the requirements of FAC 62-528.425(g). The design of those wells provides for an early warning system, allowing detection of any upward fluid movement before any drinking water is impacted.

38. The upper zone of the dual-zone monitor well is constructed to be very near the base of the underground source of drinking water. The lower zone is constructed to be well below the base of the underground source of drinking water and near the top of the confining unit and serves to act as an early warning system if fluid migration were to occur. The well is constructed to allow water samples to be collected from both monitoring zones. Water level data is also collected from both monitor zones.

39. During operation of a Class I injection well system, FDEP regulations require the operator to sample both zones of the monitor well. FAC 62-528.425(1)(g)(4). These samples must be collected on a weekly basis during the first six months to two years of operation and monthly thereafter. The water samples must be analyzed by a certified laboratory for numerous parameters that are selected to allow detection of a change in the water of the monitor zone that would be indicative of fluids migrating upward from the injection zone. A change in water quality can also impact the water level of a monitor zone. Thus, the FDEP-required continuous monitoring of water level provides a source of data to look for signs of vertical fluid migration.

40. If the groundwater monitoring were to detect migration of the injected fluid into one or both monitoring zones, FPL would be required to report this information to the FDEP and work with the FDEP to remedy the problem. FAC 62-528.415(4)(a). The nature of the remedy would depend upon the cause of the fluid migration. If the fluid migration was caused by a mechanical integrity problem with one or more of the injection or monitoring wells, FPL would remove the problematic well(s) from service, investigate the nature of the problem, and repair the problematic well(s). FDEP would need to approve the repair

plan before the repair(s) could be performed by FPL. FPL would then report the results of the repair to the FDEP prior to the FDEP approving placing the well back in service.

41. I am aware of no information indicating that the injected fluid would otherwise migrate from the Boulder Zone. However, assuming a hypothetical migration of the injected fluid upward through the confining layer (which assumes a hypothetical breach of all 985 feet of site confinement), the site monitoring wells would detect this upward migration before the migrated fluid entered any aquifer with the potential for public use. In such case, FPL would be required to report this event to the FDEP and work with the FDEP to remedy the cause of the upward migration. FAC 62-528.415(4)(a).

42. The remedy would depend upon the suspected cause of the problem, but could include performing additional mechanical integrity or other tests on the injection wells; deepening the injection wells and installing a deeper injection casing; increasing the density of the injected wastestream to equal or exceed the density of the Boulder Zone water; or removing one or more injection wells from service. If any one of the 12 or 13 injection wells to be installed at Turkey Point Units 6 & 7 has to be removed from service, Turkey Point Units 6 & 7 will have a sufficient number of backup wells that are available. As part of any remedy, FPL may increase the frequency of the monitoring data collection at the monitoring wells.

43. Based upon past FDEP practice involving other entities, the FDEP would require FPL to enter into a consent order to ensure FDEP had the legal means to compel FPL to undertake the identified remedies. FAC Rule 62-528.435(1). The FDEP could order an injection well to be plugged or abandoned if the well poses a threat to waters of the State. The nature of the problem, the remedy required to address the problem, and the potential

threat posed by the migration would be factors the FDEP would consider in specifying the deadline(s) by which FPL must complete the remedial measures. This deadline(s) would be included in a consent order to ensure legal enforceability.

C. The Injection Wells' Design, and FDEP-Required Monitoring, Will Prevent the Wastewater from Leaking Into Drinking Water

44. As explained above, FPL was required to obtain a permit from the FDEP in order to construct and perform testing on EW-1 and dual-zone monitor well number 1 ("DZMW-1"). That permit was included as Appendix A to the EW-1 Construction and Testing Report.

45. FPL obtained the exploratory well construction permit by submitting an application with supporting information to the FDEP for review. The FDEP then requested any additional information required to provide them with reasonable assurance that the well would be constructed and tested in accordance with FAC 62-528. FPL then used geologic and hydrogeologic data collected during construction and testing of EW-1 and DZMW-1 to support an application to convert EW-1 to Class I injection well IW-1. FPL will also use the information collected during construction and testing of EW-1 and DZMW-1 to support a construction permit application to allow the construction and testing of the remaining injection wells and dual-zone monitor wells.

46. EW-1 was constructed in accordance with the requirements of FAC 62-528 and the conditions of the exploratory well construction permit. The injection wells, which may include EW-1, will have to be constructed consistent with those same requirements. Specifically, EW-1 was constructed of multiple concentric steel casings cemented into place. As shown in the EW-1 Construction and Testing Report, Figure 4, the diameter of

the casings are 54-, 44-, 34-, and 24-inch cases. Each of the steel casings has a wall thickness of 3/8-inch, with the exception of the final casing, which has a wall thickness of 1/2 inch. Each of the well casings was fully encased in cement (on both the outside of the casing and the inside of the casing) with the exception of the 24-inch casing, which was cemented only on the outside. In addition to the steel casings, a fiberglass reinforced plastic ("FRP") injection liner was installed inside the 24-inch diameter steel casing. The annular space between the 24-inch diameter casing and the injection liner was sealed at the base of the tubing and at the surface and filled with a corrosion inhibiter. This protects the inside of the 24-inch diameter casing from corrosion. The FRP injection liner was selected for its resistance to corrosion. Each casing was cemented from the base of the casing to land surface to prevent movement of fluids into or between the underground source of drinking water, maintain groundwater quality in aquifers above the injection zone, and protect casings from corrosion. Ex. 8 at pp. 5-10.

47. Accordingly, the design of the injection wells – which will be similar to EW-1 – will prevent the leakage of wastewater from the wells into underground sources of drinking water. I therefore agree with the DEIS that wastewater well construction problems leading to wastewater leakage are "not expected at the Turkey Point site …." DEIS §2.3.1.2 at p. 2-55.

48. In addition, as required by the FDEP, the wells will be continuously monitored and tested to ensure they are mechanically sound and are not leaking. FAC 62-528.425(1)(b). The pressure of the sealed annular space between the 24-inch diameter final casing and the injection tubing will be monitored on a continuous basis, so any break in the final casing,

FRP injection tubing, or seal at the base or the top of the FRP injection tubing, would be detected immediately.

49. Furthermore, as the DEIS recognizes, the FDEP also requires that each Class I injection well undergo mechanical integrity testing a minimum of every five years. FAC 62-528.425(1)(d); DEIS §2.3.1.2 at p. 2-55. The mechanical integrity test consists of a video survey of the injection tubing and injection zone, and a pressure test where the annular space between the final casing and the FRP injection tubing is pressurized, typically to approximately 150 psi. The testing also includes performance of a high-resolution temperature log and radioactive tracer survey on the well. Data from these tests are summarized in a report that is also required to include the previous five years of operating and monitoring data with an interpretation of such data. This testing meets the requirements of FAC 62-528.

50. Finally, the injection well permits are required to be renewed every five years. FAC 62-528.440(3). Thus, at least every five years, the FDEP will review FPL's injection system operating data to determine if the injection well system is operating in accordance with FAC 62-528.

IV. CONCLUSION

51. The construction and operation of the proposed injection wells at Turkey Point, which are highly regulated by the FDEP, will not adversely impact the underground sources of drinking water, because the injected wastewater will be confined within the Boulder Zone. Thus, the concentrations of the Constituents are irrelevant to evaluating the injectate's impact on the environment. Data collected during EW-1 testing confirms the

existence of an approximately 985-foot thick confining unit overlying the injection zone, which will prevent the wastewater from migrating into underground sources of drinking water. Accordingly, I agree with the DEIS's assessment that groundwater-quality impacts from Turkey Point's proposed wastewater injection would be SMALL (if any).

52. In addition, the injection wells themselves will be designed consistent with FDEP requirements, to prevent wastewater leakage. As the DEIS concludes, I see no reason to expect wastewater leakage due to a problem with well construction.

53. In the highly unlikely event that leakage from the wells were to occur, or in the highly unlikely event that the wastewater were to begin to migrate up through the Boulder Zone, I also agree with the DEIS that the FDEP-required continuous monitoring of the injection wells – and the data from the duel zone monitor wells – will allow prompt action to be taken to address any issues before any underground source of drinking water is compromised.

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

David McNabb

David McNabb

Executed on December 14, 2015