

**Official Transcript of Proceedings**  
**NUCLEAR REGULATORY COMMISSION**

Title: Florida Power & Light Company Hearing

Docket Number: Docket Nos. 52-040-COL & 52-041-COL  
ASLBP No. 10-903-02-COL-BD01

Location: Homestead, Florida

Date: May 2, 2017

Work Order No.: NRC-3028 Pages 535-828

**NEAL R. GROSS AND CO., INC.**  
**Court Reporters and Transcribers**  
**1323 Rhode Island Avenue, N.W.**  
**Washington, D.C. 20005**  
**(202) 234-4433**



1 APPEARANCES:

2 On Behalf of Florida Power and Light:

3 MICHAEL G. LEPRE, ESQ.

4 ANNE LEIDICH, ESQ.

5 JOHN H. O'NEILL, ESQ.

6 DAVID R. LEWIS, ESQ.

7 THOMAS J.V. WALSH, ESQ.

8 of: Pillsbury, Winthrop, Shaw, Pittman, LLP

9 1200 Seventeenth Street, N.W.

10 Washington, DC 20036-3006

11 michael.lepre@pillsburylaw.com

12 and

13 WILLIAM BLAIR, ESQ.

14 STEVEN C. HAMRICK, ESQ.

15 of: Florida Power & Light Company

16 700 Universe Boulevard

17 Juno Beach, Florida 33408

18 william.blair@fpl.com

19

20

21

22

23

24

25

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

On Behalf of Mark Oncavage, Dan Kipnis, Southern Alliance for Clean Energy, and National Parks Conservation Association:

DIANE CURRAN, ESQ.

of: Harmon, Curran, Spielberg & Eisenberg,  
LLP  
1725 DeSales Street, N.W., Suite 500  
Washington, D.C. 20036  
dcurran@harmoncurran.com

and

JASON TOTOIU, ESQ.

of: Everglades Law Center, Inc.  
3305 College Avenue  
Ft. Lauderdale, Florida 33314  
jason@evergladeslaw.org

and

MINDY GOLDSTEIN, ESQ.

CAROLINE REISER

of: Turner Environmental Law Clinic  
Emory University School of Law  
1301 Clifton Road, S.E.  
Atlanta, Georgia 30322  
magolds@emory.edu

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

On Behalf of the Village of Pinecrest:

JOSE L. ARANGO, ESQ.

WILLIAM C. GARNER, ESQ.

GREGORY T. STEWART, ESQ.

of: Nabors, Giblin & Nickerson, P.A.

1500 Mahan Drive, Suite 200

Tallahassee, Florida 32308

bgarner@ngn-tally.com

On Behalf of the City of Miami:

XAVIER ALBAN, ESQ.

KERRI McNULTY, ESQ.

MATTHEW HABER, ESQ.

of: The City of Miami

444 SW 2nd Avenue

Miami, Florida 33130

xealban@miamigov.com

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

On Behalf of the Nuclear Regulatory Commission:

- MEGAN WRIGHT, ESQ.
- MAXINE SEGARNICK, ESQ.
- ROBERT WEISMAN, ESQ.
- SARA KIRKWOOD, ESQ.
- PATRICK MOULDING, ESQ.
- MICHAEL SPENCER, ESQ.
- CHRISTINA ENGLAND, ESQ.
- ANTHONY C. WILSON, ESQ.
- OLIVIA J. MIKULA

of: Office of the General Counsel  
Mail Stop - O-15 D21  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001  
301-415-3722 (MJB)  
megan.wright@nrc.gov

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

## I N D E X

<u>Opening Statements</u>		<u>Page</u>
Caroline Reiser		46
Jose Arango		54
Xavier Alban		58
Megan Wright		64
Michael Lepre		73
<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
<u>Joint Intervenors</u>		
INT-000-R		
Joint Intervenors' Final		
Resubmitted Pre-Filed and		
Rebuttal Exhibits List	603	603
INT-001		
Curriculum Vitae of Mark Quarles		
(current as of March 2017)	603	603

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1	INT-002-R		
2	Affidavit of Mark A. Quarles		
3	(Jan. 23, 2012) (filed in response		
4	to the Environmental Report,		
5	Turkey Point Plant, Units 6 and 7,		
6	Revision 3 (ER) prepared by FPL)		
7	(redlined strikeout of INT-002)	603	603
8			
9	INT-003-R		
10	Second Affidavit of Mark. A.		
11	Quarles (Feb. 17, 2012)		
12	(filed in response to FPL's		
13	Response to Joint Intervenors'		
14	Motion to Amend Contention 2.1		
15	(Feb. 10, 2012))		
16	(redlined strikeout of INT-003)	603	603
17			
18	INT-004-R		
19	Declaration of Mark A. Quarles		
20	in Support of Joint Intervenors'		
21	Answer to FPL's Motion for		
22	Summary Disposition of Joint		
23	Intervenors' Amended		
24	Contention 2.1 (Aug. 3, 2012)		
25	(redlined strikeout of INT-004)	603	603

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
1			
2	INT-005-R		
3	Third Affidavit of Mark A.		
4	Quarles (Feb. 2, 2016)		
5	(filed in response to FPL's		
6	Statement of Material Facts		
7	As To Which No Genuine Issue		
8	Exists, in support of FPL's		
9	Motion for Summary Disposition of		
10	Intervenors' Amended		
11	Contention 2.1 (Dec. 15, 2015))		
12	(redlined strikeout of INT-005)	603	603
13			
14	INT-006		
15	Kevin J. Cunningham, Cameron		
16	Walker, & Richard L. Westcott,		
17	<i>Near-Surface, Marine Seismic-</i>		
18	<i>Reflection Data Define Potential</i>		
19	<i>Hydrogeologic Confinement Bypass</i>		
20	<i>in the Carbonate Floridan Aquifer</i>		
21	<i>System, Southeastern Florida, SEG</i>		
22	Technical Program Expanded		
23	Abstracts 2012, (2012)		
24	(cited in the FEIS as 2012-TN4576)	603	603
25			

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
 1323 RHODE ISLAND AVE., N.W.  
 WASHINGTON, D.C. 20005-3701

1	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
2	INT-007		
3	Kevin J. Cunningham, <i>Integrating</i>		
4	<i>Seismic-Reflection and Sequence-</i>		
5	<i>Stratigraphic Methods to</i>		
6	<i>Characterize the Hydrogeology of</i>		
7	<i>the Floridan Aquifer System in</i>		
8	<i>Southeast Florida, U.S. Geological</i>		
9	<i>Survey Open File Report 2013-1181,</i>		
10	<i>(2013) (cited in the FEIS as</i>		
11	<i>2013-TN4573)</i>	603	603
12			
13	INT-008		
14	Kevin J. Cunningham, <i>Integration of</i>		
15	<i>Seismic-Reflection and Well Data</i>		
16	<i>to Assess the Potential Impact of</i>		
17	<i>Stratigraphic and Structural</i>		
18	<i>Features on Sustainable Water Supply</i>		
19	<i>from the Floridan Aquifer System,</i>		
20	<i>Broward County, Florida,</i>		
21	<i>U.S. Geological Survey Open-File</i>		
22	<i>Report 2014-1136 (2014)</i>		
23	<i>(cited in the FEIS as 2014-TN4051)</i>	603	603
24			
25			

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
 1323 RHODE ISLAND AVE., N.W.  
 WASHINGTON, D.C. 20005-3701

1	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
2	INT-009		
3	Kevin J. Cunningham, <i>Seismic-Sequence</i>		
4	<i>Stratigraphy and Geologic Structure</i>		
5	<i>of the Floridan Aquifer System Near</i>		
6	<i>"Boulder Zone" Deep Wells in</i>		
7	<i>Miami-Dade County, Florida,</i>		
8	U.S. Geological Survey Scientific		
9	Investigations Report 2015-5013		
10	(2015) (cited in the FEIS as		
11	2015-TN-4574)	603	603
12			
13	INT-010A		
14	McNabb Hydrogeologic Consulting,		
15	Inc., <i>Report on the Construction</i>		
16	<i>and Testing of Class V Exploratory</i>		
17	<i>Well EW-1 at the Florida Power</i>		
18	<i>and Light Company Turkey Point</i>		
19	<i>Units 6 &amp; 7</i> (2012) (cited in		
20	the FEIS as FPL 2012-TN1577)		
21	(originally filed as pages 1-150		
22	of Exhibit INT-010)	603	603
23			
24			
25			

	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
1			
2	INT-010B		
3	McNabb Hydrogeologic Consulting,		
4	Inc., <i>Report on the Construction</i>		
5	<i>and Testing of Class V Exploratory</i>		
6	<i>Well EW-1 at the Florida Power</i>		
7	<i>and Light Company Turkey Point</i>		
8	<i>Units 6 &amp; 7 (2012) (cited in</i>		
9	<i>the FEIS as FPL 2012-TN1577)</i>		
10	<i>(originally filed as pages 151-225</i>		
11	<i>of Exhibit INT-010)</i>	603	603
12			
13	INT-010C		
14	McNabb Hydrogeologic Consulting,		
15	Inc., <i>Report on the Construction</i>		
16	<i>and Testing of Class V Exploratory</i>		
17	<i>Well EW-1 at the Florida Power</i>		
18	<i>and Light Company Turkey Point</i>		
19	<i>Units 6 &amp; 7 (2012) (cited in</i>		
20	<i>the FEIS as FPL 2012-TN1577)</i>		
21	<i>(originally filed as pages 226-350</i>		
22	<i>of Exhibit INT-010)</i>	603	603
23			
24			
25			

	<u>Marked</u>	<u>Received</u>
1 <u>Exhibit</u>		
2     INT-010D		
3     McNabb Hydrogeologic Consulting,		
4     Inc., <i>Report on the Construction</i>		
5 <i>and Testing of Class V Exploratory</i>		
6 <i>Well EW-1 at the Florida Power</i>		
7 <i>and Light Company Turkey Point</i>		
8 <i>Units 6 &amp; 7 (2012) (cited in</i>		
9 <i>the FEIS as FPL 2012-TN1577)</i>		
10 <i>(originally filed as pages 351-450</i>		
11 <i>of Exhibit INT-010)</i>	603	603
12		
13    INT-010E		
14    McNabb Hydrogeologic Consulting,		
15    Inc., <i>Report on the Construction</i>		
16 <i>and Testing of Class V Exploratory</i>		
17 <i>Well EW-1 at the Florida Power</i>		
18 <i>and Light Company Turkey Point</i>		
19 <i>Units 6 &amp; 7 (2012) (cited in</i>		
20 <i>the FEIS as FPL 2012-TN1577)</i>		
21 <i>(originally filed as pages 451-471</i>		
22 <i>of Exhibit INT-010)</i>	603	603
23		
24		
25		

	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
1			
2	INT-011		
3	Ronald Reese & Emily Richardson,		
4	<i>Scientific Investigations Report</i>		
5	<i>2007-5207, Synthesis of the</i>		
6	<i>Hydrogeologic Framework of the</i>		
7	<i>Floridan Aquifer System and</i>		
8	<i>Delineation of the Major Avon Park</i>		
9	<i>Permeable Zone in Central and</i>		
10	<i>Southern Florida, U.S. Geological</i>		
11	<i>Survey Scientific Investigations</i>		
12	Report 2007-5207 (2008)	603	603
13			
14	INT-012		
15	Virginia Walsh & René M. Price,		
16	<i>Determination of Vertical and</i>		
17	<i>Horizontal Pathways of Injected</i>		
18	<i>Fresh Wastewater Into a Deep Saline</i>		
19	<i>Aquifer (Florida, USA) Using Natural</i>		
20	<i>Chemical Tracers, Hydrogeology</i>		
21	Journal, 18(4): 1027-1042 (2009)	603	603
22			
23	INT-013		
24	Robert C. Starr, Timothy S. Green,		
25	& Laurence C. Hull, <i>Evaluation of</i>		

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
 1323 RHODE ISLAND AVE., N.W.  
 WASHINGTON, D.C. 20005-3701

1	<i>Confining Layer Integrity Beneath</i>		
2	<i>the South District Wastewater</i>		
3	<i>Treatment Plant, Miami-Dade Water</i>		
4	<i>and Sewer Department, Dade County,</i>		
5	<i>Florida, Idaho National Engineering</i>		
6	<i>and Environmental Laboratory</i>		
7	Accession No.		
8	ML14216A601INEEL/EXT-2001-00046,		
9	Idaho Falls, Idaho (2001)	603	603
10			
11	INT-014		
12	Robert G. Maliva et al., <i>Vertical</i>		
13	<i>Migration of Municipal Wastewater</i>		
14	<i>in Deep Injection Well Systems,</i>		
15	<i>South Florida, USA (2007)</i>	603	603
16			
17	INT-015A		
18	U.S. EPA Office of Water, <i>Relative</i>		
19	<i>Risk Assessment of Management</i>		
20	<i>Options for Treated Wastewater in</i>		
21	<i>South Florida, 4-12 (2003)</i>		
22	(originally filed as pages 1-100		
23	of Exhibit INT-015)	603	603
24			
25			

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
 1323 RHODE ISLAND AVE., N.W.  
 WASHINGTON, D.C. 20005-3701

	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
1			
2	INT-015B		
3	U.S. EPA Office of Water, <i>Relative</i>		
4	<i>Risk Assessment of Management</i>		
5	<i>Options for Treated Wastewater in</i>		
6	<i>South Florida, 4-12 (2003)</i>		
7	(originally filed as pages 101-200		
8	of Exhibit INT-015)	603	603
9			
10	INT-015C		
11	U.S. EPA Office of Water, <i>Relative</i>		
12	<i>Risk Assessment of Management</i>		
13	<i>Options for Treated Wastewater in</i>		
14	<i>South Florida, 4-12 (2003)</i>		
15	(originally filed as pages 201-300		
16	of Exhibit INT-015)	603	603
17			
18	INT-015D		
19	U.S. EPA Office of Water, <i>Relative</i>		
20	<i>Risk Assessment of Management</i>		
21	<i>Options for Treated Wastewater in</i>		
22	<i>South Florida, 4-12 (2003)</i>		
23	(originally filed as pages 301-388		
24	of Exhibit INT-015)	603	603
25			

	<u>Marked</u>	<u>Received</u>
1 <u>Exhibit</u>		
2     INT-016		
3     ATSDR, <i>Division of Toxicology</i>		
4 <i>and Environmental Medicine</i>		
5 <i>ToxFAQs</i> (compiled for		
6     ethylbenzene (2007),		
7     tetrachloroethylene (2014), and		
8     heptachlor (2007))	603	603
9		
10    INT-017		
11    Alyssa M. Dausman, Christian		
12    Langevin, Michael C. Sukop,		
13    & Virginia Walsh,		
14 <i>Saltwater/Freshwater Interface</i>		
15 <i>Movement in Response to</i>		
16 <i>Deep-Well Injection in a Coastal</i>		
17 <i>Aquifer</i> , Proceedings of the 20th		
18    Salt Water Intrusion Meeting,		
19    June 23-27, Naples, Florida (2008)	603	603
20		
21    INT-018		
22    Frederick Bloetscher et al.,		
23 <i>Comparative Assessment of Municipal</i>		
24 <i>Wastewater Disposal Methods in</i>		
25 <i>Southeast Florida</i> , Water		

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1	Environment Research		
2	77(5):480-490, Alexandria,		
3	Virginia (2005)	603	603
4			
5	INT-019		
6	Florida Department of Environmental		
7	Protection, Miami-Dade South		
8	District Wastewater Treatment Plant,		
9	Domestic Wastewater Facility		
10	Permit, Permit Number FLA042137		
11	(Dec. 10, 2012)	603	603
12			
13	INT-020		
14	Florida Department of Environmental		
15	Protection, Regional Water Supply		
16	Planning, 2015 Annual Report	603	603
17			
18	INT-021		
19	Notice of Final Rule, National		
20	Primary Drinking Water Regulations;		
21	Synthetic Organic Chemicals;		
22	Monitoring for Unregulated		
23	Contaminants, 52 Fed. Reg.		
24	25,690-91 (July 8, 1987)	603	603
25			

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
 1323 RHODE ISLAND AVE., N.W.  
 WASHINGTON, D.C. 20005-3701

		<u>Marked</u>	<u>Received</u>
1	<u>Exhibit</u>		
2	INT-022		
3	Prefiled Initial Testimony of		
4	Mark A. Quarles Regarding Joint		
5	Intervenors' Contention 2.1	603	603
6			
7	INT-023		
8	Pre-filed Rebuttal Testimony of		
9	Mark A. Quarles Regarding Joint		
10	Intervenors' Contention 2.1	603	603
11			
12	<u>Florida Power &amp; Light Company</u>		
13			
14	FPL-000R2		
15	Florida Power & Light, Co.		
16	Pre-Filed Exhibits List	604	604
17			
18	FPL-001		
19	Pre-Filed Direct Testimony		
20	of Mr. Paul Jacobs	604	604
21			
22	FPL-002		
23	Pre-Filed Direct Testimony		
24	of Mr. David McNabb	604	604
25			

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

		<u>Marked</u>	<u>Received</u>
1	<u>Exhibit</u>		
2	FPL-003		
3	Pre-Filed Direct Testimony		
4	of Dr. Robert G. Maliva	604	604
5			
6	FPL-004		
7	Pre-Filed Direct Testimony		
8	of Dr. Christopher M. Teaf	604	604
9			
10	FPL-005A		
11	Report on the Construction and		
12	Testing of Class V Exploratory		
13	Well EW-1 at the Florida Power		
14	& Light Company Turkey Point		
15	Units 6 & 7 (pages 1 to 244)	604	604
16			
17	FPL-005B		
18	Report on the Construction and		
19	Testing of Class V Exploratory		
20	Well EW-1 at the Florida Power		
21	& Light Company Turkey Point		
22	Units 6 & 7 (pages 245 to 471)	604	604
23			
24			
25			

	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
1			
2	FPL-005C		
3	Report on the Construction and		
4	Testing of Class V Exploratory		
5	Well EW-1 at the Florida Power		
6	& Light Company Turkey Point		
7	Units 6 & 7 (pages 472 to 560)	604	604
8			
9	FPL-006A		
10	AECOM (2009). Engineering Report		
11	on the Construction & Testing		
12	of Deep injection Well IW-1 and		
13	Fuel Zone Monitoring Well MW-1,		
14	Robert Dean WTP, Florida City, FL		
15	(pages 1 to 61)	604	604
16			
17	FPL-006B		
18	AECOM (2009). Engineering Report		
19	on the Construction & Testing		
20	of Deep injection Well IW-1 and		
21	Fuel Zone Monitoring Well MW-1,		
22	Robert Dean WTP, Florida City, FL		
23	(pages 62 to 160)	604	604
24			
25			

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

		<u>Marked</u>	<u>Received</u>
1	<u>Exhibit</u>		
2	FPL-006C		
3	AECOM (2009). Engineering Report		
4	on the Construction & Testing		
5	of Deep injection Well IW-1 and		
6	Fuel Zone Monitoring Well MW-1,		
7	Robert Dean WTP, Florida City, FL		
8	(pages 161 to 257)	604	604
9			
10	FPL-006D		
11	AECOM (2009). Engineering Report		
12	on the Construction & Testing		
13	of Deep injection Well IW-1 and		
14	Fuel Zone Monitoring Well MW-1,		
15	Robert Dean WTP, Florida City, FL		
16	(pages 258 to 338)	604	604
17			
18	FPL-006E		
19	AECOM (2009). Engineering Report		
20	on the Construction & Testing		
21	of Deep injection Well IW-1 and		
22	Fuel Zone Monitoring Well MW-1,		
23	Robert Dean WTP, Florida City, FL		
24	(pages 339 to 361)	604	604
25			

	<u>Marked</u>	<u>Received</u>
1 <u>Exhibit</u>		
2     FPL-006F		
3     AECOM (2009). Engineering Report		
4     on the Construction & Testing		
5     of Deep injection Well IW-1 and		
6     Fuel Zone Monitoring Well MW-1,		
7     Robert Dean WTP, Florida City, FL		
8     (pages 362 to 391)	604	604
9		
10    FPL-007		
11    Cunningham, et al (2012)		
12    Near-surface, marine		
13    seismic-reflection data define		
14    potential hydrogeologic confinement		
15    bypass in the carbonate Floridan		
16    aquifer system,		
17    southeastern Florida	604	604
18		
19    FPL-008A		
20    Cunningham (2015). Seismic-sequence		
21    stratigraphy and geologic structure		
22    of the Floridan aquifer system near		
23    "Boulder Zone" deep wells in		
24    Miami-Dade (pages 1 to 40)	604	604
25		

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
2	FPL-008B		
3	Cunningham (2015). Seismic-sequence		
4	stratigraphy and geologic structure		
5	of the Floridan aquifer system near		
6	"Boulder Zone" deep wells in		
7	Miami-Dade (page 41)	604	604
8			
9	FPL-008C		
10	Cunningham (2015). Seismic-sequence		
11	stratigraphy and geologic structure		
12	of the Floridan aquifer system near		
13	"Boulder Zone" deep wells in		
14	Miami-Dade (page 43)	604	604
15			
16	FPL-009		
17	Dausman, et al (2010). Hypothesis		
18	testing of buoyant plume migration		
19	using a highly parameterized		
20	variable-density groundwater model		
21	at a site in Florida, USA.		
22	Hydrogeology Journal, 18(1), 147-160	604	604
23			
24			
25			

	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
1			
2	FPL-010		
3	Duerr (1995). Types of		
4	secondary porosity of carbonate		
5	rocks injection and test wells		
6	in southern peninsular Florida. U.S.		
7	Geological Survey Water Resources		
8	Investigation Report 94-4013	604	604
9			
10	FPL-011		
11	Duncan, et al (1994). Geological		
12	framework of the Lower Floridan		
13	Aquifer System, St. Lucie, Martin		
14	and Palm Beach Counties: Report		
15	prepared by the Florida Geological		
16	Survey for the FDEP, 126 p	604	604
17			
18	FPL-012		
19	Englehardt, et al (2001). Comparative		
20	Assessment of Human and Ecological		
21	Impacts for Municipal Wastewater		
22	Disposal Methods in Southeast		
23	Florida: Deep Wells, Ocean Outfalls,		
24	and Canal Discharges	604	604
25			

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
 1323 RHODE ISLAND AVE., N.W.  
 WASHINGTON, D.C. 20005-3701

	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
1			
2	FPL-013		
3	Maliva, et al (2007). Vertical		
4	Migration Of Municipal Wastewater In		
5	Deep Injection Well Systems,		
6	South Florida, U.S.A.: Hydrogeology		
7	Journal, v. 15, p. 1387-1396	604	604
8			
9	FPL-014		
10	Maliva & Walker (1998). Hydrogeology		
11	of deep-well disposal of liquid		
12	wastes in southwestern Florida,		
13	U.S.A.: Hydrogeology Journal,		
14	v. 6, p. 538-548	604	604
15			
16	FPL-015		
17	Maliva & Walker (2000). Deep well		
18	injection in South Florida-the		
19	vertical confinement experience:		
20	Proceedings of the 2000 Ground		
21	Water Protection Council Annual		
22	Forum, p. 63-73	604	604
23			
24			
25			

		<u>Marked</u>	<u>Received</u>
1	<u>Exhibit</u>		
2	FPL-016		
3	Metz (2016). Discharge, water		
4	temperature, and water quality of		
5	Warm Mineral Springs, Sarasota		
6	County, Florida-A retrospective		
7	analysis: U.S.G.S. Open-File Report		
8	2016-1166, 31 p	604	604
9			
10	FPL-017		
11	Miami-Dade Water and Sewer		
12	Department (2014) 20-year water		
13	supply facilities work plan		
14	(2014 - 2033) Support Data		
15	(November 2014)	604	604
16			
17	FPL-018		
18	Miller (1986). Hydrogeologic		
19	framework of the Floridan aquifer		
20	system in Florida and in parts of		
21	Georgia, Alabama, and South		
22	Carolina. U.S.G.S. Professional		
23	Paper 1403-B	604	604
24			
25			

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
1			
2	FPL-019A		
3	Miller (1990). Ground Water Atlas		
4	of the United States. Alabama,		
5	Florida, Georgia, and South		
6	Carolina. U.S. Geological Survey		
7	Report HA 730-G (pages 1 to 15)	604	604
8			
9	FPL-019B		
10	Miller (1990). Ground Water Atlas		
11	of the United States. Alabama,		
12	Florida, Georgia, and South		
13	Carolina. U.S. Geological Survey		
14	Report HA 730-G (pages 16 to 30)	604	604
15			
16	FPL-020		
17	Missimer & Maliva (2004).		
18	Tectonically induced fracturing,		
19	folding, and groundwater flow in		
20	South Florida. Gulf Coast		
21	Association Geological Societies		
22	Transactions, 54:6043-459	604	604
23			
24			
25			

	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
1			
2	FPL-021		
3	Mitchell-Tapping, et al (1999).		
4	Mud Hole: a unique warm-water		
5	submarine spring, located offshore		
6	southwestern Florida. Transactions		
7	Gulf Coast Association of Geological		
8	Societies, v.49, p. 370-383	604	604
9			
10	FPL-022		
11	Meyer (1989). Hydrogeology,		
12	ground-water movement, and		
13	subsurface storage in the Floridan		
14	Aquifer System in Southern Florida:		
15	U.S. Geological Survey Professional		
16	Paper 1403-G, 59 p	604	604
17			
18	FPL-023		
19	Reese (1994). Hydrogeology and the		
20	distribution and origin of salinity		
21	in the Floridan Aquifer System,		
22	Southeastern Florida; U.S.		
23	Geological Survey Water Resources		
24	Investigations Report 94-4010	604	604
25			

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
 1323 RHODE ISLAND AVE., N.W.  
 WASHINGTON, D.C. 20005-3701

	<u>Marked</u>	<u>Received</u>
1 <u>Exhibit</u>		
2     FPL-024		
3     Reese & Richardson (2008)		
4     Synthesis of the hydrogeologic		
5     framework of the Floridan Aquifer		
6     System and delineation of a major		
7     Avon Park Permeable zone in		
8     central and southern Florida	604	604
9		
10    FPL-025		
11    Safko & Hickey (1992). A preliminary		
12    approach to the use of borehole		
13    data, including television surveys,		
14    for characterizing secondary		
15    porosity in carbonate rocks in the		
16    Floridan Aquifer System	604	604
17		
18    FPL-026		
19    Starr, et al (2001). Evaluation of		
20    Confining Layer Integrity Beneath		
21    the South District Wastewater		
22    Treatment Plant, Miami-Dade Water		
23    and Sewer Department, Dade County,		
24    Florida. INEEL	604	604
25		

	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
1			
2	FPL-027		
3	United States Environmental		
4	Protection Agency (2003). Relative		
5	risk assessment of management		
6	options for treated wastewater in		
7	South Florida. Office of Water		
8	4606-M EPA 816-R-03-010	604	604
9			
10	FPL-028		
11	Walsh & Price (2010). Determination		
12	of vertical and horizontal pathways		
13	of injected fresh wastewater into		
14	a deep saline aquifer (Florida, USA)		
15	using natural chemical tracers	604	604
16			
17	FPL-029		
18	McNeil (2000). A Review of Upward		
19	Migration of Effluent Related to		
20	Subsurface Injection at Miami-Dade		
21	Water and Sewer South District		
22	Plant. Report prepared for the		
23	Sierra Club	604	604
24			
25			

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
1			
2	FPL-030		
3	ATSDR (Agency for Toxic Substances		
4	and Disease Registry) 1997.		
5	Tetrachloroethylene - ToxFAQs.		
6	CAS # 127-18-4. September 1997	604	604
7			
8	FPL-031		
9	ATSDR (Agency for Toxic Substances		
10	and Disease Registry) 2014a.		
11	Draft Toxicological Profile for		
12	Tetrachloroethylene. U.S. Department		
13	of Health and Human Services.		
14	October 2014	604	604
15			
16	FPL-032		
17	ATSDR (Agency for Toxic Substances		
18	and Disease Registry) 2007a.		
19	Ethylbenzene -ToxFAQs.		
20	CAS # 100-41-4. September 2007	604	604
21			
22	FPL-033		
23	ATSDR (Agency for Toxic Substances		
24	and Disease Registry) 2014b.		
25	Tetrachloroethylene - ToxFAQs.		

			566
1	CAS # 127-18-4. October 2014	604	604
2			
3	FPL-034		
4	ATSDR (Agency for Toxic Substances		
5	and Disease Registry) 2000.		
6	Toxicological Profile for Toluene.		
7	U.S. Department of Health		
8	and Human Services. September 2000	604	604
9			
10	FPL-035		
11	ATSDR (Agency for Toxic Substances		
12	and Disease Registry) 2001.		
13	Toluene - ToxFAQs.		
14	CAS # 108-88-3. February 2001	604	604
15			
16	FPL-036		
17	ATSDR (Agency for Toxic Substances		
18	and Disease Registry) 2007b.		
19	ToxFAQs for Heptachlor and		
20	Heptachlor Epoxide. CAS #76-44-8		
21	and 1024-57-3. August 2007	604	604
22			
23	FPL-037		
24	ATSDR (Agency for Toxic Substances		
25	and Disease Registry) 2010.		

1 Toxicological Profile for  
2 Ethylbenzene. U.S. Department of  
3 Health and Human Services.  
4 November 2010 604 604  
5  
6 FPL-038  
7 ATSDR (Agency for Toxic Substances  
8 and Disease Registry) 2007c.  
9 Toxicological Profile for Heptachlor  
10 and Heptachlor Epoxide. U.S.  
11 Department of Health and Human  
12 Services. November 2007 604 604  
13  
14 FPL-039  
15 ATSDR (Agency for Toxic Substances  
16 and Disease Registry) 2015.  
17 Toluene - ToxFAQs.  
18 CAS # 108-88-3. September 2015 604 604  
19  
20 FPL-040  
21 FDEP (Florida Department of  
22 Environmental Protection). 2005.  
23 Final Technical Report: Development  
24 of Cleanup Target Levels  
25 (CTLs) for Chapter 62-777,

			568
1	F.A.C. February 2005	604	604
2			
3	FPL-041		
4	FPL (FPL Central Laboratory).		
5	2013a. Laboratory results for work		
6	order 13D0159. May 1, 2013	604	604
7			
8	FPL-042		
9	FPL (FPL Central Laboratory).		
10	2013b. Laboratory results for work		
11	order 13H0145. August 13, 2013	604	604
12			
13	FPL-043		
14	FPL (FPL Central Laboratory).		
15	2013c. Laboratory results for work		
16	order 13H0286. August 26, 2013	604	604
17			
18	FPL-044		
19	FPL (FPL Central Laboratory).		
20	2013d. Laboratory results for work		
21	order 13J0216. October 31, 2013	604	604
22			
23	FPL-045		
24	FPL (FPL Central Laboratory).		
25	2014a. Laboratory results for work		

			569
1	order 14C0184. March 19, 2014	604	604
2			
3	FPL-046		
4	FPL (FPL Central Laboratory).		
5	2014b. Laboratory results for work		
6	order 14C0268. April 10, 2014	604	604
7			
8	FPL-047		
9	Genapure (Genapure Analytical		
10	Services, Inc.). 2008. Annual		
11	Sampling, Miami Dade Water & Sewer.		
12	February 29, 2008	604	604
13			
14	FPL-048		
15	Genapure (Genapure Analytical		
16	Services, Inc.). 2009. Annual		
17	Sampling, Miami Dade Water & Sewer.		
18	March 20, 2009	604	604
19			
20	FPL-049		
21	HSDB (Hazardous Substances Databank)		
22	2012. Tetrachloroethylene.		
23	CASRN: 127-18-4. May 3, 2012	604	604
24			
25			

1	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
2	FPL-050		
3	IRIS (Integrated Risk Information		
4	System). 1991. Ethylbenzene;		
5	CASRN 100-41-4. January 31, 1987	604	604
6			
7	FPL-051		
8	IRIS (Integrated Risk Information		
9	System). 2012. Tetrachloroethylene		
10	(Perchloroethylene); CASRN 127-18-4.		
11	February 10, 2012	604	604
12			
13	FPL-052		
14	KSA (KSA Environmental Laboratory,		
15	Inc.). 2007. Annual Plant		
16	Sampling, Miami Dade Water/Sewer.		
17	April 13, 2007	604	604
18			
19	FPL-053		
20	FDEP (Florida Department of		
21	Environmental Protection). 2015.		
22	Chapter 62-550. Drinking Water		
23	Standards, Monitoring, and		
24	Reporting. July 7, 2015	604	604
25			

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
1			
2	FPL-054		
3	USEPA (U.S. Environmental		
4	Protection Agency). 2016a. Ground		
5	Water and Drinking Water Table of		
6	Regulated Drinking Water		
7	Contaminants. October, 2016	604	604
8			
9	FPL-055		
10	Xenco (Xenco Laboratories). 2010.		
11	Annual Priority Pollutants.		
12	Analytical Report 363251 for Miami		
13	Dade Water & Sewer. March 17, 2010	604	604
14			
15	FPL-056		
16	Xenco (Xenco Laboratories). 2011.		
17	Annual Priority Pollutants.		
18	Analytical Report 407304 for Miami		
19	Dade Water & Sewer. March 27, 2011	604	604
20			
21	FPL-057		
22	USEPA (U.S. Environmental		
23	Protection Agency). 2016b. How EPA		
24	Regulates Drinking Water		
25	Contaminants. May 11, 2016	604	604

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
 1323 RHODE ISLAND AVE., N.W.  
 WASHINGTON, D.C. 20005-3701

	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
1			
2	FPL-058		
3	USEPA (U.S. Environmental		
4	Protection Agency). 2006.		
5	Drinking Water Contaminants.		
6	November 28, 2006	604	604
7			
8	FPL-059		
9	USEPA (U.S. Environmental		
10	Protection Agency). 1992. National		
11	Oil and Hazardous Substances		
12	Pollution Contingency Plan	604	604
13			
14	FPL-060		
15	Pre-Filed Rebuttal Testimony		
16	of Mr. David McNabb	604	604
17			
18	FPL-061		
19	Pre-Filed Rebuttal Testimony		
20	of Dr. Robert G. Maliva	604	604
21			
22	FPL-062		
23	Pre-Filed Rebuttal Testimony		
24	of Dr. Christopher M. Teaf	604	604
25			

		<u>Marked</u>	<u>Received</u>
1	<u>Exhibit</u>		
2	FPL-063		
3	Walsh, V. M. (2012). Geochemical		
4	determination of the fate and		
5	transport of injected fresh		
6	wastewater to a deep saline		
7	aquifer. Ph.D. Dissertation,		
8	Florida International University,		
9	Miami, Florida	604	604
10			
11	FPL-064		
12	Joint List of Undisputed Facts	604	604
13			
14	<u>NRC Staff</u>		
15			
16	NRC-001-R2		
17	NRC Staff Hearing Exhibit List	605	605
18			
19	NRC-002-R2		
20	NRC Staff Testimony of Ann L.		
21	Miracle, Daniel O. Barnhurst,		
22	Paul D. Thorne, and Alicia		
23	Williamson-Dickerson Concerning		
24	Contention NEPA 2.1 (Impacts of		
25	Deep Well Injection of Four		

			574
1	Constituents in Cooling-Tower		
2	Blowdown)	605	605
3			
4	NRC-003		
5	Statement of Professional		
6	Qualifications of Ann L. Miracle	605	605
7			
8	NRC-004		
9	Statement of Professional		
10	Qualifications of Daniel O.		
11	Barnhurst	605	605
12			
13	NRC-005		
14	Statement of Professional		
15	Qualifications of Paul D. Thorne	605	605
16			
17	NRC-006		
18	Statement of Professional		
19	Qualifications of Alicia		
20	Williamson-Dickerson	605	605
21			
22	NRC-007A		
23	NUREG-2176, Vol. 1, Environmental		
24	Impact Statement for Combined		
25	Licenses (COLs) for Turkey Point		

1	Nuclear Plant Units 6 and 7		
2	(Draft Report for Comment)	605	605
3			
4	NRC-007B		
5	NUREG-2176, Vol. 2, Environmental		
6	Impact Statement for Combined		
7	Licenses (COLs) for Turkey Point		
8	Nuclear Plant Units 6 and 7		
9	(Draft Report for Comment)		
10	(Feb. 2015)	605	605
11			
12	NRC-008A		
13	NUREG-2176, Vol. 1, Environmental		
14	Impact Statement for Combined		
15	Licenses (COLs) for Turkey Point		
16	Nuclear Plant Units 6 and 7,		
17	Chapters 1 to 6 (Final Report)		
18	(Oct. 2016)	605	605
19			
20	NRC-008B		
21	NUREG-2176, Vol. 2, Environmental		
22	Impact Statement for Combined		
23	Licenses (COLs) for Turkey Point		
24	Nuclear Plant Units 6 and 7,		
25	Chapters 7 to 12 (Final Report)		

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
 1323 RHODE ISLAND AVE., N.W.  
 WASHINGTON, D.C. 20005-3701

			576
1	(Oct. 2016)	605	605
2			
3	NRC-008C		
4	NUREG-2176, Vol. 3, Environmental		
5	Impact Statement for Combined		
6	Licenses (COLs) for Turkey Point		
7	Nuclear Plant Units 6 and 7,		
8	Appendices A to K (Final Report)		
9	(Oct. 2016)	605	605
10			
11	NRC-008D		
12	NUREG-2176, Vol. 3, Environmental		
13	Impact Statement for Combined		
14	Licenses (COLs) for Turkey Point		
15	Nuclear Plant Units 6 and 7,		
16	Appendices E (Final Report)		
17	(Oct. 2016)	605	605
18			
19	NRC-010		
20	EPA 816-R-03-010, Relative		
21	Risk Assessment of Management		
22	Options for Treated Wastewater in		
23	South Florida (Apr. 2003) (TN4759)	605	605
24			
25			

1	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
2	NRC-011		
3	Bloetscher, F., J.D. Englehardt,		
4	D.A. Chin, J.B. Rose, G. Tchobanoglous,		
5	V.P. Amy, and S. Gokgoz.		
6	"Comparative Assessment of Municipal		
7	Wastewater Disposal Methods in		
8	Southeast Florida."		
9	<i>Water Environment Federation</i>		
10	77(5):480-490, Alexandria, Virginia.		
11	(2005) (TN4756) . FULL TEXT COPYRIGHT	605	605
12			
13	NRC-012		
14	Dausman, A.M., C. Langevin, M.C.		
15	Sukop, and V. Walsh.		
16	"Saltwater/Freshwater Interface		
17	Movement in Response to Deep-Well		
18	Injection in a Coastal Aquifer."		
19	<i>In Proceedings of the 20th Salt</i>		
20	<i>Water Intrusion Meeting,</i>		
21	<i>June 23-27, 2008, Naples, Florida.</i>		
22	(2008) (TN4757)	605	605
23			
24			
25			

	<u>Marked</u>	<u>Received</u>
1 <u>Exhibit</u>		
2     NRC-013		
3     Florida Keys Aqueduct Authority.		
4     "Where Does Our Water Come From?"		
5     (2014) (TN3649)	605	605
6		
7     NRC-014		
8     Reese, R.S. U.S. Geological Survey		
9     Water-Resources Investigations		
10    Report 94-4010, <i>Hydrogeology and the</i>		
11 <i>Distribution and Origin of Salinity</i>		
12 <i>in the Floridan Aquifer System,</i>		
13 <i>Southeastern Florida.</i> Tallahassee,		
14    Florida (1994) (TN1439)	605	605
15		
16    NRC-017		
17    USGS, Impact of Anthropogenic		
18    Development on Coastal		
19    Ground-Water Hydrology in		
20    Southeastern Florida, 1900-2000		
21    (2005) (TN110)	605	605
22		
23    NRC-018		
24    Meyer, F.W., U.S. Geological Survey		
25    Professional Paper 1403-G,		

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1	<i>Hydrogeology, Ground-Water Movement,</i>		
2	<i>and Subsurface Storage in the</i>		
3	<i>Florida Aquifer System in</i>		
4	<i>Southern Florida. (1989) (TN2255)</i>	605	605
5			
6	NRC-019		
7	Fla. Admin. Code 62-528 Underground		
8	Injection Control (2010)	605	605
9			
10	NRC-020		
11	L-2012-089, Letter from William		
12	Maher to NRC RE: Submittal of		
13	Underground Injection Control		
14	Exploratory Well-Final Casting		
15	Setting Depth Recommendation		
16	(March 7, 2012) (TN1264)	605	605
17			
18	NRC-021		
19	Underground Injection Control		
20	Program-Revision to the Federal		
21	Underground Injection Control		
22	Requirements for Class I Municipal		
23	Disposal Wells in Florida,		
24	70 Fed. Reg. 70,513, 70,532		
25	(Nov. 22, 2005)	605	605

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
 1323 RHODE ISLAND AVE., N.W.  
 WASHINGTON, D.C. 20005-3701

	<u>Marked</u>	<u>Received</u>
1 <u>Exhibit</u>		
2     NRC-022		
3     EPA 815-F-05-033, <i>Fact Sheet:</i>		
4 <i>EPA Provides a Regulatory</i>		
5 <i>Alternative for Class I Municipal</i>		
6 <i>Disposal Wells in Specific Counties</i>		
7 <i>in Florida</i> (Nov. 2005) (TN4766)	605	605
8		
9     NRC-023		
10    Miami-Dade Water and Sewer		
11    Department Comprehensive Annual		
12    Financial Report		
13    (Sept. 30, 2014) (TN4758)	605	605
14		
15    NRC-025		
16    Fla. Admin. Code 62-600		
17    (2012) (TN1268)	605	605
18		
19    NRC-026		
20    John Bell et al, "Stripping		
21    of Volatile Organic Compounds at		
22    Full-Scale Municipal Wastewater		
23    Treatment Plants." <i>Water Environment</i>		
24 <i>Research, Vol 65, No. 6, at</i>		
25    708-716 (Oct.1993) (Melcer et al,		

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

			581
1	1993). FULL TEXT COPYRIGHT	605	605
2			
3	NRC-028		
4	Groundwater Contamination Transport		
5	and Remediation, Bedient, Rifa,		
6	Newell, pp. 216-218 (1993).		
7	FULL TEXT COPYRIGHT	605	605
8			
9	NRC-029		
10	EPA/540/2-91/022, Engineering		
11	Bulletin, Air Stripping of Aqueous		
12	Solutions, (Oct.1991)		
13	(EPA Engineering Bulletin)	605	605
14			
15	NRC-030-R		
16	Turkey Point Plant, Units 6 and 7		
17	COL Application, Part 3-		
18	Environmental Report. Rev. 6,		
19	Selected Portions of Sections 3.1,		
20	3.3 and 3.4 (2014) (TN4058)	605	605
21			
22	NRC-031		
23	Ju-Chang Huang & Chii Shang, Handbook		
24	of Environmental Engineering,		
25	Volume 4: Advanced Physicochemical		

1	Treatment Processes, Chapter 2,		
2	Air Stripping 47-79 (L. K. Wang &		
3	Y.-T. Hung, N. K. Shamas eds.)		
4	(Huang and Shang)	605	605
5			
6	NRC-032		
7	ATSDR Public Health Statement,		
8	Heptachlor and Heptachlor Epoxide,		
9	CAS#76-44-8 and 1024-57-3		
10	(Aug. 2007)	605	605
11			
12	NRC-033		
13	EPA 811-F-95-003-T, National		
14	Primary Drinking Water Regulations		
15	(Oct. 1995)	605	605
16			
17	NRC-035		
18	EPA Protecting Drinking Water		
19	Through Underground Injection		
20	Control (Mar. 2012) (TN4782)	605	605
21			
22	NRC-037		
23	EPA 816-F-09-004, <i>National Primary</i>		
24	<i>Drinking Water Regulations</i>		
25	(May 2009) (TN4901)	605	605

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
 1323 RHODE ISLAND AVE., N.W.  
 WASHINGTON, D.C. 20005-3701

	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
1			
2	NRC-038		
3	EPA Method 624: Purgeables,		
4	Appendix A to Part 136 - Methods		
5	for Organic Chemical Analysis of		
6	Municipal and Industrial Wastewater		
7	(1984) (TN4899)	605	605
8			
9	NRC-039		
10	James A. Miller, "HA 730-G, Ground		
11	Water Atlas of the United States:		
12	Alabama, Florida, Georgia, and		
13	South Carolina" (1990) (TN550)	605	605
14			
15	NRC-040		
16	Ronald S. Reese and Emily Richardson,		
17	"Synthesis of the Hydrogeologic		
18	Framework of the Floridan Aquifer		
19	System and Delineation of a Major		
20	Avon Park Permeable Zone in		
21	Central and Southern Florida"		
22	(2008) (TN3436)	605	605
23			
24	NRC-041		
25	South Florida Water Management		

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
 1323 RHODE ISLAND AVE., N.W.  
 WASHINGTON, D.C. 20005-3701

1	District Planning Document Lower		
2	East Coast Water Supply Plan Update		
3	(2013) (TN3461)	605	605
4			
5	NRC-043		
6	R. Maliva et al.; "Vertical Migration		
7	of Municipal Wastewater in Deep		
8	Injection Well Systems, South Florida,		
9	USA", <i>Hydrogeology Journal</i> 15:		
10	pp1387-1396, (2007) (TN1483)		
11	FULL TEXT COPYRIGHT	605	605
12			
13	NRC-044		
14	R. Starr et al.; "Evaluation of		
15	Confining Layer Integrity Beneath		
16	the South District Wastewater		
17	Treatment Plant, Miami-Dade Water		
18	and Sewer Department, Dade County,		
19	Florida" (2001) (TN1251)	605	605
20			
21	NRC-045		
22	Underground Injection Control		
23	Program-Relative Risk Assessment of		
24	Management Options for Treated		
25	Wastewater in South Florida;		

**NEAL R. GROSS**COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1	Notice of Availability,		
2	68 Fed. Reg. 23,673, 23,677		
3	(May 5, 2003) (TN3658)	605	605
4			
5	NRC-046		
6	Virginia Walsh & Rene M. Price,		
7	"Determination Of Vertical And		
8	Horizontal Pathways Of Injected		
9	Fresh Wastewater Into A Deep Saline		
10	Aquifer (Florida, USA) Using		
11	Natural Chemical Tracers",		
12	<i>Hydrogeology Journal</i> (2010)		
13	(TN3656) FULL TEXT COPYRIGHT	605	605
14			
15	NRC-047		
16	Dausman et al., "Hypothesis Testing		
17	of Buoyant Plume Migration Using a		
18	Highly Parameterized Variable-Density		
19	Groundwater Model at a Site in		
20	Florida, USA." <i>Hydrogeology Journal</i>		
21	18(1):147-160 (2010) (TN4760)		
22	FULL TEXT COPYRIGHT	605	605
23			
24			
25			

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
 1323 RHODE ISLAND AVE., N.W.  
 WASHINGTON, D.C. 20005-3701

	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
1			
2	NRC-048		
3	McNeill, D.F. "A Review of Upward		
4	Migration of Effluent Related to		
5	Subsurface Injection at Miami-Dade		
6	Water and Sewer South District		
7	Plant". Final Report, Coral Gables,		
8	Florida (2000) (TN4572)		
9	FULL TEXT COPYRIGHT	605	605
10			
11	NRC-049		
12	NUREG-2176, Supplement 1,		
13	Environmental Impact Statement		
14	for Combined Licenses (COLs) for		
15	Turkey Point Nuclear Plant Units		
16	6 and 7 (Dec. 2016)	605	605
17			
18	NRC-050		
19	Cunningham et al., "Near-Surface,		
20	Marine Seismic-Reflection Data		
21	Define Potential Hydrogeologic		
22	Confinement Bypass in the Carbonate		
23	Floridan Aquifer System, Southeastern		
24	Florida" (2012) (TN4576)		
25	FULL TEXT COPYRIGHT	605	605

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
 1323 RHODE ISLAND AVE., N.W.  
 WASHINGTON, D.C. 20005-3701

1	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
2	NRC-051		
3	USGS "Integrating Seismic-Reflection		
4	and Sequence-Stratigraphic Methods to		
5	Characterize the Hydrogeology of the		
6	Floridan Aquifer System in		
7	Southeast Florida" (2013) (TN4573)	605	605
8			
9	NRC-052		
10	USGS "Integration of Seismic-		
11	Reflection and Well Data to		
12	Assess the Potential Impact of		
13	Stratigraphic and Structural		
14	Features on Sustainable Water		
15	Supply from the Floridan Aquifer		
16	System, Broward County, Florida"		
17	(2014) (TN4051)	605	605
18			
19	NRC-053		
20	Kevin J. Cunningham, "Seismic-		
21	Sequence Stratigraphy and Geologic		
22	Structure of the Floridan Aquifer		
23	System Near "Boulder Zone" Deep		
24	Wells in Miami-Dade County,		
25	Florida" (2015) (TN4574)	605	605

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
1			
2	NRC-055		
3	L-2013-216, Letter from William		
4	Maher to NRC, RE: Response to		
5	NRC Request for Additional		
6	Information Letter No. 072		
7	(eRAI 6985)-SRP Section 11.02-		
8	Liquid Waste Management Systems		
9	(Aug. 9, 2013) (TN3931)	605	605
10			
11	NRC-056		
12	Florida Power & Light Co., Report		
13	on the Construction and Testing		
14	of Class V Exploratory Well EW-1		
15	at the Florida Power & Light		
16	Company Turkey Point Units		
17	6 & 7 (Sept. 2012) (TN1577)	605	605
18			
19	NRC-057		
20	Florida Power & Light Co., Report		
21	on the Construction and Testing		
22	of Dual-Zone Monitor Well DZMW-1		
23	at the Florida Power & Light		
24	Company Turkey Point Units		
25	6 & 7 (Sept. 2012) (TN4053)	605	605

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
 1323 RHODE ISLAND AVE., N.W.  
 WASHINGTON, D.C. 20005-3701

		<u>Marked</u>	<u>Received</u>
1	<u>Exhibit</u>		
2	NRC-058		
3	Freeze, Allan R. and John A.		
4	Cherry. Groundwater. Prentice		
5	Hall, Inc. (1979) (TN3275)		
6	FULL TEXT COPYRIGHT	605	605
7			
8	NRC-059		
9	USGS, Open-File Report 2014-113,		
10	"Integration of Seismic-Reflection		
11	and Well Data to Assess the		
12	Potential Impact of Stratigraphic		
13	and Structural Features in		
14	Sustainable Water Supply from the		
15	Floridan Aquifer System, Broward		
16	County, Florida". (Aug. 2014)	605	605
17			
18	NRC-060		
19	EPA Method 608: Organochlorine		
20	Pesticides and PCBs (1984)		
21	(TN4898)	605	605
22			
23	NRC-061		
24	NUREG-1555, Standard Review Plans		
25	for Environmental Reviews for		

			590
1	Nuclear Power Plants		
2	(Initial ESRP, 1999)	605	605
3			
4	NRC-062		
5	Lester J. Williams and Eve L.		
6	Kuniansky, "Revised Hydrogeologic		
7	Framework of the Floridan Aquifer		
8	System in Florida and Parts of		
9	Georgia, Alabama, and South		
10	Carolina" (2015) (TN4577)	605	605
11			
12	NRC-063		
13	MHCDEP-14-0041, Letter from David		
14	McNabb to Joseph May, RE:		
15	Florida Power & Light Company		
16	Turkey Point Units 6 & 7 Class I		
17	Injection Well DIW-1 Short-Term		
18	Injection Test Technical		
19	Memorandum; Permit #293962-002-UC		
20	(April 1, 2014) (TN4052)	605	605
21			
22	NRC-064		
23	McNeill, D.F. A Geological Review		
24	of the Confining Capability of a		
25	Regional Dolomite Unit: Application		

1	to the MDWAS South District WWTP.		
2	Coral Gables, Florida		
3	(2002) (TN4571)	605	605
4			
5	NRC-065		
6	Walsh, V.M. and R.M. Price. 2008.		
7	"Tracing Vertical and Horizontal		
8	Migration of Injected Fresh		
9	Wastewater into a Deep Saline		
10	Aquifer using Natural Chemical		
11	Tracers." <i>20th Salt Water Intrusion</i>		
12	<i>Meeting Proceedings, June 23-27,</i>		
13	<i>2008, Naples, Florida.</i> U.S.		
14	Geological Survey, Ft. Lauderdale,		
15	Florida. (TN3657)	605	605
16			
17	NRC-066		
18	FPL answer to RAI 6985		
19	(January 15, 2014)	605	605
20			
21	NRC-067		
22	Safe Drinking Water Act 42		
23	U.S.C. § 300f et seq. (TN1337)	605	605
24			
25			

	<u>Exhibit</u>	<u>Marked</u>	<u>Received</u>
1			
2	NRC-068		
3	Fla. Admin. Code 62-625 (2010)	605	605
4			
5	NRC-069		
6	EPA, How EPA Regulates Drinking		
7	Water Contaminants (2016),		
8	available at		
9	<a href="https://www.epa.gov/dwregdev/how-epa-regulates-drinking-water-contaminants">https://www.epa.gov/dwregdev/</a>		
10	<a href="https://www.epa.gov/dwregdev/how-epa-regulates-drinking-water-contaminants">how-epa-regulates-drinking-water</a>		
11	<a href="https://www.epa.gov/dwregdev/how-epa-regulates-drinking-water-contaminants">-contaminants</a>	605	605
12			
13	NRC-070		
14	L-2012-350, Letter from William		
15	Maher, Senior Licensing Director,		
16	Florida Power & Light Company,		
17	to NRC, RE: Clarification Response		
18	to NRC Request for Additional		
19	Information Letter 1112081 (RAI 5765)		
20	Related to ESRP Section 4.2		
21	Water-Related Impacts		
22	(Nov. 14. 2012)	605	605
23			
24	NRC-071		
25	Turkey Point Well Log	605	605

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
 1323 RHODE ISLAND AVE., N.W.  
 WASHINGTON, D.C. 20005-3701

	<u>Marked</u>	<u>Received</u>
1 <u>Exhibit</u>		
2     NRC-072		
3     NRC Staff Rebuttal Testimony of		
4     Ann L. Miracle, Daniel O. Barnhurst,		
5     and Paul D. Thorne Concerning		
6     Contention 2.1 (Impacts of Deep Well		
7     Injection of Four Constituents		
8     in Cooling-Tower Blowdown)	605	605
9		
10    NRC-073		
11    Affidavit of Alicia		
12    Williamson-Dickerson	605	605
13		
14    NRC-074		
15    Affidavit of Ann L. Miracle	605	605
16		
17    NRC-075		
18    Affidavit of Daniel O. Barnhurst	605	605
19		
20    NRC-076		
21    Affidavit of Paul D. Thorne	605	605
22		
23		
24		
25		

## P R O C E E D I N G S

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

9:31 a.m.

CHAIRMAN HAWKENS: Good morning. Please be seated. We can go on the record, Dylan.

Good morning. This morning we're conducting a hearing in the case entitled Florida Power & Light Company, Turkey Point Units 6 and 7, Docket No. 52-040-COL and 52-041-COL.

My name is Roy Hawkens. I'm the Chairman of this licensing board. I'm legally trained. On my right is Judge Mike Kennedy, who has his doctorate in nuclear engineering. On my left is Bill Burnett, who has his doctorate in environmental science.

Would counsel for the parties please introduce themselves starting with Joint Intervenors?

MS. CURRAN: Good morning, Judge Hawkens, members of the licensing board. My name is Diane Curran. I am here on behalf of the Joint Intervenors.

With me today are, to my left, our expert, Mark Quarles, Caroline Reiser, a fellow at Turner Environmental Law Clinic, behind me, Mindy Goldstein, Executive Director of the Turner Environmental Law Clinic, Jason Totoiu, Executive Director of the Everglades Law Center, and behind them, eight students from the Turner Environmental Law Clinic.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 CHAIRMAN HAWKENS: Good morning and  
2 welcome.

3 MR. ARANGO: Jose Arango, on behalf of the  
4 Village of Pinecrest.

5 MR. ALBAN: Good morning. Xavier Alban,  
6 on behalf of the City of Miami, and to my left is my  
7 colleague, Kerri McNulty, also with the City of Miami.

8 CHAIRMAN HAWKENS: Good. Thank you.

9 MR. LEPRE: Good morning. I'm Mike Lepre  
10 for the Applicant, FPL. I'm with the law firm of  
11 Pillsbury, Winthrop, Shaw, Pittman.

12 To my right is Anne Leidich, an attorney  
13 with our firm. And also in the hearing room today  
14 from FPL are several members of their in-house legal  
15 team, as well as their new nuclear project team,  
16 including the senior licensing director for the  
17 project, Bill Maher.

18 CHAIRMAN HAWKENS: Thank you.

19 MR. LEPRE: Thank you.

20 MS. WRIGHT: Good morning. I'm --

21 CHAIRMAN HAWKENS: -- must be Staff.

22 MS. WRIGHT: I'm Megan Wright, counsel for  
23 NRC Staff. Behind me is Bob Weisman and also Maxine  
24 Segarnick.

25 CHAIRMAN HAWKENS: Welcome.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MS. WRIGHT: Thank you.

2 CHAIRMAN HAWKENS: At the outset, I'd like  
3 to introduce several other members of the Atomic  
4 Safety and Licensing Board panel who are assisting  
5 this licensing board.

6 And I'd encourage counsel, and if they  
7 have any questions or need any assistance during the  
8 pendency of this hearing, please feel free to approach  
9 them.

10 First, our law clerks, Ms. Jen Scro, Kim  
11 Hsu, and Lindsay Simmons, our IT expert, Andy Welkie,  
12 and the licensing board's strong right arm is Ms.  
13 Karen Valloch in the back.

14 The issue that we're litigating in this  
15 case is an environmental contention brought by Joint  
16 Intervenors that we refer to as Contention 2.1. The  
17 contention asserts that FPL's application for combined  
18 licenses for Turkey Point Units 6 and 7 should not be  
19 granted because the Final Environmental Impact  
20 Statement prepared the Nuclear Regulatory Commission  
21 for the project is deficient.

22 Contention 2.1 alleges "the Final  
23 Environmental Impact Statement or FEIS is deficient in  
24 concluding that the environmental impacts for FPL's  
25 proposed deep injection wells will be small. The

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 chemicals, ethylbenzene, heptachlor,  
2 tetrachloroethylene, and toluene, in the wastewater  
3 injections at concentrations listed in the FEIS Table  
4 3-5 may adversely impact the groundwater should they  
5 migrate from the Boulder Zone to the Upper Floridan  
6 Aquifer."

7 Today's hearing is what we call a Subpart  
8 L hearing because it's governed by the procedures in  
9 Title 10 of the Code of Federal Regulations, Part 2,  
10 Subpart L.

11 Pursuant to those procedures, this board  
12 has already received from the parties several hundred  
13 pages of written testimony, several thousand pages of  
14 pre-filed exhibits, and written briefs and responses.

15 The licensing board has reviewed the  
16 written testimony and the exhibits, which, in addition  
17 to the testimony we'll hear today, will comprise the  
18 evidence we'll use in deciding this case.

19 The main purpose of today's hearing is to  
20 give the board an opportunity to question the parties'  
21 witnesses. In this respect, today's hearing will  
22 differ from a typical courtroom proceeding you may be  
23 familiar with where counsel for the parties have the  
24 primary responsibility for questioning witnesses.

25 The parties have provided this board with

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 a list of proposed questions that they've requested  
2 the board to ask. But deciding what questions to ask  
3 is a matter that's vested in the discretion of the  
4 licensing board.

5 The questions we ask today do not  
6 necessarily mean we favor or disfavor a party's  
7 position, but they reflect that the pre-filed exhibits  
8 we've reviewed have raised questions we would like to  
9 explore in order to fully understand the record.

10 For the benefit of the attending audience  
11 and as a reminder to counsel, I'll summarize the  
12 procedural steps we'll be following at this hearing.

13 At the outset, we'll swear in the parties'  
14 witnesses. Next, we'll admit the parties' pre-filed  
15 exhibits into evidence. Third, we'll hear opening  
16 statements from counsel. And, fourth, the board will  
17 question the parties' witnesses.

18 For efficiency, the witnesses will sit on  
19 five discrete panels. Each panel will answer  
20 questions relating to a particular technical topic.  
21 The five topics are as follows.

22 The first topic will explore the  
23 hydrogeologic properties of the confining unit that  
24 separates the Boulder Zone from the Upper Floridan  
25 Aquifer and whether that confining unit is likely to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 prevent wastewater injected into the Boulder Zone from  
2 migrating to the Upper Floridan Aquifer.

3 The second topic is whether the deep  
4 injection wells that will be used at the Turkey Point  
5 facility are likely to leak and introduce wastewater  
6 into the Upper Floridan Aquifer.

7 The third topic is whether FPL's  
8 monitoring systems would likely detect leaking or  
9 migrating wastewater before it reaches the Upper  
10 Floridan Aquifer.

11 The fourth topic is the impact on human  
12 health of the four contaminants if the wastewater  
13 migrates to the Upper Floridan Aquifer at  
14 concentrations listed in the FEIS.

15 And the fifth and final topic is whether  
16 the concentration of the contaminants could change  
17 after they're discharged into the Boulder Zone.

18 After we've completed questioning all five  
19 panels, counsel for the parties and for the  
20 municipalities will have the opportunity to submit  
21 proposed questions they'd like us to consider asking  
22 before the testimony -- excuse me. They'll have the  
23 opportunity to submit proposed questions they'd like  
24 us to consider based on the testimony that is raised  
25 in today's or tomorrow's hearing.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           Finally, after all the questioning is  
2 complete, the counsel will have the opportunity to  
3 present closing statements.

4           After the opening statements, we will take  
5 a brief recess in order to sit the first panel.

6           Throughout the hearing today and if we go  
7 into tomorrow, and I think it's likely we may go into  
8 tomorrow morning, if counsel or if witnesses during  
9 the questioning of the panels would like to take a  
10 brief recess for any reason, please don't hesitate to  
11 bring that to our attention.

12           We'll also take a recess for lunch today  
13 at an appropriate time, probably after we complete  
14 questioning panel 1 or at a very advanced stage of  
15 questioning panel 1.

16           This facility closes at 5:00, which means  
17 we'll need to adjourn by about 4:40 to give everybody  
18 the opportunity to pack up so we can exit the facility  
19 at 5:00.

20           As I mentioned earlier, if we do not  
21 finish the hearing today, we will reconvene tomorrow  
22 morning at a time we will agree upon later this  
23 afternoon if we need to.

24           At this point, if the counsel for the  
25 parties or the participants have any questions, let me

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 start with the parties. Ms. Curran?

2 MS. CURRAN: Judge Hawkens, I do have one  
3 question which is, if we do stay overnight -- maybe  
4 this is a question that will come up later -- can we  
5 leave our written materials -- we have binders full of  
6 testimony -- in the hearing room?

7 CHAIRMAN HAWKENS: I'll find that out and  
8 get back to you before lunch, Ms. Curran. Mr. Lepre,  
9 any questions?

10 MR. LEPRE: No, Your Honor.

11 CHAIRMAN HAWKENS: Ms. Wright?

12 MS. WRIGHT: No, Your Honor.

13 CHAIRMAN HAWKENS: Municipalities?

14 MR. ARANGO: No, Your Honor.

15 CHAIRMAN HAWKENS: All right. Thank you.  
16 Would counsel, starting with Joint Intervenors, then  
17 FPL, and then the NRC Staff, please introduce their  
18 witnesses? And would each witness stand as your name  
19 is called and remain standing?

20 MS. CURRAN: Joint Intervenors present  
21 their expert witness, Mark E. Quarles.

22 MR. LEPRE: The FPL's witnesses are Dr.  
23 Robert Maliva, Dr. Christopher Teaf, Mr. Paul Jacobs,  
24 and Mr. David McNabb.

25 CHAIRMAN HAWKENS: Good morning. Ms.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Wright?

2 MS. WRIGHT: NRC Staff witnesses are Dan  
3 Barnhurst, Paul Thorne, Ann Miracle, and Alicia  
4 Williamson.

5 CHAIRMAN HAWKENS: Thank you. And it's  
6 Dr. Miracle, I understand? Yes. All right.

7 Would the witnesses please raise their  
8 right hand? Do you solemnly swear or affirm that all  
9 the statements you'll make in this hearing will be  
10 true and correct to the best of your knowledge and  
11 belief?

12 WITNESSES: I do.

13 CHAIRMAN HAWKENS: Would the record please  
14 reflect that the witnesses all answered in the  
15 affirmative?

16 You may be seated. And I'd remind you  
17 that you may be called upon at different times today  
18 in different panels and tomorrow as well to testify.  
19 Any time you do testify you will remain under oath or  
20 affirmation.

21 Next, we are going to identify the  
22 parties' pre-filed exhibits and admit those exhibits  
23 into evidence by records to the parties' exhibit  
24 lists.

25 And I will start with Joint Intervenors.

1 I'm referring to, Ms. Curran, your Joint Intervenors'  
2 exhibit list, which is a three-page document filed on  
3 April 13, 2017. It's titled "Final Resubmitted List  
4 of Exhibits for Joint Intervenors, Initial Written  
5 Statement of Position on Contention 2.1, and Pre-filed  
6 Testimony of Mark A. Quarles Regarding the Joint  
7 Intervenors Contention 2.1."

8 Did the document I just describe contain  
9 all the exhibits you wish to have admitted into this  
10 hearing?

11 MS. CURRAN: Yes, it does. Those are  
12 Exhibits INT-000-R through INT-023.

13 (Whereupon, the above-referred  
14 to documents were marked as  
15 INT-000-R through INT-023 for  
16 identification.)

17 CHAIRMAN HAWKENS: And that is inclusive.  
18 Did you get that, Court Reporter? Thank you.

19 This board admits into evidence all of the  
20 exhibits listed in this three-page document.

21 (Whereupon, the above-referred  
22 to documents were received into  
23 evidence as INT-000-R through  
24 INT-023.)

25 CHAIRMAN HAWKENS: And just for

1 clarification, Ms. Curran, the exhibit list I'm  
2 looking at had the title on it, but it did not have  
3 the exhibit number. It is properly, will be marked as  
4 INT-000-R. Is that correct?

5 MS. CURRAN: That's correct.

6 CHAIRMAN HAWKENS: All right. Thank you.  
7 I'm now referring to FPL's exhibit list, which is an  
8 eight-page document dated April 13, 2017. And it's  
9 marked with Exhibit No. FPL-000R2.

10 Mr. Lepre, does this document I just  
11 described contain all the documents you wish to have  
12 admitted into evidence?

13 MR. LEPRE: Yes, it does.

14 CHAIRMAN HAWKENS: Hearing no objections  
15 to the admission of these exhibits, the board admits  
16 into evidence all of the exhibits listed in this  
17 document, which consist of Exhibit Nos. FPL-000R2  
18 through FPL-064 inclusive.

19 (Whereupon, the above-referred  
20 to documents were marked as  
21 FPL-000R2 through FPL-064 for  
22 identification and were  
23 received into evidence.)

24 CHAIRMAN HAWKENS: I'm now referring to  
25 the NRC Staff's exhibit list, which is a ten-page

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 document dated April 14th and which is marked Exhibit  
2 No. NRC-001-R2.

3 Ms. Wright, does this document I just  
4 described contain all the exhibits you wish to have  
5 admitted into evidence?

6 MS. WRIGHT: Yes, Your Honor.

7 CHAIRMAN HAWKENS: Hearing no objections  
8 to the admission of these exhibits, the board admits  
9 into evidence all the exhibits listed in this exhibit  
10 list, which consist of Exhibits NRC-001-R2 through  
11 NRC-076 inclusive.

12 (Whereupon, the above-referred  
13 to documents were marked as  
14 NRC-001-R2 through NRC-076 for  
15 identification and were  
16 received into evidence.)

17 CHAIRMAN HAWKENS: Are there any matters  
18 that counsel wish to address before we proceed to the  
19 opening statements?

20 We'll now hear opening statements from the  
21 counsel. We'll hear them in the following order:  
22 first from Joint Intervenors, second from the Village  
23 of Pinecrest, third from the City of Miami, next the  
24 NRC Staff, and finally FPL.

25 Opening statements will not exceed ten

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 minutes. And if board members have questions, we'll  
2 endeavor to refrain from asking them until the end of  
3 your statements.

4 As I mentioned, opening statements should  
5 not exceed ten minutes. Counsel are not obligated to  
6 use the entire time.

7 Our law clerk will assist counsel keeping  
8 track of time by raising the amber sign when two  
9 minutes are left and the red sign when your time is  
10 expired. When you see the red sign, if you could  
11 endeavor to wrap things up as quickly as possible, we  
12 would be grateful.

13 Would the opening statement presenter for  
14 Joint Intervenors please come forward? Ms. Reiser, is  
15 that correct?

16 MS. REISER: Yes.

17 CHAIRMAN HAWKENS: Good morning.

18 MS. REISER: Good morning. May it please  
19 the board, my name is Caroline Reiser. And I'm the  
20 fellow with the Turner Environmental Law Clinic at  
21 Emory Law School.

22 I am here on behalf of Joint Intervenors,  
23 the National Parks Conservation Association, the  
24 Southern Alliance for Clean Energy, and local  
25 residents, Captain Dan Kipnis and Mark Oncavage.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           With the support of our expert, Mark  
2 Quarles, who has extensive experience in wastewater  
3 disposal and contaminant investigations, Joint  
4 Intervenors have shown and will show further today  
5 that the U.S. Nuclear Regulatory Commission Staff have  
6 not produced an adequate Final Environmental Impact  
7 Statement for Turkey Point Units 6 and 7 nuclear power  
8 plant.

9           Specifically, NRC Staff fail to support  
10 their conclusions that, one, wastewater injected  
11 underground is extremely unlikely to migrate into an  
12 underground source of drinking water, or, two, if it  
13 did migrate, that the impacts would be small.

14           To reach its conclusions, NRC Staff  
15 stubbornly relies on outdated method of using a single  
16 well to analyze how likely wastewater is to migrate  
17 and ignores the demonstrated need to first conduct  
18 seismic reflection studies, a technology that is  
19 embraced and recommended by federal and local  
20 governments in this area and would provide more  
21 accurate and comprehensive data about how likely  
22 migration is to occur at the site.

23           NRC Staff can casually brush aside the  
24 toxic nature of the contaminants in the wastewater  
25 while insisting that high level disinfection, a

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 technology meant to do something else, will ensure  
2 that the concentrations of the contaminants in the  
3 wastewater will remain low enough to drink.

4 Ignoring reality in the face of  
5 potentially grave environmental impacts is what the  
6 National Environmental Policy Act was meant to  
7 prevent.

8 NEPA requires agencies take a hard look at  
9 potential environmental impacts to ensure that  
10 information is carefully considered and actions are  
11 fully understood before they are taken so that  
12 decision makers can consider alternatives to those  
13 actions or ways to mitigate any significant  
14 environmental impacts of those actions.

15 NRC Staff's continuous failure over the  
16 past seven years to use reasonable and scientifically  
17 defensible technology to support their conclusions  
18 means that they have not taken the requisite hard look  
19 at these issues.

20 Pollution of potential drinking water  
21 supplies by wastewater injection is a serious and  
22 urgent concern in South Florida because of this area's  
23 extremely complex and unique geology and the known  
24 need for additional drinking water sources in this  
25 region in the near future.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           The Turkey Point FEIS mocks NEPA's  
2 requirement of informed decision-making for an issue  
3 that has the potential to greatly impact future  
4 generations.

5           NRC Staff must either, one, support their  
6 conclusion that wastewater injected underground is  
7 extremely unlikely to migrate into an underground  
8 source of drinking water, or, if they are unable to do  
9 this, they have no choice but to acknowledge the  
10 uncertainty surrounding migration and conclude that  
11 impacts may be significant.

12           To first expand upon the issue of  
13 migration, there is a clear history of upward  
14 migration in South Florida. Time and again there have  
15 been unexpected vertical intrusions of wastewater into  
16 drinking water supplies of South Florida.

17           U.S. EPA has even stated that there is no  
18 way to be certain that water injected underground in  
19 this region will not migrate.

20           The only way to address this uncertainty  
21 is to use seismic reflection surveying, which can help  
22 locate geologic pathways that can transport injected  
23 wastewater into upper aquifers. By doing so, this  
24 technology provides the most comprehensive set of data  
25 available to explain how and why wastewater has

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 migrated through layers of bedrock previously thought  
2 to be containing.

3 NRC Staff simply can't have taken the  
4 requisite hard look at migration without using seismic  
5 reflection surveying. In fact, government experts at  
6 the local and federal levels agree that there is an  
7 immediate need for the use of seismic reflection  
8 technology in Florida.

9 For example, right here the Miami-Dade  
10 Water and Sewer Department and the U.S. Geologic  
11 Survey have been using seismic reflection to test for  
12 the presence of geologic pathways such as fractures,  
13 faults, and karst features using seismic reflection.

14 The chief of the Water and Sewer  
15 Department's hydrogeology section, Dr. Virginia Walsh,  
16 even recommended all the way back in 2012 that seismic  
17 reflection be used for all future injection sites.

18 This is because seismic reflection could  
19 help identify if a site is suitable for underground  
20 injection at all, or it could optimize the injection  
21 of monitoring and injection wells in sites, in areas  
22 where no subsurface geologic pathways are found.

23 But even with all of the support for  
24 seismic reflection surveying, NRC Staff continue to  
25 offer no convincing reasons that they didn't use this

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 effective and feasible technology.

2 They refuse to acknowledge the importance  
3 of this issue. They refuse to address the uncertainty  
4 regarding migration of injectate. And they refuse to  
5 investigate using the accepted method in South  
6 Florida, seismic reflection.

7 Instead, NRC Staff cling to an outdated  
8 method of drilling only a single test well to conclude  
9 that Turkey Point is somehow unlike many of the areas  
10 around the site and upward migration of wastewater is  
11 extremely unlikely to occur at this site.

12 But this single well cannot provide nearly  
13 enough information about the site specific  
14 characteristics of Turkey Point.

15 Without the use of seismic reflection  
16 surveying to understand where any wastewater injected  
17 at Turkey Point will end up, NRC Staff simply can't  
18 have taken the requisite hard look.

19 The second issue underlying our contention  
20 is that NRC Staff have also failed to adequately  
21 support their conclusion that if upward migration of  
22 wastewater were to occur, impacts from chemical  
23 constituents in that water would be small.

24 This conclusion is based on the incorrect  
25 assumption that there is any concentration of these

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 contaminants that would be safe in drinking water.

2 But EPA says that there is no dose,  
3 meaning zero, that is considered safe for two of the  
4 contaminants at issue, tetrachloroethylene and  
5 heptachlor.

6 In fact, the level of tetrachloroethylene  
7 measured in the FEIS is above Florida's legal limit  
8 for drinking water. This alone establishes  
9 significance.

10 EPA in Florida set the drinking water  
11 limits so low for these contaminants because they are  
12 toxic to vulnerable populations and possibly  
13 carcinogenic.

14 The potential to introduce toxins into  
15 water that has been designated as a future drinking  
16 water source requires serious contemplation, because  
17 you run the risk of widespread and long-lasting  
18 contamination.

19 To resolve this problem, the NRC Staff now  
20 claim that high level disinfection technology  
21 installed at the South District Plant in 2013 has  
22 lowered the contaminant level more than originally  
23 reported.

24 However, this technology cannot be relied  
25 upon to serve the purpose of removing the four

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 contaminants at issue today. High level disinfection  
2 is not designed to remove volatile organic compounds  
3 and semi-volatile organic compounds like the  
4 contaminants at issue.

5 Only circumstantial evidence provides NRC  
6 Staff any basis to rely on high level disinfection.  
7 But coincidence and happenstance are not sound footing  
8 for informed decision-making. NRC Staff make this  
9 unfounded argument of last resort, but it is not  
10 enough to meet NEPA's burden.

11 Therefore, NRC Staff have failed to  
12 provide adequate support that the environmental  
13 impacts would be small if wastewater containing the  
14 contaminants were to migrate into an underground  
15 source of drinking water.

16 Informed decision-making done now protects  
17 generations in the future. The NRC Staff have failed  
18 to take the hard look at upward migration of  
19 wastewater or the impacts of the chemical  
20 constituents. And, therefore, they have not made an  
21 informed decision.

22 The NRC Staff must either, one, support  
23 their conclusion that upward migration is extremely  
24 unlikely to occur using the best available and  
25 feasible science, or, two, they have no choice but to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 conclude that there is uncertainty regarding migration  
2 and that the impacts may be significant.

3 We respectfully request that the board  
4 find that the FEIS for Turkey Point is inadequate to  
5 comply with NEPA or to justify licensing Turkey  
6 Point's Units 6 and 7. Thank you.

7 CHAIRMAN HAWKENS: Thank you, Ms. Reiser.  
8 We'll now hear from Village of Pinecrest, Mr. Arango.

9 MR. ARANGO: Good morning, Judge Hawkens,  
10 Judge Kennedy, and Judge Burnett. My name is Jose  
11 Arango. I'm from the law firm of Weiss, Serota,  
12 Helfman, Cole & Bierman. I'm appearing on behalf of  
13 the Village of Pinecrest as its Village Chairman.

14 Thank you for the opportunity to provide  
15 this brief opening statement on behalf of Pinecrest.

16 You must determine today that the NRC  
17 Staff was reasonable in concluding that environmental  
18 impacts from FPL's proposed deep injection wells will  
19 be small when the potential exists that the chemicals,  
20 ethylbenzene, heptachlor, tetrachloroethylene, and  
21 toluene, will be injected into the wastewater into the  
22 Floridan aquifer system's Boulder Zone and could  
23 migrate into the underground supplies of drinking  
24 water.

25 The CDC has determined that most of these

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 chemicals are possibly carcinogenic. For one of them  
2 it is probable.

3 Given the vast quantities of wastewater  
4 that would be pumped into the ground, these chemicals  
5 may accumulate over time, posing risk to human health  
6 and the environment.

7 This is greatly concerning to the Village,  
8 to the residents of the Village of Pinecrest, the  
9 nearest of whom live within 15 miles of Turkey Point.  
10 They are not alone.

11 The Keys Gate Charter School, Kingdom  
12 Covenant Baptist Church, Christ Fellowship Church of  
13 Homestead, Neighbors in Homestead, Isles of Oasis  
14 subdivision, visitors at the Southern Comfort RV  
15 Resort, the Homestead-Miami Speedway, and the  
16 Homestead Air Force Base, among many others, are well  
17 within ten miles of Turkey Point site. Some of these  
18 locations are a little more than five miles away.

19 It may be of little comfort to residents  
20 of and visitors to South Florida's communities that  
21 scientists involved in this proceedings disagree  
22 whether the chemicals pumped into the wastewater, into  
23 the deep well might migrate only 5 miles or as much as  
24 13 miles from the site of injection.

25 They know that growth in South Florida

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 constantly taxes drinking water supplies from the  
2 Visgat aquifer and that the future brings ever  
3 increasing pressure to dig new wells and to find  
4 alternative sources of water including the Upper  
5 Floridan Aquifer.

6 The experts differ on a number of matters  
7 to be discussed today. They seem to agree on this,  
8 that seismic reflection analysis can identify water  
9 migration pathways from Boulder Zone upward when given  
10 context by other methods of testing.

11 FP&L has not done this type of analysis,  
12 citing its costs. Staff has not requested it,  
13 pointing out that seismic reflection data only show  
14 possible flow pathways of transport water from lower  
15 strata to higher strata in the aquifer system, but do  
16 not inform as to how well water might flow through  
17 those pathways.

18 If such pathways exist so that  
19 contaminated water can flow rapidly from the Boulder  
20 Zone into the Upper Floridan Aquifer, South Floridians  
21 would want to learn about their hydraulic flow  
22 properties now from FP&L's testing before the deep  
23 injection well is operating. They don't want to learn  
24 about it generations from now following an  
25 investigation into the potential causes of the cancer

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 cluster.

2 Pre-file testimony demonstrates that  
3 seismic reflection analysis can be done and that it  
4 can identify false and karst collapsed structures  
5 linking different strata within the aquifer system.  
6 Pre-file testimony also outlines the limitations of  
7 seismic reflection as a complete method of analysis.

8 Nothing in rebuttal testimony, however,  
9 suggests that seismic reflection analysis used in  
10 concert with other study methods to provide context,  
11 will fail to provide a more thorough understanding of  
12 the confining layer's ability to protect underground  
13 sources of drinking water from toxic uploading.

14 Asked that the most thorough understanding  
15 of the potential for toxic chemicals to enter drinking  
16 water sources, those whose health may be at risk will  
17 find no comfort in finding that potential impacts to  
18 the environment and to the public health will be  
19 small.

20 Testimony sponsored by the Joint  
21 Intervenors shows that, at best, the Environmental  
22 Impact Statement is incomplete. Thank you.

23 CHAIRMAN HAWKENS: Thank you, Mr. Arango.  
24 City of Miami, would you care to make an opening  
25 statement? Good morning.

1 MR. ALBAN: Good morning, Your Honors.  
2 Xavier Alban, Assistant City Attorney with the City of  
3 Miami.

4 The City of Miami has serious concerns  
5 with respect to FPL's application for a combined  
6 operating license for the Turkey Point Proposed Units  
7 6 and 7.

8 With respect to the contention before you,  
9 this matter specifically relates to the sanctity and  
10 protection of a designated underground source of  
11 drinking water, the Upper Floridan Aquifer.

12 The City is deeply concerned with the  
13 potential contamination of this underground source of  
14 drinking water. The availability of potable water for  
15 the City's residents is of paramount importance to the  
16 City. And the City's goal to ensure this availability  
17 is seriously threatened by FPL's plan to deep inject  
18 the wastewater into the Boulder Zone and the potential  
19 in contaminating the Upper Floridan Aquifer.

20 Potable water is a limited resource. And  
21 sea level rising is exacerbating saltwater intrusion  
22 into underground sources of drinking water.

23 As such, it is critical that the NRC take  
24 a "hard look" at FPL's plan to deep inject wastewater  
25 with probably carcinogens into the Boulder Zone where

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 it has a real potential of migrating upward.

2 Moreover, it's imperative that FPL and the  
3 NRC Staff demonstrate to the board's satisfaction that  
4 FPL has complied with the requirements of the National  
5 Environmental Policy Act or NEPA.

6 Under NEPA, FPL and the NRC Staff must  
7 demonstrate that the direct effect, the indirect  
8 effects, and the cumulative impacts of proposed  
9 actions will not have an adverse impact on the natural  
10 and physical environment.

11 The Final Environmental Impact Statement  
12 is deficient in this regard. And FPL has failed to  
13 adequately demonstrate that the direct effects,  
14 indirect effect, and the cumulative impacts to the  
15 natural and physical environment are "small".

16 The environmental impacts will not be  
17 small. The estimated concentrations of ethylbenzene,  
18 heptachlor, tetrachloroethylene, and toluene in the  
19 injected wastewater in Table 3-5 do not account for  
20 various factors that would increase or that could  
21 potentially increase the concentration of these  
22 chemicals.

23 Additionally, the potential and probable  
24 carcinogens being introduced into an underground  
25 source of drinking water can never be considered

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 small.

2           Given the impact the proposed action has  
3 on the environment and active underground source of  
4 drinking water, the City wishes for the board to  
5 consider and take a hard look at the following four  
6 specific issues and require that the NRC Staff and FPL  
7 definitively demonstrate that the impacts of the  
8 proposed deep injection wells are truly small.

9           First, as has been noted, the Upper  
10 Floridan Aquifer is an underground source of drinking  
11 water. Just because the water is brackish and needs  
12 to be treated prior to consumption does not lessen the  
13 direct effect, indirect effect, and cumulative impact  
14 these chemicals can have if they contaminate the Upper  
15 Floridan Aquifer.

16           The treatment of brackish water is also  
17 different than the treatment of radioactive  
18 carcinogenic matter in water. The assumption cannot  
19 be made that the same treatment used to make brackish  
20 water potable is similar to treatments to eliminate  
21 radioactive effluent or carcinogenic chemicals.

22           Additionally, the Upper Floridan Aquifer  
23 is an active underground source of drinking water  
24 that's currently being used to provide potable water  
25 to Florida residents.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           With the amount of potable water  
2 decreasing every day, it is of paramount importance  
3 that the NRC Staff and FPL definitively demonstrate  
4 that the impact of these chemicals and radioactive  
5 effluent do not contaminate this active underground  
6 source of drinking water.

7           Secondly, the concentrations of the  
8 chemicals, some of which are potentially carcinogenic,  
9 are not accurate. The reason they are inaccurate is  
10 because FPL intends to operate as many as 13 wells  
11 within a radius of less than one mile.

12           With so many wells operating at the same  
13 time in a confined area, the concentration of these  
14 chemicals would be much higher than identified in  
15 Table 3-5 and would not comply with the EPA drinking  
16 water standards.

17           FPL and the NRC Staff have failed to  
18 consider the concentrations of these potentially  
19 carcinogenic chemicals with more than one well  
20 operating simultaneously or with the operation of up  
21 to 13 deep injection wells within the radius of less  
22 than one mile.

23           Thirdly, it is estimated that the injected  
24 wastewater will not travel more than five miles  
25 horizontally. However, that estimate is also

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1       inaccurate because it does not account for the  
2       horizontal migration of the injected wastewater when  
3       up to 13 deep injection wells are operating  
4       simultaneously.

5               That many deep injection wells at such  
6       close proximity to each other have the potential of  
7       allowing the horizontal migration of the injected  
8       wastewater beyond 5 miles and up to the high end  
9       estimate of 13 miles.

10              FPL and the NRC have inadequately  
11       demonstrated the horizontal migration of the injected  
12       wastewater below more than one deep injection well  
13       operating simultaneously.

14              Finally, an adequate geologic confining  
15       layer does not exist. USGS has identified the  
16       presence with tectonic faults and karst collapsed  
17       structures in Southeast Florida. These faults and  
18       karst collapsed structures provide a vertical pathway  
19       for the injected wastewater to travel.

20              Even if there are no faults or karst  
21       collapses in the area of the deep injection wells, a  
22       horizontal migration of the injected wastewater will  
23       allow the wastewater to travel further out and find  
24       these faults or karst collapses and allow the  
25       wastewater to migrate vertically into an underground

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 source of drinking water.

2           Additionally, the limestone and dolomite  
3 that overlays the Boulder Zone also simply retards the  
4 upward migration of the injected wastewater into the  
5 underground source of drinking water.

6           Although it's layer may slow the vertical  
7 migration of the wastewater, it still acknowledges  
8 that wastewater can migrate vertically and potentially  
9 find faults or karst collapses within the limestone  
10 and dolomite overlying the Boulder Zone providing  
11 another vertical path.

12           As such, a layer that only retards the  
13 upward migration, an area that has known linear  
14 tectonic faults and karst collapsed structures, and  
15 the acknowledged potential of the horizontal migration  
16 of the injected wastewater all points to the fact that  
17 there is not an adequate geologic confining layer.

18           The City, therefore, respectfully requests  
19 that this board take into consideration the City's  
20 concerns, as well as the issues and concerns raised by  
21 Joint Intervenors and the Village of Pinecrest, and  
22 ensure that a hard look is taken to protect the  
23 environment and specifically to protect an active  
24 source of potable water for City residents, as well as  
25 residents of Miami-Dade County and Southeast Florida.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 CHAIRMAN HAWKENS: Thank you, Mr. Alban.  
2 Any questions?

3 I have just one observation, Mr. Alban.  
4 City of Miami is here in support of the Joint  
5 Intervenors Contention 2.1. And Contention 2.1 deals  
6 with four specific contaminants. It does not deal  
7 with radioactive contaminants in the wastewater. I  
8 just want to make sure you're aware of that because  
9 you referred to radioactive contaminants several times  
10 during your statement.

11 MR. ALBAN: Understood. Thank you.

12 CHAIRMAN HAWKENS: Thank you. We'll now  
13 hear from the NRC Staff, Ms. Wright. Good morning.

14 MS. WRIGHT: Good morning. My name is  
15 Megan Wright, and I'm counsel for NRC Staff. On  
16 behalf of the Staff, I want to thank the parties and  
17 the Judges for the opportunity to discuss Contention  
18 2.1 today.

19 As already noted, Contention 2.1 deals  
20 with the adequacy of the Staff's analysis in the FEIS  
21 regarding potential groundwater impacts from injection  
22 of wastewater effluent into the Boulder Zone.

23 Intervenors are concerned that the four  
24 chemical constituents named in the contention may  
25 adversely impact the quality of the groundwater if the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 wastewater migrates from the Boulder Zone to the Upper  
2 Floridan Aquifer.

3           During the time allotted to the Staff this  
4 morning, I'd like to briefly go over the main points  
5 of our position and then comment on positions Joint  
6 Intervenors have taken in their filings throughout the  
7 proceedings.

8           First, the NRC Staff took a hard look that  
9 NEPA requires at the environmental impacts of deep  
10 well injection on groundwater quality. Under NEPA,  
11 the Staff is required to take a hard look at the  
12 environmental impacts of a proposed action.

13           This is tempered by a rule of reason. So  
14 the FEIS is not intended to be a research document.  
15 The purpose of the FEIS is to disclose impacts and  
16 inform decision makers.

17           In preparing the FEIS, the Staff used  
18 multiple lines of inquiry in order to evaluate the  
19 potential impacts of deep well injection on  
20 groundwater quality.

21           For example, the Staff reviewed multiple  
22 studies that characterized the geology of the Turkey  
23 Point site and the confining ability of the middle  
24 confining unit, examined data from exploratory wells  
25 constructed at the Turkey Point site, compared

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 parameters at sites where upwelling had occurred to  
2 parameters at the proposed site, evaluated modeling of  
3 possible pathways for the flow of injected wastewater,  
4 considered the well testing and monitoring  
5 requirements of Florida's underground injection  
6 control program, and reviewed studies published by the  
7 EPA that assess the risk to human health of injecting  
8 wastewater in the region.

9 The scale of these analyses allowed the  
10 Staff to adequately analyze impacts of deep well  
11 injection at the Turkey Point site, thus meeting its  
12 obligations under NEPA.

13 Staff witnesses will explain the bases of  
14 the conclusion in the FEIS that the impacts will be  
15 small. The Staff's conclusion is largely based on  
16 three findings.

17 One, the concentrations listed in Table 3-  
18 5 of the FEIS for the four constituents at issue are  
19 below EPA's protected drinking water standards. Two,  
20 the concentrations of the constituents are likely to  
21 be even lower due to additional treatment of the  
22 wastewater prior to injection. And, three,  
23 significant upwelling of the wastewater is not likely  
24 to occur. And if it did occur, it would not impact  
25 the quality of the water in the Upper Floridan

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Aquifer. And I'll discuss each of these in turn.

2 EPA establishes Maximum Contaminant  
3 Levels, or MCLs, for drinking water that are intended  
4 to protect public health. Levels of constituents  
5 below the MCLs are considered by the EPA to be safe  
6 for human consumption.

7 Initial sampling at the South District  
8 Wastewater Treatment Plant, which is where the cooling  
9 water for Turkey Point will come from, found that  
10 levels of heptachlor, toluene, and tetrachloroethylene  
11 were below EPA drinking water standards. Ethylbenzene  
12 wasn't detected at all.

13 In fact, the water containing these  
14 constituents at these levels could be injected into  
15 the Upper Floridan Aquifer without any adverse impact  
16 on human health. But further treatment of wastewater  
17 brings concentration levels even lower. The Florida  
18 Underground Injection Control Program requires further  
19 treatment of wastewater before injection.

20 Samples were taken after the required  
21 additional treatment. And the levels of the four  
22 constituents were even lower than the values indicated  
23 in Table 3-5.

24 Concentrations of the four constituents  
25 were below what's called the Method Detection Limit,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 which means that the amount of chemicals was so small  
2 that we don't even have the technology to quantify it.

3 Because the amounts of the chemical  
4 constituents will be so low, Staff is confident in its  
5 conclusion that the risks to public health will be  
6 minimal.

7 The witnesses will also explain why they  
8 are confident in the confining capability of the  
9 middle confining unit. Joint Intervenors have said  
10 that the FEIS concluded that movement of wastewater  
11 was extremely unlikely. But the FEIS concluded that  
12 the wastewater moving into Upper Floridan Aquifer was  
13 extremely unlikely.

14 The Staff reviewed studies and confirmed  
15 FPL's modeling in order to determine the most likely  
16 scenario for movement of injected effluent in the  
17 Boulder Zone. The Staff found that upward migration  
18 would be no more than about 300 feet.

19 The Staff also concluded that, while some  
20 vertical migration may occur, the effluent would need  
21 to move through 1,400 feet of low permeability rock  
22 before it reached the Upper Floridan Aquifer, and this  
23 was extremely unlikely.

24 Further, FPL must show that the middle  
25 confining unit confines the effluent in order to be

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 issued an underground injection control permit by the  
2 Florida Department of Environmental Protection. So  
3 there is that added layer of regulatory safety from  
4 the State as well.

5 Furthermore, as the witnesses will testify  
6 to today, the injection wells will be monitored. Any  
7 migration that occurs in the vicinity of the well  
8 would be detected before reaching the Upper Floridan  
9 Aquifer, and wells can be shut down.

10 Monitoring wells are capable of detecting  
11 potential upward movement of fluid. And this  
12 decreases the likelihood that injected wastewater will  
13 flow beyond the monitoring zone.

14 To sum up, Staff is confident in its  
15 determination that the injection of wastewater into  
16 the Boulder Zone will have small impacts on  
17 groundwater.

18 The Staff found that the risk to human  
19 health from deep well injection is low and is lowered  
20 further with high level treatment of the wastewater.

21 Staff also found that it is unlikely that  
22 the wastewater would migrate out of the Boulder Zone  
23 through the middle confining unit and into the Upper  
24 Floridan Aquifer. And if it did, the risk to users of  
25 the Upper Floridan Aquifer would be minimal because

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the water would still meet EPA drinking water  
2 standards.

3 Staff witnesses are prepared to discuss  
4 these findings and their conclusions today.

5 I'd also like to take a few moments to  
6 mention some points the Joint Intervenors have made  
7 throughout the proceeding and to make NRC Staff's  
8 position on these points clear.

9 First, Joint Intervenors' witness  
10 testified that the EPA's Maximum Contaminant Level  
11 goals -- I'm just going to call these the goals -- for  
12 each of the constituents, these are more stricter than  
13 the MCLs, more strict than the MCLs, excuse me, should  
14 be met because that's the level that is most  
15 protective of human health.

16 The Staff witnesses will testify that the  
17 goals should not be the benchmark against which the  
18 constituent levels are measured because the MCLs do  
19 provide an adequate margin of safety.

20 However, Staff wants to emphasize that for  
21 two of the constituents, ethylbenzene and toluene, the  
22 concentrations found in the wastewater do meet the  
23 goals.

24 For the other two constituents, heptachlor  
25 and tetrachloroethylene, EPA set the goal at zero.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 The MCL is above zero. So the EPA determined that  
2 certain levels of these two constituents are still  
3 considered to be safe.

4 But it's not reasonable to expect the  
5 wastewater to measure at zero level concentrations, as  
6 the Joint Intervenors request, when the current  
7 detection technology can't even make that finding.

8 Secondly, Joint Intervenors argue that any  
9 concentration above zero of the constituents, except  
10 for toluene, is harmful to human health. However,  
11 even Joint Intervenors' Exhibit INT-016, which was  
12 filed to support this argument, acknowledges that  
13 small levels of these constituents in water are not  
14 harmful to human health. And this is consistent with  
15 the EPA determination.

16 Third, Joint Intervenors claim that  
17 Staff's information about the geologic characteristics  
18 of the Turkey Point site is inadequate and that more  
19 tests are needed. Staff does not agree with this  
20 argument.

21 FPL conducted all the tests that Mr.  
22 Quarles himself said needed to be conducted in his  
23 second affidavit, which is INT-003. And actually, FPL  
24 conducted even more tests than Mr. Quarles said were  
25 necessary.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           And in order to comply with the  
2           Underground Injection Control permit requirements, FPL  
3           will have to conduct additional testing and monitoring  
4           at all 12 injection sites and 6 monitoring wells on  
5           the site.

6           Joint Intervenors also challenge the  
7           methods of gathering the data and say that seismic  
8           reflection tests are necessary for site  
9           characterization.

10          Staff witnesses will testify that the  
11          methods were adequate and reasonable and that the  
12          testing conducted clearly support a finding that the  
13          middle confining unit is an adequate confining unit  
14          and that vertical migration of the injected wastewater  
15          is possible but not likely.

16          And seismic reflection tests would not  
17          provide Staff with any information regarding the  
18          hydrologic connectivity of the geologic structures  
19          beneath the site. So this type of testing would not  
20          add any valuable information.

21          To conclude, NRC Staff pre-filed  
22          testimonies, exhibits, and the witness testimony  
23          you'll hear today demonstrate that the NRC took the  
24          hard look NEPA requires. The conclusions the Staff  
25          reached in the FEIS were well-supported, and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Contention 2.1 does not have merit. NRC respectfully  
2 requests that the board find as such. Thank you.

3 CHAIRMAN HAWKENS: Thank you, Ms. Wright.  
4 Mr. Lepre.

5 MR. LEPRE: Thank you, Judge Hawken,  
6 excuse me, Dr. Burnett, Dr. Kennedy. I'm Mike Lepre,  
7 counsel for the Applicant, Florida Power & Light  
8 Company.

9 Thank you very much for the opportunity to  
10 appear before you today. And we also thank the City  
11 of Homestead for providing us with this terrific  
12 facility.

13 Underneath, the FEIS must take a hard look  
14 at the reasonably foreseeable environmental impacts at  
15 issue. The NRC is not required to look at every  
16 potential environmental impact. And it does not have  
17 to consider worst case scenarios.

18 As the Staff pointed out, an FEIS is not  
19 a research project. The NRC doesn't have to use every  
20 possible resource to study the potential impact as  
21 long as it uses reasonable methodologies, which it did  
22 here. The case law that we cited in our briefs makes  
23 all of this very clear.

24 Obviously, the Applicant believes that the  
25 NRC has more than satisfied its obligations under

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 NEPA. As the NRC details in its filings, it carefully  
2 examined the relevant data, conducted the necessary  
3 studies, and reached independent, scientifically  
4 supported, and valid conclusions. And the Applicant's  
5 expert witnesses agree.

6 These highly qualified individuals include  
7 Dr. Robert Maliva. He's a Florida-licensed geologist  
8 and foremost expert on hydrogeology in Florida.

9 Mr. David McNabb, he's also a Florida-  
10 licensed geologist. He's worked on both sides of  
11 these types of issues, first with the Florida  
12 Department of Environmental Protection, and then as a  
13 consultant permitting approximately 40 underground  
14 injection wells in the state.

15 And Dr. Christopher Teaf, a Ph.D. in  
16 toxicology, he's the current director of the Center  
17 for Biomedical and Toxicological Research at Florida  
18 State University.

19 From their perspective, there is simply no  
20 scientific basis for concluding that the environmental  
21 impacts at issue are greater than small or that  
22 further study is necessary.

23 For the board to find otherwise, it would  
24 have to discount the testimony of those witnesses and  
25 instead agree that multiple barriers to minimize the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 environmental impacts will all fail.

2 And then the board would have to find that  
3 even if all those barriers fail, the EPA's drinking  
4 water standards are insufficient to protect the public  
5 health. There's no credible basis for so determining.

6 I mentioned barriers. What are they?  
7 First and foremost, confinement. The wastewater will  
8 be injected 3,000 feet underground into the Boulder  
9 Zone beneath a confining layer of rock that's  
10 approximately 1,465 feet thick. That's about five  
11 football fields deep of confining rock.

12 Groundwater modeling shows that, at most,  
13 after 100 years the wastewater would migrate to a  
14 depth that's still 1,000 feet below the base of the  
15 lowest underground source of drinking water.

16 The Joint Intervenors present no modeling  
17 of their own. Instead, they simply mischaracterize  
18 and misinterpret articles to claim there might be  
19 unidentified features that could lead to vertical  
20 migration. That's not science. That's just pure  
21 speculation.

22 Intervenors argue that confinement could  
23 be bypassed if a well leaks. But the uncontroverted  
24 testimony in this case shows that ever since new well  
25 construction techniques were implemented 25 years ago,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 no Class I injection well has ever leaked. So a leak  
2 is not reasonably foreseeable.

3 What's another barrier? Monitoring. As  
4 Mr. McNabb testifies, FPL will implement a monitoring  
5 program for leaks and migration in compliance with the  
6 Florida Department of Environmental Protection  
7 requirements. This will include continuous monitoring  
8 of the angular space between the injection tubing and  
9 one of the outer casings. So any leaks would be  
10 detected immediately.

11 It will also include continuous monitoring  
12 of water levels from two zones. Joint Intervenors did  
13 not address either of these monitoring programs in  
14 their testimony.

15 In the extremely unlikely event that  
16 confinement and monitoring somehow fail, what other  
17 barriers are there? Well, there's dilution and  
18 volatilization.

19 When it's cycled through the cooling water  
20 system and injected into the Boulder Zone, the  
21 concentrations of the constituents in the wastewater  
22 will be substantially reduced to levels even further  
23 below drinking water standards. The Intervenors  
24 completely ignore the impact of dilution and  
25 volatilization.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           Next, any remnants of the constituents  
2 that somehow overcome all this still won't be near any  
3 potable water source. The closest potable water  
4 source is 11 miles west of Turkey Point in the  
5 opposite direction of groundwater flow in the Upper  
6 Floridan Aquifer.

7           Joint Intervenors have advanced no  
8 scientific basis for the proposition that wastewater  
9 from Turkey Point would somehow travel to that site.  
10 Instead, they merely speculate that someday someone  
11 might build a potable water well at Turkey Point.

12           But, as Dr. Maliva testifies, that's  
13 extremely unlikely. FPL owns the land at and  
14 surrounding the site. There are no current or  
15 projected plans to build potable wells there.

16           And finally, even if someone eventually  
17 built a potable well at Turkey Point, there is yet  
18 another barrier. Any water accessed by such a well  
19 would be brackish. And for that reason, it would have  
20 to be treated through desalination or dilution.

21           Those processes would even further reduce  
22 or remove the constituents at issue if the wastewater  
23 were to somehow pass through the 1,465 feet of  
24 confining rock and avoid monitoring.

25           So we have confinement, the well

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 construction, monitoring, multiple stages of dilution,  
2 flow direction, no nearby potable wells,  
3 volatilization, and desalination.

4 But let's assume for a moment all of these  
5 are ineffective. What are the consequences? Well,  
6 the concentrations at issue here, which the parties  
7 have agreed are conservative, are already well below  
8 federal drinking water standards.

9 Put simply, the EPA allows the  
10 constituents in the concentrations set forth in the  
11 FEIS to be present in its drinking water systems  
12 because there are no adverse human health impacts.  
13 That fact alone supports a finding that the impacts at  
14 issue here will be no greater than small.

15 But Dr. Teaf puts an even finer point on  
16 it. His expert testimony shows that you need to have  
17 much greater concentrations than those at issue here  
18 to even begin to see any measurable adverse impacts.

19 Depending on the constituent, studies  
20 shows that the concentrations at issue would need to  
21 be multiplied by thousands or tens of thousands for  
22 even measurable impacts.

23 As Dr. Teaf testifies, the mere presence  
24 of a chemical is not enough to say there will be an  
25 adverse health impact. You obviously have to take

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 into account dose, concentration, and drinking water  
2 intake levels.

3 There's no basis for the NRC to apply to  
4 this wastewater, which will be confined 3,000 feet  
5 below the surface, a standard that's greater than the  
6 EPA applies to systems that actually distribute  
7 drinking water to the public.

8 Finally, Intervenors want more data. But  
9 as Dr. McNabb, as Mr. McNabb, Dr. Maliva, and the NRC  
10 experts all testify, more data is simply not  
11 necessary.

12 As the uncontroverted testimony shows, the  
13 data requested by Joint Intervenors, including more  
14 than one exploratory well and seismic reflection  
15 surveys, have never been required in the history of  
16 permitting Class I injection well systems in Florida.

17 Intervenors imply that seismic reflection  
18 surveys are some kind of new technology. That's  
19 simply not true. Dr. Maliva testifies that seismic  
20 reflection surveys have been performed for other  
21 purposes in Florida since the 1970s.

22 The reason they have not been used for  
23 injection well permitting is because they're not  
24 useful for that purpose. And they're not necessary.

25 In the entire history of the deep well

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 injection program in Florida dating back to 1943,  
2 through over 180 injection wells, wastewater has never  
3 entered the potable supply well. It's just not  
4 reasonably foreseeable that that will happen here.

5 For all these reasons, the FEIS accurately  
6 characterizes as small the reasonably foreseeable  
7 environmental impacts at issue in this case. Thank  
8 you.

9 CHAIRMAN HAWKENS: Thank you. At this  
10 point, as the board mentioned earlier, we're going to  
11 take a short recess so the first panel of witnesses  
12 can sit. Ms. Curran, would ten minutes be adequate to  
13 sit your panel of witness?

14 MS. CURRAN: Yes, thank you.

15 CHAIRMAN HAWKENS: And that would be  
16 adequate for FPL and the NRC Staff as well?

17 MR. LEPRE: Yes, it would.

18 MS. WRIGHT: Absolutely, yes.

19 CHAIRMAN HAWKENS: Thank you. We'll take  
20 a ten-minute recess and reconvene at about 37 after.  
21 Thank you.

22 (Whereupon, the above entitled matter went  
23 off the record at 10:26 a.m. and resumed at 10:38  
24 a.m.)

25 CHAIRMAN HAWKENS: Ms. Curran, earlier you

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 asked the question about the possibility of leaving  
2 belongings here in the hearing room. We checked with  
3 the Office of the City Clerk. She said you may, that  
4 they would lock the doors. However, individuals  
5 themselves would be responsible for what they left  
6 behind. The City of Homestead cannot assume  
7 responsibility for the security, but you may do it,  
8 and they will lock the doors.

9 MS. CURRAN: Great. Thank you very much.

10 CHAIRMAN HAWKENS: All right. We've  
11 seated the first technical topical panel for the  
12 evidentiary hearing. As a reminder, the topic for  
13 this first panel is the ability of the hydrogeological  
14 layer unit above the boulder zone to prevent  
15 wastewater from migrating upward to the Upper Floridan  
16 Aquifer, the likely extent of horizontal and vertical  
17 migration of wastewater after it's injected into the  
18 boulder zone, and the predicted velocity of such  
19 migration.

20 Would the witnesses for each party please  
21 introduce themselves for this panel, starting with  
22 Joint Intervenors.

23 MR. QUARLES: My name is Mark Quarles.

24 DR. MALIVA: Robert Maliva.

25 MR. McNABB: My name is David McNabb.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. THORNE: My name is Paul Thorne.

2 MR. BARNHURST: My name is Dan Barnhurst.

3 CHAIRMAN HAWKENS: Thank you. Good  
4 morning.

5 DR. BURNETT: Good morning. I'd like to  
6 first ask for a display to be shown. It's Florida  
7 Power & Light-003-015. It shows the hazard geologic  
8 section at Turkey Point. Thank you.

9 Dr. Maliva, so this was in your pre-filed  
10 testimony and I wanted to just be clear. Are you  
11 comfortable with this hydrogeologic representation?

12 DR. MALIVA: Yes, I am.

13 DR. BURNETT: I notice that the Avon Park  
14 Permeable Zone, abbreviated APPZ, has a question mark  
15 next to it. Could you explain why that's the case?

16 DR. MALIVA: Well, the Avon Park Permeable  
17 Zone is an interval of fractured dolomite which is  
18 present there in most of Southeastern Florida, at  
19 both the Turkey Point site and South District. It's  
20 just not as well developed so those were approximate  
21 depths. You do find more permeable zone there but  
22 it's not as well developed as elsewhere.

23 DR. BURNETT: Not as well developed.  
24 Would that mean it's thinner than it is elsewhere?

25 DR. MALIVA: Well, you've got, I guess,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the same intensity of fracturing as detectable on  
2 geophysical logs. So there's a more permeable zone  
3 present there, but it's not as permeable as elsewhere.

4 DR. BURNETT: Okay. Is the Avon Park  
5 Permeable Zone part of the Upper Floridan Aquifer?

6 DR. MALIVA: No, not as currently defined.  
7 It's the zone within the middle Floridan confining  
8 zone. It separates that into an upper and lower zone,  
9 so it's by definition within the middle confining.

10 DR. BURNETT: So in past classifications  
11 perhaps it was included as part of the Upper Floridan  
12 Aquifer?

13 DR. MALIVA: There was some  
14 interpretations that put it there, but the current  
15 interpretation which was based on most recent U.S.  
16 Geological Survey regional investigation of the  
17 Floridan Aquifer system by I guess Reese & Richardson  
18 now clearly place it within the middle of the middle  
19 confining zone. So it's not part of the Upper  
20 Floridan Aquifer.

21 DR. BURNETT: Is the Avon Park Permeable  
22 Zone, would you consider it an underground source of  
23 drinking water?

24 DR. MALIVA: It depends on the depth at  
25 which it's located with respect to the 10,000

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 milligram per liter TDS line. So it could be above or  
2 below it. Here, it's below the base of the USDW.

3 DR. BURNETT: So the underground source of  
4 drinking water is defined not only by the total  
5 dissolved solids being less than 10,000 milligrams per  
6 liter, but also by the depth below surface?

7 DR. MALIVA: No, the base of the USDW is  
8 defined purely as based on the 10,000 milligrams per  
9 liter of TDS. It's purely a water quality --

10 DR. BURNETT: So it's purely water quality  
11 for the definition?

12 DR. MALIVA: Yes.

13 DR. BURNETT: So even though the Avon Park  
14 Permeable Zone is not well developed at Turkey Point,  
15 does the water quality meet that less than 10,000  
16 milligrams per liter limit?

17 DR. MALIVA: The base of the USDW is at  
18 1,450, so it's high, greater than 10,000. It's not  
19 part of the USDW at Turkey Point.

20 DR. BURNETT: Okay. All right, so it  
21 wouldn't be considered an underground source of  
22 drinking water then?

23 DR. MALIVA: No, it would not.

24 DR. BURNETT: Okay. You don't happen to  
25 know what the total dissolved solid concentration is,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 do you offhand?

2 DR. MALIVA: I don't know the exact --

3 DR. BURNETT: But you believe it's greater  
4 than 10,000?

5 DR. MALIVA: Well, it's definitely below  
6 10,000. That's part of -- for any injection project,  
7 a key requirement is to locate the lowest depth at  
8 which water greater than -- with less than 10,000  
9 occurs. That's the -- called the base of the USDW.  
10 Everything below the base of the USDW is greater than  
11 10,000. So where it is in that spectrum from 10,000  
12 to 35,000 sea water salinity I'm not sure --

13 DR. BURNETT: Some time during the course  
14 would you be able to identify where in the record that  
15 information is? If the APPZ is less than 10,000?

16 DR. MALIVA: No, the APPZ is greater than  
17 10,000.

18 DR. BURNETT: Right. Would you be able to  
19 cite something in the record for the Licensing Board?  
20 It need not be now but sometime during --

21 DR. MALIVA: Oh, yes, we can do that for  
22 you.

23 DR. BURNETT: Thank you.

24 DR. MALIVA: Mr. McNabb has that  
25 information.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. BURNETT: We'll come back to that once  
2 someone locates it.

3 There seems to be some slight disagreement  
4 about where the primary confinement layer begins. In  
5 the diagram it shows it beginning at 1,930 feet if I'm  
6 interpreting this correctly. Is that correct?

7 DR. MALIVA: Well, the confinement between  
8 the injections on the base of the USDW is provided by  
9 the cumulative thickness of strata between those  
10 depths. So each interval can provide incrementally  
11 some confinement. But the most effective lowest  
12 permeable strata does occur at the bottom of that  
13 interval. So 1,900 feet is between the top -- the  
14 bottom thousand feet provides the most effective  
15 confinement. That's the tightest strata there.

16 DR. BURNETT: In the report, I believe  
17 authored by Mr. McNabb, the primary confinement layer  
18 was stated to begin at 1,980, so slightly different.

19 DR. MALIVA: It's approximately. It's not  
20 a --

21 DR. BURNETT: Yes?

22 MR. McNABB: I believe the report  
23 indicated 1,930.

24 DR. BURNETT: Okay, perhaps my notes are  
25 in error. Thank you.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           Could I ask Mr. Quarles to comment on this  
2 hydrogeologic section? Are you comfortable the way  
3 the positions are made?

4           MR. QUARLES: So, first of all, good  
5 morning. Thank you for allowing us to be here, Your  
6 Honor, Dr. Kennedy and Dr. Burnett.

7           You know the conceptual cross section up  
8 there was presented. When you look at the data that  
9 was produced from the single bore hole EW1 which went  
10 down to about 3,000 feet, what is clear is that they  
11 make reference to primary confinement which is from  
12 1,900 down to about 2,900 feet.

13           What I didn't see in the McNabb report on  
14 the EW1 was that there was no clear definition of what  
15 all the other published studies talked about. There  
16 was a sandwiched APPZ, the Avon Park Permeable Zone  
17 and then the traditional confined layer, MC1 above and  
18 MC2 below that you see here and in other USGS type  
19 documents.

20           So according to the EW1, there's some  
21 question about whether or not the MC1 exists and  
22 whether or not the Avon Park Permeable Zone. I guess  
23 in the big picture, the bottom line is that when you  
24 look at the EW1 report, they're measuring water  
25 quality at different intervals and there are intervals

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that are reported to be less than 10,000 milligrams  
2 per liter TDS which is indicative of a regulated USDW.

3 So what is unclear is whether or not there  
4 is an APPZ and most reportably beyond that is whether  
5 or not there's an upper MC1 above that USDW before you  
6 get to the intermittent confining layer of the  
7 Biscayne Aquifer.

8 DR. BURNETT: So what you're calling the  
9 MC1 is that what is referred to in the diagram as the  
10 Middle Floridan Confining Unit at 1,430, 1,450?

11 MR. QUARLES: So I didn't produce that  
12 diagram, but when you look at traditional USGS type  
13 documents and such, there are no confined layer. MC1  
14 is traditionally located above the Avon Park Permeable  
15 Zone and the MC2 being below the APPZ in the Lower  
16 Floridan Aquifer.

17 DR. BURNETT: So I'm going to ask for  
18 another section. So Andy, could you pull Joint  
19 Intervenors Exhibit 12, page 4. Yes. Thank you.

20 So is this closer to what you were  
21 referring to? This is, by the way, this is from a  
22 publication by Walsh & Price, 2010.

23 MR. QUARLES: That is what you  
24 traditionally when discussing the confining layers in  
25 the Avon Park Permeable Zone.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. BURNETT: Do you happen to know -- so  
2 this is for the site. It's not the same site. It's  
3 for the North District and the South District  
4 Wastewater Treatment Plants in Dade County. So it's  
5 actually a composite of two sites. And notice that  
6 the Avon Park Permeable Zone doesn't have a question  
7 mark here. Do you happen to know if the water in that  
8 zone would be considered an underground source of  
9 drinking water?

10 MR. QUARLES: Any water that has a TDS  
11 less than 10,000 milligrams per liter is a USDW  
12 regardless of whether it's an Avon Park Permeable Zone  
13 or whatever formation it comes from.

14 DR. BURNETT: Okay.

15 MR. QUARLES: So whether or not the Avon  
16 Park Permeable Zone exists or this thick at Turkey  
17 Point is important, but it's also -- we have to  
18 recognize that any ground water that meets the  
19 definition of USDW is protected ground water.

20 DR. BURNETT: Thank you. Mr. Quarles, you  
21 had mentioned in your pre-filed testimony that the  
22 core sampling program only included 122 feet of the  
23 entire 33,230 feet well which translates to about 4  
24 percent of the total. So the core recovery is low for  
25 the test well.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           On the other hand, didn't the geophysical  
2 logs monitor the entire sequence?

3           MR. QUARLES:       The geophysical logs  
4 typically do monitor the entire sequence. So what  
5 happens is you use data that you collect from perhaps  
6 a pilot hole and then that helps you select your  
7 intervals that you're going to test for your  
8 analytical testing across the permeability hydraulic  
9 conductivity, that sort of thing. So it does help you  
10 kind of pre-select what you suspect to be the  
11 confining layers because you have to use that  
12 information, the actual analytical and numeric data to  
13 support your determination of confinement.

14          DR. BURNETT: So from the geophysical logs  
15 themselves, can you define the confining layer?

16          MR. QUARLES: I typically rely on the  
17 analytical data itself because it's an actual sample  
18 that is pulled from the ground that you can see. It  
19 has a numeric value that's useful for any sort of  
20 calculations that you might run.

21          DR. KENNEDY: Can I jump in here? Are you  
22 suggesting that you discount the geophysical log data  
23 over the -- I guess the analytical, you meant the raw  
24 data from the borings?

25          MR. QUARLES: I'm not saying you discount

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that. It's just part of what you use to determine  
2 where you think you need to collect your samples for  
3 determination of confinement.

4 DR. KENNEDY: Would you suggest in that  
5 some vein that -- I know in your testimony you had  
6 some concerns about the number of core samples that  
7 were taken and that the full length wasn't  
8 represented.

9 MR. QUARLES: Yes, so let's put this into  
10 perspective. Three thousand foot hole, you decide to  
11 core 122 feet. And you do that based on your  
12 observations of the hydro cuttings and the geophysical  
13 because you have to make a numeric determination for  
14 the confinement.

15 Some of the other experts have said that  
16 seismic doesn't give you a numeric value on whether or  
17 not how much or how quickly ground water might migrate  
18 to a conduit, for example. Geophysical evaluation  
19 doesn't give you a numeric value of why transmissivity  
20 in the hydraulic conductivity. That's why you collect  
21 these samples and do Packer tests that that sort of  
22 thing. So it's just part of the investigation.

23 So when you go and you collect a core  
24 sample, you have to recognize that this is perhaps a  
25 two inch diameter core that you're pulling out of the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 ground. And so then this is where the percent  
2 recovery and the percent porosity come into play  
3 because you manually grab and select two- to four-  
4 inch interval of that core sample to submit to your  
5 laboratory for analysis. So you cannot manually  
6 select a sample for an analytical test for porosity  
7 conductivity if it's intact or most importantly if it  
8 didn't recover it at all, if it didn't recover in your  
9 core sample it could be because it's extremely  
10 fractured. If it's extremely fractured and you had  
11 high porosity or low recovery, that sample, analytical  
12 value that you sent to the lab would not reflect the  
13 worst case scenario because it's what you're able to  
14 retrieve, not what didn't come up out of the ground.

15 DR. KENNEDY: I think I understand that  
16 specific example. Did you review NRC Exhibit 056  
17 which is the data from the exploratory well 1? It  
18 appears to be an extensive array of data.

19 MR. QUARLES: I did. So what's really  
20 fascinating on this is that you have a number of  
21 values of hydraulic conductivity and generally they  
22 were in the  $10^{-4}$ ,  $10^{-6}$  centimeters per second  
23 permeability or hydraulic conductivity range. Right?

24 So if you -- so then you say okay, what  
25 does that mean? Well, Mr. McNabb concluded that those

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 values indicated the confined nature of that thousand-  
2 foot section, appeared, I think the word was appeared  
3 to indicate confinement. But when you look at, like  
4 for example, the STAR Report, the Idaho National Lab  
5 that was done, the investigation for the South  
6 District Wastewater Treatment Plant, when they  
7 reviewed existing data for the South District Plant  
8 they said that the data were not sufficient to  
9 demonstrate confinement. And in particular, he  
10 pointed out that permeability or hydraulic  
11 conductivity values in the range of  $10^{-4}$  which I  
12 believe 38 percent of the core samples that were sent  
13 at Turkey Point represent  $10^{-4}$  were representative of  
14 a vertical permeability or seepage rate equivalent to  
15 a silty sand. So that would not be indicative of  
16 confinement.

17 DR. KENNEDY: Let me interrupt you. That  
18 was for the South District Water Treatment Plant?

19 MR. QUARLES: Correct.

20 DR. KENNEDY: Which is some distance from  
21 the Turkey Point site?

22 MR. QUARLES: It's about nine miles.

23 DR. KENNEDY: Now this data here that's in  
24 NRC Exhibit 056 this is data for the Turkey Point  
25 site.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. QUARLES: It is. But what I did was  
2 a comparison of -- like 38 percent of the values of  
3 hydraulic conductivity were  $10^{-4}$ . They did range from  
4  $10^{-4}$  to  $10^{-6}$ , but a lot of them, 30 percent, were in  
5 the  $10^{-4}$  range which according to publications, that's  
6 indicative of a flow rate of a silty sand which is  
7 arguably not very confined.

8 DR. KENNEDY: Does  $10^{-6}$  indicate more  
9 confinement or less?

10 MR. QUARLES: It does, yes.

11 DR. KENNEDY: Let's go back to the 38  
12 percent. It was  $10^{-4}$ , is that what you said?

13 MR. QUARLES: Yes.

14 DR. KENNEDY: Does that mean there was 62  
15 percent if it was  $10^{-6}$ ?

16 MR. QUARLES: That does.

17 DR. KENNEDY: And what I understood you to  
18 say is that FP&L selected a value that's at the end of  
19 that confinement region, the  $10^{-4}$  value.

20 MR. QUARLES: The conclusion was that the  
21 hydraulic conductivity values between  $10^{-4}$  and  $10^{-6}$   
22 were all indicative of confinement.

23 DR. KENNEDY: Okay, thanks for clarifying  
24 that.

25 DR. BURNETT: Sir, I'd like to go back to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Dr. Maliva and could I ask for Exhibit FPL-003-60. So  
2 I want to go back to the question concerning logging  
3 and how we interpret them and what do they tell us?  
4 I believe this is from one of your publications.

5 DR. MALIVA: Not this particular figure,  
6 but I've seen this before.

7 DR. BURNETT: It was entered as an exhibit  
8 from Florida Power & Light. And the diagram on the  
9 left is actually from Turkey Point. It's from EW1 and  
10 it's showing sonic velocity.

11 DR. MALIVA: Yes.

12 DR. BURNETT: The one on the right is from  
13 Houston and I believe that's near Lake Okeechobee, so  
14 it's in the north. And it's also showing sonic  
15 velocity. And you can tell the profiles are quite  
16 different. Could you explain how you can tell whether  
17 or not layers are confining or not confining based on  
18 this comparison?

19 DR. MALIVA: Yes, this actually is a  
20 critical issue. Based on the modeling that I did both  
21 before I was involved with Turkey Point as part of  
22 this project as well as the EPA modeling, the middle  
23 confining zone strata, if it's not fractured, if it's  
24 a sufficiently low permeability, that it would act as  
25 an effective confining zone. The cumulative thickness

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 again is sufficient to keep migration to USDW.

2 Where confinement has been compromised is  
3 where there's been widespread fracturing of the  
4 confining zone. And the bore hole geophysical logs is  
5 absolutely critical for confining analysis because it  
6 provides a continuous record of the bore hole and you  
7 can readily recognize unfractured from fractured  
8 strata.

9 One indication of fractured is you have  
10 very long sonic transit times. Another evidence is  
11 just on a caliper log you can see the bore hole  
12 diameter spikes and the bore hole diameter. So for  
13 any injectional project in South Florida, the critical  
14 task is just to look at the state of the confining  
15 zone strata. Is it fractured? Is it unfractured?  
16 And this was provided as an example of the two  
17 extremes.

18 We have the Turkey Point log here and we  
19 see similar things at other wells in South Florida.  
20 The Florida Keys Aqueduct Authority is similar to the  
21 FPL well where we don't have very minimal fracturing.  
22 But then there's other wells where fracturing is much  
23 more widespread. So whenever we look at a new  
24 injectional project, we want to see what we see at  
25 Turkey Point that we don't see very low sonic transit

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 time is usually ideally less than 80 micro seconds per  
2 foot for most of the interval. We don't want to see  
3 any sort of bore hole enlargement associated with  
4 fracturing. So again, this is sort of a diagram  
5 showing what you don't want to see versus what you do  
6 want to see if you have effective confinement and the  
7 bore holes geophysical logs from Turkey Point are very  
8 clearly in the good confinement category.

9 DR. BURNETT: If you look at the Turkey  
10 Point log, can you recognize layers that aren't  
11 permeable?

12 DR. MALIVA: Well, you can identify layers  
13 that have higher porosity. The sonic porosity is  
14 related. Porosity can be estimated from the sonic  
15 transit time to get -- the sonic log doesn't give you  
16 permeability directly. Now what we do to get  
17 estimates of hydraulic conductivity is we use the core  
18 data to get a transform of hydraulic conductivity  
19 versus porosity and then we apply that equation to the  
20 sonic log to get a hydraulic conductivity versus depth  
21 of profile. But there's no way from a bore hole  
22 geophysical log to directly measure permeability. You  
23 have to get at it using other parameters.

24 DR. BURNETT: Let's take a look at another  
25 one. Could we go to Florida Power & Light 61, Exhibit

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 61, page 18? And I want to focus on the geophysical  
2 logs on the right-hand side.

3 So this is showing the --- what's called  
4 the caliper which apparently gives you the size to the  
5 bore hole.

6 DR. MALIVA: Yes, here we have the bore  
7 hole diameter, yes.

8 DR. BURNETT: This is not from Turkey  
9 Point, but it does show -- now there's two lines.  
10 There's a red line and a blue line. One is an X and  
11 one is a Y caliper, is that just dimensions?

12 DR. MALIVA: Yes, the way the tool  
13 operates, the caliper log has sort of two arms  
14 connected by a -- on the sort of spring tension and 90  
15 degrees, they're orthogonal to each other, so you get  
16 two readings of caliper. And this is the way of  
17 looking at asymmetry of bore hole, of the bore hole  
18 diameter. It's giving you a minimal and maximum  
19 direction.

20 DR. BURNETT: So the X and Y are equal, it  
21 seems to be in most cases.

22 DR. MALIVA: The circular bore hole.

23 DR. BURNETT: Then it's symmetrical.  
24 Okay. So going down, it looks pretty even and then  
25 around 2,450 or so it suddenly changes. So what does

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that -- that simply means a hole that larger for some  
2 reason?

3 DR. MALIVA: Yes, above 2,400, you're  
4 getting into the injection zone there which occurs  
5 about 450 feet shallower at South District than here.  
6 So again below 2,400, you're into the boulder zone  
7 there. So you see greater bore hole diameter and  
8 greater sonic transit times. So again it really  
9 contrasts the bore hole response to unfractured strata  
10 versus the fractured strata of the boulder zone.

11 DR. BURNETT: Let's go to another area.  
12 Could you show the Joint Intervenors Exhibit 14, page  
13 8. I'm going to direct questions again to Dr. Maliva  
14 because this, I'm sure, is from one of your papers.

15 DR. MALIVA: Definitely.

16 DR. BURNETT: It's got your name on it.

17 DR. MALIVA: Definitely.

18 DR. BURNETT: And this concerns some  
19 modeling that you did?

20 DR. MALIVA: Yes.

21 DR. BURNETT: And tell us of your  
22 modeling. So looking at the diagram, the warm colors  
23 represent high dissolved solids. So 35 would be  
24 equivalent to sea water. And cool colors represent  
25 fresher water and then you have everything in between.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 And you can see the diagram on the bottom shows the  
2 structure of what you're looking at. So I'd like to  
3 ask you about Scenario B. And if I understand this  
4 correctly, each scenario is based on different  
5 assumptions that you put into your model.

6 DR. MALIVA: Yes.

7 DR. BURNETT: So in Scenario B, the second  
8 one from the top, the cooler colors which could  
9 indicate waste water because that tends to be fresher  
10 is migrating vertically and horizontally, but it's  
11 migrating vertically to the extent that it does seem  
12 to intercept the Upper Floridan Aquifer.

13 So I guess my question is Scenario B were  
14 the assumptions you made realistic? And could you  
15 remind me what the time frame is to go from the  
16 starting conditions to the ending conditions?

17 DR. MALIVA: I don't recall the specific  
18 time conditions. Basically, what the modeling -- we  
19 modeled the Baseline Scenario A which is based on  
20 actual field ideologic conditions using the type of  
21 hydraulic conductivity, vertical hydraulic  
22 conductivities.

23 DR. BURNETT: In Scenario A, the  
24 conductivity was  $10^{-7}$ .

25 DR. MALIVA: Yes.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. BURNETT: In Scenario B, you changed  
2 the hydraulic conductivity to  $10^{-3}$ . So it's four  
3 orders of magnitude different.

4 DR. MALIVA: Yes, and if the hydraulic  
5 conductivity was much greater, yes, you're going to  
6 have very rapid vertical migration and the rate is  
7 going to depend upon what value you assign to the  
8 vertical hydraulic conductivity.

9 DR. BURNETT: Now this was not done for  
10 the Turkey Point site, but was done for South Florida  
11 type geology?

12 DR. MALIVA: Yes, this was purely a  
13 theoretical paper that we did. It was roughly based  
14 on some of the data from Palm Beach County, but it was  
15 purely an academic exercise.

16 I've written several papers. Once this  
17 upward migration issue occurred, we looked at detail  
18 to try to understand why upward migration occurs, what  
19 are the hydrogeologic conditions that would allow  
20 water to move up to a USDW.

21 So we developed a hypothetical model for  
22 the Floridan Aquifer System and did various  
23 simulations to change different variables. It was  
24 sort of if we have this condition, then we get very  
25 rapid migration. But if our hydraulic conductivities

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 were the values that we mentioned in the formations,  
2 we wouldn't see vertical migration.

3 And we did a similar model based on Turkey  
4 Point that was --

5 DR. BURNETT: Mr. Quarles had stated a few  
6 minutes ago that the hydraulic conductivities in the  
7 bore hole from Turkey Point was in the range of  $10^{-4}$   
8 to  $10^{-6}$ . So if you had put those kind of values into  
9 this model, how much would Scenario B have changed?

10 DR. MALIVA: Well, the way I would answer  
11 that is we did a site-specific model for Turkey Point  
12 similar to this. It was actually a modification of  
13 this model using the actual data from Turkey Point.  
14 And our model results showed that after 60 years of  
15 injection and another 40-year period of no injection,  
16 that is after a 100 year time frame, the top of the  
17 injected water would have risen about 400 to 450 feet  
18 and the top of the injected water would still be about  
19 1,000 feet below the base of the USDW. So that model  
20 which was also provided is based on site-specific data  
21 for Turkey Point this was again a theoretical model  
22 for what was basically an academic study.

23 DR. BURNETT: In the Turkey Point model  
24 that you referred to, do you recall did you use the  
25 conductivities that we just mentioned,  $10^{-4}$  to  $10^{-6}$ ?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. MALIVA: It incorporated a whole range  
2 of values. The model was based on hydraulic  
3 conductivities that were obtained to ones actually  
4 measured. I used the sonic log to get a crossing  
5 versus at profile and then I used a transform of  
6 hydraulic conductivity versus porosity from the core  
7 data to get a vertical and hydraulic conductivity  
8 versus depth profile and that data was upscaled to the  
9 model grid. So the model was based on actual data.

10 DR. BURNETT: Okay. Switching gears a  
11 little bit, in your pre-filed testimony, you mentioned  
12 that ground water flow in a boulder zone suggests that  
13 flow is in a westward or inland direction at an  
14 extremely slow rate, less than 60 feet per year.

15 The question is can the wastewater flow  
16 faster than the regional flow because of the pressure  
17 of injecting it underground?

18 DR. MALIVA: Well, the rate of lateral  
19 horizontal flow of wastewater is largely a matter of  
20 just physical displacement. You inject a certain  
21 volume of water into sort of a disk. You have a  
22 certain thickness, certain porosity. The water is  
23 going to move much faster than that ten feet. That's  
24 just the ambient gradient. But again, it's purely a  
25 physical displacement. How far out the water moves in

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 a given time interval is going to depend on the  
2 injected volume, the injections on thickness, and the  
3 porosity of the injection zone. Really, hydraulic  
4 gradients or natural flow of gradients would be much  
5 less than that.

6 DR. BURNETT: Thank you. I'd like to ask  
7 Mr. Barnhurst a question along the same lines. You  
8 had indicated that the natural flow in the boulder  
9 zone in Eastern Florida is generally westward and very  
10 slow on the order of thousands of years to cross  
11 peninsula Florida. Do you know offhand how did they  
12 determine the direction and the speed? You had  
13 mentioned a citation from Meyer in 1989.

14 MR. BARNHURST: Yes, sir. Meyer is one of  
15 the exhibits that we included, I believe, and I'm  
16 looking for the exhibit number.

17 DR. BURNETT: It's NRC-018.

18 MR. BARNHURST: 018. Thank you.

19 DR. BURNETT: If you go to Meyer and if  
20 you would permit me to do that quickly, Meyer used a  
21 number of ways to estimate the velocity of movement in  
22 the boulder zone. One of those ways was age dating  
23 using carbon-14. Here we go. It's Figure 12, Figure  
24 13, I used the parent carbon-14 each dating from  
25 different sites in Florida. And so based on the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 differing ages of waters at those sites, he developed  
2 an idea of how long it took the water to flow between  
3 those two sites.

4 On page G-23 of that exhibit, he gets a  
5 range based on his data and also based on previous  
6 reports.

7 DR. BURNETT: Okay, that's fine. So it's  
8 based on carbon-14 data?

9 MR. BARNHURST: It's based on carbon-14  
10 and he estimates --

11 DR. BURNETT: Presumably, the ages got  
12 older that you went --

13 MR. BARNHURST: Older as you moved inland.  
14 And it was about 55 feet per year, I think, 54.6 feet  
15 per year on average.

16 DR. BURNETT: Okay, good. Mr. Thorne, you  
17 had mentioned in your pre-filed testimony that any  
18 migration within the boulder zone beyond the site  
19 would move northeast toward, but beneath Biscayne Bay  
20 and away from areas in which the upper aquifers are  
21 used.

22 But I thought the flow in the boulder zone  
23 was to the west? So is it actually --

24 MR. THORNE: I believe that was based on  
25 the displacement of water by the injected water of the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 water at the boulder zone.

2 DR. BURNETT: It wasn't a regional flow?

3 MR. THORNE: Right. I believe that's  
4 correct.

5 MR. BARNHURST: If I could also add to  
6 that, that was a part of the -- I believe the  
7 environmental impact statement and in our testimony,  
8 we were talking about a hydrogeologic conceptual model  
9 flow accounting for injection. And so -- and it was  
10 based on previous studies, one of which is McNeill  
11 2002 that is one of our exhibits. It talked about the  
12 surface structure on the bottom of the middle  
13 confining unit and how it dips slightly to the  
14 northeast.

15 And so in that discussion we were talking  
16 about the different steps of the wastewater, the  
17 injected effluent would likely take after it was  
18 injected first moving regularly outward. And as it  
19 moved away from the injection pressure being maybe  
20 more effluence since it was on top of the water column  
21 because it was less dense. By the structure on the  
22 bottom of confining unit and flowing, potentially  
23 flowing in the direction of the up-dipped portion of  
24 that confining until it mixed more and then became  
25 more a part of the natural westward movement of the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 water in the boulder zone.

2 DR. BURNETT: In your analysis, was the  
3 analysis for one well pumping all the time or more  
4 than one?

5 MR. BARNHURST: The evaluation in the  
6 environmental impact statement was an evaluation of  
7 one well but pumping at the total, the injection rate  
8 that would be expected from all 12 wells.

9 DR. BURNETT: And by the way, is it  
10 actually, 12 or 13 wells?

11 MR. BARNHURST: From my understanding the  
12 exploratory is an additional well, so --

13 DR. BURNETT: It would be 13.

14 MR. BARNHURST: Twelve plus the  
15 exploratory well.

16 DR. BURNETT: So 13. Okay. So what do  
17 you think the difference would be if you have one well  
18 that's in your analysis pumping at full capacity or if  
19 you had all 13 wells pumping at full capacity? How  
20 would that affect the flow direction and velocity?

21 MR. BARNHURST: I don't believe there  
22 would be an effect on the flow direction and the  
23 velocity. I think one way that may be to consider the  
24 evaluation of one well pumping is more conservative  
25 than all wells pumping is that you have the total flow

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 rate going down one well and so it would -- there  
2 would be more going -- you would have I guess more  
3 velocity in that one location and so if you were to  
4 spread that out over the additional wells, you would  
5 be injecting the same amount in the area of the site,  
6 but you would have to inject at a lower injection rate  
7 per well.

8 DR. BURNETT: And so if you halve the  
9 number of wells, say five or six wells, I don't know  
10 if it's the same total flow --

11 MR. BARNHURST: Same total flow.

12 DR. BURNETT: Your opinion is it wouldn't  
13 change the velocity or direction?

14 MR. BARNHURST: I believe the evaluation  
15 of the EIS is conservative because we evaluated it  
16 with one, so no, I think overall it would affect that.

17 DR. BURNETT: Can I ask Mr. Quarles, do  
18 you have an opinion on that? Does it matter if you  
19 have one well pumping the full amount or if you have  
20 all 12 or 13 wells, pumping the same total amount, but  
21 distributed on different wells?

22 MR. QUARLES: So let me respond to that  
23 kind of by also adding about the velocity and the rate  
24 of flow, direction flow. A study done by Dawson, I  
25 don't remember if it was the 2007 or 2010 report that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 she did talked about one of the injection sites, not  
2 Turkey Point, but talked about water level rose in the  
3 Upper Floridan Aquifer by 20 feet in about 30 years.

4 So what that means is that the no  
5 confining layer number one was not intact to prevent  
6 that from happening. So ground water flows by  
7 pressure, so the direction is influenced by pressure  
8 or if you're pumping water from it, it would be -- I  
9 hate to call it a vacuum, but nonetheless, it's  
10 flowing by pressure.

11 So if you have water that rises 20 feet at  
12 the point of injection, then you would expect the  
13 direction of ground water flow to be much different  
14 than an ambient ground water flow.

15 So to respond to your question directly  
16 about 1 well versus 12 wells, well, my guess is the  
17 model that's in the assumption of the thousands of  
18 years and flowing is based upon the conductivity and  
19 no enormous vertical leakage. So if you have one well  
20 that's injecting and you're not around a natural  
21 conduit fracture or fault, perhaps a collapsed  
22 structure, that sort of thing, that would be much  
23 different than if you had 12 wells that perhaps might  
24 be located in the vicinity of a natural feature  
25 fracture that might lose water vertically. So I think

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that there would be a difference in the rate and  
2 direction of flow with 12 wells versus 1.

3 DR. BURNETT: Okay, so it depends on where  
4 the wells are sited relative to other features?

5 MR. QUARLES: That's right. And so like  
6 if I could go back a little bit, you know the ground  
7 water model that Dr. Maliva was talking about -- let's  
8 remember, too, that EPA and their UIC preamble rule in  
9 2005 said that they didn't really have any confidence  
10 in ground water modeling being representative of the  
11 actual flow rate direction, and risk just because of  
12 the complexity of Southeast Florida.

13 The other side of that is let's remember,  
14 too, that we're using data from a single well point,  
15 EW1. So the geophysical logs, for example, would not  
16 represent a widespread evaluation of the entire site  
17 because the geophysical logs are in the immediate  
18 vicinity of the bore hole, so there's a lot of  
19 variables that would go into that. But the fact is if  
20 you don't incorporate those natural features and the  
21 possibility and probability of those happening, then  
22 you're just relying upon generic information.

23 DR. BURNETT: Thank you. Dr. Maliva, you  
24 mentioned in your pre-filed testimony that ground  
25 water modeling that you used, you used a model called

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 SEAWAT, S-E-A-W-A-T.

2 DR. MALIVA: Yes, I have.

3 DR. BURNETT: Which is an density  
4 dependent solu-transport code.

5 DR. MALIVA: Yes.

6 DR. BURNETT: Because it's density  
7 dependent the salt content is very important and so  
8 the question is do we have a good idea of what the  
9 salt content of the waste water is including the  
10 treatment it receives at Turkey Point and before it's  
11 injected?

12 DR. MALIVA: Yes. I use the value that  
13 the design engineers came up with, it was about 5,000  
14 or so TDS. The value that I used was based upon the  
15 wastewater composition and the number of cycles that  
16 would go through the cooling cycle. Those numbers  
17 were provided to me. I did not do an independent  
18 evaluation of that. But it's fairly fresh, so it will  
19 be a high buoyancy. And that's the reason why  
20 vertical migration occurs. It's driven by the lower  
21 salinity and that's greater buoyancy as the wastewater  
22 --

23 DR. BURNETT: But if you recall, the  
24 number is around 5,000 milligrams per liter?

25 DR. MALIVA: The 4,000 to 5,000 range.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. BURNETT: Can anyone on this panel  
2 address that question? And to be more specific what  
3 I'm interested in is the salinity of the water that's  
4 actually injected after all the processes that is  
5 experienced and how constant that value is. If it's  
6 5,000, is it always 5,000? Or is it plus or minus  
7 2,000?

8 It seems like the result of the model will  
9 depend critically on that value.

10 DR. MALIVA: Well --

11 DR. BURNETT: The vertical flow is because  
12 of buoyancy.

13 DR. MALIVA: Right. Yes, the model  
14 results are sensitive to the salinity of the injected  
15 water, but up to a point. It's not so sensitive that  
16 if we modeled it at 5,000 or 6,000 or it was 4,000,  
17 we'd get grossly different results.

18 DR. BURNETT: It wouldn't change that  
19 much?

20 DR. MALIVA: It's not sensitive to that.  
21 If you change it to the situation where the  
22 alternative disposal strategy of injecting sea water,  
23 then it's totally different because you don't have the  
24 buoyancy. Again, the model results isn't sensitive to  
25 small variations in salinity.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. BURNETT: Mr. Quarles, so you  
2 mentioned in your rebuttal testimony that the EPA does  
3 not believe that modeling can provide an adequate  
4 demonstration of the complex geology of Florida. What  
5 did they suggest instead?

6 MR. QUARLES: So EPA recognized that all  
7 these injection well sites had received an  
8 investigation of collecting data the old fashioned  
9 way, traditional methods, and that a large percentage  
10 of those were not representative of the actual  
11 conditions to demonstrate confinement and protection  
12 of ground water.

13 So it talked about -- and this is a 2005  
14 UIC rule or preamble change to the rule. So it talked  
15 about other technologies would be useful to be able to  
16 demonstrate these conduit-type situations that seemed  
17 to be occurring. They didn't specify one technology  
18 or the other, but clearly the use of seismic  
19 technologies would fill a void and be very useful and  
20 reasonable when it comes to explaining the instances  
21 of unintended vertical migration of wastewater.

22 DR. BURNETT: They didn't specifically  
23 mention seismic reflection.

24 MR. QUARLES: I don't recall that it did.

25 DR. BURNETT: If one used seismic

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 reflection techniques and generated these profiles and  
2 you see tectonic faults, as Mr. Cunningham has shown  
3 in his papers, does that necessarily mean that they  
4 will be hydraulically active?

5 MR. QUARLES: It's certainly as Mr.  
6 Cunningham had concluded it, represents a plausible  
7 pathway and could explain all the other unintended  
8 vertical migrations.

9 Let's also consider -- his work talked  
10 about not only the faults and the faults breaching  
11 multiple confined layers and multiple bedrock  
12 formations and they illustrate that. But let's also  
13 talk about what is not really discussed, but it's no  
14 doubt occurring, is that you can have vertical joint  
15 sets that are related to like, for example, karst  
16 collapsed features that are not necessarily faults.  
17 Right?

18 So if you remember that the bedrock  
19 originally was laid down as a parallel flat structure  
20 and then through tectonic forces you have some rises,  
21 you have some falls, you have some collapses. And so  
22 these fractures in these vertical joint sets that are  
23 no doubt occurring can also span different bedrock  
24 formations.

25 DR. BURNETT: Thank you. So could I have

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Joint Intervenors Exhibit 9, page 13? Thank you.  
2 This is from one of the -- I guess it's probably the  
3 most recent paper by Cunningham, 2015 and it shows the  
4 seismic reflection profile from Biscayne Bay and the  
5 blue areas are interpreted as being more permeable.  
6 The red is less permeable. And the yellow straight  
7 lines are interpretations of some of the faults that  
8 had been mentioned.

9           Could I ask Dr. Maliva, can you see how  
10 migration could be potentially active on some of these  
11 faults?

12           DR. MALIVA: A couple background points I  
13 need to make first. This discussion of faults and  
14 collapsed structures, even going back further,  
15 subsurface deformation has been an interest of mine  
16 for well over a decade. I published a couple of  
17 papers on it in 2004, 2006, discussing again it was a  
18 Miocene/Pliocene deformation event that impacted much  
19 of Florida. I give examples, numerous examples of  
20 where I found this using well data and seismic  
21 reflection data. But a critical point is that this  
22 was a Miocene -- an event that occurred during an  
23 Miocene and Pliocene epochs several million years ago.  
24 So we have to be clear. This isn't modern faulting.  
25 This isn't karst collapse such as you see in North

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Florida or Central Florida. This is a fossil event  
2 that's very widespread.

3 And none of this -- Dr. Cunningham  
4 collected, and his team, some outstanding data here.  
5 But his interpretation is just speculation. If you  
6 read his reports, he just made a comment these things  
7 may be plausible. I'm not sure if plausible means --  
8 you could say that it means a non-zero probability.  
9 Well, anything is possible.

10 He provided no evidence that there are  
11 flow features. He didn't even provide any discussion  
12 of why he thought they were flow features. And this  
13 is a widespread phenomenon in Florida. I worked on a  
14 site in Palm Beach County, East Central Wastewater  
15 Treatment Plant where I was putting in a new injection  
16 well and there were already six wells there and the  
17 data clearly indicates that one of these features goes  
18 right through the site. It was an earlier paper that  
19 identified it as being under a fault or a fold or some  
20 sort of other deformation feature. It literally  
21 passes between injection wells 3 and 4.

22 But when you look at the data, there's no  
23 suggestion whatsoever about the migration at the site.  
24 Effluent was never detected in any dual zone monitor  
25 well. And when we installed the seventh well, we were

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 very careful to see how far up did the wastewater  
2 migrate up that site. And this is a major injection  
3 on site, over 100 million gallons a day is injected.  
4 And the injected water was still 650 feet below land  
5 surface.

6 So again, you have one of these features  
7 that it's unequivocal. I independently reviewed the  
8 data, but it's not active. So I mean the seismic  
9 reflection is wonderful data, but it doesn't provide  
10 you actionable information. You get no information  
11 about the properties of the strata. So that's why  
12 it's never been done. And we've been using this  
13 technique since the 1970s, USGS has done seismic  
14 reflection and has shown this Miocene/Pliocene  
15 deformation event evidence for it. And there's a  
16 reason why it hasn't been done because it isn't  
17 useful.

18 MR. McNABB: If I could and this is a  
19 minor clarification. Dr. Maliva had indicated that  
20 injected water was detected at 650 feet below land  
21 surface, I believe.

22 DR. MALIVA: Below the face of the USDW.

23 MR. McNABB: Good correction. They are  
24 not land surface, it was below the base of the USDW.

25 DR. MALIVA: Okay, thank you for

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 correcting that. And I've seen other sites, too, and  
2 Bonita Springs is a huge deformation structure there.  
3 They have injection. It was on a plank in the middle.  
4 No upper migration. The seismic reflection is an  
5 actionable information. It's very useful from a  
6 historical geology perspective to try to identify what  
7 happened in the past, but it's not useful information.  
8 Certainly, it's not worth a million dollar plus cost  
9 to run it and process the data.

10 DR. BURNETT: It doesn't really matter  
11 when the fractures occurred though, does it? I mean  
12 if they're there, they're there.

13 DR. MALIVA: Well, fractures tend to heal  
14 over time. You get fracturing. You get circulation  
15 of water. You get cements precipitate and you very  
16 frequently see that in cores and bore hole videos.

17 DR. BURNETT: So if a fracture is healed,  
18 perhaps became filled with secondary cement or  
19 mineral, would they still show up as a seismic  
20 reflection?

21 DR. MALIVA: Yes, the seismic reflection  
22 maps contrasting acoustic impedance between strata.  
23 You're looking at the boundaries of formation, but it  
24 doesn't provide any information about the actual  
25 properties of the formations themselves.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           This healing process is very commonly  
2           observed. I can cite another example, the Sanibel  
3           Island Water Association Well. When we drilled that  
4           we found hundreds of feet of breccia there, fractured  
5           rock, but it was all cemented. We were worried that  
6           we didn't have enough transmissivity for an injection  
7           well because this tends to heal over time.

8           DR. BURNETT: Okay. Thank you. Mr.  
9           Quarles, could I ask you also, when you look at this  
10          profile, does it say anything to you? Does it say  
11          migration?

12          MR. QUARLES: It does. And the reason it  
13          does is any time you see, if you see the yellow lines  
14          --

15          DR. BURNETT: Yes.

16          MR. QUARLES: They're in the area of this  
17          incline which is a bowl-type structure where the  
18          bedrock, if you -- let's go down a little bit further.  
19          Right there.

20                 All right, so what you see is the density  
21          of fractures around that collapsed structure and the  
22          faults on both sides. So clearly that deformation has  
23          resulted in faults and fractures. Right? So I guess  
24          I respond to the comment about the fractures and  
25          faults will heal over time. If all fractures and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 faults healed over time we would never have sink holes  
2 in Florida, right? Because they began as a small  
3 crack and fission launched on bedrock and solution  
4 enlargement made them bigger.

5 So you can't always assume that a fracture  
6 is going to heal. It can turn into conduit type flow.  
7 So I'll make that point.

8 And then, two, let's not forget the extent  
9 and distribution of those fractures, vertically and  
10 horizontally, are very important when it comes to  
11 injection. And Dr. Maliva wrote a report back in 2007  
12 that made that very conclusion, the extent and  
13 distribution of fractures are what's important to  
14 determine the rate and direction of injected  
15 wastewater flow and not relying upon individual data  
16 from the bore hole.

17 DR. BURNETT: Thank you. Could I have  
18 Florida Power & Light Exhibit 7, page 3? So this will  
19 be another seismic reflection profile. This is from  
20 Cunningham also, but it's his earlier paper, 2012.  
21 And I'd like to focus on the diagram on the left hand  
22 side, if you could extend that? Thank you.

23 This is from Biscayne Bay, I believe.  
24 Yes. And you can see that the author has superimposed  
25 the fault line, vertical fault line with the left side

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 going up and the right hand side dropping down, so a  
2 normal fault. And if you could reduce the  
3 magnification, zoom out? Yes.

4 So you can see that the fault extends all  
5 the way down to the bottom and it extends for  
6 thousands of feet.

7 So Dr. Maliva, this looks like this could  
8 be a conduit. It could transport water a very, very  
9 long distance if this interpretation is correct.

10 DR. MALIVA: A fault can be a flow  
11 feature. It can be seal. If you're in the gas  
12 industry, you find faults that a fault can be filled  
13 with less permeable material and actually add value to  
14 the flow. Or a fault could be neutral. So there's  
15 three options there.

16 Looking at this, you can't say anything  
17 about whether it's a flow feature. As they noted  
18 earlier, they had a flow feature at the East Coast  
19 Regional Water Treatment Plant that went all the way  
20 down. But again, it wasn't an active feature. It's  
21 not interpretable in terms of ground water hydraulic  
22 properties. You can speculate that it might be a flow  
23 feature, but that's not telling you anything about its  
24 properties because it could be either a flow feature.  
25 It could be a seal. Or it could be a neutral feature.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. BURNETT: Is there any geophysical  
2 technique that could be combined with seismic  
3 reflection to give you hydraulic properties, as well  
4 as the structure?

5 DR. MALIVA: I know some people use  
6 resistivity for looking at underground salinity, but  
7 probably not on this scale. This is thousands of  
8 feet. I can't really think of any technique that  
9 would be practical to evaluate that.

10 DR. BURNETT: Okay. Thanks. Mr. Quarles,  
11 does this say anything to you, this diagram?

12 MR. QUARLES: It does. It says a lot.  
13 And you hit the nail on the head in that these faults  
14 can extend thousands of feet and breach confined  
15 layers that a single bore hole or EPA would even say  
16 multiple bores instead of drill through a single point  
17 may not illustrate the presence of a fault.

18 What it says to me is it's a very  
19 reasonable explanation for the heterogeneity that has  
20 been discussed by Walsh and Price, Dr. Walsh,  
21 Cunningham, Dawson, Dr. Maliva, that is the great  
22 illustration that is a very plausible explanation of  
23 why the previous hydrogeologic investigations have not  
24 shown confinement. Or they have, but in fact, there  
25 has not been confinement.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. BURNETT: Mr. Quarles, changing the  
2 subject a little bit, if the wastewater is not used by  
3 Florida Power & Light for cooling, it will still be  
4 generated at the wastewater treatment plant and  
5 disposed of underground. In fact, at the South  
6 District Wastewater Treatment Plant, it's one of the  
7 sites where some migration appears to have occurred.  
8 So isn't it preferable to have some good use made of  
9 this wastewater since it will be injected underground  
10 anyway?

11 MR. QUARLES: So I guess I would respond  
12 to that by saying Dr. Walsh in Miami-Dade County has  
13 probably studied the South District, North District  
14 plants more than anybody. Her recommendation is that  
15 all future new proposed injection sites have seismic  
16 technology in addition to traditional down hole  
17 methods. So that's a really good idea. So I don't  
18 think it makes sense where you know you've had  
19 unintended vertical migration to say it's okay to send  
20 it nine miles to the south where we have not had any  
21 ground water contamination issues down there. So  
22 that's not a good explanation to take it from one  
23 place and send it to another that does not already  
24 have ground water contamination.

25 DR. BURNETT: Mr. Quarles, you had

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 mentioned in your pre-filed testimony that high  
2 percent porosity found in the Cave Study, that's the  
3 study of the test well, indicates that the bedrock  
4 will not be an effective confining layer. But isn't  
5 it the case that high porosity can be associated with  
6 low permeability?

7 MR. QUARLES: I'm glad you asked that  
8 question. So the other testimonies talked about how  
9 there could be high porosities of sand and clay. So  
10 when ground water flows through sand and clay, that  
11 would be flow through a porous media. So the flow  
12 path to go from one side to the other or top to bottom  
13 has to go around all of those small particles of soil  
14 due to porosity.

15 So what's different in bedrock is that the  
16 greatest opportunity for flow -- it's really an apples  
17 and oranges comparison, talking porosity of bedrock,  
18 comparing it to porosity of clay because flow through  
19 a bedrock, if the porosity is isolated, and focused on  
20 a fracture, it would be much faster in a straight line  
21 as opposed to going around the individual particles of  
22 a clay or sand. Does that make sense?

23 DR. BURNETT: I'd like to address a  
24 question to Mr. Barnhurst. You had stated that staff  
25 analysis show that in the absence of enhanced vertical

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 flow features, upward migration could occur, but would  
2 likely be limited to 300 feet into the base of the  
3 middle confining unit.

4 So the question is are the enhanced  
5 vertical flow features the types of features mentioned  
6 by Cunningham and we discussed here this morning?

7 MR. BARNHURST: So that I think was a  
8 general way to describe any feature that can allow for  
9 upward migration, so it could be one of the type of  
10 features mentioned by Cunningham.

11 DR. BURNETT: Okay, so it could be.

12 MR. BARNHURST: It could be. It could  
13 also be a well, some type of well failure.

14 DR. BURNETT: So what if you had included  
15 some of those features in your analysis?

16 MR. BARNHURST: We actually did. We  
17 evaluated Florida Power & Light's numerical modeling  
18 that was discussed. We performed an independent  
19 evaluation. We evaluated three scenarios. One was  
20 the potential for ore zone flow, how far might that  
21 go. One was the potential for vertical flow, how far  
22 might injected wastewater travel vertically through a  
23 nonfractured confining unit. And then we assumed the  
24 scenario, we used a scenario that assumed a full  
25 breach of the middle confining unit full of wastewater

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 up into the Upper Florida Aquifer, the internal impact  
2 that might have on ground water quality.

3 DR. BURNETT: I'll follow that up with --  
4 and you can answer this or perhaps Mr. McNabb. So  
5 there were actually two wells drilled, a test well,  
6 AW1; and then a dual-zone monitor well. And the  
7 question is was the same test conducted on both bore  
8 holes? And if they were, were the results similar?

9 MR. BARNHURST: Who would you like to  
10 answer that, Your Honor?

11 DR. BURNETT: Mr. McNabb.

12 MR. McNABB: Not exactly all the same  
13 tests. For example, on the dual-zone monitor well, we  
14 do not collect any cores. There's a reason for that.  
15 You focus your core collection in your expected  
16 confining interval. We install our dual-zone monitor  
17 wells so our upper zone is just near the base, the top  
18 of our primary confining unit. So there would be no  
19 reason for us to be collecting cores in our monitor  
20 well.

21 Other than that, the geophysical logging  
22 program was similar. The Packer testing not as  
23 extensive because the Packer testing is primarily in  
24 our injection well, we're primarily looking at  
25 confinement evaluation with our Packer test. Our

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Packer test and our dual-zone monitor well are really  
2 more interested in water quality because the design of  
3 our dual-zone monitor well is dependent on that water  
4 quality with our positioning of an upper zone at or  
5 near the base of the underground source of drinking  
6 water and our lower zone near the top of our primary  
7 confinement unit and below the base of the underground  
8 of drinking water.

9 DR. BURNETT: And another question for  
10 you. I believe this is in your report on well EW1.  
11 You had estimated that 18.6 million gallons per day  
12 would be necessary for cooling using only reclaimed  
13 water, but approximately 84.8 million gallons per day  
14 when using only the backup saline water.

15 So it seems like a very large difference  
16 from 18.6 to 84.8. Why is it so different?

17 MR. McNABB: That's based on the water  
18 quality of the two water sources. The reclaimed water  
19 quality is going to be much lower in total dissolved  
20 solids. You can suck cycle it up a few times through  
21 the cooling tower before you send it down the  
22 injection well. Whereas, when they're operating with  
23 a marine -- with salt water, I think it goes through  
24 the cycle once and then down the injection well. It's  
25 just so saline you don't want to cycle it up much

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 because it starts plating out, precipitating solids in  
2 the cooling tower.

3 DR. BURNETT: Okay. I see. Thank you.

4 MR. McNABB: Sure. Dr. Burnett, you had  
5 previously asked about water quality of the Avon Park  
6 Permeable Zone.

7 DR. BURNETT: Yes.

8 MR. McNABB: And I said we'd get back to  
9 you. Could I address that real quick?

10 DR. BURNETT: Yes, please.

11 MR. McNABB: This is based on Packer tests  
12 performed on the exploratory well. We don't have one  
13 exactly in the Avon Park Permeable Zone, but we have  
14 got a Packer test at 1,505 to 1,535. Our total  
15 dissolved solids there was 13,890.

16 Our next one down was at 1,930 to 1,952.  
17 Total dissolved solids, 32,167. So it's safe to  
18 assume that the Avon Park Permeable Zone is somewhere  
19 in between there as far as total dissolved solids.

20 DR. BURNETT: The first one you mentioned  
21 was 1,505 until the second interval?

22 MR. McNABB: 1,535.

23 DR. BURNETT: 1,535.

24 MR. McNABB: That was our test interval  
25 for that first test I mentioned.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 CHAIRMAN HAWKENS: What was the exhibit  
2 number that, Mr. McNabb?

3 MR. McNABB: That is in the report that I  
4 did for the exploratory well. Here we go, FPL-005B.

5 CHAIRMAN HAWKENS: A couple of follow-up  
6 questions. First for Mr. McNabb, the data then, you  
7 got the test data from the monitor well. That was not  
8 principally for the purpose of designing the confining  
9 characteristics of the confining unit. Is that  
10 correct?

11 MR. McNABB: You are correct.

12 CHAIRMAN HAWKENS: Okay. Thank you. I  
13 have a follow-up question also for Mr. Quarles going  
14 to porosity. You did state in your initial testimony  
15 that high percent porosity is indicative generally of  
16 a lack of confinement. Correct?

17 MR. QUARLES: Correct.

18 CHAIRMAN HAWKENS: Is it also true that  
19 high percent porosity may not represent a lack of  
20 confinement?

21 MR. QUARLES: So the example of clay --

22 CHAIRMAN HAWKENS: No, no. Can you just  
23 answer that question for the data that we're dealing  
24 with here from EW1. Is it correct to say that high  
25 percent porosity may not be indicative of a lack of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 confinement?

2 MR. QUARLES: High percent porosity  
3 coupled with hydraulic conductivity and the percent  
4 recovery all together suggest that it's not confining  
5 in nature.

6 CHAIRMAN HAWKENS: Okay. So it's fair to  
7 say then that the high percent porosity standing alone  
8 may not be indicative of a lack of containment.

9 MR. QUARLES: Correct.

10 CHAIRMAN HAWKENS: Thank you.

11 DR. BURNETT: Mr. Quarles, if deep well  
12 injection has the kind of problems that you've brought  
13 to our attention, what are the alternatives?

14 MR. QUARLES: Well, in the past if there's  
15 been some ocean out faults, surface water out faults.  
16 Those have all been used here in the State of Florida  
17 in addition to the deep well injection. So now the  
18 question is is going forward what is the best way to  
19 review and select the site for deep well injection.  
20 And the use of seismic technology in addition to  
21 traditional bore hole well, drilling, geophysical, all  
22 of that when you couple it together, it gives you the  
23 best opportunity to evaluate risk, select a site, good  
24 or bad, and to have a -- to use Cunningham's word,  
25 scientifically defensible investigation that gives

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 reasonable assurance.

2 I'm not saying that deep well injection is  
3 a bad idea. I'm saying just do a thorough site-  
4 specific evaluation to give you the best information  
5 to make every useable informed decision.

6 DR. BURNETT: Thank you.

7 DR. KENNEDY: Just a quick follow-up to  
8 that. I'm just specifically what does the seismic  
9 reflection study add to the discussion about  
10 confinement? Why is that such a significant missing  
11 element in this hearing?

12 MR. QUARLES: So I have the luxury of  
13 living in Tennessee where we have bedrock that is  
14 exposed at or very near the ground surface. So every  
15 day that I drive to school, my son to school or to the  
16 grocery, I get to see the heterogeneity of a limestone  
17 carbonate formation. I have background education  
18 experience in karst geology which is very prevalent,  
19 prominent in Florida with sink holes and conduit flow.

20 The importance of the seismic evaluation  
21 gives you a widespread -- to use Cunningham's words --  
22 like it's never been seen before. It gives you a  
23 visual observation of the widespread characteristics  
24 of the subsurface that would indicate where you would  
25 have the highest likelihood of fractures and faults.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 If you recall the diagram that had the yellow lines in  
2 it.

3 Single bore hole, even the geophysical,  
4 the single borings, the analogy that we use in the  
5 world of karst geology is if I'm trying to drill a  
6 well into a conduit, I would be no more likely to  
7 randomly locate that well than I would if you blind  
8 folded me and spun me around and told me to throw a  
9 dart at a dart board to hit a bull's eye. It's just  
10 a guess.

11 The seismic evaluation gives you the best  
12 opportunity to find these natural pathways of  
13 fractures and faults prior to your selection of site.

14 DR. KENNEDY: And in this case, FP&L has  
15 selected a site and they did an exploratory well and  
16 it appears from the data that that exploratory well  
17 shows a measure of confinement. Is the issue here the  
18 extent of the characterization of that site from the  
19 one well? As you use in your testimony the word  
20 heterogeneity, you indicated that would -- that could  
21 exist across short distances, even across short  
22 distances.

23 What kind of distances are we talking  
24 about?

25 MR. QUARLES: I'll give you an example.

1 I see it every day. And I, as a geologist, imagine  
2 when I would drill a hole at this location, I could  
3 drill a hole at this point and I would get intact  
4 bedrock the whole duration of the boring. But I could  
5 move three feet to the left and I could drill a boring  
6 and I could get into a six foot open conduit, three  
7 feet to the left.

8 Or I could drill a boring down to 75 feet  
9 and hit rock, competent rock. But if I went to 80  
10 feet, I would also, I would have gotten lucky and hit  
11 conduit. So single bore holes, the likelihood that  
12 you find these natural features is virtually slim to  
13 none.

14 DR. KENNEDY: You're suggesting that the  
15 subsurface geology could vary on the order of feet?

16 MR. QUARLES: It could. For example, if  
17 there's a fault there and if you drill here and the  
18 fault is five feet over there, you may miss the fault.  
19 In karst class structures where you have -- I think  
20 I've read where some of these are like three miles in  
21 diameter and you would have some fracture there in  
22 there associated with that. But you would also have  
23 horizontal bedding planes that would be influent for  
24 downward pathways. And then you would have vertical  
25 joint sets that are vertical fractures that are not

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 displacement faults.

2 So today, you want to use the best  
3 technology which would be combining, incorporating of  
4 seismic.

5 DR. MALIVA: May I make a comment?

6 DR. KENNEDY: Yes, but let me ask the  
7 questions, but I was going to turn to you exactly, to  
8 give you, both yourself and the staff to offer their  
9 opinions on the heterogeneity of the site or defend  
10 the use of one exploratory well.

11 DR. MALIVA: First of all, this is not  
12 Tennessee. This is not even Central Florida or West  
13 Central Florida. We don't have well developed karst  
14 in the Florida aquifer system. I've been drilling  
15 wells here for 20 plus years. We don't find these big  
16 solution cavities and caves in the Florida aquifer  
17 system in South Florida, south of Lake Okeechobee,  
18 totally different geology. So the argument that you  
19 can drill here and miss something three feet away is  
20 just not applicable.

21 DR. KENNEDY: Is there something in the  
22 record, an exhibit that FP&L or the staff has  
23 submitted that could help support the characterization  
24 of the geology around the Turkey Point site for its  
25 consistency in regard to the exploratory well?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. MALIVA: You know it's an issue I  
2 didn't think would even be raised, to be honest. I  
3 think all of us who are familiar with South Florida  
4 geology know that yes, you do get some karstic  
5 features in the Biscayne Aquifer, but you don't see  
6 that type of structure in South Florida. It's just  
7 different geology. It didn't occur to me that I  
8 needed to address that issue.

9 Another comment is you quoted Dr.  
10 Cunningham. I've read his papers and I've never seen  
11 these quotes, nor did I ever recall Virginia Walsh  
12 said all seismic reflection needs to be done for all  
13 injection well systems. I don't recall her ever  
14 saying that.

15 This is an ancient deformation structure.  
16 It's very widespread throughout Florida. We haven't  
17 had in Miami, Broward, Palm Beach County, there's only  
18 been three instances where upward migration to a USDW  
19 has occurred. And the two, Miami-Dade, North District  
20 and South District, there's a very high likelihood  
21 that was due to well construction issues.

22 And another, I think, mischaracterization  
23 was of the conclusion of the USEPA and 2005 study. It  
24 was recognized at that time that the hydrogeologic  
25 demonstration approach, that is, collecting more and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 more data to demonstrate that you had sufficient  
2 confinement so that endangerment of the USDW would not  
3 occur, that was recognized to be unsatisfactory. Even  
4 if we ran seismic reflection surveys crisscrossing the  
5 whole area, you could always still argue that you have  
6 this feature three feet away from the seismic profile  
7 that you missed.

8           Instead, the strategy that was adopted was  
9 to maintain the current confinement analysis  
10 procedures and then upgrade the treatment process.  
11 You know, with respect to municipal injections wells,  
12 they have the requirement that they go to high-level  
13 disinfection as a way of preventing endangerment to  
14 the USDW.

15           The injected water already meets federal  
16 drinking water standards. You don't even have an  
17 endangerment issue any more, so it's kind of hard to  
18 make the argument that even under the worst case  
19 scenario that you have migration into the lower USDW,  
20 the water would still meet federal drinking water  
21 standards. Well, there's not a regulatory issue  
22 there. So why would you want to spend millions of  
23 dollars to do seismic reflection.

24           DR. KENNEDY: That's kind of an expansive  
25 response. I was going to try to cut you off but you

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 beat me to the punch.

2 Before -- Mr. Barnhurst, you look like you  
3 want to say something. I'd like to go back to Dr.  
4 Quarles -- Mr. Quarles.

5 Two questions come to mind. The seismic  
6 reflection thing is probably the single most, I think,  
7 disputed topic that we've heard so far today. Does  
8 the State of Florida require a seismic reflection  
9 study for a new injection well? And if it doesn't  
10 currently, are you aware that they're contemplating  
11 introducing such a regulation through rulemaking?

12 MR. QUARLES: I am not aware of any  
13 contemplating of a rulemaking change and it currently  
14 is not required.

15 DR. KENNEDY: Okay.

16 MR. QUARLES: But according to Dr. Walsh  
17 and Cunningham, it certainly -- there's an immediate  
18 need that it would be useful and beneficial.

19 DR. KENNEDY: Let me just ask one -- I  
20 guess I need a microphone freed up. Maybe Mr.  
21 Barnhurst, could you release your microphone. I got  
22 it back. Thank you. I'm not getting very good at  
23 this.

24 Just one last question, Mr. Quarles, in  
25 regard to permitting of underground injection wells.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Are you aware of any case in Florida where an  
2 injection well actually used more than one exploratory  
3 well prior to getting their permit? Do you have any  
4 example that somebody felt required to do that?

5 MR. QUARLES: I'm not aware of that. I  
6 haven't researched the permit to the other side.

7 DR. KENNEDY: Fair response. I'm going to  
8 release my microphone, but ask Mr. Barnhurst, we had  
9 a discussion going here earlier and it looked like you  
10 wanted to say something.

11 MR. BARNHURST: Yes, sir. Hopefully, I  
12 can follow the notes I was taking there. Just in  
13 reference to I believe the original question was how  
14 much geology can vary over short distances in  
15 Southeast Florida. The records that comes to my mind,  
16 there are numbers of them and based on our review for  
17 the final environmental impact statement, the answer  
18 is that it doesn't vary greatly over short distances  
19 and I think Williams and Kuniansky, I need to look and  
20 see if that's one of our exhibits that we filed, but  
21 certainly one that we used in the environmental impact  
22 statement talks about the fact that the variance in  
23 the no confining unit, is that as you travel southeast  
24 in Florida, it becomes thicker and it becomes more  
25 confining.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Another point, just quickly, if I could  
2 make about seismic injection and seismic reflection  
3 and the impact it may have on the ability for water to  
4 up well. Cunningham himself recognized in the absence  
5 of seismic data, there are other types of data to be  
6 used to evaluate the nature of the confining unit. In  
7 fact, sonic logs bore hole logs are one type of data  
8 that you pointed to specifically in one of his  
9 reports. That type of data has been collected at the  
10 Turkey Point site. We have evaluated it.

11 In addition to that, the injection well  
12 and the observation well which doesn't go through, all  
13 the way through the no confining unit, it was used to  
14 evaluate the confining nature of the no confining unit  
15 through injection pressure testing where you inject  
16 into the injection well and you measure any  
17 fluctuations in pressure at the observation well. If  
18 there were connectivity through the middle confined  
19 unit, you would expect to see variations in pressure  
20 in your observation well. That's why the well is  
21 there. And there was none noted during that pressure  
22 test.

23 CHAIRMAN HAWKENS: Can you cite us to an  
24 exhibit number on that, please?

25 MR. BARNHURST: Yes, I can. The pressure

1 testing. And perhaps Mr. Thorne can also help me out  
2 -- I called it out here. We discussed in the FEIS.  
3 I believe it's Section 5.2 of the FEIS, but it's also  
4 an exhibit, NRC-055.

5 If I could just make one more point  
6 related to what we've been talking about. As part of  
7 our evaluation of the FEIS, we evaluated the nearest  
8 possible site that we could that had an abundance of  
9 data and that was the South District Wastewater  
10 Treatment Plant. There is seismic data at the South  
11 District Wastewater Treatment Plant. And the seismic  
12 data at that plant indicates that there are no seismic  
13 reflection, excuse me, no features that cross cut the  
14 no confining unit. There are features there. They're  
15 located in the Lower Florida Aquifer beneath the  
16 middle confining unit, and yet, there's up welling at  
17 that plant.

18 We may talk in greater detail about why  
19 that is, but there's been a variety of reports about  
20 evaluating the cause of up welling at that plant and  
21 they point to three main issues related to well  
22 construction or well corrosion. And so Virginia Walsh  
23 in her dissertation which is I think at Exhibit FPL-  
24 063 also used isotopic data to evaluate mixing between  
25 the different units at the South District Plant and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that data also indicated that where you have ammonium  
2 which uses tracer in -- because it's part of the  
3 injected wastewater, the wells where you saw ammonium  
4 were the only wells where you had any type of mixing.  
5 And the other wells, it all showed that the water in  
6 the different aquifers there at the site was well  
7 confined and plotted in different places on that, on  
8 the graphs.

9 DR. KENNEDY: Mr. Barnhurst, I can't let  
10 you leave your microphone without telling me what you  
11 think short distances involve.

12 MR. BARNHURST: Certainly short distances  
13 -- I thought about that very question this morning.  
14 We actually remembered it because we considered it in  
15 the EIS. A long distance would be greater than what  
16 you would expect to see in and around the site. I  
17 think the site is a couple thousand feet across, maybe  
18 a little bit more.

19 I wouldn't expect to see based on the  
20 evaluation of geology in Southeast Florida significant  
21 differences in the geologic units beneath the site  
22 over distances on that magnitude. Even within the  
23 distance that the modeling indicates that ground water  
24 may move horizontally, which is less than four miles.

25 DR. KENNEDY: Just out of curiosity, and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 I don't know if this should be to the staff or to  
2 NP&L, there's going to be more data taken as the  
3 injection wells, I guess, are dug or drilled. Is that  
4 true?

5 MR. BARNHURST: My understanding is that  
6 each well is subjected to the FDEP UIC which is the  
7 Underground Injection Control Rules and Regulations  
8 which we've included as one of our exhibits as well.

9 My understanding is at each location where  
10 they plan to do injection each well has to satisfy the  
11 requirements of that rule which is for the State of  
12 Florida to demonstrate that migration won't occur at  
13 that site.

14 DR. KENNEDY: So if during the injection  
15 one of these pathways that should have been uncovered  
16 through the seismic study presents itself, what  
17 happens? Does anyone know? I mean, does that no  
18 longer become an injection well or does it taint the  
19 entire site?

20 MR. BARNHURST: Based on my read of the  
21 FDEP UIC requirements that well would not be allowed  
22 to be used for that.

23 DR. KENNEDY: If one of the wells that was  
24 drilled showed a pathway to the upper Floridan  
25 aquifer, would that well be used and what does that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 say about the characterization of the site in general  
2 and how does the State of Florida view that?

3 MR. McNABB: Well, first let me confirm  
4 the previous answer. Absolutely DEP is going to make  
5 every well stand on its own. Every well is going to  
6 undergo the same test and similar testing that we did  
7 for the exploratory well.

8 Now, let me address your question. If it  
9 were found that one of the wells had a confinement  
10 issue what -- this would be driven by DEP. Once we  
11 identified that there is a problem, by rule we are  
12 required to inform DEP that we suspect we may have an  
13 issue. They would invite us in to have a conversation  
14 with them and ultimately I would expect there would be  
15 a consent agreement with one of the requirements being  
16 remove that well from service.

17 DR. BURNETT: Mr. McNabb, can you tell us  
18 what bit drop is and what it indicates?

19 MR. McNABB: Could you repeat the  
20 question?

21 DR. BURNETT: In your report on EW-1 you  
22 mention the term called bit drop.

23 MR. McNABB: Oh, bit drop. That would  
24 probably be in some of the drill cutting and possibly  
25 the core descriptions where the word intra-particulate

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 porosity was probably mentioned which is an indication  
2 that we are making note that, "Yeah, it looks like  
3 these bores are connected."

4 DR. BURNETT: So where do you get drop?

5 MR. McNABB: Oh, is it intra or inter?

6 DR. BURNETT: No, bit drop.

7 MR. McNABB: I'm sorry. I'm not hearing  
8 correctly at all. I'm sorry. I'm not hearing  
9 correctly at all. I apologize. Bit drop. It's  
10 something that we really didn't experience in our  
11 construction. Bit drop would be an indication of  
12 encountering a void during the drilling process.

13 For example, it's rare, but it does happen  
14 when you encounter the boulders occasionally you will  
15 be drilling along and all of a sudden the bit will  
16 drop four feet. It's very unusual but it does happen  
17 in our boulder zone.

18 But it did not occur at this site. Every  
19 single foot that was drilled for that well was hard  
20 fought. Never did it occur that they drilled a couple  
21 feet and then dropped a couple feet. That just was  
22 not happening.

23 DR. BURNETT: So in the absence of bit  
24 drop, is there information you can use to say it's  
25 unlikely that there is voids that you're passing

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 through?

2 MR. McNABB: Yes. Based simply on that  
3 you can say it's very unlikely. When you include the  
4 geophysical log data, you can say it's extremely  
5 unlikely. The geophysical log data would indicate  
6 voids.

7 Our caliber log would show that we have  
8 some large cavities. Our bore hole compensated sonic  
9 log would indicate the presence of voids as well. We  
10 just don't see that. It's not there in the  
11 geophysical log data and certainly no one encountered  
12 a bit drop.

13 DR. BURNETT: Dr. Maliva, you had  
14 mentioned in your pretrial testimony, and also just a  
15 few minutes ago, that it's likely that the migration  
16 experience that the South District waste treatment  
17 plant was due to well construction issues rather than  
18 natural fractures. Can you explain why you feel that  
19 way?

20 DR. MALIVA: Okay. Well, there were  
21 several isolated plumes of upward migration at this  
22 site. If you had unfavorable geologic conditions  
23 where the combining zone was fractured, you would  
24 expect the upward migration to be everywhere.

25 You wouldn't have a situation such as

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 observed there in a dual-zone monitor well where you  
2 didn't see anything in the lower zone but you saw it  
3 in the middle ground. It's just not a pattern that  
4 you would expect.

5 There was one area there in the boulder  
6 zone, BZ well cluster, where it's unequivocal there  
7 was a casing failure there and upward migration.  
8 Everybody who has looked at this site, you know, Walsh  
9 and Price, USGS, the data is suggestive of well  
10 construction but it's not unequivocal.

11 The geochemical data alone cannot say one  
12 option to the other. To me the fact that it's  
13 isolated plumes around wells and, again, in some wells  
14 one zone is a shower zone, is imperative but not a  
15 deeper zone when you expected geologic conditions  
16 would all move up uniformly. I think it's highly  
17 suggestive of well issues.

18 DR. BURNETT: Is there something different  
19 about the way that wells are constructed today and  
20 they were constructed when those wells were dug?

21 DR. MALIVA: Oh, very much so. I think  
22 the experiences at South District sort of prompted  
23 changes in well drilling practices. One of the  
24 suspected cause of problems was you drill a pilot hole  
25 first to the total depth and then afterwards you would

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 read it.

2 If those two holes are not -- don't  
3 coincide, you can leave the vertical conduit. The  
4 pilot hole may still be open and then you main is  
5 shifted over in another direction. Based on some of  
6 these concerns probably starting in 1980s, 1990s we  
7 now cement up that pilot hole before we read.

8 Another construction change is for any  
9 casing we have a dual-zone monitor where we now use  
10 fiber glass tubings instead of steel, more corrosion-  
11 resistant materials. Certainly any process with the  
12 UIC program over time you like to think you  
13 progressively do things better and learn from some  
14 past lessons.

15 DR. BURNETT: One more question on a  
16 different matter, In Virginia Walsh's Ph.D.  
17 dissertation she suggested that CO2 enriched injecting  
18 could increase the porosity of the injection zone by  
19 dissolving some of the limestone. What do you think  
20 about that idea?

21 DR. MALIVA: It's basic geochemistry.  
22 Carbonate solubility increases the PCO2. To improve  
23 the performance of wells we actually intentionally  
24 inject CO2 into it. We believe that's a good thing if  
25 that happened. It would increase the permeability.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 I don't think it would ever occur to the extent that  
2 it would compromise the injection zone.

3 Ideally you want your injected fluids to  
4 be slightly under-saturated with respect to calcium  
5 carbonate because you don't want the reverse process  
6 of calcium carbonate scaling to occur. Ideally you  
7 want to be slightly below calcite saturation just to  
8 prevent a scaling problem.

9 DR. BURNETT: Thank you. That's all.

10 MR. QUARLES: Is it possible that I might  
11 be able to offer a couple more comments that would  
12 respond to the last two questions?

13 DR. BURNETT: Yes. Go ahead.

14 MR. QUARLES: So the question is whether  
15 or not you can blame leakage on faulty well  
16 construction versus a natural geologic feature. I  
17 haven't seen any proof other than one example of a  
18 casing of a well that was improperly constructed or  
19 corroded or something happened that perhaps failed.

20 Maybe it wasn't deep enough but it was  
21 blamed on some vertical leakage. Initially, for  
22 example, at the North District plant back in 2010 it  
23 was believed or suspected that a faulty well was to  
24 blame for the upward migration there. Dr. Walsh's  
25 dissertation concluded that was not -- that did not

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 occur. That is not to blame.

2 Dr. Maliva wrote a report again back in  
3 2007 that at least back then that there was -- he  
4 commented that there was no proof that faulty well  
5 construction could be blamed for the upward migration  
6 so I haven't seen any new proof.

7 I disagree when Dr. Maliva said everyone  
8 has looked at the South District plant. Their opinion  
9 suggested it's a faulty well, I can tell you that.  
10 The Star reports back in 2001 suggested either a  
11 faulty well or a natural feature.

12 These multiple plumes that have occurred  
13 at the South District plant can happen and it doesn't  
14 surprise me that you would have multiple plumes if you  
15 have fractures, multiple fractures. Again, fractures  
16 joint steps typically can be parallel and closely  
17 related to each other.

18 That could easily suggest why you would  
19 have multiple plumes in addition to multiple bypasses  
20 that are not seen in a monitored well that is deep,  
21 but yet you see them in shallow wells.

22 The other thing that I would add is that,  
23 again, the CO2 enrichment is very clear that it can  
24 create new pathways as well as in large existing  
25 pathways according to Dr. Walsh.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. BURNETT: Thank you.

2 CHAIRMAN HAWKENS: Given that the NRC  
3 staff has ultimately responded here, would you like to  
4 respond to what Mr. Quarles just said?

5 MR. BARNHURST: Yes, I would. Thank you.  
6 We looked at everything we could get our hands on  
7 about the South District Waste Water Treatment Plant.  
8 We considered the experience there to be very  
9 informative as we considered what would happen at the  
10 Turkey Point site.

11 Just two points. Virginia Walsh is,  
12 indeed, the expert at what has occurred there. I'll  
13 say in her -- I think it's her 2010 report -- I was  
14 just looking for that -- she mentioned there is no  
15 indication of fracturing in the middle confined unit  
16 at the South District Waste Water Treatment Plant.

17 There was evidence of three different  
18 types of either well failure that Dr. Maliva talked  
19 about, too. One additional one is one that Ms. Walsh  
20 mentions. It's from a report by McNeill in 2002 we  
21 included as Exhibit 64.

22 It's the 10 of 17 wells that were  
23 installed at one time at the site were drilled through  
24 the most significant portion at the confined unit and  
25 then cased, I think, about 500 feet above that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 confined unit. As they injected, they injected  
2 directly into the confined unit rather than the  
3 injection zone. It's not something that proves  
4 absolutely what the cause is but I think it's a really  
5 good indication.

6 Another point I just wanted to make  
7 quickly from Dr. Walsh's thesis which, again, is FPL-  
8 62, is on page 159 she says, "No evidence of upper  
9 migration of injected was observed in any wells in the  
10 upper Floridan aquifer at both sites -- both sites  
11 meaning the North District and the South District --  
12 based on ammonia concentrations to stable isotopes,  
13 tritium, and dissolved gas data."

14 So what I think is interesting about that  
15 is that despite the fact that for whatever reason  
16 upwelling has been noted to occur at the South  
17 District and the North District site, it had not  
18 entered the upper Floridan aquifer according to her  
19 chemical analysis.

20 MR. QUARLES: Can I respond to that?

21 CHAIRMAN HAWKENS: Before you do, I have  
22 a follow-up question. FPL Exhibit 0063, which is the  
23 Walsh dissertation, also says, and I quote, "Seismic  
24 data acquisition is recommended for any future  
25 injection sites as it may be able to optimize the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 location of future injection sites in areas where  
2 subsurface features are not found." I'm wondering if  
3 -- first, I'll ask Dr. Maliva to respond to that  
4 particular statement.

5 DR. MALIVA: Well, I mean, first that's  
6 one person's opinion. I think when you talk about  
7 seismic reflection you have to understand, too,  
8 there's only certain areas where you can practically  
9 do it. It is not something that you can realistically  
10 do anywhere, particularly in developed area.

11 The seismic reflection --

12 CHAIRMAN HAWKENS: But it's not your  
13 position that it can't be done at Turkey Point, is it?

14 DR. MALIVA: I'm not sure if it can to be  
15 honest. You need to have a deep enough canal nearby  
16 to allow a fairly large-size boat with all the  
17 equipment to pass through and you need to have proper  
18 canal bottom conditions so it's not clear to me that  
19 it is, in fact, possible to do there.

20 Even if it were, the USGS did their  
21 seismic reflection. They did it offshore or on some  
22 of the major canals so unless your injection well just  
23 happens to be there, you know, a fairly deep enough  
24 canal that you can bring all the equipment in, it's  
25 not practical. Doing it on land obviously in a

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 residential area you can't start setting off  
2 explosions and doing seismic --

3 CHAIRMAN HAWKENS: Let's assume that it  
4 could be done at the Turkey Point site. At the end of  
5 the day is it just that you and Dr. Walsh have a  
6 professional disagreement on whether these tests  
7 should be conducted?

8 DR. MALIVA: I mean, I would disagree with  
9 her on that. I mean, I think decisions on half of her  
10 characterization methods you need to look at the cost  
11 of information versus the value of information. We  
12 know that running seismic reflection is very expensive  
13 to do. I believe that the total budget for the USGS  
14 project for the North and South District, and also  
15 included some modeling, was over \$12 million. This is  
16 not a trivial exercise to do.

17 So what is the value of this information?  
18 If we were to run this and found some sort of  
19 deformation structure near where we wanted to install  
20 our injection wells, I don't think it would be  
21 sufficient reason not to proceed with the project.

22 Again, because I give an example of the  
23 East Central Waste Water Treatment Plant site where we  
24 had a structure going right through and there was no  
25 impact on it. It's not going to lead to an actionable

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 decision on whether to go or no go on it.

2 What is the real value of doing it? It's  
3 great academic interest. You can really see this  
4 episode in the history of Florida he wouldn't tell you  
5 no, don't do injection wells near Turkey Point.

6 CHAIRMAN HAWKENS: All right, thank you.

7  
8 Mr. Barnhurst, do you have anything to add  
9 to that? Or Mr. Thorne.

10 MR. BARNHURST: I guess my response would  
11 be a little bit different in that the staff's  
12 responsibility underneath is to consider the best  
13 available information. That information was not  
14 available at the Turkey Point site so we couldn't  
15 consider it at DIS.

16 We consider it a kind of snapshot in time  
17 so as we performed our evaluation we looked at the  
18 wealth of information that was out there. If, indeed,  
19 we thought FPL needed to have obtained that data at  
20 that site, that's not something that we could under  
21 the NEPA process which is we do an evaluation and  
22 disclose the impacts.

23 CHAIRMAN HAWKENS: Although under NEPA,  
24 and I understand you're not the staff's attorney in  
25 this case, but is it your understanding that under

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 NEPA the staff is required to take a hard look?

2 MR. BARNHURST: Absolutely.

3 CHAIRMAN HAWKENS: And if you determine  
4 that a hard look is required of this seismic  
5 information, wouldn't you require it for part of your  
6 NEPA analysis?

7 MR. BARNHURST: Maybe this is where I do  
8 defer to my attorney because I'm not sure what our  
9 legal capability to have that -- to require that kind  
10 of information. I will say that we didn't feel like  
11 it was needed in this case to make an impact  
12 determination because our impact determination didn't  
13 rely solely on the fact that the injection well may or  
14 may not be confined within the boulder zone although  
15 we did evaluate that.

16 CHAIRMAN HAWKENS: All right. Thank you.

17 Mr. Quarles, you may have the last word  
18 unless we decide afterwards that you don't get it.  
19 What do you have to say?

20 MR. QUARLES: So let me respond to a  
21 comment about Dr. Walsh's report, dissertation saying  
22 that there's no demonstrated occurrence of  
23 contamination reaching the UFA. It's very important  
24 there's about four or five words in that report that  
25 talk about -- she clarifies that statement to say that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 it could be the result of perhaps wells that are in  
2 the UFA above an injection well site are not properly  
3 located to detect contamination in the UFA if it  
4 occurred. Right?

5 Secondly, I'll add to that because when  
6 you look at historical discussions about upper  
7 migration, the most common zones that are monitored,  
8 there are three of them. Top to bottom the MC one  
9 which is the upper confined layer above the Avon Park  
10 Permeable Zone. The Avon Park Permeable Zone itself  
11 is number two. Then number three is the MC2.

12 What has been demonstrated is that ammonia  
13 levels have been found in MC1 above the Avon Park  
14 Permeable Zone. What I have not seen is any  
15 discussion about the commonality of having monitoring  
16 wells and lots of them, there are several of them, in  
17 the UFA.

18 If you don't have wells in the UFA, and  
19 Dr. Walsh pointed that out, that the wells whether  
20 they are there or not, they may not be adequate to  
21 conclude that the migration has not made it through  
22 the upper confined level into the UFA.

23 CHAIRMAN HAWKENS: Thank you.

24 DR. KENNEDY: Just a couple closing  
25 questions. Dr. Maliva, in your pre-filed testimony,

1 which is FPL Exhibit 003 on pages 10 through 11 you  
2 speak very confidently that there is no firm evidence,  
3 and I'm quoting "of unrecognized culture fractures  
4 extending upward from the boulder zone that would  
5 allow for vertical migration of fluids into a USDW at  
6 any injection well site in South Florida."

7 Couple of questions. What is that bold  
8 statement based on and did I accurately -- maybe first  
9 did I accurately capture your statement and then, if  
10 that is accurate, what is that statement based on? It  
11 seems quite broad.

12 DR. MALIVA: You know, we have -- there  
13 has only been a small number of sites in South Florida  
14 where migration into the USDW has happened. All these  
15 sites have been investigated. There has been no study  
16 or evidence or any suggestion by anyone that it was  
17 related to a fault.

18 DR. KENNEDY: So all of those instances  
19 were related to faulty wells?

20 DR. MALIVA: No. There are some wells  
21 sites where the geologic condition just turned out not  
22 to be favorable. It was quite evident in the data  
23 that was collected during construction. A good  
24 example would be the DV Lee well in the Melbourne,  
25 Florida area. It was simply fractured. That was

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 amply evident in the geophysical logs.

2           Again, I don't know of any instances where  
3 somebody found a fault or any other structure and has  
4 been able to relate upward migration to that. I mean,  
5 they did the seismic. If there is information, I  
6 haven't seen it and I've investigated in detail.

7           DR. KENNEDY: Mr. Quarles, would you like  
8 to have the last word on that topic?

9           MR. QUARLES: Well, it may not be the  
10 last, of course. We might keep going but, you know,  
11 the bottom line is EPA has acknowledged that the  
12 geology of Southeast Florida is very complex and  
13 likely the result of these upper migrations.

14           EPA and everybody else has talked about  
15 and written about instances of migration into USDW  
16 and/or unintended migration whether or not it went to  
17 a USDW or not. If you look at the 1718 side stat  
18 that's reported, a fairly large percentage of those,  
19 I don't remember exactly, but maybe 35 percent or so  
20 are in Southeast Florida. It underscores the  
21 importance of knowing what you're doing in the unique  
22 geology of Southeast Florida.

23           What I've read and the people who talk  
24 about the reference reports whether it's Cunningham,  
25 Dausman, Dr. Maliva, it's all about the extent and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 nature of the fracture. When it's all said and done  
2 I haven't seen a report that really put the widespread  
3 blame on a faulty well.

4 DR. KENNEDY: Is one of the take-aways  
5 here, and I guess I'm picking up a little bit on what  
6 Dr. Maliva just said, is if you properly site the  
7 injection well you have a higher chance of success of  
8 no upper migration?

9 MR. QUARLES: That's exactly right.  
10 Cunningham would call that scientifically defensible  
11 for a reasonable assurance. I think at the end of the  
12 day all you can do is the best that you can do using  
13 the most available readable technology to make that  
14 choice for site selection.

15 Like Dr. Walsh said, the usefulness of  
16 seismic would perhaps eliminate a site from being a  
17 potential site as opposed to let's just take a well  
18 out of service, you know, if we find a feature that we  
19 got lucky and hit.

20 DR. KENNEDY: Thank you. One last point  
21 of clarification. This is going to be a reading test  
22 for me. I noted in Dr. Maliva's pre-filed testimony  
23 that -- I'm using FPL-002 and PDF page 9. If you want  
24 to display it, we can test my reading if that's  
25 possible. 3, I'm sorry. Just in case we need the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 reference.

2 What I'm looking for is a statement that  
3 puts the top of the upper Floridan aquifer at a depth  
4 of 2,915. Maybe it was 002. I don't see it there,  
5 Andy. I wrote down 2 but you convinced me 3 because  
6 I have 3 on the next question. Let's try page 9. I'm  
7 ready to withdraw my question. Right there. Okay.  
8 Go down just a little bit more. Right there.

9 "Between the base of the USDW at a depth  
10 of 1,450 feet and the top of the upper Floridan  
11 aquifer at a depth of 2,915 feet." I'm wondering if  
12 that should be the top of the lower Floridan aquifer  
13 as opposed to upper. Again, only important if we need  
14 this dimensioning sometime in the decision.

15 MR. QUARLES: That should be lower  
16 Floridan aquifer.

17 DR. KENNEDY: Sorry to take us through  
18 such painful -- I was just curious. I felt that was  
19 the right answer.

20 MR. QUARLES: That is a typo. It should  
21 be lower Floridan aquifer.

22 DR. KENNEDY: We'll take it as a typo.  
23 Thank you.

24 CHAIRMAN HAWKENS: That concludes our  
25 questioning of Panel 1 on this topic, for the time

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 being anyway. I suggest that we take a recess for  
2 lunch. I would propose an hour and 15 minutes unless  
3 you would like to cut it down to an hour. Let me poll  
4 the council.

5 MS. CURRAN: Judge Hawkens, we don't have  
6 any idea how long it takes to walk to where we can get  
7 a sandwich. Is it pretty close by?

8  
9 CHAIRMAN HAWKENS: No, I'm not from this  
10 area so I can't tell you.

11 MS. CURRAN: Well then --

12 CHAIRMAN HAWKENS: We can go for an hour-  
13 and-a-half and it will give you some time to unwind.

14 MS. CURRAN: I think that would be a  
15 better idea. Thanks.

16 CHAIRMAN HAWKENS: NRC staff, an hour-and-  
17 a-half. Is that satisfactory with you?

18 MS. WRIGHT: That's fine. We don't have  
19 a preference.

20 CHAIRMAN HAWKENS: Okay. FPL?

21 MR. LEPRE: That's fine with us as well.

22 CHAIRMAN HAWKENS: All right. I have that  
23 it's 12:40 now. We'll resume at 2:10. We'll be in  
24 recess until 2:10. Thank you.

25 (Whereupon, the above-entitled matter went

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 off the record at 12:40 p.m. and resumed at 2:10 p.m.)

2 CHAIRMAN HAWKENS: Please be seated and  
3 we'll resume in just a few moments. This afternoon,  
4 we're going to start with Topic 2.

5 And in Topic 2, we will discuss the  
6 ability of well construction procedures and technology  
7 to prevent upward migration of wastewater to the Upper  
8 Floridan aquifer due to faulty well construction or  
9 well deterioration over time.

10 I note that the witnesses for Topic 2 are  
11 the same as they were for Topic 1, but would you  
12 please introduce yourselves once more for the record,  
13 starting with Joint Intervenors?

14 MR. QUARLES: My names is Mark Quarles.

15 DR. MALIVA: My name is Robert Maliva.

16 MR. McNABB: My name is David McNabb.

17 MR. THORNE: This is Paul Thorne.

18 MR. BARNHURST: My name is Dan Barnhurst.

19 CHAIRMAN HAWKENS: Thank you. And  
20 observing that the witness, witnesses on Panel 2 are  
21 the same for Panel 1 before we embark on our Panel 2  
22 questions, Judge Burnett has a couple of questions  
23 from the first topic that we discussed this morning.

24 DR. BURNETT: Mr. McNabb, I asked you  
25 about this this morning, but I want to, we still need

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 some clarification.

2 This concerns the point at which the main  
3 confining layer begins at Turkey Point. We have seen  
4 that, in most cases, 1,930 feet below surface is the  
5 indication.

6 But twice in the W-1 report, 1,980 was  
7 mentioned. And twice in the FEIS, 1,980 was  
8 mentioned, 1,930 feet below surface is mentioned most  
9 of the time. But there are these other mentions of  
10 1,980.

11 And it's a small difference, but in fact,  
12 it does change the number of Packer tests in the main  
13 confining level, whether it's 1,930 or 1,980.

14 So, if we could ask you, you don't have to  
15 search for it now, but if you could reconfirm to us  
16 which of those two is the number that everyone is  
17 using.

18 MR. McNABB: I can do that.

19 DR. BURNETT: Or the one that you think is  
20 most accurate.

21 MR. McNABB: I can do that right now, and  
22 that number is 1,930.

23 DR. BURNETT: Okay. So the 1,980 that  
24 shows up is a typo, perhaps? Or --

25 MR. McNABB: Perhaps.

1 DR. BURNETT: This is the standard?

2 MR. McNABB: I would like to see its use,  
3 but perhaps it's a typo. But 1,930 is --

4 DR. BURNETT: Okay, fine.

5 MR. McNABB: -- top of confinement.

6 DR. BURNETT: Thank you. And I wanted to  
7 question Mr. Quarles. And another clarification for  
8 Mr. Quarles.

9 You were talking about monitoring in the  
10 Floridan aquifer, and when we were discussing over  
11 lunch, some of us thought that you may have said that  
12 in the, in the Walsh study at the South District and  
13 North District wastewater treatment plant, that they  
14 did not have any monitor wells in the, in the Upper  
15 Floridan aquifer. Did you in fact say that?

16 MR. QUARLES: What I said was that Dr.  
17 Walsh, she made a comment about whether or not upper  
18 migration into the UFA had occurred, and that she said  
19 there was no indication that it did.

20 But perhaps the reason there's no  
21 indication is that it may be well placement that is  
22 not adequate to determine whether or not the migration  
23 in the UFA occurred.

24 DR. BURNETT: Okay. So you were  
25 indicating placement of the monitor wells --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. QUARLES: Correct.

2 DR. BURNETT: -- just may have missed --

3 MR. QUARLES: Right.

4 DR. BURNETT: -- perhaps. Okay. That's  
5 fine. Thanks very much.

6 CHAIRMAN HAWKENS: We'll now, we'll now  
7 proceed to questions on Topic 2.

8 TOPIC 2 QUESTIONING

9 DR. KENNEDY: I've been practicing  
10 microphone technology. Hopefully it'll get better in  
11 the second half. So this set of questions is directed  
12 at well construction.

13 In general, reviewing the pre-filed  
14 testimony, well construction procedures and  
15 technologies credited to prevent wastewater migration  
16 from the Upper Floridan aquifer. This is repeatedly  
17 referred to as modern well technology.

18 I'd like to start with Mr. McNabb, and is  
19 it FP&L's position that current well construction  
20 techniques has a role in preventing upwelling of the  
21 wastewater to the UFA?

22 MR. McNABB: Yes, absolutely. The proper  
23 construction techniques will prevent fluid migration.  
24 And those techniques, what's changed when we say  
25 modern, with really, what we're really getting at

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 there is, we are backplugging our pilot holes that are  
2 through a confinement, with cement.

3 DR. KENNEDY: So is that the biggest why  
4 you believe that it's a preventative technology? Is  
5 it the backfilling of pilot holes?

6 Or is there, is there other significant  
7 improvements that you'd like, that we should be aware  
8 of?

9 MR. McNABB: Really the primary item is  
10 the backplugging of the pilot holes with cement.  
11 There have been maybe a few newer logs that have come  
12 in, but they really haven't had a large impact in,  
13 what should I say, making sure that everything is  
14 constructed properly.

15 It's really through our proper cementing  
16 techniques, our proper testing to evaluate the  
17 geology.

18 Running these items past DEP, we have to  
19 make recommendations to DEP with regard to where we  
20 set casings, where we monitor, set our monitor zones.

21 What, I'm really hanging my hat primarily  
22 on the backplugging of pilot holes, because I believe  
23 that is the primary source of fluid migration.

24 DR. KENNEDY: And this backplugging, does  
25 that take the pilot hole, prevent the pilot hold from

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 being a bypass to the Upper Floridan aquifer from the  
2 boulder zone? Is that the intent of it?

3 MR. McNABB: Indeed, it is. The intent is  
4 to eliminate that pilot hole, return it to nearly pre-  
5 drilled condition.

6 DR. KENNEDY: So this backplugging turns  
7 the pilot hole into impenetrable or impermeable zone?

8 MR. McNABB: Impermeable is probably a  
9 word I'd want --

10 DR. KENNEDY: Okay.

11 MR. McNABB: -- to be careful of. But  
12 yes, it prevents the fluid migration up a conduit.

13 DR. KENNEDY: Okay, thank you.

14 MR. McNABB: Sure.

15 DR. KENNEDY: When were these changes to  
16 well technology introduced?

17 MR. McNABB: I would estimate the late  
18 1990s.

19 DR. KENNEDY: And what precipitated a  
20 change in well technology? I think this may have been  
21 asked this morning and answered, but I just, to put it  
22 together here in the regular --

23 MR. McNABB: Well, I believe that people  
24 started realizing that these double pilot holes were  
25 something that could happen.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           Actually they had been observed on a video  
2 during the well construction where they were doing a  
3 video and they were surprised to see, whoa, look at  
4 this.

5           The ream hole actually walked off the  
6 pilot hole. So now we know that this can happen,  
7 let's prevent it.

8           DR. KENNEDY: Okay. Thank you. Staying  
9 with Mr. McNabb, are these well technology  
10 improvements, the improvements to well technology, are  
11 they voluntary or mandatory? Is this something the  
12 state of Florida regulates?

13          MR. McNABB: There's no rule requiring the  
14 backplugging. So it's not required. It is voluntary.

15          DR. KENNEDY: So would you call this the  
16 best practice? Or, I mean, there's no reason you have  
17 to follow it, I guess, is what I'm hearing.

18          MR. McNABB: There's no reason, although,  
19 this is suspicion, during the permitting process, I  
20 suspect that if my application did not indicate I was  
21 going to backplug pilot holes, I would expect an RAI  
22 question regarding it.

23                 And it would probably come back again  
24 unless I said, we're going to backplug those pilot  
25 holes.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. KENNEDY: So is it the intent as you  
2 move forward in developing the remaining injection  
3 wells and monitoring wells, that any pilot holes would  
4 be backplugged?

5 MR. McNABB: Any pilot hole penetrating  
6 the confining interval, yes.

7 DR. KENNEDY: Okay. Very good. That's  
8 for the clarification. How much, well, how much  
9 industry operating experience, I guess you said they  
10 were introduced in 1990. Do you have any sense of how  
11 many years of injection well data there is with the  
12 new technology?

13 MR. McNABB: Well, I would, I would  
14 estimate, if I go late '90s, then I would guess that  
15 we've got about 20 years of data using the new  
16 technique.

17 DR. KENNEDY: And I guess, can you speak  
18 to the operating history with the report, I guess  
19 we've used the word faulty wells.

20 And maybe we could later talk about what  
21 a faulty well is. But has there been any evidence  
22 that this new technology has led to any faulty well  
23 conditions?

24 MR. McNABB: Not that I'm aware of.

25 DR. KENNEDY: And I guess with that, I

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 guess I can turn to Mr. Quarles. If he would want to  
2 have a counterpoint to what you just heard about well  
3 construction and the plugging, backplugging of the  
4 pilot holes, if you have any counter-position. This  
5 is a good time to speak.

6 MR. QUARLES: And clearly, you know, let's  
7 back up. Every well that was ever drilled as an  
8 injection well in the state of Florida was approved by  
9 someone, and it was state of the art at the time.

10 So clearly, the procedure that was used  
11 back then was approved and certified by several  
12 people. All right.

13 So here we are, I guess the big concern is  
14 that even though, according to Mr. McNabb, that the  
15 industry has recognized that this is a problem.

16 They haven't changed the rule to require  
17 backfilling, backplugging of that pilot hole. So I  
18 guess that's, you know, first comment.

19 So it lead it up to the discretion of the  
20 person drilling the well. Backfilling, backplugging  
21 is a great idea that should be done. Absolutely. So  
22 I fully support that.

23 DR. KENNEDY: Do you have, I didn't take,  
24 I didn't practice enough. Do you have any reason I  
25 believe, I mean, we just heard Mr. McNabb say that it

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 is their best practice and their intent to use it  
2 going forward. Is there any reason to believe that  
3 they wouldn't heed that position?

4 MR. QUARLES: When you say they, yes.

5 DR. KENNEDY: FP&L. In the injection  
6 wells that they will be potentially developing over  
7 the next years.

8 MR. QUARLES: There's no indication that,  
9 according to these guys, that they're not going to  
10 institute the backfilling practice.

11 DR. KENNEDY: If they do the backfilling  
12 practice, do you have any additional concerns about  
13 well technology that we should be aware of?

14 MR. QUARLES: Well, I do. There was a, I  
15 think it was the city of Sunrise, where it was, there  
16 was some leakage that was attributed to faulty well  
17 construction.

18 So the pilot hole is not the only way that  
19 a well can leak. If you set the surface casing, the  
20 protective casing that's drilled into the confining  
21 layer, if you miss it, if you, if you drill it too  
22 shallow and set it too shallow, there are other ways  
23 that a well can become a pathway.

24 DR. KENNEDY: Maybe it's a good time to,  
25 because the word faulty well is all through the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 testimony.

2 And I'll give you a first shot at  
3 characterizing what would constitute a faulty well.  
4 I mean, we've talked about a pilot hole, which I  
5 envision to be a bypass of the, a bypass pathway.

6 And there, you just alluded to other  
7 potential mechanisms to constitute a faulty well or  
8 leakage into the environment.

9 MR. QUARLES: So they talk about the pilot  
10 hole. If a the cementing of the pilot hole, what  
11 happens is, when you go to fill the bore hole full of  
12 cement to seal it, you're making a calculation of how  
13 many gallons of grout you're going to inject into the  
14 ground based on the diameter and the depth of the  
15 hole. All right?

16 So then you say, the rule of thumb is you  
17 want to make sure that you put more grout in there  
18 than what your calculation suggests. So it's a grout  
19 balance.

20 So you're assuming that the grout that you  
21 inject is going and filling in the right hole. Plus  
22 you're going to lose some grout into the cracks  
23 adjacent to the bore hole. All right?

24 So it's not a perfect science, but that's  
25 what you can do because you don't have eyes and ears

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that are down the hole.

2 Where you set the casing into the  
3 confining layer is very important because that, and  
4 that's based upon your hydro-geologic characterization  
5 where you determine where your primary confining  
6 layers are.

7 So you have to know where those are so  
8 that you know how deep to put your protective casing.  
9 All right?

10 And so then, so then you inject grout  
11 around that. And you're doing a very similar grout  
12 calculation to make sure that you're cementing those  
13 casings in place.

14 And so you're assuming that the amount of  
15 grout that's going where it's supposed to do and  
16 completely surrounding your protective casings.

17 The mechanical integrity test that they  
18 would do, they would also try to demonstrate that  
19 cement is in fact all the way around the protective  
20 casing.

21 So it's a complicated process to drill a  
22 deep well and to make sure that you've got all of  
23 these telescoping layers, or intervals of pipe are  
24 sealed in the proper locations.

25 DR. KENNEDY: Is the mechanical integrity

1 testing, and we'll get to a little bit more of that  
2 later on. Is that the only potential testing that  
3 would be useful in establishing integrity of the well?

4 MR. QUARLES: They've also discussed a  
5 pressure testing. It's very common.

6 DR. KENNEDY: Thank you. Mr. McNabb, I'm  
7 sure you would like to provide some argument to this  
8 as well.

9 MR. McNABB: I would. Regarding the, what  
10 he referred to, or what I refer to as short casing  
11 where you, indeed you set that final casing too  
12 shallow.

13 We need to get our final casing approved  
14 by DEP. They've learned from these mistakes. They  
15 make us set it within, certainly within 50 feet of the  
16 top of the boulder zone.

17 Typically we're setting it within 20 feet.  
18 You won't get it approved unless you're setting  
19 casing, you know, right on top of your boulder zone.

20 With regard to this many, the backplugging  
21 of the pilot hole. We're not dependent upon any  
22 cementing volume or calculations.

23 What we're doing there is, we are pumping,  
24 we look at the caliper log and say, okay, we want to  
25 bring it up 200 feet.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           That's equivalent to, say, 300 barrels.  
2           We pump that 300 barrels. We give that cement time to  
3           set up.

4           Wait until our, we collect a sample and  
5           have that on the surface. We look at that sample on  
6           the surface. When that sample is hard, we know we can  
7           go in and tag it and expect the cement to be hard.

8           So we go in and physically tag the top of  
9           the cement. So we don't anticipate where the top of  
10          the cement is.

11          We can't make any mistakes because we're  
12          going in and actually tagging it. When we, when we're  
13          cementing casing in place, remember that cement, there  
14          is no grout. This is not concrete. This is cement.

15          It's just a slurry, and it's very, very,  
16          a low viscosity fluid, and it's tough to imagine that  
17          you could cement one side of the casing and have 200  
18          feet of liquid cement on one side of the casing  
19          without it falling down and filling in the entire  
20          circumference of the casing.

21          Another case where we're very cautious,  
22          when we're cementing those casings, we first of all,  
23          first thing we do after our cement stage is go in and  
24          run a temperature log, and we run that temperature log  
25          to get an estimate of where the top of cement is.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           You know, and do the, you know, hydrations  
2           and where the temperature is valuable. We then go  
3           confirm it with the physical tab with our cement  
4           running, and actually go down and tag that to confirm  
5           that depth. So we're very cautious not to leave any  
6           voids.

7           DR. KENNEDY: Can you give me a little  
8           better sense, I guess tagging is sort of not, I guess  
9           as a nuclear engineer, I don't, tagging things, I'm  
10          not sure what, I'm not sure we're doing the same  
11          tagging you're doing.

12          MR. McNABB: I'm sorry. I use these well  
13          terms too loosely, I believe, sometimes. Tagging,  
14          what we're doing is, when we're cementing, we're  
15          cementing through a cement train.

16          It's usually a 2 3/8 inch diameter cement  
17          line that we actually, they're in 30 foot joints. You  
18          have to screw them together and keep on lowering them  
19          down on the back side of the casing where the cement  
20          is. And we lower that down until we actually hit the  
21          top of that cement.

22          So we can actually, that's the physical  
23          tag of the cement. And we, again, we're, before that,  
24          we're doing that temperature log.

25          We're making sure that these, that the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 information is consistent between the two so that we  
2 don't get fooled.

3 DR. KENNEDY: So it's like, tag, you're  
4 it.

5 MR. McNABB: Yes.

6 DR. KENNEDY: So you touched a --

7 MR. McNABB: You got it.

8 DR. KENNEDY: Is that, is that, it's a  
9 physical, as far as sensing that you hit the concrete,  
10 or hit the bottom?

11 MR. McNABB: That's correct.

12 DR. KENNEDY: Okay. Thank you.

13 DR. MALIVA: May I briefly just add one  
14 point? This whole process is very rigorously overseen  
15 by the DEP as well as by the engineers. There's  
16 continuous onsite supervision.

17 You know, as far as issues like cementing  
18 the pilot hole, that is required in the technical  
19 specifications that are prepared.

20 So it's not something that is left to the  
21 option of the well driller. And each step along the  
22 way, there's, you know, David or whoever is the  
23 engineer of record, you're required to provide  
24 documentation, you know, come up with a, you know,  
25 make a strong technical case of where you're going to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 set your casing.

2 You have to do all of the mechanical  
3 integrity testing, provide a detailed analysis of that  
4 data to demonstrate that the well does have mechanical  
5 integrity testing.

6 Drilling a deep, a classical injection  
7 well is very different from any other drilling job in  
8 terms of just the rigorous oversight there is. And  
9 both the engineer's, the owner's representatives as  
10 well as the DEP.

11 DR. KENNEDY: You're alluding to  
12 specifications and such. Is this well cementing  
13 process, is there a procedure for it?

14 Is it something that's been developed over  
15 time and, you know, based on experience and testing  
16 and operating history, it has grown into a less  
17 science and more factually-driven from experience?

18 DR. MALIVA: Oh, very much so. You know,  
19 every time a write a drilling, specs from the  
20 injection log, you learn from lessons of the past and  
21 I think we even tie the, every step of the way there's  
22 detailed instructions about how things should be done.

23 DR. KENNEDY: Are those procedures or  
24 instructions, are they previewed with the Florida  
25 Department of Environmental Protection?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. MALIVA: Oh, very much so.

2 DR. KENNEDY: So they --

3 DR. MALIVA: That's part of the  
4 application to provide detailed specifications. And  
5 they go over it page by page. If they have any  
6 questions or comments or requirements --

7 DR. KENNEDY: So they have an oversight  
8 and review role?

9 DR. MALIVA: Very much so. You have to  
10 report to them on a weekly basis on what's going on,  
11 drilling progress, what you've done this week, what  
12 you plan next week, the results of any testing during  
13 that one week, that previous week period.

14 You need to provide them copies of all of  
15 the geophysical logs run. It's a very rigorous  
16 oversight procedure.

17 DR. KENNEDY: All right, thank you. This  
18 makes me wonder, and I'll start with Mr. Barnhurst,  
19 but you can hand it off to your colleague there.

20 But I'm curious what role the NRC staff  
21 plays in this cementing of the injection well, if any.  
22 Is it, is there any oversight role? Do you, do you  
23 get involved at all?

24 MR. BARNHURST: It's part of preparation  
25 to the environmental impact statement we learned. We

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 weren't there onsite the day the cementing happened,  
2 but we did throughout the preparation of the draft  
3 environmental impact statement.

4 And we go to the site and we visited the  
5 trailer and we talked to them about the different  
6 requirements that they had to follow as they installed  
7 the well.

8 The other thing that we did as part of  
9 preparation to the environmental impact statement is  
10 to review the actual Florida Administrative Code,  
11 which is 62-528, and it's NRC 019, is the exhibit that  
12 talks about all of this. And so we were, we became  
13 familiar with what was required by the state of  
14 Florida.

15 DR. KENNEDY: Okay, just out of curiosity,  
16 is there any credit taken, and maybe you just  
17 answered, what credit is taken for the well technology  
18 in evaluating the environmental impact of, say, a  
19 faulty well at Turkey Point?

20 MR. BARNHURST: The credit taken for well  
21 technology, and I think that we, as part of review,  
22 and Mr. Thorne can certainly jump in, just want to  
23 ensure that the best practices are being followed.

24 And so as we're, you know, as we're  
25 evaluating the Florida Administrative Code for all of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the different requirements for, I got monitoring well  
2 construction standards in front of me right now.

3 It's an education to us about what they  
4 have to do in order to get their permit. And then we,  
5 during preparation to FDIS, received a copy of that  
6 permit to verify that they had indeed received that  
7 permit from Florida in order to assure that these  
8 things had been all to the satisfaction of the Florida  
9 Department of Environmental Protection.

10 DR. KENNEDY: Is it, is it fair to say, or  
11 is it an overstatement to say that in your assessment  
12 of the environmental impact of the potential upwelling  
13 of wastewater into the potential source of drinking  
14 water, did well technology play any role in that  
15 assessment?

16 MR. BARNHURST: So one part of our  
17 analysis, we evaluated the confining ability in the  
18 middle confining unit.

19 And as we talked about earlier today, one  
20 of the reasons why you may have a lack of confinement  
21 is because of issues with well construction or failure  
22 over time.

23 And so certainly that's something that we,  
24 that we were mindful and evaluated as part of our  
25 preparation of our environmental impact statement.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. KENNEDY: All right, thank you.

2 MR. THORNE: Yes, I might add --

3 DR. KENNEDY: Go ahead.

4 MR. THORNE: -- a couple of things. We,  
5 even at the very beginning of the EIS process after  
6 the audit, the staff met with people from the UIC,  
7 Florida UIC Department to discuss what the  
8 requirements were and what some of the issues were.

9 So it's something we've been looking at,  
10 you know, through the whole process developing the  
11 EIS.

12 And also when they were drilling  
13 exploratory well, we reviewed the daily drilling  
14 reports and the reports that were issued by FDL's  
15 contractor's to make sure we understood how the  
16 drilling process was going and what the requirements  
17 were and what the design and technologies that would  
18 be used to, would be to be sure that they would  
19 provide adequate seals to prohibit upwelling.

20 DR. KENNEDY: But is it, is it fair to  
21 say, I guess what I'm trying to get to is, you know,  
22 there's been a general conclusion drawn that the  
23 environmental impact would be small.

24 And I guess I'm really probing to see if  
25 the well construction and the well technology has any

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 role in assessing that impact as being small?

2 MR. THORNE: I think it has a role. I  
3 mean, there might be other factors as far as the  
4 nature of the wastewater and, you know, other things  
5 that would also come into play.

6 But I think that, you know, it's another  
7 piece or anything kind of layer of protection I guess  
8 for the, for the groundwater supply are these EIC  
9 requirements.

10 So we take those seriously and feel like  
11 we need to understand that make sure that that  
12 provides the type of confinement that state officials  
13 are looking for, so they can assess that.

14 DR. KENNEDY: All right. Thank you.  
15 Thank you.

16 MR. THORNE: Okay.

17 DR. KENNEDY: All right, change of subject  
18 just slightly, but still talking about wells and  
19 faulty wells.

20 In the staff's rebuttal testimony, and NRC  
21 Exhibit 072 at Pages 22 and 23, a statement is made  
22 that the claims of upwelling can be attributed to  
23 faulty wells. I guess I'll turn to Mr. Barnhurst, but  
24 again, you may hand it off to your colleague.

25 We just, I think we're going in

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 alphabetical order. There's got to be some indication  
2 here.

3 MR. BARNHURST: I should change my name.

4 DR. KENNEDY: So why does the staff  
5 believe that the noted potential upwelling is due to  
6 faulty wells?

7 MR. BARNHURST: So I think, as it's been  
8 pointed out earlier, there are a number of different  
9 studies that were referenced in the environmental  
10 impact statement and as part of this proceeding that  
11 talk about potential causes of upwelling.

12 That statement is based on my professional  
13 opinion, based on what I've, what I've read, reports  
14 that talk about the three different types of potential  
15 well-related upwelling that can occur.

16 And also a knowledge of the reports of  
17 the, of the geology that we reviewed indicating what  
18 features may or may not occur at the site. And so I  
19 think specifically for the South District wastewater  
20 treatment plant, which is --

21 DR. KENNEDY: Okay.

22 MR. BARNHURST: -- which is what is being  
23 talked about there, in short, as I reviewed  
24 Cunningham, there's our seismic reflection lines that  
25 go north of the site and south of the site, and there

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 were no course collapse features in the unit, other  
2 than the Lower Floridan aquifer, according to this  
3 seismic, that seismic reflection data.

4 Virginia Walsh concluded that the middle  
5 confined unit at the site was not fractured. And so  
6 without either of those nature mechanisms for, to  
7 create upwelling, you're left with widespread reports  
8 of well issues at the site. And so really that's my  
9 professional opinion based on, based on that.

10 DR. KENNEDY: All right. The Intervenors  
11 had a similar, contradictory opinion, which is in  
12 their Exhibit 22 at Page 16.

13 And Mr. Quarles, you state, the FEIS  
14 incorrectly attributes vertical migration of  
15 contaminated wastewater to faulty wells rather than  
16 geological conduits.

17 And I think we've been down this path a  
18 few times. It may be a good time to sort of summarize  
19 here why you believe that this noted upwelling is not  
20 due to faulty wells?

21 MR. QUARLES: You know, you could, you  
22 could start back, as far as the start of 2001 and  
23 recently the Walsh and Price, 2010 where there was  
24 some suspicion at the North District plant that it was  
25 related to a faulty well that was then disproved by

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Dr. Walsh and her dissertation in 2012.

2 Bottom line is that they've all discussed  
3 possibility of a faulty well and/or natural features.  
4 And lots of people have done these research  
5 investigations to try to figure out what the cause is,  
6 and I haven't read any of, any of these, you know,  
7 published documents that proved faulty wells are the  
8 cause of these multiple sources of plumes at the South  
9 District plant.

10 You know, in fact, like for example, at  
11 the North District plant, it was thought it was a  
12 faulty well, but Dr. Walsh concluded that it was  
13 actually a natural feature that was offsite.

14 You know, the contaminated plume migrated  
15 offsite to the vertical feature, and then migrated  
16 with the direction of regional groundwater, flowed  
17 back to the site.

18 So you know, the documents that I read  
19 that they cited as well, you know, pointed my opinion  
20 more to these natural geologic features as opposed to  
21 faulty wells.

22 DR. KENNEDY: So in the, it's sounds like  
23 in the studies that looked at potential upwelling in  
24 sites other than Turkey Point, and again, we don't  
25 really have any data there, you know, there is no

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 smoking gun.

2 There's nothing that says it's this, it's  
3 that, it's the other thing. It seems to be there is  
4 a possibility that it could be a conduit or a pathway,  
5 or it could be a leaky well.

6 MR. QUARLES: It could be a leaky well,  
7 and it, and so I guess, you know, going back to  
8 Cunningham, his, you know, it's plausible that these  
9 geologic features are these natural pathways of  
10 vertical migration.

11 DR. KENNEDY: And maybe back to the NRC  
12 staff, is there a smoking gun? Did I miss it?

13 MR. BARNHURST: So in reviewing these same  
14 documents, I just, I don't know that I could see  
15 evidence that the middle confining unit had natural  
16 features at the South District wastewater treatment  
17 that would allow upwelling.

18 I will note, as Mr. Quarles had said, that  
19 each of the studies that evaluated the potential  
20 causes of upwelling at the South District, would make  
21 a statement such that it could be a nature feature.

22 However, it's more likely a well-related  
23 issue. And I guess one study in particular that comes  
24 to mind is Alyssa Dausman with the USGS, I believe it  
25 was, I'm sorry.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 I'll have it for you in just, it's her  
2 2010, no. I've got it marked on my exhibit list. I  
3 apologize. I just want to give you the correct, well  
4 Alyssa Dausman, I, oh, NRC 47.

5 It's entitled Hypothesis Testing of  
6 Buoyant Plume Migration Using a Highly Parameterized  
7 Variable-Density Groundwater Model.

8 In that, she evaluated two different  
9 potential causes of upwelling at the, at the South  
10 District site, using a numerical model.

11 And while she mentioned that, there it is  
12 right there. On the first page, second column over,  
13 the bottom, oh, I'm sorry. It's, if I could just read  
14 it.

15 However, flow through a channelized  
16 pathway caused by well construction appears to be more  
17 likely.

18 That seemed to be the general tone in all  
19 of the, of all the studies that we, that we read and  
20 evaluated, was that it was, could not rule out the  
21 fact that it might've been a natural pathway.

22 There was no evidence for pathways at the  
23 South District. Through the entire middle confining,  
24 and that it was more than likely a channelized pathway  
25 caused by well construction.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. KENNEDY: All right, thank you.  
2 That's close to the smoking gun, but I'm going to ask  
3 Mr. Quarles, if that's not as smoking as I think it  
4 is. Go ahead, Mr. Quarles.

5 MR. QUARLES: So, I'll refer to the 2010  
6 Dausman's report as well. Where she referred to the  
7 confining layer, the Delray Dolomite is only partially  
8 effective as a confining layer.

9 And the secondary porosity features such  
10 as fractures of the natural vertical conduit could be  
11 acting as a pathway for upward migration.

12 And then she also referred to isolated  
13 vertical conduit. It says through the heterogenous  
14 confining layers. So again, she said it could go  
15 either way, one or more causes.

16 DR. KENNEDY: Okay. So, there's both  
17 sides of the story in her article. I was kind of  
18 liking the however conclusion that has a more likely  
19 in it, but I think at the end of the day, it's both  
20 potential path, potential arguments are still in play.  
21 Still on well construction, one second.

22 MR. McNABB: May I add something with  
23 regard to our last question?

24 DR. KENNEDY: Are you buying me some time,  
25 Mr. McNabb?

1 MR. McNABB: Yes sir.

2 DR. KENNEDY: If you are, I'll take it.

3 MR. McNABB: Yes, Your Honor. One thing  
4 to note is that, as was pointed out, there seems to,  
5 that most of the studies seem to conclude or at least  
6 allude to, it is likely well construction issues.

7 It's also important to note that, you  
8 know, really since we've changed our construction  
9 techniques, we're just not seeing the problems that we  
10 were having.

11 And I think that helps support the cause  
12 of this being, these issues being related to well  
13 construction.

14 DR. KENNEDY: Right. Are you arguing that  
15 these noted instances were really of older wells, and  
16 that we haven't seen, there hasn't been any recent  
17 evidence of upwelling? These are time-related sort  
18 of, time shifted?

19 MR. McNABB: Yes.

20 DR. KENNEDY: Mr. Quarles, you've got to  
21 respond to that. Do you know of any more recent or  
22 possibly non-older-welled situations? I didn't talk  
23 about this until you brought it up.

24 MR. QUARLES: I've not researched the 17  
25 or 18 sites to know when the wells were installed.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 But I guess I would redirect your question, that's  
2 relevant is, do we know the age of all the wells that  
3 were installed in the 17, 18 in Florida that have a  
4 demonstrated upward migration?

5 DR. KENNEDY: Mr. McNabb, do you know the  
6 answer to that?

7 MR. McNABB: I do not, but --

8 DR. KENNEDY: Okay.

9 MR. McNABB: -- certainly we have records  
10 that demonstrate when those wells were constructed.

11 DR. KENNEDY: So it would've been, let me  
12 try it from a different way. You know, and later, the  
13 next issue we'll talk about well monitoring, or  
14 migration detection monitoring.

15 Did any of the injection wells have any  
16 signs that there was a failure in the, that they were  
17 faulty wells? I mean, was that noted anywhere?

18 Every, there's discussion about continuous  
19 pressure monitoring and, in the FEIS. Is any, was  
20 that in play in the older wells or does anybody know?  
21 I just wonder if there's any indication from the well  
22 itself that it may have been faulty.

23 MR. McNABB: The continuous monitoring of  
24 the annulus of an injection well, we only have that  
25 annulus for an industrial injection well. The

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 municipal wells do not have that.

2 DR. KENNEDY: Okay. So --

3 MR. McNABB: But the, where we have, there  
4 have been very few instances where actually the well  
5 has demonstrated a loss of annular pressure.

6 And in these pieces, we had developed a  
7 leak at the, at the packer at the bottom of the well.  
8 Or in some older wells that were not constructed with  
9 fiberglass-reinforced plastic, you had a steel casing  
10 that corrosion took care of.

11 In all of those instances, what happens is  
12 the, what we're losing is fluid from the annulus, the  
13 corrosion inhibitor actually leaks into the well, out  
14 the bottom of the well into the boulder zone.

15 DR. KENNEDY: Okay. Thank you. I think  
16 Mr. Quarles, you started talking about this a little  
17 bit before when we were talking about well  
18 construction technology.

19 But in your pre-file testimony, Exhibit  
20 ING 022, at Pages 22 and 23, you state the contact  
21 between bedrock and the outer casing must be sealed  
22 for the entire depth of the well. Could you, you may  
23 have said this before, but could you explain to us  
24 what that means?

25 MR. QUARLES: So what I'm saying that the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 annular space needs to be sealed between the casing  
2 and the bedrock formation just to make sure that it's  
3 sealed.

4 DR. KENNEDY: Okay. For the entire  
5 length?

6 MR. QUARLES: For the entire length,  
7 through the confining layer, and ideally, for the  
8 entire depth of boring. Because you have multiple  
9 layers of groundwater that the casing is drilled  
10 through.

11 DR. KENNEDY: And you may have mentioned  
12 this before, but is there any way to ensure that  
13 there's good contact between the bedrock and the well  
14 for the entire depth? Is there any sort of testing or  
15 --

16 MR. QUARLES: So the methods that Mr.  
17 McNabb talked about on the grouting, the pumping, with  
18 trimming pipe, and then the pressure testing and the  
19 mechanical integrity test that they used.

20 DR. KENNEDY: And does the, maybe this is  
21 to Mr. McNabb. Does the continuous pressure  
22 monitoring have anything to do with the proper sealing  
23 of the casing, or is that a different issue?

24 MR. McNABB: It's very related. We're  
25 talking about the final. And yes, if we were to pop

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 a hole in that final casing, pop a hole in our  
2 injection tubing, pop a hole in that annulus at the  
3 surface or at the bottom of the well, we would know  
4 instantly because the regulations require continuous  
5 monitor, pressure monitoring of that annulus.

6 That annulus is maintained at a higher  
7 pressure than your injection pressures. So that, we  
8 pop a hole, boom. We see immediately a decrease in  
9 pressure.

10 And what's going to happen is we're  
11 ensuring that our corrosion inhibitor is blowing out  
12 of the annulus and out the well into the boulder zone.

13 DR. MALIVA: May I please add one point?  
14 As part of the mechanical integrity testing procedure,  
15 you're required to do a cement bond log, which  
16 evaluates whether the cement is bonded to both the  
17 casing and the formation.

18 So that is, that is in fact evaluated as  
19 part of the mechanical integrity testing, as well as  
20 doing temperature logging during the cementing, which  
21 will tell you if there's any gaps or anything in the  
22 cement.

23 So that's a legitimate issue raised by Mr.  
24 Quarles, but that is looked at in great detail as part  
25 of the normal mechanical integrity testing process.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1                   CHAIRMAN HAWKENS:   A follow-up question  
2                   for Mr. McNabb about the pressure monitor.   Does an  
3                   alarm go off if it reveals that there is a break in  
4                   the integrity?   Or is that a gauge that's monitored  
5                   periodically?

6                   MR. McNABB:   You have, typically have a  
7                   gauge on it, but it's also a pressure transducer.   So  
8                   that is typically sent through at the control room.  
9                   My guess is typically they'll have an alarm.

10                  But you, you know, it's there, visible.  
11                  You are required to compile the data on a monthly  
12                  basis.

13                  So even if you were asleep at the switch  
14                  and weren't paying attention to that pressure data,  
15                  when you were compiling your monthly operating report,  
16                  it forces you to look at that data.

17                  So at that point, it should be very  
18                  obvious, in which case you are required to make  
19                  contact with DEP.

20                  CHAIRMAN HAWKENS:    If there was a  
21                  catastrophic break, we're going to have to wait a  
22                  month for somebody to take a very close look at those  
23                  figures, or would that come to somebody's attention  
24                  faster?

25                  MR. McNABB:   Well, if there were alarms

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 set, it would, they would automatically --

2 CHAIRMAN HAWKENS: Well, that's what I  
3 asked. Are there, are there alarms associated with  
4 that?

5 MR. McNABB: Not required. And I do not  
6 know the, our intention with regard to FPLs, how  
7 they're setting up their control room.

8 But you, in theory, you could spring a  
9 leak in your injection tubing or casing, and if you're  
10 not paying attention, it wouldn't become clear until  
11 you were preparing that monthly operating report.

12 Now, let's remember, if we do spring a  
13 leak, what's happening is we're losing annular fluid  
14 out the bottom of the well and into the boulder zone,  
15 and this is a non-hazardous annular fluid.

16 If we, if after that pressure is released  
17 from the annulus, then the pressure will equalize  
18 between the well and the annular space.

19 We sprung our leak, we've depressurized  
20 it, essentially, the annular space. And now those two  
21 would be similar.

22 Worst case scenario, we get some of the  
23 fluid that we're injecting down the well, actually  
24 goes into the annular space.

25 But again, that annular space is sealed

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1       except for this leak we've just developed that has  
2       access only to the interior of the well.

3                   CHAIRMAN HAWKENS:   That's sealed by the  
4       concrete that you were, or the cement that you were  
5       talking about before that's between the casing and the  
6       --

7                   MR. McNABB:   Yes.   If we spring a leak in  
8       the, in the, in the final casing, depends on where we  
9       spring it.

10                   If we spring it down below where there's  
11       only the final casing, what we have to do is go  
12       through the half inch wall fit steel casing.

13                   We've got to go through approximately five  
14       inches of cement.   And then what we're doing is we're  
15       losing, again, non-hazardous annular fluid out  
16       wherever that leak is.

17                   Now, if we spring our leak, say, at a  
18       depth of, we'll call it 400 feet, all right.   Now  
19       we've got to go through our half inch, half inch thick  
20       steel casing, through another approximately five  
21       inches of cement, through our 3/8 inch thick wall, 34  
22       inch diameter casing, through five more inches of  
23       cement.

24                   Another 3/8 inch wall thickness of 44 inch  
25       casing, through five inches of cement.   And now it

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 finally can get to the environment. Many barriers.

2 CHAIRMAN HAWKENS: Let me ask a question  
3 of Mr. Quarles. I have a question, Mr. Quarles, for  
4 you. It seems like the state has come up with  
5 comprehensive requirements for the injection wells,  
6 and the industry itself has come up with best  
7 practices in an effort to prevent leakage occurring.

8 Is there a specific procedure that you  
9 view, either the state requirements or an industry  
10 practice, as being inadequate or deficient for  
11 purposes of this case?

12 MR. QUARLES: I don't see the procedures  
13 as being inadequate or deficient. The only thing that  
14 I would say is that you're drilling a well 3,000 feet  
15 deep and it's an imperfect science sometimes, and  
16 mistakes do happen, as indicated by the past leakages.  
17 Nobody drilled a well that they expected to leak.

18 So there's a lot of science that goes into  
19 this, and we try our best to drill a well that will  
20 never leak. But sometimes mistakes happen.

21 DR. KENNEDY: Do you think under the new  
22 technology with the continuous pressure monitoring  
23 that the leak would not be detected?

24 I mean, I get that it can have leaks. But  
25 would it go undetected or undetected for a period of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 time?

2 MR. QUARLES: I mean, clearly there's a  
3 period of time where, they were talking about, there's  
4 no alarm that goes off.

5 And so then you're doing a monthly report  
6 and then perhaps you don't know until a month. And  
7 so, you know, lots of these studies that talk about  
8 these leakage or upward migration, yet it can happen  
9 very rapidly.

10 So the question is, you know, how rapid is  
11 rapid and how soon is soon enough for a detection?  
12 And obviously if there would be a continuous alarm, I  
13 think that would go a long way and be in a best  
14 practice.

15 DR. KENNEDY: Thank you. The one, we've  
16 been talking a little bit here about mechanical  
17 integrity testing.

18 And I guess I note in the testimony that  
19 mechanical integrity testing is performed every five  
20 years. Mr. McNabb, is that a requirement of the state  
21 or is something that, you know, in plans to do?

22 MR. McNABB: Indeed it's a requirement of  
23 the state, every five years repeat the mechanical  
24 integrity testing.

25 DR. KENNEDY: And just what does

1 mechanical integrity testing involve?

2 MR. McNABB: Okay. During construction,  
3 our mechanical integrity's going to consist of, first  
4 of all, we're going to do a, run a pressure test on  
5 the final casing, the 24 inch diameter steel casing.  
6 We are going to run a temperature log on that final  
7 casing.

8 We are then going to install our FRP  
9 injection liner. Now we're going to run a pressure  
10 test on the annular space between the FRP and the  
11 final steel casing.

12 Although the two pressure tests I speak  
13 of, they are run at approximately 150 psi for one hour  
14 duration, and to pass, you must have less than a 5  
15 percent pressure fluctuation during that period.  
16 Okay. Let's see.

17 We've also got a radio at the tracer  
18 survey that is performed on the final well. And I  
19 need to back up.

20 Before we install our FRP on, at their  
21 construction, we've got to run a cement bond log, to  
22 run the cement bond log on that final casing. So then  
23 we can install the FRP.

24 And I believe I've run through what we do  
25 for our initial MIT on, right after construction.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Five years later, we do the same except there's no  
2 CBL. No cement bond log because the FRP injection  
3 liner's in place.

4 So we do, we do the annular pressure test,  
5 the radioactive tracer survey, the temperature log,  
6 and I did leave something else out. Video survey.

7 We run a video survey of the well, looking  
8 for any things that may negatively impact the  
9 operation of the well.

10 DR. KENNEDY: To 3,000 feet?

11 MR. McNABB: Yes. We run it to the total  
12 depth of the well or until we either run into a, say  
13 an obstruction in the open bore hole, or sometimes at  
14 the bottom of a hole there's full of just extremely,  
15 I'll call it turbid water that had a lot of suspended  
16 elements in it.

17 Sort of in the bottom of the well, it's  
18 sort of stagnant, so things tend to just become  
19 stagnant there and you end up with a, oftentimes maybe  
20 50 feet of dirty, turbid water.

21 Once we get into that, you're logging  
22 blind. You can't see anything with the video. So  
23 then we cut it short.

24 DR. KENNEDY: You used the acronym FRP?

25 MR. McNABB: Yes. Fiberglass-reinforced

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 plastic.

2 DR. KENNEDY: Thank you.

3 MR. McNABB: Sorry.

4 DR. KENNEDY: Mr. McNabb, could you  
5 briefly explain how the radioactive tracer test works?

6 MR. McNABB: Yes. I'd like to do that.  
7 The test begins with running a background gamma ray  
8 log from land, from total depth of the well to land  
9 surface.

10 The tool, the tool itself consists of  
11 three gamma ray detectors all spaced on the tool.  
12 We've got an upper, a middle, and a low ray detector.

13 We've also got a tracer ejector. The  
14 tracer ejector is located a few feet above our middle  
15 detector.

16 The, after they've run our background log  
17 with all three detectors operating, they take the tool  
18 out and they load it with Iodine-131, typically  
19 anywhere between 5 and 10 millicuries, the tool is  
20 loaded with.

21 The tool is then lowered down the well so  
22 that the ejector port on the RTS tool is located five  
23 feet inside the base of casing. We establish an  
24 injection velocity.

25 So we're pumping into the well at a low

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 rate of three to five feet per minute. So what we're  
2 doing is just creating a slow downward moving down the  
3 well.

4 And we release the tracer and we're moving  
5 very slow so we're giving it plenty of time to  
6 disperse after it's released.

7 And what we're doing with this tracer is  
8 looking for opportunities for it to migrate upward on  
9 the back side of the casing, which would indicate, oh,  
10 you've got a channel in your casing, or in your  
11 cement.

12 So, you provide opportunity for the tracer  
13 to move on the back side of the casing, up any  
14 existing channels.

15 You then use your detectors on your gamma  
16 ray detector. Especially the top one. The top one is  
17 a, is above where the ejection took place.

18 If you see elevated gamma ray counts on  
19 your top detector, it had to come up, had to go  
20 outside the casing and go up the back side.

21 It can't come, can't go back up inside the  
22 well because we're injecting it three to five feet per  
23 minute.

24 So looking at that top detector, we see  
25 elevated gamma ray counts, uh-oh, there may be a

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 channel here.

2 If that does happen, what we do is we  
3 would move the tool up 20 feet and continue to run the  
4 test and see, is it, is it migrating up further?

5 We would try to track that to see if we  
6 actually see a channel that, if it ends at 30 feet,  
7 while it's a feature of note for sure and needs to be  
8 pointed out in our report, it's nothing that's going  
9 to alarm DEP if we still have nearly 1,000 feet of  
10 cemented casing.

11 DR. BURNETT: How long do you monitor the  
12 gamma ray?

13 MR. McNABB: The, we do two ejections,  
14 typically. The first ejection, we stay and monitor it  
15 stationary for one hour.

16 Now after we've, that one hour, we're  
17 going to log upward 200 feet, log upward looking for  
18 any stray anomalous gamma ray counts that may be an  
19 indication of a problem.

20 We're then going to actually try to flush  
21 that tracer away from the bore hole. So we're going  
22 to pump a minimum of 500 gallons down the well.  
23 Oftentimes more like 10,000 gallons.

24 And then we're going to do another log up  
25 200 feet just to see if, by flushing, did that somehow

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 chase any tracer behind the casing?

2 We then repeat the whole thing. We do  
3 another tracer ejection. Your ejection's typically 1  
4 millicurie.

5 So we reposition five feet inside casing,  
6 eject 1 millicurie of iodine. This time we wait 30  
7 minutes. Wait for any signs of fluid migration.

8 We do our 200 foot log. We then go down  
9 to the bottom of the hole, empty the tool of tracer  
10 and do a final background gamma ray log from the base  
11 of the well to land surface.

12 It's a very rigorous test. It's the best  
13 technology we have for identifying any sort of  
14 channels in, behind casing.

15 DR. BURNETT: Thank you.

16 DR. KENNEDY: Just one final question.  
17 Mr. Quarles, if I remember your testimony, you had  
18 indicated that this mechanical integrity testing is  
19 not sufficient.

20 If I remember that correctly, and you get  
21 to decide, I guess I'm curious, are you concerned  
22 about the frequency of testing or the type of testing,  
23 and if you could elaborate on that.

24 MR. QUARLES: So in my testimony, I  
25 discussed the mechanical integrity test cement bond

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 log not being done to the full depth, length of the  
2 boring. And the fact it was done, then I was  
3 incorrect in that comment.

4 DR. KENNEDY: Does that alleviate your  
5 concern over the mechanical integrity testing then?

6 MR. QUARLES: It does.

7 DR. KENNEDY: Thank you, sir. And with  
8 that, I have no additional questions. If my  
9 colleagues have any follow-ups?

10 CHAIRMAN HAWKENS: Let me ask Counsel, the  
11 Board is ready to proceed to the next panel. We can  
12 take a 10 minute break if you all would like.

13 MS. CURRAN: We would appreciate a break.  
14 Thank you.

15 CHAIRMAN HAWKENS: All right. Let's take  
16 a 10 minute break. I have five after. We'll  
17 reconvene at a quarter after. Thank you.

18 (Whereupon, the above-entitled matter went  
19 off the record at 3:06 p.m. and resumed at 3:17 p.m.)

20 CHAIRMAN HAWKENS: Please be seated.  
21 We're now going to begin questioning our third panel.  
22 Third panel members are the same as the first and  
23 second panel, but would you please identify yourself  
24 for the record starting with Joint Intervenors?

25 MR. QUARLES: My name is Mark Quarles.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. MALIVA: My name is Robert Maliva.

2 MR. McNABB: My name is David McNabb.

3 MR. THORNE: My name is Paul Thorne.

4 MR. BARNHURST: My name is Dan Barnhurst.

5 CHAIRMAN HAWKENS: Thank you. And the  
6 witnesses are once again reminded that they remain  
7 under oath or affirmation.

8 This Board will be discussing whether  
9 upward migration of wastewater would likely be  
10 detected before it reached the Upper Floridan aquifer.

11 TOPIC 3 QUESTIONING

12 DR. KENNEDY: Okay. So far we've passed  
13 the mic test. Some of the, some of the questions here  
14 have been touched on, both under the well construction  
15 and in some of our previous discussion.

16 So I'll try to cull through the, but I may  
17 miss a few, so you may be punished with an additional  
18 question that you've already answered. So I  
19 appreciate your patience.

20 As Judge Hawkens said, this is about the  
21 detection of the upper migration of wastewater, and it  
22 being detected before it reaches the Upper Floridan  
23 aquifer. I'll direct my first question to Mr. McNabb.  
24 Glad to see you back on Issue number 3, sir.

25 MR. McNABB: Thank you.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. KENNEDY: If you could describe, and  
2 I know we touched on this before, but just to, for  
3 this part of the, part of the discussion, describe the  
4 general terms, the proposed monitoring system to  
5 detect injection well failures and potential  
6 wastewater migration.

7 MR. McNABB: Sure. And the way this begin  
8 was FDL is required to submit a proposed monitoring  
9 plan to DEP, and they then modify it as they see fit,  
10 and that ends up in our permit as a requirement.

11 So the permit requires that we monitor,  
12 let's, we'll, let's start with the injection well.  
13 Continuous flow rate monitoring, continuous annular  
14 pressure monitoring, continuous wellhead operating  
15 pressure monitoring.

16 The waste stream that goes down the  
17 injection well is also sampled on a weekly basis. The  
18 weekly sampling that we're, that I'm talking about,  
19 typically after about six months of operational  
20 testing, that gets reduced to monthly.

21 You send a request to DEP to reduce that.  
22 If they agree that the data will support a reduction  
23 in sampling the frequency, it can go to monthly.

24 So we start off weekly sampling of the, of  
25 the injection well. That ultimately is likely to move

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 to monthly.

2 That sample, water sample, waste stream  
3 sample is going to be monitored or analyzed for  
4 roughly 10, 12 parameters.

5 Fairly basic parameters. PH temperature,  
6 sulfate, total dissolved solids, chloride, specific  
7 conductivity, sulfate.

8 There's going to be some other parameters  
9 that they are wanting, even initially they're going to  
10 have these following parameters would be on a monthly  
11 basis.

12 Calcium, bicarbonate, potassium,  
13 magnesium. I'm probably leaving one or two out, just  
14 off the top of my head.

15 But it's a fairly, should I say, a fairly  
16 simple parameter list. Okay. That's our injection  
17 well.

18 Our monitor well, we are going to be  
19 continuously monitoring the water level of both zones  
20 of the monitor well.

21 The idea there, if we see, say, a  
22 freshening trend, if we see relatively fresh water  
23 migrating into that zone, we're going to see an  
24 increase in pressure.

25 So that gives us very quick indication if

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 we, if we see an increasing trend in pressure, we may  
2 have some freshwater moving in.

3 It's time to, time to look very closely at  
4 the well. Also we're sampling on a weekly basis, both  
5 zones. Same parameters in the waste stream.

6 The parameters are really selected to help  
7 you identify, to serve, in a sense, as markers. You  
8 notice that we had TDS chlorides conductivity.

9 We've got all sort of salinity-related.  
10 This is, you know, if we've got some fresher water  
11 moving into the, into the zone, we're going to see  
12 that freshening trend.

13 So that's what the whole idea of the  
14 monitoring the program is. Let's, first of all, let's  
15 see if there's an instantaneous problem.

16 If we see actually a well mechanical  
17 issue, all right. Let's monitor our monitor zones.  
18 Especially that, you know, we're monitoring both  
19 zones, but our lower zone's our early warning system.

20 We see pits there, we see something that  
21 is alarming, we've got time to react. We've still got  
22 about over 400 feet of material before we would hit  
23 the USDW. That gives time to move into action.

24 More than likely, if we see pits at that  
25 monitor well, we're probably removing that well from

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 service. That's the monitoring program.

2 DR. KENNEDY: Okay. So the pressure  
3 monitoring is on the injection well, and this level  
4 monitoring system is on the monitoring well?

5 MR. McNABB: Yes. We've got pressure on  
6 the annulus of the injection well, and pressure on the  
7 wellhead operating pressure.

8 DR. KENNEDY: Okay.

9 MR. McNABB: And yes, the, we'll call it  
10 level. You could also call it pressure of your  
11 monitor water levels.

12 DR. KENNEDY: And I guess I'm, so that you  
13 were making a distinction between, it's a, you measure  
14 the same parameters that you do on the injected fluid?

15 MR. McNABB: That is correct.

16 DR. KENNEDY: And so if you see those  
17 parameters in your monitoring well, is that an  
18 indication that wastewater has breached the lower  
19 region of your monitoring well --

20 MR. McNABB: Not --

21 DR. KENNEDY: -- or not?

22 MR. McNABB: I'm sorry.

23 DR. KENNEDY: I guess, so you, because  
24 you're making a distinction between a freshwater,  
25 which I guess has some bearing on the impact of the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 condition of your monitoring well, versus the 10  
2 parameter, the injection parameters that you're  
3 monitoring, and what you infer from that. And I guess  
4 that's the piece I was missing in the monitoring well.

5 MR. McNABB: Okay. For example, our lower  
6 monitor zone, I believe the total dissolved  
7 concentration in that lower monitor zone, if I  
8 remember correctly, is roughly 20,000 to 25,000  
9 milligrams per liter.

10 The fluid that we're injecting is, I  
11 believe, closer to 4,000 or 5,000 milligrams per  
12 liter, total dissolved solids.

13 So if that, if we did have migration from  
14 our injection zone, that fluid with a 4,000 or 5,000  
15 TDS, you know, we're going to see that mixing in with  
16 our 20,000. All of a sudden you'll see a freshening.  
17 Did I, did I answer your question?

18 DR. KENNEDY: I believe so. So it's  
19 really the trending of that, of those parameters in  
20 the lower, in the lower part of the monitoring well  
21 that is, what begins to get your attention?

22 MR. McNABB: You are correct.

23 DR. KENNEDY: Yes, okay.

24 DR. BURNETT: Mr. McNabb, Walsh used  
25 ammonium as a tracer for the injectate. Would the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 ammonium concentration in the fluid injected at Turkey  
2 Point still have high ammonium, or does that come out  
3 in treatment?

4 MR. McNABB: I expect it's going to have  
5 ammonia, although I must say I'm not qualified to, I  
6 really don't know exactly what our waste stream is  
7 going to look like.

8 I know, got an idea of the total dissolved  
9 solids, but I don't have a good characterization of  
10 that.

11 DR. BURNETT: Is there anyone else on this  
12 panel that can answer that question? Ammonium was not  
13 listed in your parameters, I don't believe. But you  
14 didn't feel that you remembered all of them.

15 MR. McNABB: Ammonia is not one of them.  
16 Ammonia is part of total Kjeldahl nitrogen. It's a  
17 component of total Kjeldahl nitrogen. So when it's --

18 DR. BURNETT: And that is, that is  
19 measured --

20 MR. McNABB: Yes.

21 DR. BURNETT: -- Kjeldahl nitrogen?

22 MR. McNABB: Correct.

23 DR. BURNETT: Thank you.

24 DR. KENNEDY: So what are the remediation  
25 actions if a leak is detected, I guess, I guess first

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 in the injection well? I guess that would be the  
2 continuous pressure monitoring?

3 MR. McNABB: If a problem were detected in  
4 the injection well, more than likely what it's going  
5 to be is a leak in the packer at the bottom of the  
6 well.

7 When they do develop a leak, that's  
8 usually where it's at. As long as it's a recent well  
9 that has a FRP injection liner.

10 There are ways to fix that and that's what  
11 happens. You have to fix it. You can, I did one  
12 recently where what we did was we set a bridge plug or  
13 a plug down below the base of the casing, base of,  
14 yes, below the base of the casing.

15 We put some, spotted some cement there.  
16 Put a little bit of cement, I got, I'm sorry. I'll be  
17 careful of well drilling terms.

18 Placed a little bit of cement on top of  
19 that bridge plug. We pulled up the FRP liner, pulled  
20 it out of its packer, and then we pumped cement down  
21 the well called a pressure grout.

22 So that we were pumping cement, it was  
23 being released about three feet inside the base of the  
24 casing. The top of the well is sealed.

25 The only place for the cement to go is out

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the base of the casing and up the back side of our  
2 FRP.

3 We filled up about 75 feet of that open  
4 annular space at the bottom of the annular space.  
5 Filled that up with about 75 feet of cement, thus  
6 repairing the leak.

7 We then went in with what's called a mud  
8 motor. Something that you can put down the well that  
9 will drill out that cement plug that was left after  
10 the cement job.

11 So there are ways to repair such leaks.  
12 If it's a leak in that, in injection tubing, you pull  
13 it out and replace it.

14 We've not had any pop a leak in the final  
15 casing. Now, if that were to occur, my recommendation  
16 was patch it.

17 There are patches out there that you can  
18 lower to where that leak location is, and you can run  
19 a tool through it that'll make it expand and seal up  
20 against the inside of the casing.

21 So there are, there are repair options.  
22 Now, well, I think you were going to ask further, but  
23 you just asked about the injection wells.

24 DR. KENNEDY: Right. So let's just, so  
25 the, I guess the part of what I was after is the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 injection well, if it's repairable, it's repaired.

2 It's not, so it's taken out of service,  
3 the leak is diagnosed and potentially repairs are  
4 made, and then put back into service. Is that the way  
5 I should think of this?

6 So it's a repair, you know, stop injecting  
7 I guess, repair, and then being the injection process  
8 again?

9 MR. McNABB: You got it. Now, I will say  
10 this. When, a few cases where we've seen a leak  
11 develop, say at the, at the bottom of the well at the  
12 packer, it is, all right, guys.

13 You guys continue to operate your well,  
14 but we need a plan from you now. You know, this is,  
15 this particular well is located at a wastewater and  
16 water treatment plant. They need to operate.

17 But, and they also take into account, look  
18 what, look what's happening here. Our non-hazardous  
19 annular fluid is going out the bottom of the well and  
20 into our boulder zone.

21 So they see no environmental risk in  
22 allowing us to operate. But they, unless there's an  
23 environmental risk, they allow us to operate until we  
24 have a plan in place, and then they push us to  
25 implement that plan.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. KENNEDY: I guess I was wondering too,  
2 and maybe just part of what you're alluding to, the  
3 sensitivity of the pressure monitoring system, small  
4 leaks, big leaks.

5 I mean, how sensitive is it? Is it, is it  
6 able to detect a relatively small, and again, I don't,  
7 I have no feel for what kind of leak size we should be  
8 talking about here, but I guess I'm really wondering,  
9 is that your first line of defense, the pressure  
10 monitoring system, the injection well, or is the more  
11 important system the dual zone monitoring system?

12 MR. McNABB: In my opinion, the dual zone  
13 monitor well. You know, if we detect a leak in that  
14 well, it's extremely unlikely that it's leaking  
15 outside the, going out into the formation through the  
16 casings and the cement.

17 So if we develop a leak, it's going to be  
18 at the, either in that tubing or in the packer at the  
19 bottom of the well.

20 And what's happening? We're just getting  
21 fluids going down the boulder zone. So there's no  
22 environmental harm in that case.

23 So we detect a problem with the injection  
24 well. Really, no environmental risk, but you know,  
25 our detection method is now, should I say,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1       compromised.

2                   So we want to repair it real quick and get  
3       our monitoring up. Your monitor well, we see hits  
4       there.

5                   That means, oh, you know, we have seen  
6       something come up through either, more than likely  
7       confinement, since it's not going to come out via side  
8       of the well in my opinion.

9                   So then that would be of more concern for  
10      sure. At the, we hit the lower zone, there's a  
11      concern, but it's not a violation.

12                   But now let's take action and make sure we  
13      don't have a violation. And that's, again, possibly  
14      removing the well from service. That sort of thing.

15                   DR. KENNEDY:       The potential for a  
16      violation, is that based on, is that with the dual  
17      zone monitoring, you would rely on that to have, make  
18      that assessment?

19                   In that, because that really says you're  
20      having wastewater migrating in a direction you don't  
21      want it to go in.

22                   MR. McNABB: Yes. That's going to be our,  
23      unless we, for example, in our mechanical integrity  
24      testing, we found a problem. There was an obvious  
25      issue.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           But yes, it's, if we see that migration  
2 into that lower zone, it's time to pay attention and  
3 come up with a plan for making sure we do not impact  
4 the USDW, which would be a violation.

5           DR. KENNEDY: That's one of the things I  
6 struggle with. It seemed to me like the continuous  
7 pressure monitoring would be a real strong tool to  
8 understand the health of the injection well.

9           But I could also see you could have  
10 spurious alarms if it was alarmed, and you could have  
11 small leaks, you know, causing all kinds of alarms.

12           And yet you'd still have the capability to  
13 continue operating without any impact. And it sounds  
14 like that's, that, to me, is what you just  
15 communicated is that there's an assess and evaluate  
16 option available to the operators of these, this well  
17 system.

18           MR. McNABB: I don't believe that is the  
19 case. You know, we have to give the data to DEP, or  
20 so we can't just make our own evaluation.

21           Or if we do, I guess DEP's going to do  
22 their own as well. But it is very sensitive. The  
23 pressure, the annular pressure monitoring is very  
24 sensitive.

25           We've found leaks through, they send me

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 data. You see a decreasing trend in pressure. Where  
2 you, typically this is on a new well that, where  
3 you've got a leak in your nitrogen system that is  
4 keeping your annular pressure system pressurized at  
5 surface.

6 Part of our annular system is an annular  
7 pressure tank, typically, oh, a, we'll call it a 400  
8 gallon tank, half full of Baracor, or corrosion  
9 inhibitor.

10 And this is connected to our annulus. And  
11 the way we're pressurizing our annulus is we're  
12 actually pressurizing the annular pressure tank.

13 Typically that's being pressurized, well,  
14 oftentimes being pressurized with nitrogen tanks, and  
15 that piping between the nitrogen tanks and the annular  
16 pressure tank, oftentimes you can develop leaks.

17 It's hard to get them initially.  
18 Sometimes a new well, in the first month or so, you're  
19 chasing these very, very minor but detectable,  
20 nitrogen leaks. You go in with the soapy water, find  
21 them, tighten things down, and you put an end to that  
22 trend.

23 DR. KENNEDY: So the, do I, I'm getting  
24 your sense, does state of Florida have a requirement  
25 on both the, or a specification on the sensitivity of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 this pressure monitoring system?

2 And if it alarms or goes off or indicates  
3 a leak, is it, do you have to report that to the state  
4 of Florida?

5 MR. McNABB: First part of the question,  
6 I'm not aware of any requirement with regard to  
7 sensitivity.

8 DR. KENNEDY: Okay.

9 MR. McNABB: Second, yes. The rule, the  
10 permit that they have, the rules require, and their  
11 permit states, within 24 hours of an indication of a  
12 lack of mechanical integrity must make contact with  
13 DEP to inform them of the issue.

14 DR. KENNEDY: So without the state  
15 requirement on sensitivity, how do you set, you know,  
16 the sensitivity of your system?

17 I mean, how did you decide, you know, how,  
18 what size leaks you want to detect or leak at all, I  
19 guess?

20 MR. McNABB: That's a toughy. We've gone  
21 with, you know, quite honestly, I've always used a  
22 similar system. It's proven to be sensitive, very  
23 sensitive. That's the best I have for that question.

24 It, quite honestly, my clients want to  
25 know if there's an issue with their well. They're not

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 going to let me put something in there that's not  
2 going to detect an issue.

3 DR. KENNEDY: In mechanical integrity.

4 MR. McNABB: That's correct.

5 DR. KENNEDY: In terms of the final setup  
6 of the wells and dual monitoring system, I guess I  
7 meant to check it but I didn't, but is there a good  
8 diagram within the exhibits that shows the layout of  
9 the injection wells and the dual zone monitoring  
10 wells? And I'm also kind of interested in what the  
11 aerial footprint of that combination of equipment is.

12 MR. McNABB: May I ask my client that  
13 question?

14 DR. KENNEDY: Feel free. And Mr.  
15 Barnhurst has his hand up as well.

16 MR. BARNHURST: Yes, sir. I believe that  
17 what you may be looking for is Figure 3-7 in the final  
18 environmental impact statement.

19 It's the planned view of where the  
20 injection wells are going to be located. It's NRC-  
21 008A, is the number.

22 And it's a planned view of where the  
23 injection wells will be located, over to the  
24 observation wells, monitoring wells.

25 DR. KENNEDY: Maybe Andy, what page was

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that, or what --

2 MR. BARNHURST: I'm sorry.

3 DR. KENNEDY: It was Figure 3-7?

4 MR. BARNHURST: It's Figure 3-7 and it's  
5 on Page 3-12.

6 MR. McNABB: Would you like me to give you  
7 just a very brief overview?

8 DR. KENNEDY: That would be great because  
9 I --

10 MR. McNABB: Oh.

11 DR. KENNEDY: -- I think I missed this  
12 picture.

13 MR. McNABB: Okay. Our injection wells,  
14 we've got 12 injection wells, six monitor wells. The  
15 injection wells are actually placed as pairs with a  
16 monitor well between each pair.

17 Do you see the set of three dots placed?  
18 Okay. Those represent our, we'll call them little  
19 pairs of injections wells with the monitor well in  
20 between.

21 Those, the injections wells are roughly,  
22 approximately 75 feet from the monitor well that's in  
23 between the two. And I believe we've got a 600 foot  
24 spacing between our pairs.

25 DR. KENNEDY: So between these, any set of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 three dots, there's a 600 foot separation? Is that  
2 what you just said?

3 MR. McNABB: I believe that to be the  
4 case.

5 DR. KENNEDY: Okay. And so, okay. This  
6 is good picture. And let, if we could leave it up  
7 there for just a second, I wanted to turn to Mr.  
8 Quarles because, when I start thinking about this  
9 groundwater, this monitoring system for the  
10 wastewater, in your, in your testimony on Page 23 on  
11 Exhibit INT-022, you indicate that it is likely to be  
12 able to detect upward migration in time.

13 And I guess there's a time factor here.  
14 And you point to two factors. The sampling is not  
15 frequent enough, and we talked a little bit about the  
16 frame, the sampling frequency, and the constituency  
17 may migrate horizontally before moving upward.

18 So guess, is the potential that something  
19 catastrophic could happen in between the sampling  
20 frequency and not be detected, and it's possible that  
21 the fluid from one of these injection wells would  
22 migrate horizontally before moving upward and being  
23 detected. Is that, is that your concern, among  
24 others?

25 MR. QUARLES: Among others. So you know,

1 back to what ETA said back in 2005 is that compliance  
2 monitoring programs are not sufficient to protect  
3 against movement of contaminants in the USDWs, nor do  
4 they provide sufficient early warning of  
5 contamination.

6 They also concluded that once  
7 contamination is detected, it may be too late to  
8 prevent endangerment.

9 So you know, that's very, very important  
10 to remember those two conclusions of the complex  
11 geology of southeast Florida.

12 The other thing that I'll add is that when  
13 you look at Walsh and Price and Cunningham, they  
14 frequently use the word bypass.

15 Bypass, meaning they bypass confined  
16 layers and show up in shallower wells, but not in  
17 deeper wells. All right?

18 So the adequacy of a system must be  
19 capable of detecting a bypass. When I look at, and so  
20 that's just in the general term of the EPA and whether  
21 or not early release detection worked.

22 DR. KENNEDY: Just, was that in regard to  
23 wastewater-type constituents like we're dealing with  
24 here or --

25 MR. QUARLES: It is.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. KENNEDY: -- just in general?

2 MR. QUARLES: Specific to wastewater  
3 injection that UIC cites. All right. So you talked  
4 about, okay, we have four constituents of concern.  
5 How often do we test of those and where do we test for  
6 them?

7 If you look at the South District  
8 wastewater treatment permit, they don't test for the  
9 four constituents of concern for their wastewater  
10 discharge permit.

11 Mr. McNabb just described the sample  
12 program, but the injection wastewater that he had,  
13 they intend to sample, and did not include the four  
14 constituents of concern in the list of parameters.

15 Instead, you know, have the, our dozen  
16 "basic"-type indicator parameters. All right? So if  
17 you're not testing for the four constituents, and then  
18 you recognize that you have limitations in the  
19 adequacy of the monitoring system, according to EPA,  
20 to even detect an early release detection, and even in  
21 fact bypass deeper wells and confining layers and in  
22 the deep down and shallow layers.

23 And that raises all kinds of issues. And  
24 I guess when I look at this diagram, I see the  
25 Biscayne Bay on the right, which would be your left.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           And the monitoring wells are clustered  
2 around the eastern side and the southern side of the  
3 site.

4           One of you asked earlier this morning  
5 about, what is the direction of groundwater flow after  
6 injection begins?

7           And I think there was some discrepancy,  
8 some people said that the direction of groundwater  
9 flow is going to be to the west.

10           Somebody else said it's going to be to the  
11 east. In that diagram, if it flows to the west, there  
12 aren't monitoring wells.

13           MR. McNABB: I thought, I thought the,  
14 there's two different concepts being discussed this  
15 morning. One was sort of the general flow direction,  
16 which was to the west, and the other had to do with  
17 when there was an injection, and that that could've  
18 had an eastward component to it. So I'm not sure.  
19 They may be different, to me there were different  
20 types of movements.

21           MR. QUARLES: I guess this diagram here  
22 assumes that upon injection, all of the groundwater,  
23 the direction of the new groundwater flow with  
24 injection will be to the east toward Biscayne Bay and  
25 not the west.

1           So obviously the location isn't important,  
2 both by depth and what part of the site that you're  
3 monitoring.

4           But even with that, ETA is saying,  
5 compliance monitoring systems don't work. So then  
6 while we're talking about monitoring, the COC,  
7 constituents of concern are not monitored at the  
8 wastewater plant.

9           They're not proposed to be monitored prior  
10 to injection here. So then the question is, are  
11 potable water supply systems routinely testing for  
12 these four constituents of concern?

13           And the answer is, initially potable water  
14 systems might have to test on a quarterly basis, but  
15 then if they have no detections they can request that  
16 they no longer sample for the OCs.

17           So let's just say long term, if there's a  
18 few quarters of non-detect, they may never sample for  
19 these four constituents again. So if they were there  
20 in the potable water supply, you may never know it.

21           DR. KENNEDY: And I get the sense that  
22 you, it seems like this is part of a state of Florida  
23 program to monitor this injectate, and it sounds like  
24 the EPA presents a picture that is folly.

25           And I'm not sure how to, how would, to be,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 you know, how do reconcile that dilemma for me? So  
2 the state has been doing this for some time, and  
3 they've developed a program with all kinds of  
4 requirements. And the FP&L here seems to be trying to  
5 follow those requirements.

6 MR. QUARLES: So particularly related to  
7 the adequacy of a monitory system to be effective as  
8 an early release detection is further complicated by  
9 the presence of natural vertical conduits.

10 It may or may not exist at the site that  
11 the seismic evaluation would be a reasonable  
12 scientific evaluation to determine the likelihood of  
13 the presence of those.

14 That's where it gets complicated is that,  
15 is that where those conduits are present, EPA is  
16 saying there's very little confidence in the ability  
17 of a monitoring program to protect prior to  
18 endangerment.

19 DR. KENNEDY: Did that also include  
20 systems like this that has a, say a continuous  
21 pressure monitor on the injection well? Or is it only  
22 speaking to the, that sort of dual zone monitoring  
23 system that we have here?

24 MR. QUARLES: Speaking to what the EPA  
25 discussed in the 2005 UIC Rule.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. KENNEDY: Okay. Dr. Maliva, would you  
2 like to --

3 DR. MALIVA: Yes. There's a whole hand  
4 full of points here that need to be clarified. First  
5 of all, as far as groundwater flow direction, the  
6 general belief, as far as regional groundwater flow  
7 direction, ambient, is within the boulder zone, is a  
8 very slow movement inland to the west.

9 Within, above the boulder zone, with the  
10 Upper Floridan aquifer system, the groundwater flow  
11 direction is clearly to the southeast.

12 We have in Florida, the Polk City  
13 potential metric. High groundwater flows regularly  
14 away from there. So at this site, within the Upper  
15 Floridan aquifer, it's going to flow offsite.

16 The Intervenors are correct that the  
17 monitoring program doesn't include those four  
18 programs.

19 For the monitor programs, you use  
20 indicator parameters that would clearly indicate the  
21 presence of injected water.

22 You wouldn't use parameters that are  
23 already present just at the edge of detection limits  
24 as you're monitoring your parameters for wastewater.  
25 I mean, that would make no sense.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           You'd use things like chloride, salinity,  
2           nitrogen in which there's a very large difference  
3           between interjected water and the native ground water,  
4           so that even if you saw a little bit of mixing, you  
5           would detect it and you would know from those  
6           indicated parameters.

7           You, I mean, it's non-workable to say  
8           you're going to, you should monitor for every  
9           parameter that could conceivably be present in  
10          wastewater on a weekly basis. That's not practical.

11          So it's a very well-thought out set of  
12          parameters and indicators that would let you know if  
13          vertical migration were to occur.

14          And again, the comments on what the USEPA  
15          concluded, and wonders if that is correct, that you're  
16          never going to have perfect monitoring as a means of  
17          providing that 100 percent mathematical certainty,  
18          that endangerment of the USDWs is not going to occur.

19          What they did recommend instead was an  
20          added level of treatment so that you treat your water  
21          so that if it migrated up to it's at the USDW, it  
22          would not result in a regulatory violation.

23          So the strategy that was adopted was just  
24          to maintain the current monitoring program of a dual  
25          zone monitor well, your injection well, which is the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 location most likely to detect it.

2 And then, again, treat water to a higher  
3 degree so that if you, in the very unlikely event that  
4 it did migrate into USDW, it wouldn't result in  
5 endangerment.

6 And if we're already starting out with  
7 water that meets drinking, federal drinking water  
8 standards, there's no endangerment issue.

9 Endangerment is defined as causing a  
10 violation of a primary drinking water standard. If  
11 your injected water already is there, you know,  
12 there's not a regulatory issue.

13 CHAIRMAN HAWKENS: Mr. McNabb, I'm looking  
14 for EW1 on here. I may be overlooking it.

15 MR. McNABB: You are not.

16 CHAIRMAN HAWKENS: Where would it be in  
17 relation to these wells?

18 MR. McNABB: It would be to the southeast  
19 corner, just off corner. Southwest, I apologize.  
20 Southwest.

21 CHAIRMAN HAWKENS: With the placement of  
22 the monitoring wells, are they required by the state  
23 regulations, or have they been determined by best  
24 industry practice?

25 MR. McNABB: Placement of the monitor

1 wells are required to be within 150 feet of the  
2 injection well. That's because it's the most likely  
3 place where migration would occur.

4 First of all, we have our greatest  
5 pressure buildup right near our injection well. So  
6 we, they want us to keep our monitor wells nearby.

7 Also they're the buoyant forces is  
8 greatest there. As we move away from the well, we get  
9 mixing, decrease on Buoyant force. So DEP wants us to  
10 put it, locate it in the place where we're most likely  
11 to have an issue.

12 DR. KENNEDY: Is there any philosophy here  
13 on how these, this pattern of wells is arrayed in the  
14 south and the east? Or is that purely coincident?

15 MR. McNABB: That's really to accommodate  
16 construction of the plant. Keep, you know, keep the,  
17 these on the perimeter and away from the main activity  
18 of construction.

19 DR. KENNEDY: All right, thank you.

20 CHAIRMAN HAWKENS: What are the, when  
21 everything is up and running, what is the maximum,  
22 what are the maximum number of wells that you  
23 contemplate would be used on any given day?

24 MR. McNABB: During the normal operation  
25 with reclaimed water --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. KENNEDY: Yes.

2 MR. McNABB: -- I believe that to be  
3 three. It may be four. And I suspect that one of the  
4 other panels will be able to clarify that.

5 Mr. Jacobs would be able to provide a  
6 better answer. But I've looked, three or four.

7 During operation of, with seawater, I  
8 believe it's nine. But again, he'll tell me, tell you  
9 guys if I'm wrong.

10 DR. KENNEDY: And what dictated the  
11 sampling frequency? I think it, was it monthly that  
12 you had indicated?

13 MR. McNABB: Start of weekly, but as long  
14 as the monitoring data is showing that the system is  
15 operating properly and in compliance, after six months  
16 we prepare a request to reduce frequency.

17 If DEP agrees with us that, hey,  
18 everything looks good, they typically will allow that  
19 reduction to monthly.

20 DR. KENNEDY: What about this question of  
21 horizontal migration? What would it take to bypass  
22 the monitoring well?

23 I mean, is it, is this a realistic  
24 scenario? I mean, it seems like that region down  
25 there is sort of open and things could move.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. McNABB: Things could move laterally  
2 some distance from the injection well. And extremely  
3 unlikely case that it moved upward into a zone that  
4 monitored by, say, the lower monitor zone.

5 If it were far enough away, I don't think  
6 it would detect it. But let's keep in mind, we're  
7 placing that monitor well in the place where it's most  
8 likely to have fluid migration.

9 But yes, I'll tell you, if we moved a mile  
10 away and it migrated upward, it would be very dilute  
11 by then.

12 We'd have very, very little Buoyant force.  
13 The mixing would remove the buoyancy. But I cannot  
14 tell you there's zero chance that would happen.

15 DR. KENNEDY: So there is a real  
16 possibility that it could bypass the monitoring well,  
17 even though it's in compliance with the Department of  
18 Environmental Protection requirements to be within so  
19 many feet?

20 MR. McNABB: While highly, highly  
21 unlikely, yes, it's possible that this fluid that  
22 we're injecting that meets federal drinking water  
23 standards could indeed migrate away from the well  
24 upward and not be detected.

25 MR. QUARLES: Can I, can I respond?

1 DR. KENNEDY: Mr. Quarles --

2 MR. QUARLES: Thank you.

3 DR. KENNEDY: -- please do.

4 MR. QUARLES: So I've heard it, I've heard  
5 it several times today, now that we're talking about  
6 migration prior to reaching the USDW, a discussion  
7 about, things are protected because the constituents  
8 don't exceed the federal drinking water standard.

9 But what I had not heard discussion about  
10 is the fact that the tetrachloroethylene exceeds the  
11 Florida drinking water standard.

12 DR. KENNEDY: We will be discussing that  
13 in the next panel discussion.

14 MR. QUARLES: Okay. Find.

15 DR. KENNEDY: If you want to hold that  
16 thought.

17 MR. QUARLES: So just to clarify that, I  
18 guess the other thing that I want to add is to use,  
19 you know, the quotation, it makes no sense to test for  
20 the four constituents of concern, and I would argue  
21 that it does because, what, three are probable  
22 potential human carcinogens at very low  
23 concentrations.

24 So the cost of testing for these four  
25 constituents is not, in the big scheme of things, is

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 not much at all.

2 So I would counter to say that it does  
3 make sense to consider the testing of those four  
4 constituents.

5 The other thing that I would say is that  
6 the ambient direction of groundwater flow of the USDW,  
7 according to Dr. Maliva, is to the southeast, which  
8 justifies the placement of those wells.

9 But if, in fact, the confining layer leaks  
10 and you have upwelling of wastewater, like Dausman  
11 talked about in the 2008 study.

12 The water levels in the USA increased 20  
13 feet over 30 years. If you increase, if it does leak  
14 and you have this upwelling into the UFA, you could  
15 reverse the direction of groundwater flow in the  
16 opposite direction.

17 So it's, you know, putting all your wells  
18 in the southeast side assumes ambient conditions will  
19 be there for the duration of the program.

20 And then the last thing I will say is that  
21 Dr. Walsh at the north district plant showed that the  
22 water migrated laterally, horizontally offsite,  
23 entered an offsite natural conduit, rose into the  
24 USDW, and then migrated onsite.

25 So lots of crazy things can happen with

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the monitoring system. But I think it's unfair to  
2 assume that ambient groundwater flow conditions are  
3 going to occur all the time.

4 DR. KENNEDY: I guess I find it  
5 interesting. The point that Dr. Maliva made about  
6 the, if the high disinfectant treatment is given to  
7 the wastewater, then these chemicals are really below  
8 detectable limits.

9 And I, to me it's a very compelling  
10 argument not to use those as a leading indicator of if  
11 you've got a, got a leak in your system.

12 I'm a bit surprised that you don't find  
13 that a compelling argument. I'll give you a chance to  
14 restate it. Maybe I misunderstood.

15 But that seems like a very compelling  
16 argument to have use something else as a leading  
17 indicator of when you have a problem.

18 MR. QUARLES: So to respond to that, I  
19 would have to talk about my opinion on the accuracy  
20 and viability long term of the four samples that were  
21 collected after the use of the HLD, the high level  
22 disinfection, which I thought was kind of off limits.

23 DR. KENNEDY: I'm going to get, I'm sure  
24 we're going to talk about that in the other, the other  
25 panels, of which I know you're a member.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           CHAIRMAN HAWKENS: Before going onto the  
2 next panel, I want to see if, especially the staff,  
3 has any final response to Mr. Quarles final  
4 statements.

5           MR. BARNHURST: Yes, thank you. I just  
6 wanted to speak to, just quickly, something that,  
7 Judge Kennedy, that you brought up.

8           You noted that there seemed to be some  
9 maybe disagreement between the FDEP underground  
10 injection control program requirements of new  
11 migration, and then the EPA who, as Mr. Quarles said,  
12 expressed uncertainty that the observation wells would  
13 detect any kind of potential upwelling.

14           If I could just talk to that document,  
15 that's a document that we considered. I read through  
16 quite a bit as we were preparing the final  
17 environmental impact statement.

18           And he's correct that they, that the EPA  
19 did say that they, because of the geology of Florida  
20 and the potential for upwelling, that they, I'm trying  
21 to find the quote here.

22           But basically that you couldn't, in the  
23 EPA's opinion, they expressed some uncertainty in the  
24 ability of the monitoring wells to detect the  
25 upwelling.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           And so as a result, and I think it's  
2 already been alluded to by Dr. Maliva, the EPA shows  
3 how this infection as a, as a way to, they said that  
4 if you treat to that level, that even if it migrates,  
5 it's below a level which would threaten the, any  
6 groundwater sources at the site.

7           And so I just, I just wanted to I guess  
8 point out the fact that we noticed that as well.  
9 FDEP, Florida Department of Environmental Protection,  
10 takes a different approach.

11           They say that confinement, or upwelling  
12 cannot occur. EPA takes a different approach. Both  
13 of those approaches taken together I think are very  
14 protective in that you're cleaning up the source of  
15 the water.

16           You're also taking steps to limit any  
17 potential for upwelling and monitor for it. I think  
18 that was the point I wanted to make. Thank you.

19           CHAIRMAN HAWKENS: Dr. Maliva, any final  
20 --

21           DR. MALIVA: I would just, we will get to  
22 this later, but when we talk about cancer risk, we  
23 cannot forget the point that --

24           CHAIRMAN HAWKENS: We'll talk about that  
25 in the --

1 DR. MALIVA: Yes, the upper Floridan water  
2 has to go through an RO plant before it can be potably  
3 consumed.

4 So you know, even arguing over Florida  
5 versus federal NCLs, it's going to go through a  
6 desalination plant before anybody drinks it. It's  
7 going to be tremendously diluted. So I mean, that's  
8 where, you know, the small, I call infinitesimal risk  
9 comes into being.

10 CHAIRMAN HAWKENS: All right. Frankly,  
11 we'll discuss that in Panel 5. Will you be back to  
12 join us?

13 DR. MALIVA: Yes.

14 CHAIRMAN HAWKENS: So, with that, let's  
15 take a five minute break so we can have the fourth  
16 panel come up. We will start Topic number 4.

17 We may not be able to finish today, but  
18 we'll see how far we can get. Five minute recess. We  
19 will reconvene at six after.

20 (Whereupon, the above-entitled matter went  
21 off the record at 4:01 p.m. and resumed at 4:08 p.m.)

22 CHAIRMAN HAWKENS: Good afternoon. We're  
23 now prepared to question the fourth topical panel. As  
24 a reminder, in this panel we will discuss the impact  
25 of the four contaminants on human health if wastewater

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 were to reach the Upper Floridan aquifer at the  
2 concentration values reported in Table 3-5 of the  
3 FEIS.

4 This panel has some new witnesses on it  
5 and several witnesses have left. So would the panel  
6 members please introduce themselves, MPL, or excuse  
7 me, Joint Intervenors?

8 MR. QUARLES: Once again, Mark Quarles.

9 DR. TEAF: My name is Christopher Teaf.

10 DR. MIRACLE: Ann Miracle.

11 TOPIC 4 QUESTIONING

12 CHAIRMAN HAWKENS: Thank you. Dr. Teaf  
13 and Dr. Miracle, let me start off by reviewing a few  
14 definitions.

15 My understanding is the EPA maximum  
16 contaminant level goal is a level of the chemical in  
17 drinking water at which no known or anticipated  
18 adverse effect on the health of persons would occur,  
19 and which allows an adequate safety of margin. Dr.  
20 Teaf, is that the understanding?

21 DR. TEAF: Yes, sir. And as we talked  
22 about earlier today, it differs for individual  
23 chemicals.

24 CHAIRMAN HAWKENS: Correct. And you would  
25 agree, Dr. Miracle?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. MIRACLE: Yes, I would agree.

2 CHAIRMAN HAWKENS: Okay. Mr. Quarles, I,  
3 you would agree with that as well?

4 MR. QUARLES: Yes, sir, I would.

5 CHAIRMAN HAWKENS: Okay, thank you. Andy  
6 would you display the FPL Exhibit 064 and of Page 5?  
7 All right. Dr. Teaf, let's deal first with  
8 ethylbenzene and toluene.

9 According to this, which is the Table 3-5  
10 in the FEIS, the reliable and conservative value of  
11 ethylbenzene that will be injected into the boulder  
12 zone is below the method detection limit. Now, can  
13 you explain what the method detection limit is,  
14 please?

15 DR. TEAF: Yes, sir. The method detection  
16 limit is the value that is established as being  
17 reportable by laboratory with confidence of 99 percent  
18 that it is present.

19 It may not be present low, which is  
20 quantifiable numerically, but it is present, but it is  
21 not reliable below that level.

22 CHAIRMAN HAWKENS: All right. Dr.  
23 Miracle, you would agree with that definition of  
24 method detection limit?

25 DR. MIRACLE: Yes, I do.

1 CHAIRMAN HAWKENS: All right. And Mr.  
2 Quarles, you have, you concur?

3 MR. QUARLES: I don't know about the  
4 percent being accurate, but the method detection limit  
5 is a limit that can be reliably reproduced.

6 CHAIRMAN HAWKENS: All right. And I do  
7 think it's important on this Board to recognize the  
8 expertise of Dr. Teaf and Dr. Miracle in toxicology.  
9 What is your Doctorate in, Dr. Teaf?

10 DR. TEAF: It's in toxicology. Yes, sir.

11 CHAIRMAN HAWKENS: All right, thank you.  
12 And Dr. Miracle?

13 DR. MIRACLE: More broadly, molecular  
14 biology, but with experience in environmental  
15 toxicology.

16 CHAIRMAN HAWKENS: All right. Mr.  
17 Quarles, you have expertise in a broad number of  
18 areas, as demonstrated by the panels you're testifying  
19 on today. But is it correct to say that your  
20 expertise does not extend to the science of  
21 toxicology?

22 MR. QUARLES: I think it's fair to say  
23 that I don't have a degree in toxicology, but it, but  
24 it is fair to say that, you know, being in this  
25 business for 30 years, that you routinely use drinking

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 water standards, risk of exposure levels, health based  
2 standards as a mechanism of determining the level of  
3 risk to humans, animals, that sort of thing.

4 So just by the nature of doing this sort  
5 of thing for a living, you're exposed to some degree  
6 of use of numeric standards for human and ecological  
7 effect.

8 CHAIRMAN HAWKENS: All right. Thank you.  
9 Dr. Teaf, the concentration of ethylbenzene is below  
10 a minimum detection limit, and for toluene it's  
11 0.00174. Now, the EPA maximum contaminant level goal  
12 for ethylbenzene is 0.7. Is that correct?

13 DR. TEAF: Milligrams per liter. Yes, sir.

14 CHAIRMAN HAWKENS: So by definition, the  
15 concentration of ethylbenzene that's being injected  
16 into the boulder zone is at a level at which no known  
17 or anticipated adverse effect on the health of person  
18 would occur, and which allows an adequate margin. Is  
19 that correct?

20 DR. TEAF: Yes, sir.

21 CHAIRMAN HAWKENS: Dr. Miracle?

22 DR. MIRACLE: Yes, sir.

23 CHAIRMAN HAWKENS: Mr. Quarles, would you  
24 agree with that? By definition, can you just answer  
25 that yes or no? The definition of the EPA maximum

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 contaminant level goal.

2 MR. QUARLES: I have to confess, I was  
3 distracted. I was getting a drink of water. What was  
4 the question? Sorry.

5 CHAIRMAN HAWKENS: The goal, the maximum  
6 level contaminant goal for ethylbenzene is 0.7.

7 MR. QUARLES: I will agree with that.  
8 Thank you.

9 CHAIRMAN HAWKENS: And ethylbenzene is  
10 below the MVA. And therefore, by definition, you  
11 could inject this into drinking water, and no known or  
12 anticipated adverse effect would occur on health and  
13 it would allow an adequate margin as well.

14 MR. QUARLES: Correct.

15 CHAIRMAN HAWKENS: All right. Thank you.  
16 Let's address toluene. Concentration injected into  
17 the boulder zone is 0.00174?

18 DR. TEAF: Yes, sir.

19 CHAIRMAN HAWKENS: And the EPA maximum  
20 contaminant level goal is 1.0. Is that correct?

21 DR. TEAF: Yes, sir.

22 CHAIRMAN HAWKENS: So what's being  
23 injected is several magnitudes less than what the goal  
24 is. Is that correct?

25 DR. TEAF: Yes, sir. It's true for both

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 ethylbenzene and for toluene that it's about 700 times  
2 less than drinking water standard. Therefore --

3 CHAIRMAN HAWKENS: And therefore, by  
4 definition, the injection of toluene into the boulder  
5 zone is a level in which as if it were injected in  
6 drinking water itself, no known or anticipated adverse  
7 effect on health of persons would occur, and which  
8 also allows an adequate margin of safety. Is that  
9 correct?

10 DR. TEAF: That's true.

11 DR. MIRACLE: Yes, that is correct.

12 MR. QUARLES: Yes, sir. Correct.

13 CHAIRMAN HAWKENS: Mr. Quarles, then, if  
14 that's the case, would you agree that for at least  
15 ethylbenzene and toluene, if they were injected into  
16 the boulder zone at the concentrations listed in Table  
17 3.5, their environmental effects would be no greater  
18 than small?

19 MR. QUARLES: I would say that those  
20 constituent concentrations don't exceed the federal  
21 drinking water standard or the MCLG.

22 CHAIRMAN HAWKENS: Thank you. Can you  
23 answer my question now, with the environmental impacts  
24 as stated in the federal environmental, the final  
25 environmental impact statement --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. QUARLES: Yes.

2 CHAIRMAN HAWKENS: -- would their impacts  
3 be no great than small?

4 MR. QUARLES: According to the USEPA, it  
5 would, it would have no adverse health effects.

6 CHAIRMAN HAWKENS: All right. Thank you.  
7 Dr. Teaf, let's move to heptachlor and to  
8 tetrachloroethylene.

9 DR. TEAF: Yes, sir.

10 CHAIRMAN HAWKENS: The concentration for  
11 heptachlor is 0.00023 for injection into the boulder  
12 zone.

13 DR. TEAF: I think there's actually four  
14 zeros.

15 CHAIRMAN HAWKENS: There are four zeros.  
16 I only said three, I meant to say four.

17 DR. TEAF: Yes.

18 CHAIRMAN HAWKENS: 0.000023. The EPA goal  
19 for that is zero. On the other hand, the EPA maximum  
20 contaminant level for that is significantly higher,  
21 0.0004. Is that correct?

22 DR. TEAF: Yes, sir. It's about 17 times  
23 higher.

24 CHAIRMAN HAWKENS: And it's your testimony  
25 based on the pre-filed material you filed with this

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Board, that we, the determination of whether it will  
2 have an adverse impact on human health and safety  
3 should be determined by the EPA MCL, as opposed to the  
4 MCLG. Is that correct?

5 DR. TEAF: Yes, sir. That's correct.

6 CHAIRMAN HAWKENS: And can you explain why  
7 that is?

8 DR. TEAF: Yes, sir. The MCL is the  
9 standard established under the Safe Drinking Water  
10 Act.

11 It is the number that is used to determine  
12 the safety of distributed water throughout the United  
13 States.

14 Therefore, that number could be present in  
15 drinking water essentially anywhere, whether it's  
16 groundwater in this particular instance, or whether  
17 it's distributed water in a municipal water supply.

18 CHAIRMAN HAWKENS: Mr. Quarles, I'd like  
19 to hear from you on that, please.

20 MR. QUARLES: The MCL includes a number of  
21 factors in the determination in addition to the  
22 health-based standards.

23 It includes feasibility treatment,  
24 economics, that sort of thing. So it's not a purely  
25 health-based standard.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 CHAIRMAN HAWKENS: Yes, I didn't hear the  
2 last statement. I'm sorry.

3 MR. QUARLES: It is not, the MCL is not  
4 solely a health-based standard.

5 CHAIRMAN HAWKENS: That's correct. But  
6 according to the EPA is it nevertheless safe for human  
7 consumption at those levels?

8 MR. QUARLES: The EPA has determined that  
9 it is acceptable as a primary drinking water standard,  
10 including the economics and the technology associated  
11 with being able to treat it.

12 CHAIRMAN HAWKENS: All right. Thank you.  
13 Dr. Teaf and if Dr. Miracle, it's true that both  
14 heptachlor and tetrachloroethylene concentrations in  
15 Table 3.5 are below the EPA MCLs. Is that correct?

16 DR. MIRACLE: Yes, that's correct.

17 DR. TEAF: Yes, sir.

18 CHAIRMAN HAWKENS: And Dr. Miracle, I want  
19 to confirm, is it true that qualified professionals in  
20 the field of toxicology, let me, and let me direct  
21 that to Dr. Teaf.

22 Is it true that qualified professionals in  
23 the field of toxicology would typically use MCLs and  
24 not the MCLGs to assess environmental impacts from  
25 these constituents?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. TEAF: Yes, sir.

2 CHAIRMAN HAWKENS: And do you agree with  
3 Dr. Teaf?

4 DR. MIRACLE: Yes.

5 CHAIRMAN HAWKENS: Do you have any reason  
6 to disagree with them?

7 MR. QUARLES: MCLs are primary drinking  
8 water standards that are typically and primarily used,  
9 but they, the MCLG also can be considered.

10 CHAIRMAN HAWKENS: All right. Let me ask  
11 a question of you, then, Mr. Quarles. The next series  
12 of questions will be directed to you.

13 Since the maximum concentration of  
14 heptachlor here, which is 0.000023, is less than its  
15 MCL, what greater than small health effects do you  
16 think would be associated in this case with  
17 discharging heptachlor into the boulder zone?

18 MR. QUARLES: Well, heptachlor, it does  
19 exceed the MCLG. And heptachlor is, I forget if it's  
20 a possible or a probable human carcinogen at  
21 concentrations that, the EPA said the MCLG, zero is  
22 the safe amount that should be, could be consumed.

23 CHAIRMAN HAWKENS: Thank you. Can you  
24 point to any study in this record where heptachlor in  
25 a concentration, it's listed in Table 3-5 or less is

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 found to have a great than small adverse human health  
2 effect?

3 MR. QUARLES: So I did not do any research  
4 beyond the ATSDR ToxFAQs evaluation of heptachlor.

5 CHAIRMAN HAWKENS: All right. Let's turn  
6 to that then. Then I want to follow up with this  
7 question then.

8 You're not able then to point to any study  
9 where this concentration was associated with any  
10 adverse health effects. Is that correct?

11 MR. QUARLES: That is correct.

12 CHAIRMAN HAWKENS: All right.

13 MR. QUARLES: But assuming that the EPA,  
14 to determine that the MCLG would be zero had done a  
15 thorough evaluation to determine that such risk would  
16 occur.

17 CHAIRMAN HAWKENS: Let's turn again, rely  
18 on the ATSDR ToxFAQ, FAQ document. That's INT-016.  
19 And you testified that heptachlor, "can negatively  
20 affect the immune and nerve systems"?

21 Does that not even say heptachlor can  
22 negatively affect the immune and nerve system in the  
23 concentration at issue here?

24 MR. QUARLES: It does not give a specific  
25 concentration.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1                   CHAIRMAN HAWKENS:  Doesn't that document  
2                   say that little is known about heptachlor's health  
3                   effects in humans, but that at "high levels",  
4                   heptachlor, "may cause damage to your liver and  
5                   nervous system"?

6                   MR. QUARLES:  It does.

7                   CHAIRMAN HAWKENS:  Is it --

8                   MALE:  It's displaying ethylbenzene.  It  
9                   must be --

10                  CHAIRMAN HAWKENS:  Right.  Andy, if you  
11                  could go to page, keep scrolling down on that document  
12                  and you'll come to an, or heptachlor.  There you go.  
13                  Thank you.

14                  Is it your position that heptachlor that's  
15                  listed at the level in Table 3-5 represents a high  
16                  level of heptachlor consistent with this document?

17                  MR. QUARLES:  That document doesn't define  
18                  what a high level is.  I guess the thing that really  
19                  stands out to me is anything that is a potential  
20                  probable human carcinogen would be very concerning to  
21                  me.

22                  CHAIRMAN HAWKENS:  Dr. Teaf, I think I  
23                  remember reading in your testimony that the EPA MCL  
24                  took into effect the potential carcinogenic affect.  
25                  Is that correct?  And if yes, can you please explain

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that?

2 DR. TEAF: It does, Your Honor. And yes  
3 I can explain it. In addition to EPA's consideration  
4 on technical feasibility of the way in which they do  
5 that is that they look at what's called the practical  
6 quantitation limit.

7 It's not quite the MDL, but it's a similar  
8 concept. That is the functional definition of zero,  
9 as far as the analytical chemists can define it for  
10 us.

11 So while that number certainly could go  
12 down over time, that number is clearly a safe value  
13 because it falls in EPA's potential cancer risk range,  
14  $10^{-4}$ ,  $10^{-6}$ , 1 in 10,000 to 1 in 1 million.

15 So heptachlor has been considered not only  
16 on an analytical basis, but also on a risk-based  
17 health basis.

18 CHAIRMAN HAWKENS: Dr. Miracle, do you  
19 have anything to add to Dr. Teaf's testimony?

20 DR. MIRACLE: Only to point out that in  
21 the same document, INT-016, on Page 6, describing  
22 further recommendations to protect human health, it  
23 also lists another, two other agencies.

24 The FDA, the Food and Drug Administration,  
25 and OSHA, Occupational Safety and Health

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Administration, and their limits regarding exposure to  
2 workers from occupational types of activities, and  
3 also for food sources on raw food crops and also  
4 edible seafood. And the concentrations in both of  
5 those cases is larger than the MCL for safe drinking  
6 water.

7 CHAIRMAN HAWKENS: All right. Thank you.

8 DR. TEAF: I meant to say that. I meant  
9 to say that.

10 CHAIRMAN HAWKENS: Mr. Quarles, do you  
11 have any response to that?

12 MR. QUARLES: I would just add that food  
13 crops and edible seafoods, you know, we're talking  
14 about a groundwater exposure in the discussion.

15 CHAIRMAN HAWKENS: Fair enough. In Dr.  
16 Teaf's direct testimony, he cites a study where he  
17 testifies that, "the lowest observed adverse effect  
18 level" for heptachlor occurred in animals at a dose  
19 that's more than 49,000 times greater than the dose  
20 for heptachlor that could occur at the concentration  
21 in Table 3.5. Do you have any reason to disagree with  
22 Dr. Teaf's statement in that regard, Mr. Quarles?

23 MR. QUARLES: I do not.

24 CHAIRMAN HAWKENS: Let's turn now to  
25 tetrachloroethylene. Andy, back to the FPL-064

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 exhibit please, Page 5.

2 Yes, thank you. The concentration table  
3 of 3.5 for tetrachloroethylene is 0.00359, and the MCL  
4 for that is 0.005.

5 But the Florida Department of  
6 Environmental Protection MCL, now, do they call it MCL  
7 in Florida as well, or do they have a different term  
8 for it?

9 DR. TEAF: They use that term.

10 CHAIRMAN HAWKENS: Their level is 0.003.  
11 And there's controversy in the testimony about why if  
12 that's, in fact, an enforceable limit, it shouldn't be  
13 enforced here. Can you address that, Dr. Teaf? And  
14 then we'll hear from Dr. Miracle.

15 DR. TEAF: Yes, sir. I can.  
16 Tetrachloroethylene is, it's also perchloroethylene or  
17 perc, you may, I may slip and call it that, is a  
18 substance that has a great deal of regulatory  
19 interest.

20 It's present in groundwater and soils in  
21 a great number of contaminated sites, and so therefore  
22 it's been the subject of attention by EPA, by DEP, by  
23 most state agencies, by the Agency for Toxic  
24 Substances and Disease Registry.

25 So it has heard its toxicology reviewed

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 over and over and over again. In 2012, the USEPA  
2 released a new metric that is used to evaluate cancer  
3 risk called the cancer slope factor.

4 That cancer slope factor released in 2012  
5 was about 25 times greater, less restrictive than,  
6 less restrictive than the value that was available in  
7 the mid-1980s when the original MCLs were established  
8 within Florida and at the federal level.

9 If one uses that new slope factor, both  
10 the cancer risk at the MCL at the federal level and  
11 the MCL at the state level are both well below  $10^{-6}$ ,  
12 1 in a million cancer risk, which is the, considered  
13 to be the de minimis cancer risk.

14 So to the extent that EPA or DEP are ever  
15 going to review and recalculate their MCLs, changing  
16 only that single value, which is now co-defined in  
17 EPA's regulations, you would yield numbers  
18 considerable greater than 3, 0.003 or 0.0005.

19 My point is not to say that they should or  
20 might or would change their MCLs. Agencies tend to do  
21 that only with great thought.

22 My point is that the new EPA drinking  
23 water, tap water criteria that's been released  
24 probably within the last year or 18 months, is 11  
25 micrograms failure, 0.011 milligrams per liter.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 CHAIRMAN HAWKENS: And that's the  
2 recommended? That's not, they're recommending that to  
3 be the MCL or what are they recommending?

4 DR. TEAF: It is the tap water level for  
5 comparison with groundwater and drinking water  
6 concentrations. It doesn't change the MCL. You're  
7 absolutely correct.

8 But my experience with regulatory agencies  
9 is, if the new number is higher than the old number,  
10 then you keep the old number in case.

11 But it doesn't mean that a number slightly  
12 greater than 3 is dangerous. And that's particularly  
13 true in the case of perchloroethylene or  
14 tetrachloroethylene because of this new official  
15 change about five years ago on the part of EPA.

16 So I have no concern with, whatsoever,  
17 with respect to potential human health risk here at  
18 all.

19 CHAIRMAN HAWKENS: Dr. Miracle?

20 DR. MIRACLE: In the FEIS and Table 3-5,  
21 we considered only the federal MCLs when we came to  
22 our conclusions regarding these levels or the  
23 concentrations in Table 3-5 as being protective of  
24 human health.

25 However, I'd also like to point out that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the south district wastewater treatment plant did add  
2 an additional technology including high level  
3 disinfection.

4 At a year's worth of sampling, at least  
5 four different sampling times were then included in  
6 Table 3-5 as a footnote, but it's still included in  
7 Table 3-5. And for all four of the constituents, were  
8 not detected.

9 CHAIRMAN HAWKENS: Do either of you know  
10 whether the state of Florida has signed off on this  
11 well as this injection level of tetrachloroethylene,  
12 what can be inferred from that?

13 And another way of asking that question  
14 is, does the state of Florida perhaps recognize that  
15 its state MCL is more conservative than it need be?

16 This is, again, based on your experience.  
17 And I'm just wondering if there's answer and whether  
18 you can provide an answer.

19 DR. TEAF: I think my, well, no, I don't  
20 think. My answer is that the state of Florida would  
21 go through, perhaps not quite the process we're going  
22 through here, but a similar one in which they would  
23 look at all the kinds of considerations you're looking  
24 at.

25 Fate in transport, injection

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 concentration, injection volumes, well construction,  
2 hydro-geology and all those things.

3 I literally cannot imagine, based on my 35  
4 years of experience, that the state of Florida would  
5 say that you can't inject water, which is 19 percent  
6 above the state drinking water standard, 3,000 feet  
7 down into the water zone under the assumption that it  
8 could magically make its way to a drinking water  
9 source at the surface, even understanding that that  
10 drinking water source is too saline to use as it is,  
11 and would have to undergo further treatment beyond  
12 that. Those are the kinds of safeguards they would be  
13 looking for.

14 CHAIRMAN HAWKENS: All right. Thank you.  
15 Anything to add?

16 DR. MIRACLE: I want, I was going to add,  
17 I think our next panel, Panel 5 will probably be  
18 discussing that in a little bit more detail.

19 CHAIRMAN HAWKENS: Yes they will. Mr.  
20 Quarles, do you have any response to what's been said  
21 to the Board?

22 MR. QUARLES: I do. So, let me give you  
23 a little bit of background. Dr. Teaf mentioned the  
24 expression, it has no concerns about injecting  
25 wastewater that might exceed the Florida MCL,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 tetrachloroethylene.

2           Let me give you a little background of why  
3 I have a conservative view of being protective. Back  
4 in 2001, I was asked by a consulting firm, which is  
5 EPA Region IV star coordinator in the state of  
6 Tennessee to review a rumored cluster of birth defects  
7 in a small town west of Nashville that was rumored be  
8 related to ingestion of trichloroethylene, which is a  
9 solvent very similar in nature to perchloroethylene.

10           So it was believed that, according to CDC  
11 and some other researchers, that a one-time ingestion  
12 of trichloroethylene during the first trimester of  
13 pregnancy could cause a cleft palate, cleft lip.

14           And there's a cluster that occurred and  
15 was suspected to have been related to a one-time  
16 ingestion.

17           And so you have a landfill that had known  
18 industrial waste in it. You had a municipal well that  
19 was located adjacent, a municipal potable drinking  
20 water well that was located adjacent to the landfill.

21           Then you have a wastewater, a water  
22 treatment plant that was taking water from surface  
23 waters in addition to ground water for distribution to  
24 a potable water system that went to an entire, most of  
25 the entire county.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           So everybody's following the rules, and  
2           that particular drinking water plant was required to  
3           test for volatile organic compounds to meet their  
4           permit once a year.

5           And so they had been following the  
6           calendar year to do that because they had never  
7           detected TCE in their potable water supply.

8           And around Christmastime, they sampled it  
9           as a formality, and recognizing it's a finished water  
10          that's already in the distribution system.

11          And so lo and behold, they had a detection  
12          of trichloroethylene, just slightly below the federal  
13          MCL, and that really surprised --

14          CHAIRMAN HAWKENS:     I'm sorry.     What  
15          contaminant?

16          MR. QUARLES:     It was trichloroethylene.

17          CHAIRMAN HAWKENS:     Okay.

18          MR. QUARLES:     Which is very similar to  
19          tetrachloroethylene. And in fact, tetrachloroethylene  
20          degrades to, under certain degradation conditions,  
21          into trichloroethylene, which degrades into vinyl  
22          chloride, which is, has an even lower MCL than both  
23          tetrachloroethylene and trichloroethylene.

24          I guess the lesson learned there is that  
25          even when you follow the rules, somebody can get hurt.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 And in this case, nobody expected a volatile organic  
2 compound to be in a potable drinking water system that  
3 was distributed to, you know, tens of thousands of  
4 people.

5 And so, you know, to say that you have no  
6 concerns about an injection of a, of a constituent  
7 that exceeds the Florida DEP MCL, I would not agree  
8 with that. And the MCL --

9 CHAIRMAN HAWKENS: May I interrupt. I  
10 would agree with that also, and I think Dr. Teaf would  
11 agree with you.

12 If that was said outside the context, I  
13 think what he was saying, he had objection here where  
14 it had exceed the Florida MCL, but was in fact was  
15 below the federal EPA MCL. So I think it's important  
16 to keep that in mind.

17 MR. QUARLES: Oh, okay. Right, right. So  
18 in this case, what usually happens, what does happen  
19 is states have the opportunity to set a primary  
20 drinking water standard equal to or more stringent  
21 than the federal standard, and they take into  
22 consideration state-specific conditions.

23 And I would not doubt, I've not read, you  
24 know, in the background of why the EPA decided to  
25 choose a lower standard, but perhaps it's related to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the reliance upon drinking water, groundwater for  
2 drinking water.

3 With filtration and disinfection being  
4 really the only sort of treatment that is most typical  
5 for potable water supply in Florida.

6 So just the prevalence of reliance of  
7 groundwater to drinking water standard, perhaps could  
8 explain that more stringent position.

9 So thank you for listening to that long  
10 explanation, but I tend to take things a little bit  
11 more seriously and conservative because I was a guy,  
12 for example, at that case, that got calls from the  
13 mothers who had these children who had birth defects  
14 who had to live with the guilt that perhaps they had  
15 done something to cause their child to be, to have a  
16 cleft palate, cleft lip, when in fact it could've been  
17 as simple as drinking water from the tap that exceeded  
18 the standard.

19 CHAIRMAN HAWKENS: All right. I'm going  
20 to, one second, please.

21 (Off the record comments.)

22 DR. BURNETT: Dr. Teaf, you mentioned that  
23 much of the Upper Floridan aquifer is brackish and to  
24 be used as a drinking water source, desalination is  
25 required.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           And you implied that during that process,  
2           which would be, I assume, reverse osmosis, that the  
3           four constituents, if present, would be removed at  
4           that step.

5           Has that ever been looked at? Do we know  
6           if reverse osmosis can remove these volatile  
7           components?

8           DR. TEAF: I didn't mean to be that  
9           specific. Let me, let me say that it's certainly true  
10          that in that instance, for reverse osmosis and/or  
11          manifolding with water from the Biscayne aquifer can  
12          occur.

13          I'm not specifically familiar with the  
14          effectiveness of removal of these chlorinates by  
15          reverse osmosis.

16          But what are certain to be single digit or  
17          fractional microgram per liter concentrations, there's  
18          virtually no dilution required at all to meet drinking  
19          water standards.

20          DR. BURNETT: Thank you.

21          DR. TEAF: Yes, sir. Could I make a  
22          comment, sir? It's just in response to Mr. Quarles.

23          CHAIRMAN HAWKENS: Yes, please.

24          DR. TEAF: I'm familiar with the situation  
25          that he described, and I think to put a sort of a

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 period at the end of the sentence, the Center for  
2 Disease Control did not conclude that there was a  
3 relationship between the groundwater contamination and  
4 the cleft palates in that instance. So it's a sad  
5 story. It's a terrible story. It's simply not  
6 relevant.

7 CHAIRMAN HAWKENS: All right. Thank you.  
8 I think Mr. Quarles looks like he has a response.

9 MR. QUARLES: I do. In fact, one of the  
10 great mistakes was made by the CDC in that they  
11 concluded that the potable drinking water well was not  
12 used and could not have been related to the TSE in the  
13 groundwater because it was not distributed, it was not  
14 used and it was not distributed to the entire country.

15 And in fact, kind of made the argument  
16 that there were other water utility districts who  
17 people, where they live, where they work, you know,  
18 have these birth defects.

19 So therefore, there couldn't have been a  
20 cause and effect, when in fact, this potable supply  
21 well was used, that finished water was sold to other  
22 utility districts.

23 So there is some commonality between the  
24 TSE and the distribution of water. So the CDC made a  
25 real grave mistake in their evaluation of the facts of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the case.

2 CHAIRMAN HAWKENS: Thank you. It's  
3 interesting anecdotal information. It's not here to  
4 be how relevant or how material, if it is relevant to  
5 this case it is, but thank you for bringing it to our  
6 attention. And Dr. Teaf, thank you for clarifying it  
7 as well.

8 At this point, if you'll remember, and I  
9 mentioned this morning, the city of the Homestead  
10 likes to shut down at 5:00, and if we're going to do  
11 that, I'd like to make sure everybody has time to pick  
12 up and exit the facility so we don't wear out our  
13 welcome.

14 So I would suggest we adjourn for today  
15 and I think we can start early tomorrow. If we have  
16 probably another half an hour on this topic, and then  
17 we'll have the final topic to be followed then by  
18 providing lists of additional questions if Counsel  
19 have any, and then closing statements.

20 I would suggest we start no later than  
21 9:00. We could start earlier if Counsel are amenable.  
22 Let me start with Ms. Curran.

23 MS. CURRAN: 9:00 will work fine for us.  
24 Thank you.

25 CHAIRMAN HAWKENS: Mr. Lepre, is 9:00 good

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 for you?

2 MR. LEPRE: 9:00 is fine. Earlier is fine  
3 as well.

4 CHAIRMAN HAWKENS: All right.

5 MS. WRIGHT: Yes, 9:00 works. I also have  
6 a question. Does the Board have any idea how long  
7 Panel 5 questioning may take? NRC staff witnesses  
8 have travel arrangements that may need to be changed.

9 CHAIRMAN HAWKENS: I'd say, I'd say at  
10 least an hour.

11 (Off the record comments.)

12 CHAIRMAN HAWKENS: We contemplate an hour  
13 and a half max for Panel 5.

14 MS. WRIGHT: Okay, thank you.

15 CHAIRMAN HAWKENS: Okay. In fact, we'll  
16 make sure it does not exceed an hour and a half.

17 MS. WRIGHT: Thank you very much.

18 CHAIRMAN HAWKENS: We will adjourn. As we  
19 mentioned earlier, if you wish, you may leave material  
20 here.

21 It will be locked, but the city cannot  
22 take responsibility for anything that's left behind.  
23 We are adjourned. Thank you.

24 (Whereupon, the above-entitled matter went  
25 off the record at 4:44 p.m.)

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701