PMTurkeyCOLPEm Resource

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Sent: Wednesday, July 06, 2016 11:22 AM
To: Comar, Manny
Cc: TurkeyCOL Resource; Maher, William; Orthen, Richard
Subject: [External_Sender] UIC program
Attachments: NRC FPL Meeting 14FEB13 final.pdf

Manny
As discussed. UIC info starts on slide number 18. This presentation is from a public meeting we held with the staff on 2/14/2013.
Thanks
Steve Franzone
NNP Licensing Manager - COLA
“A little more persistence, a little more effort, and what seemed hopeless failure may turn to glorious success.” ~ Elbert Hubbard
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NRC/FPL Public Meeting Regarding Radioactive Effluent Disposal Practices

Bill Maher

Senior Licensing Director

February 14, 2013

Agenda

- Opening Remarks
- Regulatory Analysis
- Discussion of Draft RAIs
- UIC Program
- Conclusion/Document Actions

Agenda

- Opening Remarks
- **Regulatory Analysis**
- Discussion of Draft RAIs
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Regulatory Framework

- Consistent with 10 CFR 20.2001, FPL proposes to release licensed material in liquid effluents, within section 20.1301 limits, through deep well injection
- Although human exposure from normal deep well injection operations is not reasonable, FSAR Sec. 11.2 and ER Sec. 5.4 assumed an off-normal operations scenario to assign a potential receptor dose
- If 10 CFR 20.2002 were to apply, sufficient information is provided in the COL Application to meet its requirements
- In sum, whether under 20.2001 or 20.2002, FPL has demonstrated that the disposal method meets the dose limits of Part 20

10 CFR 20.2002 Requirements and Information Provided in the COL Application which Addresses Each Requirement

10 CFR 20.2002 Requirements	Information Provided in FSAR/ER Sections
(a) A description of the waste containing licensed material to be disposed of, including the physical and chemical properties important to risk evaluation, and the proposed manner and conditions of waste disposal; and	(a) FSAR Sections: 11.2.1, and 11.2.3.5; ER Sections: 3.5.1, 3.9.1, and 10.2.1
(b) An analysis and evaluation of pertinent information on the nature of the environment; and	(b) FSAR Sections: 2.4.12, and 2.5.1; ER Sections: 2.3.1, Table 10.1-2
(c) The nature and location of other potentially affected licensed and unlicensed facilities; and	(c) ER Sections: 10.2.1.2, and Tables 10.1-1 and 10.1-2
(d) Analyses and procedures to ensure that doses are maintained ALARA and within the dose limits in this part.	(d) FSAR Sections: 11.2.3.5 ER Sections: 5.4.1.1, and 5.11

Agenda

- Opening Remarks
- Regulatory Analysis
- **Discussion of Draft RAIs**
- UIC Program
- Conclusion/Document Actions

A summary of each draft request for additional information (RAI) is provided below relating to COLA Section 11.2.3.5 & SRP Sec. 11.02, Liquid Waste Management System

Liquid Waste Management System, SRP Sec. 11.02

1. The applicant is requested to consider radiological impacts of the disposal method should radioactivity be brought up to the surface by

   (1) drilling activities undertaken at a location beyond the control of the applicant (licensee),

   (2) failure of a well casing or packing that could contaminate the Upper Floridan Aquifer, and

   (3) upward migration of the injectate from the Boulder Zone into the base of the Upper Floridan Aquifer.

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Liquid Waste Management System, SRP Sec. 11.02

2. The applicant is requested to address the following exposure scenarios and pathways in bracketing the range of events and doses to members of the public that could result if exposed to the injectate:

- A drilling scenario near the plant site involving contaminated drilling mud and cuttings being brought to the surface and exposing workers during drilling activities and nearby members of the public.
- The failure of injection well packings and joints after closure and abandonment, with the assumption that the failed wells become conduits connecting the radioactive plume within the Boulder Zone to the Upper Floridan aquifer from which water would be used at the surface. The applicant should present a detailed analysis of potential exposure pathways and doses from this scenario and describe all supporting assumptions. The applicant should discuss the effects and expiration of institutional controls, if any, on deep well injection activities and use of the land and groundwater in the vicinity of the plant site.
- A U-tube scenario where offsite well drilling activities and differential pressures associated with injection would result in the radioactive plume, within the Boulder Zone, being hydraulically pushed into the Upper Floridan aquifer. The analysis should consider the potential migration of fluids and radioactivity through off-site wells or formation/fissures, and well penetrations to USDW as well as natural migration into overlying aquifers.
- Alternatively, the applicant could develop a single bounding scenario

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Liquid Waste Management System, SRP Sec. 11.02

3. Consider the cumulative inventories of long-lived radionuclides expected to be present after 40 years of operations for both reactor units. The applicant should present a detailed analysis, identify long-lived radionuclides of importance to dose modeling, describe the physical and chemical properties important to the dose assessment, and describe the expected behavior of each radionuclide in the Boulder Zone based, in part, on their deposition and adsorption characteristics. The analysis should provide radionuclide specific estimates of their concentrations in and around the injection point and in radial directions of the plume within the Boulder Zone after 40 years of plant operation. The source term should consider whether the injectate results in a plume (depending on the use of reclaimed municipal waste water or seawater) that is buoyant or readily miscible within the 200-foot thick Boulder Zone formation brine.

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Liquid Waste Management System, SRP Sec. 11.02

4. The applicant is requested to indicate if in modeling the movement of radioactivity in the Boulder Zone, the evaluation considered the application of retardation factors, and, if so, describe how Kd values were modified and assigned to radionuclides. The applicant is requested to indicate whether the presence of residual concentrations of organic compounds in reclaimed municipal waste water were considered in developing distribution coefficients and retardation factors.

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Liquid Waste Management System, SRP Sec. 11.02

5. The applicant is requested to address (1) a rise in pressure given the combined operation of multiple wells, and (2) potential fractures and formation of hydraulic connections, followed by upwelling into the above confining units. Describe design features of well casings and joints, and measures that will be implemented in ensuring the mechanical integrity of the injection and monitoring wells over their operational lives. Describe plant operations and procedures should any upwelling or failures of the injection system be noted, and whether interim provisions will be made to use backup systems in disposing or storing of radioactive liquid effluents. Describe well abandonment procedures, if needed during the lifetime of the license, including steps to confirm the mechanical condition of the wells, and methods and materials that would be used to plug and seal wells.

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A summary of each draft request for additional information (RAI) is provided below relating to COLA Section 11.2.3.5 & SRP Sec. 11.02, Liquid Waste Management System

Liquid Waste Management System, SRP Sec. 11.02

6. A review of ER, Rev. 3, Section 5.2.3.2.4 indicates that the stated flow rates are 12,500 gpm and 58,000 gpm, which are consistent with ER Rev. 3, Table 3.3-1 under normal and maximum cases. However, ER [FSAR] Rev. 3, Section 2.4.12.2.1.3 refers to peak and operational injection rates, with a stated 14,000 gpm for reclaimed water and 62,500 gpm for seawater as implied normal operational flow rates.

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A summary of each draft request for additional information (RAI) is provided below relating to COLA Section 11.2.3.5 & SRP Sec. 11.02, Liquid Waste Management System

Liquid Waste Management System, SRP Sec. 11.02

7. Describe in the appropriate FSAR section deep well injection rates under different plant conditions, procedural controls for the disposal of liquid effluents whenever the plant is in an outage mode, sources of dilution flow rates in this operating status, and expected dilution flow rates.

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A summary of each draft request for additional information (RAI) is provided below relating to COLA Section 11.2.3.5 & SRP Sec. 11.02, Liquid Waste Management System

Liquid Waste Management System, SRP Sec. 11.02

8. Applicant is requested to assess the likelihood of injection equipment failure, such as injection pipe damaged by a moving vehicle, valve failures, over pressurization, blowout of seals, joint failures, and operator errors. This evaluation would consider radiation exposures and doses to plant workers and accidental spill of the injectate on the site and runoff to unrestricted areas via the site's surface water drainage system. These analyses should consider the specific design features of the deep well injection system, its location on the property, and engineered and administrative controls used in terminating the injection flow or diverting it to other injection wells.

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A summary of each draft request for additional information (RAI) is provided below relating to COLA Section 11.2.3.5 & SRP Sec. 11.02, Liquid Waste Management System

Liquid Waste Management System, SRP Sec. 11.02

9. The applicant should identify specific conditions of FLDEP permit and discuss the extent to which such provisions would also address NRC requirements and guidance for routine operational inspections, periodic testing in confirming the mechanical integrity of injection and monitoring wells, and describe system components and their design features that will be used to reduce leakage before pumping into the injection wells and avoid uncontrolled and unmonitored releases of liquid effluents to the environment. Relevant NRC guidance is presented in IE Bulletin 80-10, "Contamination of Nonradioactive System and Resulting Potential for Unmonitored, Uncontrolled Release to Environment," Regulatory Guide (RG) 4.21 "Minimization of Contamination and Radioactive Waste Generation: Life Cycle Planning," and Nuclear Energy Institute (NEI) Topical Report (TP) 08-08A "Generic FSAR Template Guidance for Life Cycle Minimization of Contamination."

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A summary of each draft request for additional information (RAI) is provided below relating to COLA Section 11.2.3.5 & SRP Sec. 11.02, Liquid Waste Management System

Liquid Waste Management System, SRP Sec. 11.02

10. With respect to environmental radiological monitoring, the applicant is requested to describe sampling locations and elevations above the Boulder Zone, sampling frequency, and analytical program in detecting the presence of long-lived and environmentally mobile radionuclides. The applicant should identify specific conditions of FLDEP permit on environmental monitoring and discuss the extent to which such provisions would also address NRC requirements of the radiological environmental monitoring program (REMP). The environmental radiological monitoring program should also acknowledge, given the information presented in ER[FSAR] Rev. 3, Section 2.4.12.2.1.2, that the sampling and analysis program will include the evaluation of water samples from Upper Floridan aquifer production wells that are used to supply cooling and process water for the operation of FPL Units 1, 2 and 5.

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A summary of each draft request for additional information (RAI) is provided below relating to COLA Section 11.2.3.5 & SRP Sec. 11.02, Liquid Waste Management System

Liquid Waste Management System, SRP Sec. 11.02

11. As part of the REMP, the applicant should also address the presence of naturally occurring radioactivity in the Upper and Lower Floridan aquifers. For example, a December 1996 article published in the Florida Water Resources Journal notes that gross alpha activity concentrations of 90 and 375 pCi/L were noted in the Upper and Lower Floridan aquifers, respectively. These concentrations are associated with the presence of U, Ra and Th and their respective decay products. The applicant should include in its operational monitoring program the means to assess the variability of the concentrations of naturally occurring radioactivity over an appropriate time period. A baseline should be established before the operation of injection and monitoring wells since the presence of alpha radioactivity in environmental samples could be erroneously attributed to fuel failure.

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Agenda

- Opening Remarks
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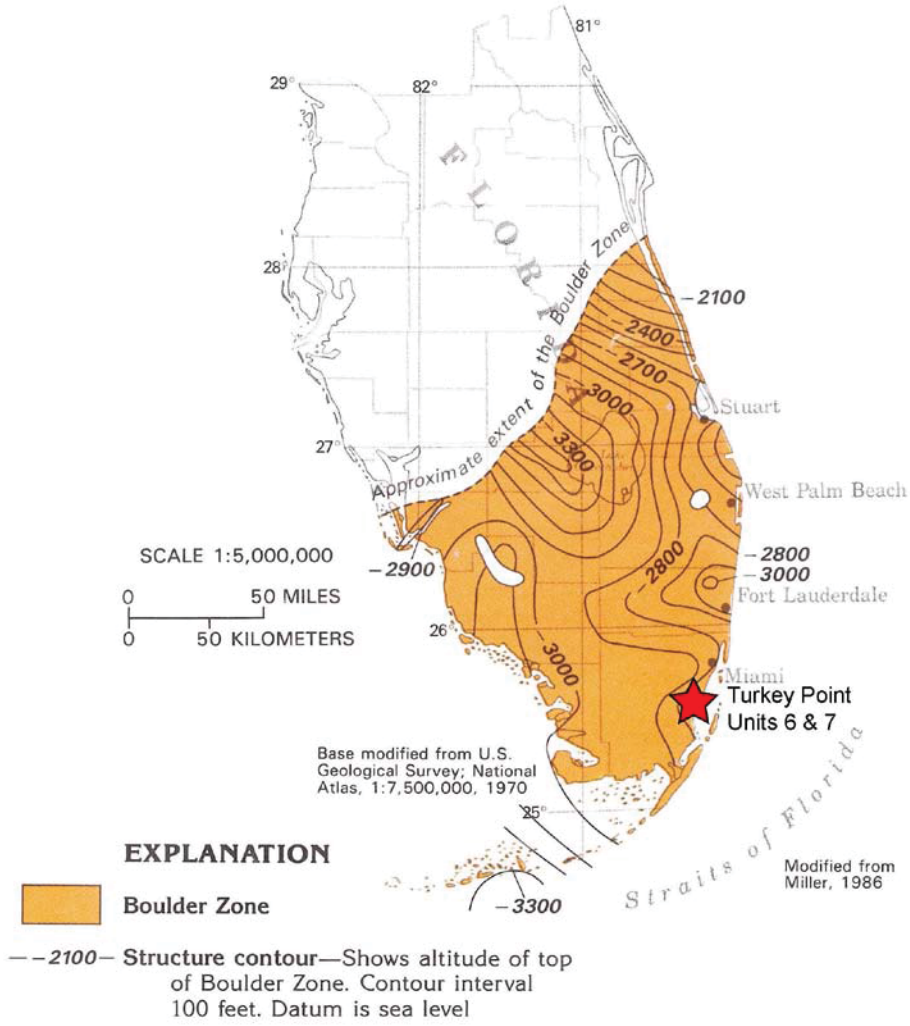
- **UIC Program**
- Conclusion/Document Actions

Related Hydrology – Boulder Zone

- **Geology**
  - Highly transmissive zone of limestones and dolomites found in the lower Oldsmar Limestone in the Lower Floridan aquifer in southeastern Florida
  - Consists mostly of massively bedded dolostones within which secondary permeability has been extensively developed
  - Occurs at a depth of about 3,000 ft near site
- **Transmissivity**
  - 3,200,000 to 24,600,000 ft^2/d
- **Water quality**
  - Geochemically similar to seawater (37,000 mg/L TDS)
- **Current Uses by Permittees**
  - Wastewater disposal by deep well injection
  - Oil field brines, municipal and industrial wastewater



Slide taken from FPL to NRC Orientation Session presentation on July 28, 2009 & updated

Turkey Point Units 6 & 7 – Underground Injection Control

History of Underground Injection in Florida

- **1943 – First injection into the Floridan Aquifer took place**
  - Oil Field Brine
- **1959 – First injection of municipal effluent into the Upper Floridan Aquifer**
- **1966 – First injection of non-oil field related industrial wastewater into the Lower Floridan Aquifer (Boulder Zone)**
- **1970s – Injection into Upper Floridan ceases and is replaced by injection into the Boulder Zone**
- **1983 - Florida is granted primacy of the State's UIC Program**
- **Today there are approximately 180 active Class I injection wells in Florida**

Slide taken from FPL to NRC Hydrology Audit presentation on March 22, 2010 & updated

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Turkey Point Units 6 & 7 – Underground Injection Control

Class I Wells

- **Class I - industrial and municipal disposal wells which inject fluids beneath the lowermost unit containing an underground source of drinking water (USDW)**
  - Class I Municipal – disposes of treated domestic wastewater
  - Class I Industrial – disposes of non-hazardous industrial wastewater
- **Most dispose of treated municipal effluent**
- **Many dispose of reverse osmosis (RO) concentrate or a combination of treated wastewater and RO concentrate**
- **Power Plant industrial wastewater – primarily cooling tower blowdown**

Slide taken from FPL to NRC Hydrology Audit presentation on March 22, 2010 & updated

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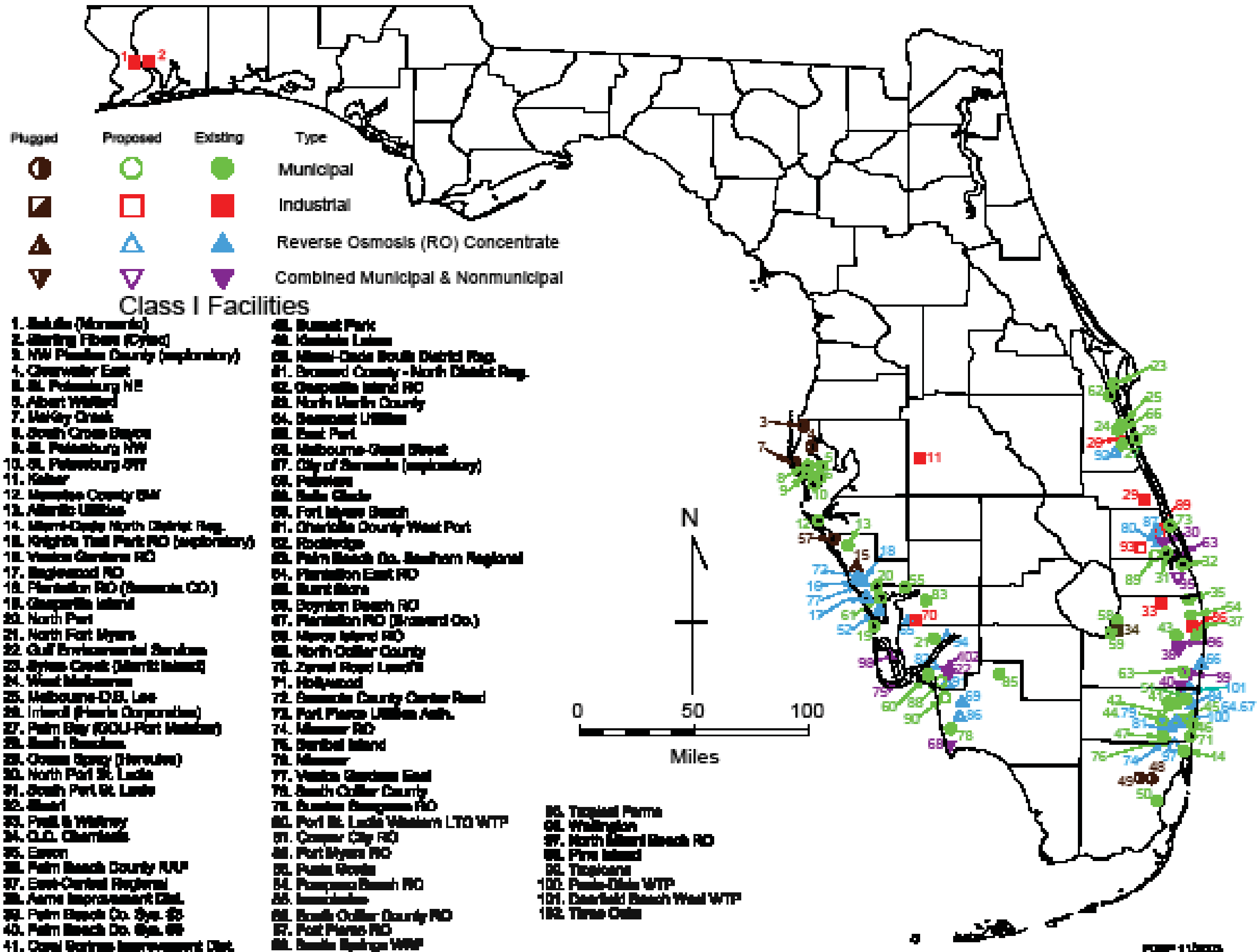
CLASS I INJECTION FACILITIES



Class I Facilities

1. Solutia (Monsanto)
2. Sterling Fibers (Cytec)
3. NW Pinellas County (exploratory)
4. Clearwater East
5. St. Petersburg NE
6. Albert Whitted
7. McKay Creek
8. South Cross Bayou
9. St. Petersburg NW
10. St. Petersburg SW
11. Kaiser
12. Manatee County SW
13. Atlantic Utilities
14. Miami-Dade North District Reg.
15. Knights Trail Park RO (exploratory)
16. Venice Gardens RO
17. Englewood RO
18. Plantation RO (Sarasota CO.)
19. Gasparilla Island
20. North Port
21. North Fort Myers
22. Gulf Environmental Services
23. Sykes Creek (Merritt Island)
24. West Melbourne
25. Melbourne-D.B. Lee
26. Intersil (Harris Corporation)
27. Palm Bay (GDU-Port Malabar)
28. South Beaches
29. Ocean Spray (Hercules)
30. North Port St. Lucie
31. South Port St. Lucie
32. Stuart
33. Pratt & Whitney
34. O.O. Chemicals
35. Exxon
36. Palm Beach County NAP
37. East-Central Regional
38. Acme Improvement Dist.
39. Palm Beach Co. Sys. #9
40. Palm Beach Co. Sys. #8
41. Coral Springs Improvement Dist.
42. Margate
43. Royal Palm Beach
44. Sunrise
45. Plantation Utilities
46. G.T. Lohmeyer
47. Pembroke Pines (Century Village)
48. Sunset Park
49. Kendale Lakes
50. Miami-Dade South District Reg.
51. Broward County - North District Reg.
52. Gasparilla Island RO
53. North Martin County
54. Seacoast Utilities
55. East Port
56. Melbourne-Grant Street
57. City of Sarasota (exploratory)
58. Pahokee
59. Belle Glade
60. Fort Myers Beach
61. Charlotte County West Port
62. Rockledge
63. Palm Beach Co. Southern Regional
64. Plantation East RO
65. Burnt Store
66. Boynton Beach RO
67. Plantation RO (Broward Co.)
68. Marco Island RO
69. North Collier County
70. Zemel Road Landfill
71. Hollywood
72. Sarasota County Center Road
73. Fort Pierce Utilities Auth.
74. Miramar RO
75. Sanibel Island
76. Miramar
77. Venice Gardens East
78. South Collier County
79. Sunrise Sawgrass RO
80. Port St. Lucie Western LTO WTP
81. Cooper City RO
82. Fort Myers RO
83. Punta Gorda
84. Pompano Beach RO
85. Immokalee
86. South Collier County RO
87. Fort Pierce RO
88. Bonita Springs WWF
89. Port St. Lucie Westport
90. North Collier County WWF
91. Bonita Springs RO
92. Palm Bay RO
93. CPV Cana Power Plant
94. North Lee County WTP
95. Tropical Farms
96. Wellington
97. North Miami Beach RO
98. Pine Island
99. Tropicana
100. Peele-Dixie WTP
101. Deerfield Beach West WTP
102. Three Oaks

Turkey Point Units 6 & 7 – Underground Injection Control

Class I Injection Technology

- **Inject into the Boulder Zone in the Lower Floridan Aquifer**
- **Thick confining beds separate the Boulder Zone from the Underground Source of Drinking Water (USDW)**
  - USDW is an aquifer that supplies drinking water for human consumption; classified as F-1, G-1, or G-II groundwater by FDEP rules; or which contains a total dissolved solids concentration of less than 10,000 mg/L; and which is not an exempted aquifer.
- **Confinement of low permeability limestone and dolomite is confirmed at the Turkey Point site**
  - 985-foot thick confining layer
  - Vertical hydraulic conductivity 10^{-4} to 10^{-6} cm/sec

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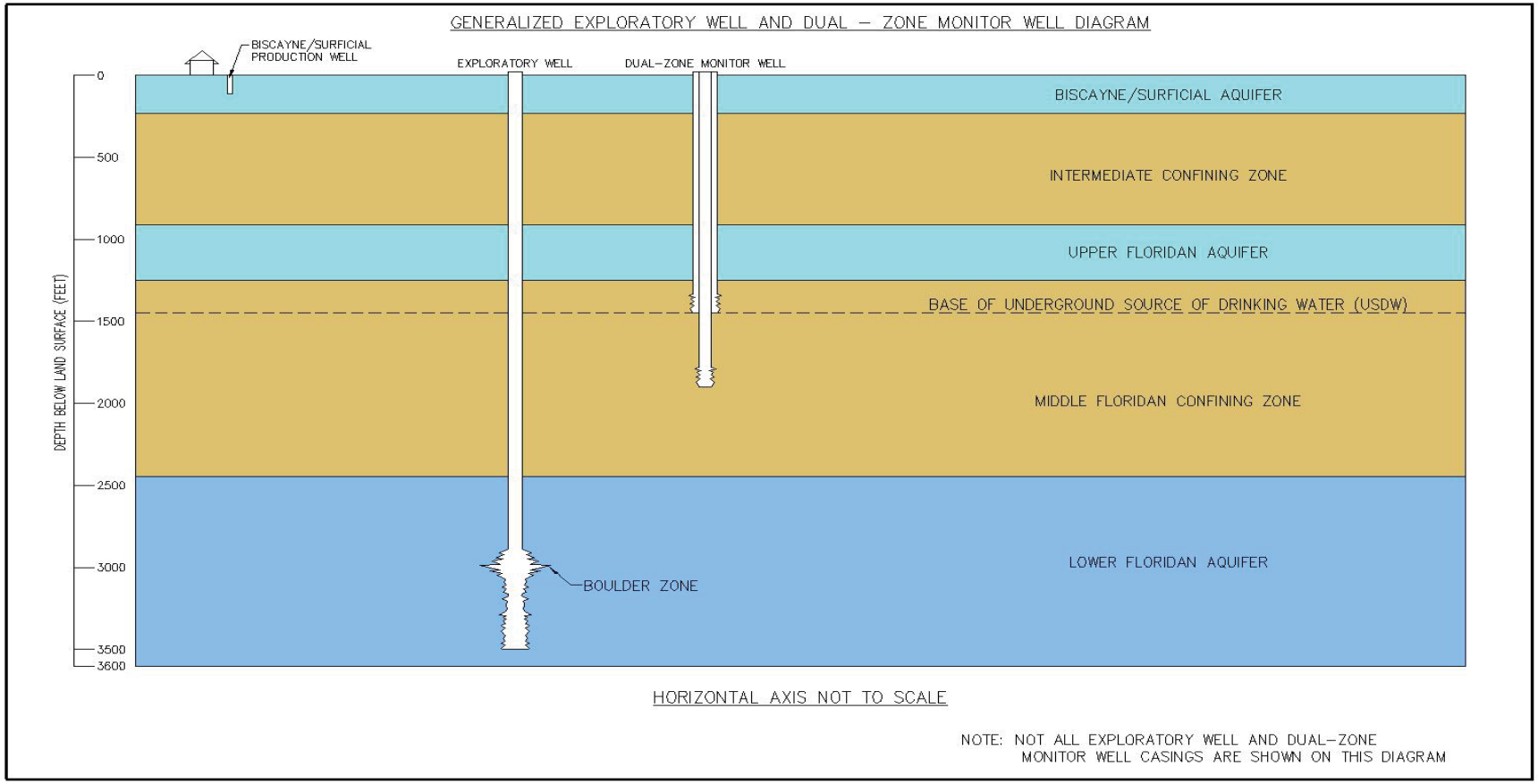
Turkey Point Units 6 & 7 – Underground Injection Control



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Turkey Point Units 6 & 7 – Underground Injection Control

Florida's UIC Permitting Process

- **The Florida Department of Environmental Protection (FDEP) administers the UIC Program in Florida**
- **Chapter 62-528, Florida Administrative Code**
- **Technical Advisory Committee (TAC)**
  - District and Tallahassee FDEP offices, USGS, Water Management District, local Health Department, and USEPA

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Turkey Point Units 6 & 7 – Underground Injection Control

Florida's UIC Permitting Process – cont.

- **Exploratory Well Construction Permit Application**
  - Request to conduct a detailed evaluation of the site hydrogeology (including extent of confining layer) and suitability of site geology for underground injection
- **Exploratory Well Construction Permit**
- **Class I Construction Permit**
  - Conversion of exploratory well to a Class I injection well
  - Short-term injection test
  - Operational testing – 6 to 24 months of test operation with increased monitoring requirements
  - Permit duration is 5 years
- **Operating Permit**
  - Allows operation of the Class I injection well system
  - Must be renewed every 5 years

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Turkey Point Units 6 & 7 – Underground Injection Control

Injection Well Design

- **Multiple concentric casings**
  - 54-, 44-, 34-, and 24-inch diameter steel fully cemented casings
  - 0.375-inch wall thickness except final casing is seamless 0.5-inch
  - 34-inch and 24-inch diameters casings set below base of USDW
- **Fiberglass Reinforced Pipe (FRP) injection tubing**
  - Protects final casing from corrosion
  - Packer at base of FRP isolates FRP-casing annulus
  - Annulus filled with corrosion inhibitor
- **10-inch overdrill on final casing to allow 5-inch cement thickness around casing**

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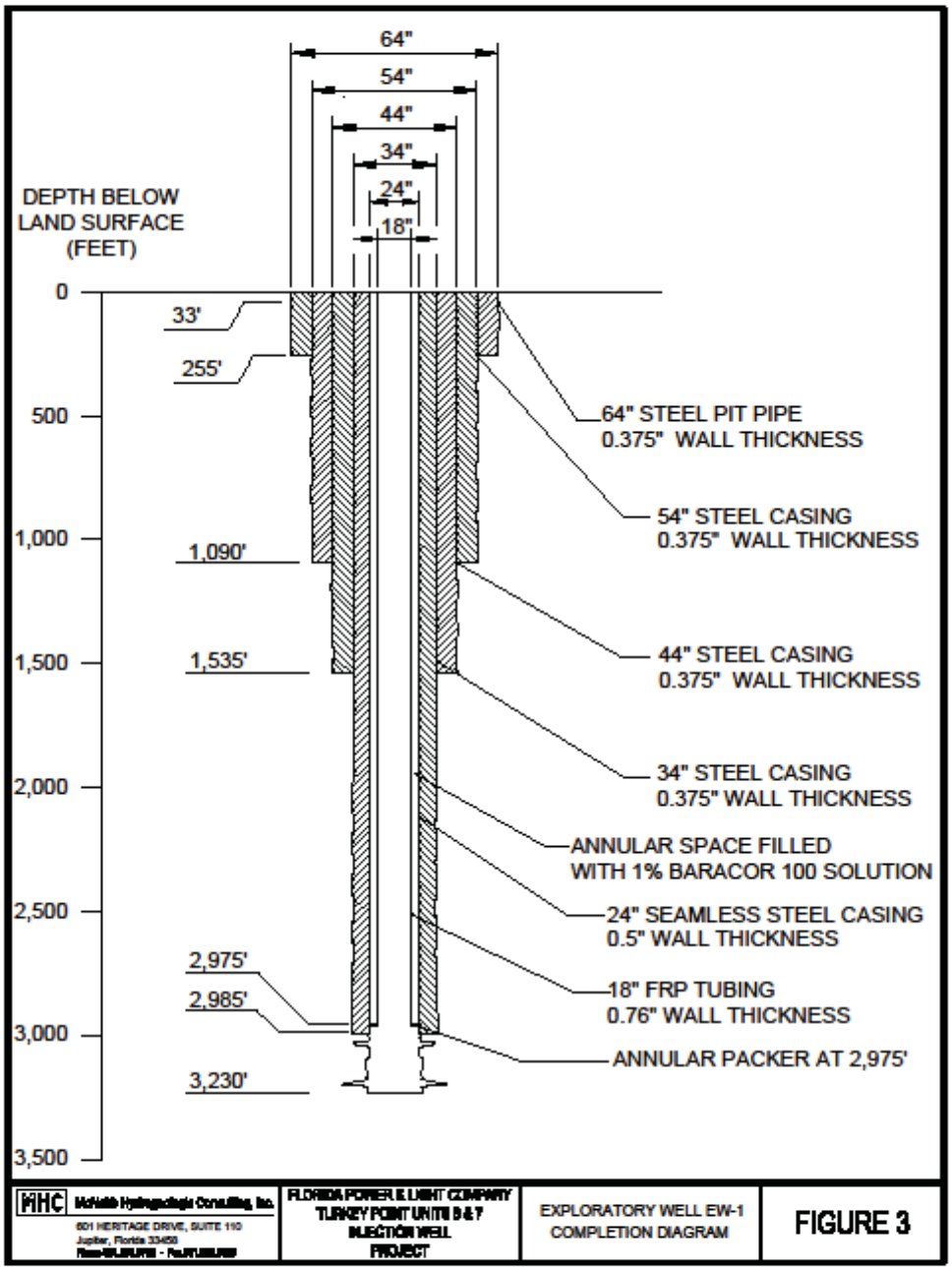

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Turkey Point Units 6 & 7 – Underground Injection Control

Dual-Zone Monitor Well Design

- **Multiple concentric casings**
  - 34-, 24-, 16-, and 6.625-inch diameter casings
  - 16-inch diameter casing is 0.5-inch wall thickness steel, 34- and 24-inch diameter casings are 0.375-inch wall thickness steel
  - 6.625-inch diameter casing is FRP to provide corrosion protection
- **Monitors two separate zones**
  - Upper zone monitors just above or at the base of the USDW
  - Lower zone monitors below base of the USDW and just above the primary confining unit – typically a few hundred feet below the base of the USDW to provide early warning system

Slide taken from FPL to NRC Hydrology Audit presentation on March 22, 2010 & updated

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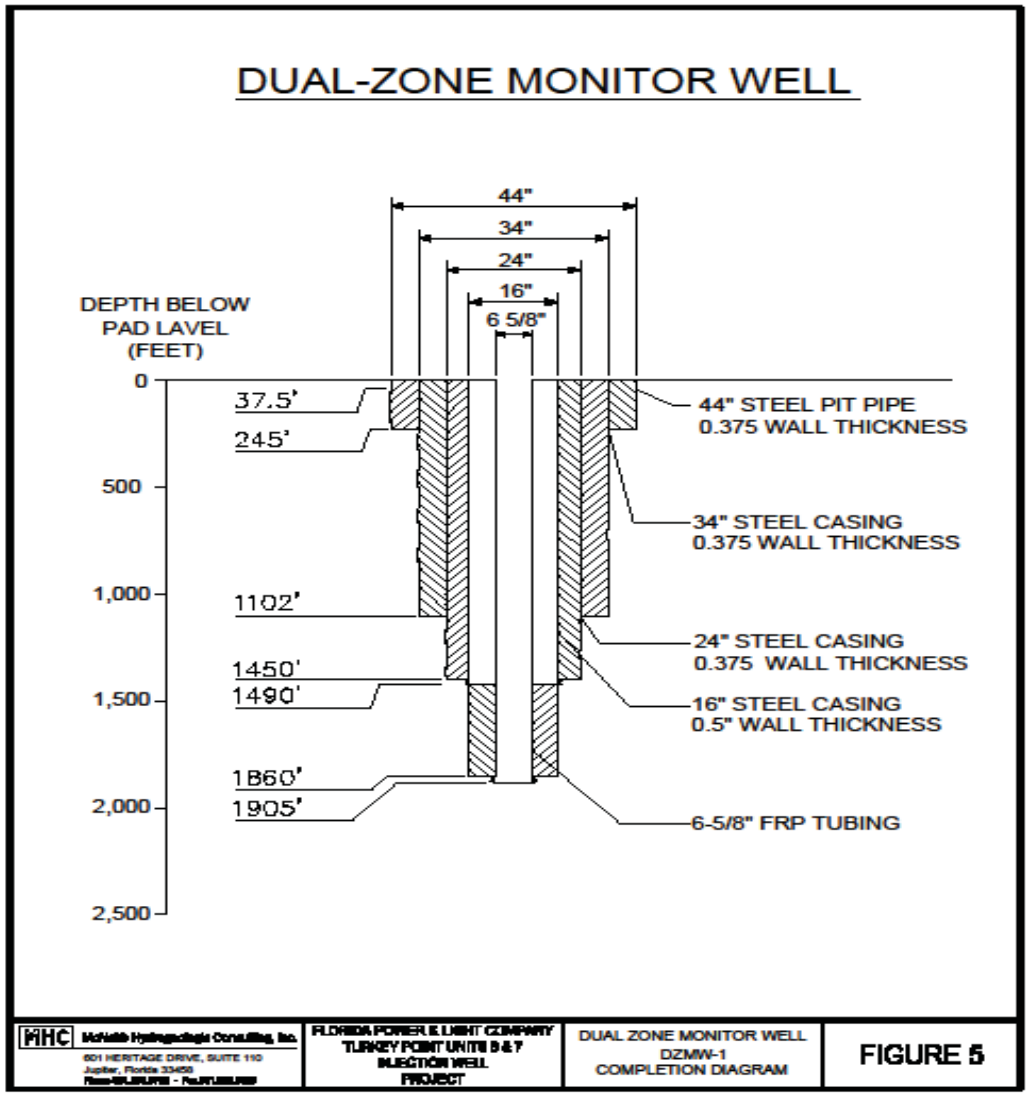

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Turkey Point Units 6 & 7 – Underground Injection Control

Injection Well Mechanical Integrity Test

- **Mechanical integrity testing (MIT) is required every 5 years**
- **MIT consist of the following**
  - Video survey – visual inspection of injection tubing, packer and open hole interval
  - High-resolution temperature logging – leak detection
  - Annular pressure test – test for leaks in tubing, final casing and packer
  - Radioactive tracer survey – test the integrity of the cement seal at the base of the final casing
  - Interpretation of previous five years of monitoring and operating data
- **Results compiled in report and submitted to FDEP for review and approval**

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Turkey Point Units 6 & 7 – Underground Injection Control

Confinement Characterization

- **Geophysical logs**
- **Rock Cores**
  - Laboratory Analysis of core samples
- **Straddle Packer Testing**
  - Hydraulic and water quality data

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Turkey Point Units 6 & 7 – Underground Injection Control

Vertical Fluid Migration Detection

- **Monitor well is located less than 150 feet from injection well**
- **Monitor well sample collection**
  - Weekly during operational testing
  - Monthly thereafter
  - Total dissolved solids, conductivity, chloride, phosphorus, sulfate, sodium, calcium, magnesium, potassium, bicarbonate, temperature, pH, gross alpha, and combined radium-226 and radium-228
- **Monitor well water level monitoring**
- **Changes in monitor zone water quality and level can indicate vertical migration**

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Turkey Point Units 6 & 7 – Underground Injection Control

Typical Class I Injection Wellhead

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