

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before the Licensing Board:

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

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

**DECLARATION OF MARK A. QUARLES IN SUPPORT OF JOINT INTERVENORS'  
ANSWER TO FPL'S MOTION FOR SUMMARY DISPOSITION OF JOINT  
INTERVENORS' AMENDED CONTENTION 2.1**

Mark A. Quarles states as follows under penalty of perjury:

**Qualifications**

1. My name is Mark A. Quarles. I am an expert in the field of investigating planned and accidental releases of environmental pollutants to the environment and evaluating the risks associated with those releases.
2. I have specific education and experience performing environmental investigations in fractured sedimentary bedrock such as limestone and have specific education and experience in karst geologic bedrock conditions.
3. I also have specific experience conducting municipal wastewater flow studies of large metropolitan separate and combined collection systems that flow to wastewater treatment plants with millions of gallons per day capacity, in such areas as Boston and Atlanta.

4. I also have specific experience sampling water for volatile organic compounds (VOCs) consistent with US EPA sampling and quality assurance protocol.
5. I also have specific experience working in industrial plants that use potable water supplies for makeup water, create industrial equipment blowdown wastewater, and reuse makeup water prior to disposal.
6. An accurate copy of my curriculum vitae is attached to this Declaration.
7. I have reviewed and assessed certain sections of the Environmental Report, Turkey Point Plant, Units 6 and 7, Revision 3 (ER) prepared by Florida Power & Light Company (FP&L) relative to the potential for wastewater injection operations to contaminate the groundwater and drinking water aquifers.
8. I have provided two previous affidavits upon my review of certain sections of the ER (affidavit #1 dated January 23, 2012) and NRC Staff's Answer to the Joint Intervenor's Motion to Amend Contention NEPA 2.1, February 10, 2012 (affidavit #2 dated February 17, 2012).
9. I have reviewed and assessed the Florida Power & Light Company's Motion for Summary Disposition of Joint Intervenor's Amended Contention 2.1, July 19, 2012, prepared by Florida Power & Light Company (FP&L) where FP&L identified the source of the data of four chemicals (ethylbenzene, toluene, tetrachloroethylene, and heptachlor); provided a description of how estimated concentrations were obtained; and performed a "bounding" analysis that demonstrated that the environmental impacts of injecting those four chemicals into the aquifer are SMALL.
10. I have also reviewed the Declaration of David M. Wagner in Support of Florida Power and Light Company's Motion for Summary Disposition of Joint Intervenor's Amended Contention 2.1. Summary Disposition, Attachment 2.
11. This Declaration contains my expert opinions, which I hold to a reasonable degree of scientific certainty. My opinions are based on my application of professional judgment and expertise to sufficient facts or data, consisting specifically of documents related to this matter. These are facts and data typically and reasonably relied upon by experts in my field.
12. In my expert opinion, FP&L has not adequately analyzed and discussed the risks associated with wastewater injection activities, and the potential of certain constituents – including heptachlor, ethylbenzene, toluene, and tetrachloroethylene – to contaminate underground aquifers. FP&L concluded in their Environmental Report (ER) that the potential impact to the groundwater quality in both the underground source of drinking water (USDW) and the Boulder Zone injection formation beneath the Turkey Point plant is "SMALL". ER, Section 5.2.3.2.4 at 5.2-25. This determination relied upon inaccurate and unreliable data and made improper assumptions.



### Summary of Opinions

*FP&L plans to inject harmful amounts of tetrachloroethylene and heptachlor into the underground drinking water aquifer, according to safe concentrations established by the US EPA. FP&L did not consider more harmful concentrations in the ER when determining that the impact to human receptors would be SMALL.*

13. The US EPA defines the Maximum Contaminant Level Goal (MCLG) as “*the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, and which allows an adequate margin of safety*”. When determining an MCLG, EPA considers the risk to sensitive subpopulations (infants, children, the elderly, and those with compromised immune systems) of experiencing a variety of adverse health effects.
14. Tetrachloroethylene is a manufactured chemical used in dry cleaning operations and also as an industrial degreaser to remove oils and greases from industrial machinery during manufacturing or maintenance.
15. The US EPA has determined that there is no safe concentration of tetrachloroethylene for human consumption. The MCLG for tetrachloroethylene is ZERO. Tetrachloroethylene is a probable human carcinogen.
16. FP&L concluded (after assuming dilution from variable plant water sources), that the “final effluent concentration” of tetrachloroethylene that will be injected into the underground aquifer will be just slightly less than the US EPA’s 0.005 mg/L Maximum Contaminant Level (MCL) drinking water standard. FP&L calculated that concentration to be 0.00359 mg/L – or just a mere 0.00141 mg/L less than the MCL. ER at 3.6-7 and Summary Disposition at Exhibit 5.
17. A bounding analysis performed by FP&L determined that without dilution and with *normal* plant operations, the concentration of tetrachloroethylene would actually *increase* to 0.0044 mg/L – or just 0.0006 mg/L less than the US EPA drinking water standard. Summary Disposition at Exhibit 5.
18. Heptachlor is a manufactured chemical insecticide. The chemical evaporates very slowly in air and can stay in soil and water for many years. The chemical damages the liver and fertility of animals that ingest heptachlor, with worse affects occurring when the exposure is high or when the exposure lasts many weeks. ATSDR ToxFAQs, Heptachlor and Heptachlor Epoxide at 1.
19. The US EPA has also determined that there is no safe concentration for the consumption of heptachlor. The MCLG for that chemical is also ZERO. Heptachlor is a possible human carcinogen.

20. FP&L concluded (after assuming dilution from variable plant sources) that the final effluent concentration of heptachlor that will be injected into the underground aquifer will be just slightly less than the US EPA's 0.0004 mg/L MCL drinking water standard. FP&L calculated that concentration to be 0.000023 mg/L - just 0.000377 mg/L less than the MCL. ER at 3.6-7 and Summary Disposition at Exhibit 5.
21. A bounding analysis performed by FP&L determined that without dilution and with normal plant operations, the concentration of heptachlor would actually increase to 0.000028 mg/L - just 0.000372 mg/L less than the MCL. Summary Disposition at Exhibit 5.

*Analytical sampling relied upon by FP&L fails to accurately and reliably characterize the reclaimed wastewater stream given the variability of that waste stream and FP&L's reliance upon a single sample collected by others.*

22. According to the Wagner Declaration, analytical results for the years 2007 through 2011 prepared by the Miami-Dade County Water and Sewer Department (MDWASD) were the basis for the water quality analysis included by FP&L in the ER. FP&L assumed that the highest reported concentration of ethylbenzene, toluene, tetrachloroethylene, and heptachlor of only five (5) samples for that five-year period was the "source concentration" for the makeup water supply to the future circulating water cooling system. Further, Wagner concluded that each concentration represented a "worst-case" concentration. Motion for Summary Disposition, Attachment 2 at 3.
23. Although the data were collected over a five-year period, each sample from each year was only representative of the wastewater quality on a single day in February of that year. Samples from the five-year period were all collected on: February 22, 2007 (Thursday); February 7, 2008 (Thursday); February 19, 2009 (Thursday); February 23, 2010 (Tuesday); and February 18, 2011 (Friday). Miami-Dade County, 2007. Genapure, 2008. Miami-Dade County 2009. Genapure 2010. Genapure 2011. A single sample from a single day cannot possibly be considered representative of yearlong wastewater quality or the worst-case concentration.
24. Chemical constituents and their concentrations in municipal wastewater can vary seasonally during the year and can depend on such additional variables as the compliance history of the treatment plant for any given month, the compliance history of commercial and industrial dischargers to the plant for any given month, and the types of industrial and commercial users connected to the wastewater collection system for the South District Plant.
25. This seasonal variability necessitates the use of long-term sampling to achieve an accurate indication of actual chemical concentrations in wastewater.
26. FP&L has not specified how annual samples were collected, other than specifying that a "24-hour" composite sample was collected for the 2007, 2008, 2009, and 2011 sampling events, according to the Chain of Custody Records that accompanied those sample



containers. No specificity was given for the sample collected in 2010 - the Chain of Custody form for that event just listed the "C" designation for "composite".

27. The "24-hour" sample designation used by FP&L suggests that the samples were time-weighted samples where an equal aliquot of wastewater was collected at equally spaced time intervals during the day, regardless of whether or not spikes in flow or chemical concentrations from industrial and commercial users occurred during the day – as is expected and normal when industrial and commercial discharges occur during normal work-day business hours.
28. Time-weighted flow monitoring that collect equal sample aliquots at pre-specified equally spaced times during the day give the same sample relevance for a sample collected at nighttime (when perhaps no industrial users are operating) and when the corresponding industrial related chemical concentrations would be the lowest, compared to a sample aliquot collected during the day.
29. According to the US EPA, a composite sample represents the *average* wastewater characteristics during the compositing period. EPA SOPQAM at 9-2.
30. Given that FP&L apparently used 24-hour composite samples, those samples would not represent annual or daily worst-case concentrations, but rather represent the average, *time-weighted* chemical concentrations for just that single day.
31. Where the wastewater stream is variable and when spikes in industrial flow amounts and chemical concentrations would be higher during certain times of a day, the US EPA recommends that *flow proportional* composite samples be collected rather than time-weighted sampling used by the South District Plant and relied upon by FP&L. EPA SOPQAM at 9-2. When flow proportional sampling is used to collect samples, the accuracy of the sample volume collected is dependent upon having an accurate, calibrated flow measuring device along with the automated sampling device.
32. Given the wastewater variability and method of composite sample collection, FP&L cannot accurately and reliably estimate chemical concentrations without first performing a long-term, flow-proportional study of the South District Plant.
33. FP&L cannot conclude that the environmental impact on the underground source of drinking water from the use of the deep injection wells planned for the Turkey Point units would be SMALL because FP&L has relied on inaccurate and unreliable data in its previous analyses.

***Sample collection methods that were used to eventually estimate chemical concentrations in the ER, and subsequently amended later in the Motion for Summary Disposition, did not meet the required US EPA collection protocols and may have resulted in under-reporting chemical concentrations.***

34. Environmental and scientific professionals with expertise in the field of environmental investigations use US EPA sampling, analysis, and quality assurance manuals and protocols as their own standard of practice when developing their own sampling programs for environmental media throughout the United States.
35. Three of the four chemicals in question in the wastewater - ethylbenzene, toluene, and tetrachloroethylene – are volatile organic compounds. As such, special care is required to collect any water sample so that the chemicals do not volatilize or degrade during the collection period, during transport, or during storage prior to analysis.
36. According to the Chain of Custody Record for the February 7, 2008 sampling event, the sample bottles were not properly received without headspace. As a result, the reported concentrations for ethylbenzene, toluene, and tetrachloroethylene can be assumed to be under-reported.
37. According to the US EPA water sampling protocol, water samples are supposed to be collected with “zero-headspace” in the container, meaning that there shall be no bubbles in the container that would enable chemicals in the water to evaporate into the bubbles. EPA SOPQAM at 9-6.
38. FP&L cannot conclude that the environmental impact on the underground source of drinking water from the use of the deep injection wells planned for the Turkey Point units would be SMALL because FP&L has relied on samples and analytical results that used improper sample collection procedures.

***The bounding analysis used by FP&L in the Motion for Summary Disposition to theoretically calculate the maximum estimated concentrations of the four chemicals relied on inaccurate and unreliable data and made inaccurate assumptions.***

39. FP&L concluded that the bounding analysis resulted in an “extremely conservative” and a “conservatively high estimate” of the concentrations of chemicals that will be injected into the aquifer. Summary Disposition at 2 and 10.
40. The bounding analysis relied on the five years of sampling data (2007 – 2011) collected by and provided by Miami-Dade County from the South District Plant. As was previously discussed, that data are unreliable and inaccurate and therefore should not be used as a conservatively high estimate of chemical concentrations.
41. FP&L estimated in the ER that the estimated concentration of ethylbenzene that would be injected into the aquifer would be 0.001045 mg/L. ER at 3.6-7. This concentration contradicts the Wagner Declaration where no concentration was provided for that chemical, instead reporting “not applicable” for that final effluent concentration. Summary Disposition at Exhibit 5.
42. The bounding analysis is further flawed because FP&L also relied on dilution of the reclaimed wastewater obtained from the South District Plant to reduce theoretical, calculated maximum chemical concentrations to less harmful amounts. According to



FP&L, dilution will occur by wastewater from these other plant water systems: blowdown from the service water systems; sanitary wastewater treatment system effluent; wastewater retention basin effluent; and liquid radwaste treatment effluent. Motion for Summary Disposition at 9.

43. Discharges from those dilution sources are variable and as such, cannot be relied upon for theoretical dilution calculations. In fact, there might not be *any flow* from one or more sources on any given day.
44. Service water system blowdown to the combined effluent will be variable and cannot be relied upon as a continuous source for dilution because blowdown only occurs sporadically when the wastewater quality has sufficiently degraded, thus requiring a blowdown.
45. Sanitary wastewater discharges used for dilution may in fact not provide any dilution at all. FP&L decided that that wastewater will be hauled off during construction of the permanent wastewater treatment plant, instead of being mixed with other wastewaters and being used for dilution according to FP&L. Second, according to FP&L the temporary sanitary waste treatment plant would also be used during peak construction or outage activities to augment the permanent system. ER, Section 3.6-2. As a result, that flow sanitary wastewater component will not provide any dilution during certain times of the year.
46. Sanitary wastewater discharges are variable and are dependent upon the number of persons present, the amount of wastewater those persons generate per day, and when the wastewater is actually treated to form an effluent. Small-scale sanitary wastewater treatment plants commonly hold the wastewater flow and treat it in a one-time “batch” during the day, instead of providing a continuous effluent throughout the day. Further, FP&L has estimated that wastewater generation will be highly variable depending on the number of employees working – ranging from 500 to 1,000 persons per day. ER at 3.6-2.
47. Discharges from the wastewater retention basin are also variable and sporadic and cannot be relied upon for daily dilution of the reclaimed water. Wastewater flow to that basin is variable during maintenance and inspection activities such as equipment and floor washdown operations, operation of the turbine drain system, flow from the oil / water separator, fire water discharges if / when they occur, and flow from the demineralized water system. ER at 3.3-10.
48. Because the flow rates of plant water systems and their contribution to final injected wastewater amounts are so sporadic and variable, FP&L should not have relied on diluted concentrations as representative of a “conservatively high estimate” of concentrations that will be injected into the aquifer. Summary Disposition at 10.
49. When FP&L assumed in the bounding analysis that reclaimed water would not be diluted (as is probable), the chemical concentrations in the injected fluid would instead *increase*, when compared to previously submitted concentrations in the ER. FP&L concluded that the concentrations would increase due to re-circulated and evaporation during the four

cycles of reuse. Summary Disposition at 10.

50. The bounding analysis performed by FP&L cannot be used to conclude that the environmental impact on the underground source of drinking water from the use of the deep injection wells planned for the Turkey Point units would be SMALL because FP&L relied on inaccurate and unreliable data and made inaccurate assumptions.

***Sampling methods and quality assurance measures used to produce analytical data for volatile organic compounds require extraordinary sampling and quality assurance protocol that may not have been used, given the lack of adherence to other important VOC sampling protocol.***

51. When volatile organic compounds are collected during a compositing period, sample containers must be refrigerated, otherwise the accuracy of the volatile organic compound concentrations reported by the laboratory can under-report actual wastewater concentrations. EPA SOPQAM at 9-3. Whether or not samples were refrigerated during the day-long sampling event each year is not known.
52. Concentrations of volatile organic compounds in wastewater samples can also be under-reported if extreme care is not made when transferring liquid samples from the main automatic sampler containers to the required separate, 40-milliliter volatile organic compound sample bottles. Excessive turbulence during that transfer can reduce actual concentrations reported by the laboratory. EPA SOPQAM at 9-7.
53. When automatic samplers are used to collect wastewater samples for volatile organic compound analyses, Teflon tubing is required to collect the samples and transfer them to sample containers. EPA SOPQAM at 9-4. Whether or not that Teflon tubing existed during each day-long sampling event each year is not known.
54. If residual chlorine is present in municipal wastewater, wastewater samples that are collected for volatile organic compound analysis requires a special collection procedure to first remove that residual chlorine prior to placing a volatile organic compound sample into its own 40- milliliter container. EPA SOPQAM at 9-7. Residual chlorine is common in wastewater that contains potable water as a source of wastewater, which will occur at the Turkey Point plant. Whether or not this special collection technique was actually used each year for each day-long sampling event is not known.
55. Although volatile organic compound chemicals were targeted for analyses, FP&L did not collect Trip Blank sample containers for the years 2007, 2010, or 2011. Trip Blank samples are required for every study where water samples are collected for volatile organic compound analysis to ensure the quality assurance of the samples. EPA SOPQAM at 5-35.
56. FP&L cannot conclude that the environmental impact on the underground source of drinking water from the use of the deep injection wells planned for the Turkey Point units would be SMALL because FP&L has relied on inaccurate and unreliable data in its previous analyses due to inadequate sample collection and quality assurance protocol.



Sources:

1. Environmental Report (ER), Revision 3, Part 3, COL Application, Turkey Point Plant, Units 6 & 7, Florida Power and Light Company.
2. Environmental Protection Agency, Region IV, Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (SOPQAM), November 2001.
3. *Florida Power & Light Company's Motion for Summary Disposition of Joint Intervenor's Amended Contention 2.1, July 19, 2012.*
4. Genapure, Annual Sampling Report, including analytical results, letter to Clive Powell, Miami Dade Water & Sewer from Maria Pacheco, February 29, 2008.
5. Genapure, Analytical Report 363251 for Miami Dade Water & Sewer, Clive Powell, March 17, 2010.
6. Genapure, Analytical Report 407304 for Miami Dade Water & Sewer – South District, Clive Powell, March 27, 2011.
7. Miami-Dade County, Reclaimed Water Analysis Report, letter to Todd Brown, FDEP from Vicente Arrebola, P.E., May 22, 2007.
8. Miami-Dade County, letter to Joseph May, P.G., FDEP including Annual Sampling analytical results from Vicente Arrebola, P.E., April 15, 2009.
9. ToxFAQs, Agency for Toxic Substances and Disease Registry, Heptachlor and Heptachlor Epoxide, August 2007.

Dated: August 3, 2012

  
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MARK A. QUARLES