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CHAPTER 3 PLANT DESCRIPTION

3.1 EXTERNAL APPEARANCE AND PLANT LAYOUT

3.1.1 EXISTING SITE

The 218-acre Units 6 & 7 plant area is located within the approximately 9400-acre Turkey Point plant property in Miami-Dade County, Florida, approximately 25 miles south of Miami, 8 miles east of Florida City, and 9 miles southeast of Homestead, Florida. Units 1 through 5 occupy approximately 195 acres on the Turkey Point plant property.

Units 1 & 2 are each 400 MWe (nominal) natural gas/oil steam electric generating units that have been in service since 1967 (Unit 1) and 1968 (Unit 2), respectively. Units 3 & 4 are 700 MWe (nominal) pressurized water reactor nuclear units that have been in service since 1972 (Unit 3) and 1973 (Unit 4), respectively. Turkey Point Unit 5 is a nominal 1150 MWe (nominal) natural gas combined-cycle unit that began operating in 2007. All five of the steam electric generating units lie within the developed area of the Turkey Point plant property. An aerial photograph showing the five existing power generating units is provided as Figure 3.1-1.

A closed-loop system of canals is used by Units 1 through 4 to provide cooling. This system is a permitted industrial wastewater facility. The industrial wastewater facility is a closed-loop system of recirculating canals occupying an area of approximately 5900 acres on the Turkey Point plant property. Unit 5 uses mechanical draft cooling towers for heat dissipation. These towers receive water from the Upper Floridan aquifer for use as makeup water and route their blowdown to the cooling canals of the industrial wastewater facility.

3.1.2 PROPOSED SITE

The Westinghouse AP1000 plant design has been selected for Units 6 & 7 (approximately 1100 MWe each, net output power), a nuclear plant design certified under 10 CFR Part 52, Subpart B. The location of the new units would be directly south of Units 3 & 4 in the northeast portion of the industrial wastewater facility, with Biscayne Bay to the east. An aerial photograph of the Units 6 & 7 plant area showing the existing generating units (Units 1 through 5) in the background is provided in Figure 3.1-2. Figure 3.1-3 shows the plot plan with major structures identified. Figure 2.7-15 provides topographical features within a 5-mile radius around Units 6 & 7.

Units 6 & 7 would share the primary and backup meteorological towers with Units 3 & 4. The current meteorological tower locations are shown on Figure 6.4-1 and Figure 6.4-2. (The backup meteorological tower would be relocated during Units 6 & 7 construction to a suitable area on the Turkey Point plant property.) The radioactive liquid release points and the radioactive gaseous release points for the new units are presented in Section 3.5. The nonradioactive liquid release

points and the nonradioactive gaseous release points for the new units are presented in Section 3.6.

The new AP1000 units and support facilities are designed around a Westinghouse standardized unit approach. Each AP1000 unit consists of five principal structures:

1. Nuclear island
2. Turbine building
3. Annex building
4. Diesel generator building
5. Radwaste building

The structures that make up the nuclear island include the containment building, shield building, and auxiliary building. The foundation for the nuclear island will be an integral basemat that supports these buildings. The containment building will be a free-standing steel containment vessel with elliptical upper and lower heads. It will be surrounded by the shield building. The shield building will be a structure that, in conjunction with the internal structures of the containment building, provides the required shielding for the reactor coolant system and the other radioactive systems and components housed in the containment building.

The auxiliary building will be a reinforced concrete structure that wraps around approximately 70 percent of the circumference of the shield building. The primary function of the auxiliary building is to provide protection and separation for the mechanical and electrical equipment located outside of the containment building. The main control room will be contained within the auxiliary building. The auxiliary building will provide protection to safety-related equipment from the consequences of either a postulated internal or external event. The auxiliary building will also provide shielding for the radioactive equipment and piping that is housed within the building.

The turbine building will be a rectangular steel column and beam structure with its long axis oriented radially from the containment building. The turbine building will house the turbine, generator, and associated mechanical and electrical systems.

The annex building will be a combination reinforced concrete and steel-framed structure with insulated metal siding. The annex building will provide the main personnel entrance to the power block. The building also will contain the control support area, machine shop, the ancillary diesel generators, other electrical equipment and various heating, ventilation, and air conditioning systems.

The diesel generator building will be a single-story, steel-framed structure with insulated metal siding. The building will house two diesel generators to provide backup power in the event of disruption of the normal power source.

The radwaste building will be a steel-framed structure. The radwaste building will house low-level liquid radwaste holdup tanks and processing system. The building will include facilities for segregated storage of various categories of waste before processing, for processing by mobile systems, and for storing processed waste in shipping and disposal containers.

For each unit, the closed-cycle circulating water system (CWS) would consist of three mechanical draft cooling towers, an open channel (flume) with a pump intake structure, and the two sources of makeup water for the cooling towers. The primary source of makeup water for the cooling towers would be treated reclaimed water from the Miami-Dade Water and Sewer Department (MDWASD). The other source available for makeup water to the CWS would be saltwater via substratum radial collector wells. Saltwater would be used when a sufficient supply and/or quality of treated reclaimed water is unavailable. The CWS cooling towers would be situated at the southern end of the Units 6 & 7 plant area. Blowdown flow from the cooling towers would be directed to a common blowdown sump before being discharged to deep injection wells. A description of the CWS, including deep injection wells, is provided in Section 3.4.

In addition to the CWS cooling towers, Units 6 & 7 will include one service water system cooling tower (a 2-cell tower) for each unit. These mechanical draft cooling towers will occupy an area of approximately 0.5 acre per unit and will be located near the turbine building. The source of makeup water for the service water cooling towers would be potable water from the MDWASD potable water supply.

Additional plant structures would include warehouses, nuclear administration building, training building, other offices and buildings, security buildings, parking areas, sanitary waste treatment plant, switchyard, and transmission towers. A reclaimed water treatment facility, makeup water reservoir, and pipelines would be constructed for treating, storing, and delivering the reclaimed water from the MDWASD.

Units 6 & 7 would be constructed from materials architecturally similar to Units 1 through 4. The overall goal would be to provide an aesthetically pleasing effect. An artist's rendition of Units 6 & 7 with the existing Units 1 through 5 is provided in Figure 3.1-4. Photographs that show the new units from several vantage points are included as Figures 3.1-5 and 3.1-6. Figure 3.1-5 shows the expected view from the local transportation corridor-SW 344th Street/Palm Drive. Figure 3.1-6 shows the expected view from Biscayne Bay.

Figure 3.1-1 Existing Turkey Point Units 1 to 5

Figure 3.1-2 View of Location of Units 6 & 7 with Existing Units 1 to 5 in Background

Figure 3.1-3 Plot Plan Showing Major Structures

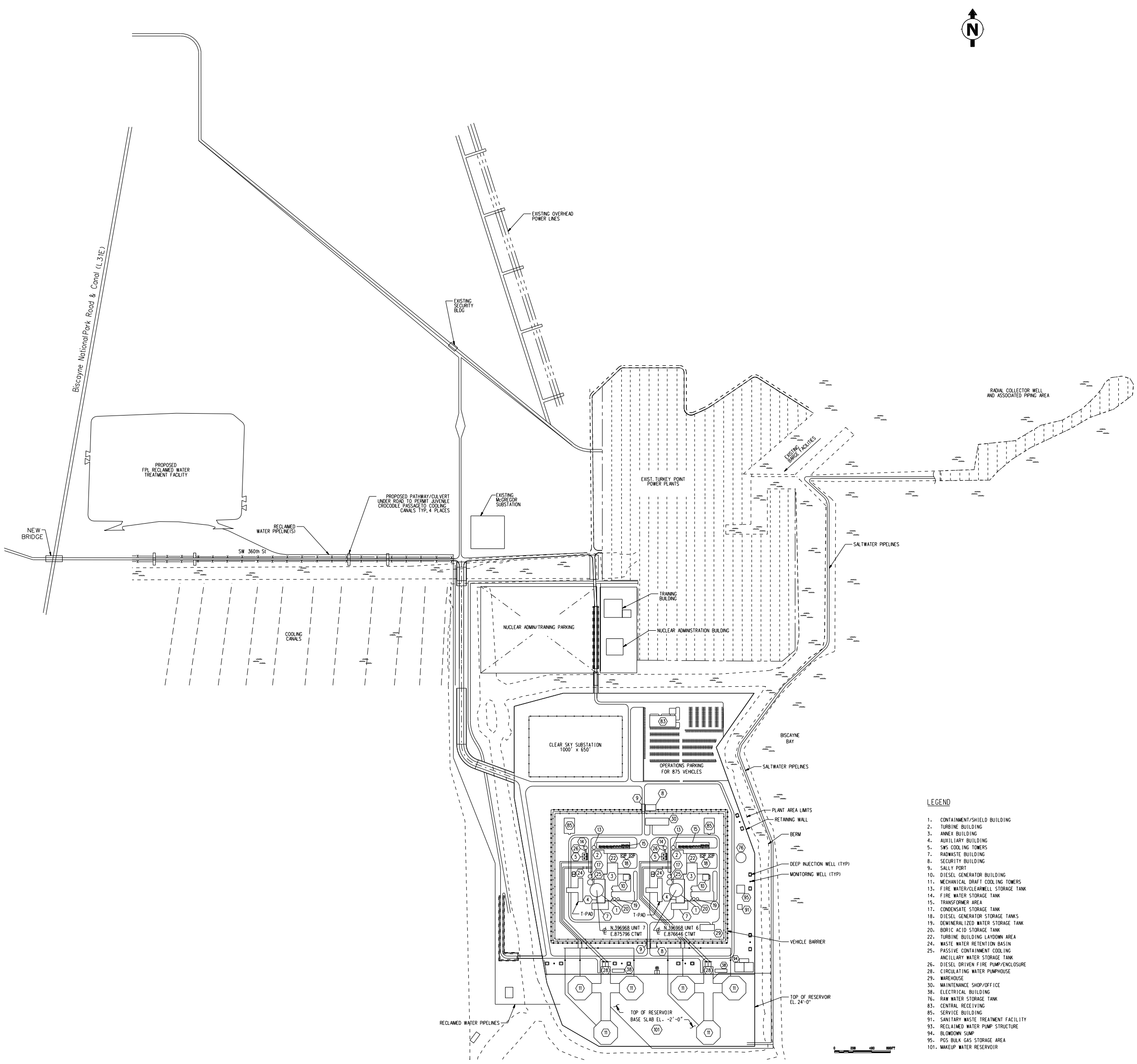
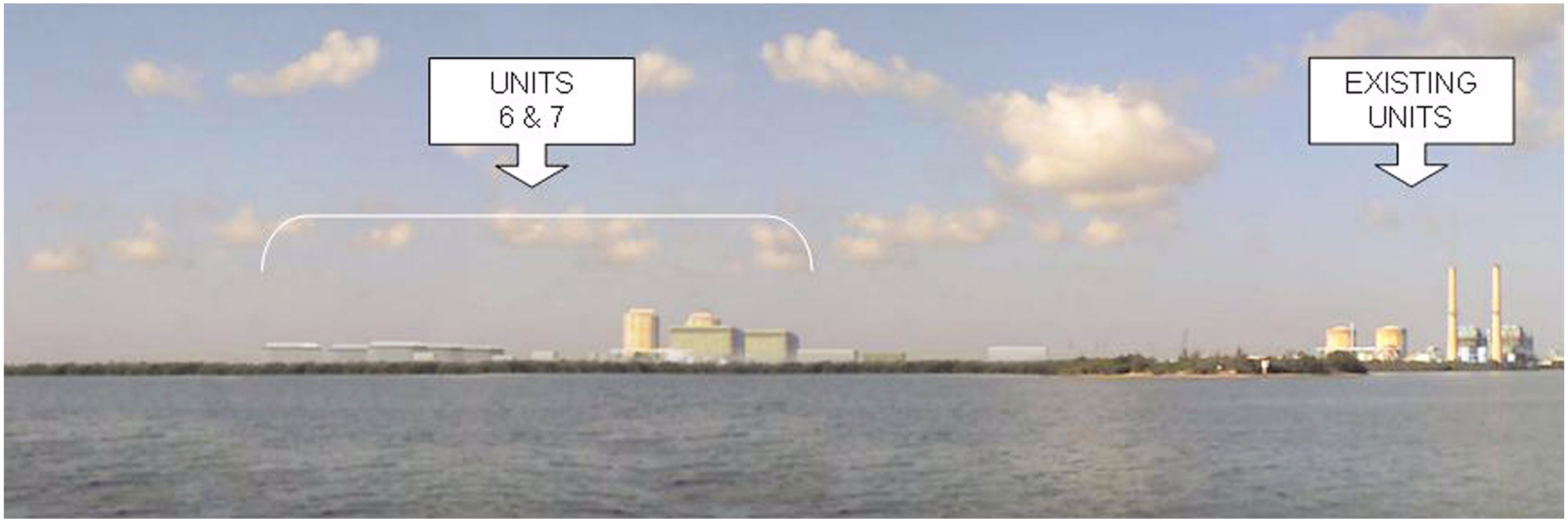


Figure 3.1-4 Architectural Feature Rendering for Units 6 & 7

Figure 3.1-5 Visual Rendering From Transportation Corridor

Figure 3.1-6 Visual Rendering From Biscayne Bay



3.2 REACTOR POWER CONVERSION SYSTEM

Two Westinghouse AP1000 units are proposed for Units 6 & 7. The architect-engineer has not yet been selected. Major components for each unit include a single reactor pressure vessel, two steam generators, and four reactor coolant pumps for converting reactor thermal energy into steam. A single high-pressure turbine and three low-pressure turbines drive a single electric generator. Figure 3.2-1 provides a simplified diagram of the reactor power conversion system.

The reactor contains a matrix of fuel rods assembled into 157 mechanically identical fuel assemblies along with control and structural elements. A fuel assembly consists of 264 fuel rods in a 17 x 17 square array. The assemblies, containing various fuel enrichments, are configured into the core arrangement located and supported by the reactor internals. The reactor internals also direct the flow of the coolant past the fuel rods. The coolant and moderator is light water at a normal operating pressure of 2250 psia. The fuel, internals, and coolant are contained within a heavy-walled reactor pressure vessel.

The fuel rods consist of enriched uranium, in the form of cylindrical pellets of sintered uranium dioxide contained in ZIRLO™[1] tubing, with an initial fuel cycle enrichment of 2.35 to 4.45 weight percent U-235. The average concentration of U-235 in reloads is 4.54 weight percent. The total weight of uranium dioxide is 211,588 pounds as shown in DCD Table 4.1-1 (WEC 2011). Reload core designs, as well as the initial cycle design, are anticipated to operate approximately 18 months between refueling, accumulating an average burnup of discharged fuel of approximately 50,553 megawatt-days per metric ton of uranium (MWD/MTU), with a cycle burnup of approximately 21,000 MWD/MTU. The NRC has approved maximum fuel rod average burnup of 60,000 MWD/MTU. Extended burnup to 62,000 MWD/MTU has been established as described in DCD Subsection 4.3.1.1.1. The total fuel capacity for each unit is approximately 84.5 MTU.

The ZIRLO tubing is plugged and seal-welded at the ends to encapsulate the fuel. An axial blanket comprised of fuel pellets with reduced enrichment may be placed at each end of the enriched fuel pellet stack to reduce the neutron leakage and to improve fuel use.

The AP1000 reactor is connected to two steam generators via two primary hot leg pipes and four primary cold leg pipes. A reactor coolant pump is located in each primary cold leg pipe to circulate pressurized reactor coolant through the reactor core. The coolant flows through the reactor core, making contact with the fuel rods containing the enriched uranium dioxide fuel. As the coolant passes through the core, heat from the nuclear fission process is transferred from the fuel rods to the coolant. The heat is transported to the steam generators by the circulating reactor coolant and passes through the steam generator tubes to heat the feedwater from the secondary

1. ZIRLO is a registered trademark of Westinghouse Electric Company.

system. Reactor coolant is pumped back to the reactor by the reactor coolant pumps, where it is reheated to start the heat transfer cycle over again. Inside the steam generators, the heat from the primary system is transferred through the tube walls to convert the incoming feedwater from the secondary system into steam. The steam is transported from the steam generators by the main steam piping to drive the high-pressure and low-pressure turbines connected to the electric generator. After passing through three low-pressure turbines, the steam is condensed back to water by cooled water circulating inside the tubes of three main condensers. The heat rejected in the main condensers is removed by the circulating water system. The condensate is then preheated and pumped back to the steam generators as feedwater to repeat the steam cycle.

Transportation of fuel and waste is addressed in Section 3.8.

3.2.1 ENGINEERED SAFETY FEATURES

Engineered safety features protect the plant workers and the public in the event of an accidental release of radioactive fission products from the reactor coolant system. The engineered safety features function to localize, control, mitigate, and terminate such accidents and to maintain radiation exposure levels to the public below applicable limits and guidelines, such as those in 10 CFR Part 20 and 10 CFR Part 100. The following subsections define the engineered safety features.

3.2.1.1 Containment

The containment vessel is a free-standing cylindrical steel vessel with ellipsoidal upper and lower heads. It is surrounded by a Seismic Category I reinforced concrete shield building. The function of the containment vessel, as part of the overall containment system, is to contain the release of radioactivity following postulated design basis accidents. The containment vessel also functions as the safety-related ultimate heat sink by transferring the heat associated with accident sources to the surrounding environment. The following paragraph details this safety-related feature.

Passive Containment Cooling System: The function of the passive containment cooling system is to maintain the containment air temperature below a specified maximum value and to reduce the containment temperature and pressure following a postulated design basis event. The passive containment cooling system removes thermal energy from the containment atmosphere. The passive containment cooling system also serves as the safety-related ultimate heat sink for other design basis events and shutdowns. The passive containment cooling system limits the release of radioactive material to the environment by reducing the pressure differential between the containment atmosphere and the external environment. This diminishes the driving force for leakage of fission products from the containment to the atmosphere in the event of a postulated design basis accident.

3.2.1.2 Containment Isolation System

The major function of the containment isolation system of the AP1000 is to provide containment isolation to allow the normal or emergency passage of fluids through the containment boundary while preserving the integrity of the containment boundary, if required. This prevents or limits the escape of fission products that may result from postulated accidents. Containment isolation provisions are designed so that fluid lines penetrating the primary containment boundary are isolated in the event of an accident. This minimizes the release of radioactivity to the environment.

3.2.1.3 Passive Core Cooling System

The primary function of the passive core cooling system is to provide emergency core cooling following postulated design basis events. The passive core cooling system provides reactor coolant system makeup and boration during transients or accidents where the normal reactor coolant system makeup supply from the chemical and volume control system is lost or is insufficient. The passive core cooling system provides safety injection to the reactor coolant system to provide adequate core cooling for the complete range of loss of coolant accident events up to, and including, the double-ended rupture of the largest primary loop reactor coolant system piping. The passive core cooling system provides core decay heat removal during transients, accidents, or whenever the normal heat removal paths are lost.

3.2.1.4 Main Control Room Emergency Habitability System

The main control room emergency habitability system is designed so that the main control room remains habitable following a postulated design basis event. With a loss of all alternating current power sources, the habitability system maintains an acceptable environment for continued operating staff occupancy.

3.2.1.5 Fission Product Control

Post-accident safety-related fission product control for the AP1000 is provided by natural removal processes inside containment, the containment boundary, and the containment isolation system. The natural removal processes, including various aerosol removal processes and pool scrubbing, remove airborne particulates and elemental iodine from the containment atmosphere following a postulated design basis event.

3.2.2 TURBINE GENERATOR

The turbine generator serves no safety-related function and therefore has no nuclear safety design basis. The turbine generator system is designed to convert the thermal energy of the steam flowing through the turbine into rotational mechanical work, which rotates a generator to

provide electrical power. It consists of a double-flow, high-pressure cylinder (high-pressure turbine) and three double-flow, low-pressure cylinders (low-pressure turbines) that exhaust to the condenser. It is a six-flow, tandem compound, 1800 rpm reheat unit. The turbine system includes stop, control, and intercept valves directly attached to the turbine and in the steam flow path, crossover and crossunder piping between the turbine cylinders and the moisture separator reheater. This design is provided as the reference design in DCD Chapter 10. The manufacturer of the turbine generator system has not yet been selected.

Each turbine generator has an output of approximately 1200 MWe for each reactor thermal output of 3415 MWt. The generator rating is 1,375,000 kVA with a power factor of 0.9. Plant electrical consumption (station and auxiliary service loads) is approximately 108 MWe or approximately 9 percent of generator output at rated power. The systems of the turbine cycle have been designed to meet the maximum expected turbine generator conditions. The net electrical power is addressed in FSAR Section 1.1.

The significant design features and performance characteristics for the major steam and power conversion system components are listed in DCD Table 10.1-1. Turbine generator design parameters are listed in DCD Table 10.2-1.

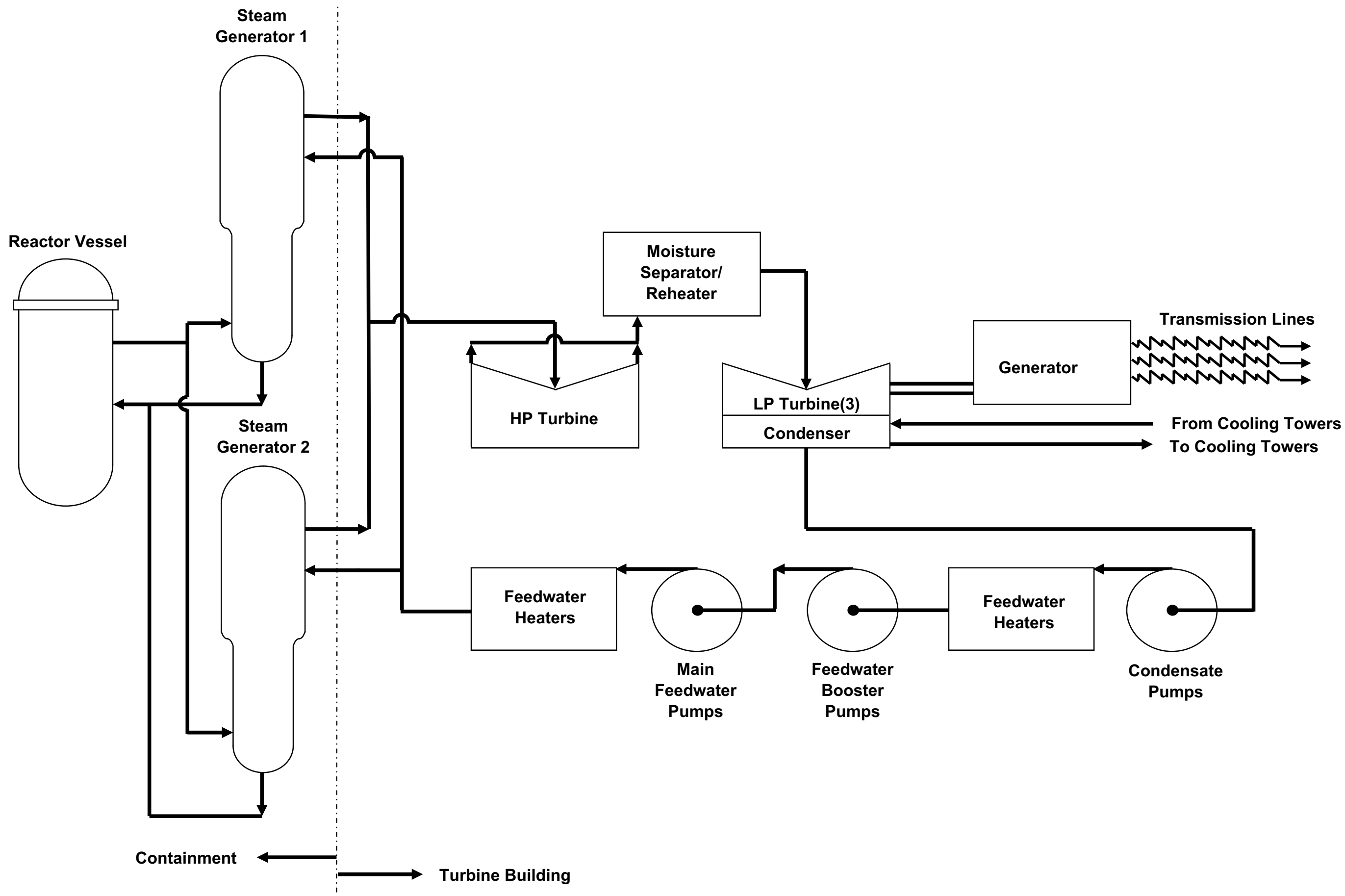
The main condenser is a three-shell, single-pass, multi-pressure, spring-supported unit with a total surface area of 12.36E5 square feet or 4.12E5 square feet per shell available for heat transfer. Each shell is located beneath its respective low-pressure turbine. The condenser rejects approximately 7.54E9 Btu/hour of waste heat to the circulating water system. The condenser is equipped with titanium tubes. The titanium material provides good corrosion and erosion resisting properties. Additional main condenser design data is presented in DCD Table 10.4.1-1.

In a multi-pressure condenser, the condenser shells operate at slightly different pressures and temperatures. Condensate in the low-pressure condenser shell drains through internal piping to the high-pressure (hottest) shell where it is slightly heated and mixed with condensate of the high pressure shell. This condensate then flows through a single outlet to the suction of the condensate pumps.

Section 3.2 References

WEC 2011. Westinghouse Electric Company, LLC. *AP1000 Design Control Document*, Document No. APP-GW-GL-700, Tier 2 Material, Rev. 19, June 13, 2011.

Figure 3.2-1 Simplified Diagram of Reactor Power Conversion



3.3 PLANT WATER USE

Plant water use for Units 6 & 7 is based on two AP1000 units. Consumption and treatment requirements are determined from the DCD (WEC 2011) water quality guidelines and site characteristics. Reclaimed water from the Miami-Dade Water and Sewer Department (MDWASD) would supply makeup water for the circulating water system of Units 6 & 7. When reclaimed water cannot supply the quantity and/or quality of water needed for the circulating water system, additional makeup water would be saltwater supplied from radial collector wells. The circulating water system would be designed to accommodate 100 percent supply from reclaimed water, saltwater, or a combination of the two sources. The ratio of water supplied by the two makeup water sources would vary based on the availability of reclaimed water from the MDWASD. Makeup water for the service water system would be supplied by the MDWASD potable water supply. This water would also be the source for potable water, the demineralized water system, fire protection, and miscellaneous water users. Effluents would be discharged to the Boulder Zone via deep injection wells permitted by the Florida Department of Environmental Protection (FDEP) underground injection control program.

3.3.1 WATER CONSUMPTION

Each unit would use closed-cycle, mechanical draft cooling towers for both circulating water system cooling and service water system cooling. Makeup water would be required to replenish circulating water system and service water system water lost to evaporation, drift, and blowdown.

For makeup to the circulating water system, reclaimed water would be supplied to the FPL reclaimed water treatment facility from the MDWASD. In accordance with FDEP regulations (Florida Administrative Code 62-610.668), MDWASD would be required to provide high-level disinfection of reclaimed water before industrial use by FPL in open cooling towers. The FPL reclaimed water treatment facility would be designed to further treat the reclaimed water from MDWASD prior to use in the circulating water system. The FPL reclaimed water treatment facility would include pumps, trickling filters, clarifiers, deep bed filters, and solids-handling equipment to reduce the levels of iron, magnesium, oil and grease, total suspended solids, nutrients, and silica to usable levels for the circulating water system.

From the FPL reclaimed water treatment facility, the treated reclaimed water would be piped to and stored in the makeup water reservoir before being pumped to the circulating water system cooling tower basins for each unit. Additional circulating water makeup would be saltwater supplied from radial collector wells. The wells would be located on the Turkey Point peninsula, east of the existing units. These wells would provide water to the circulating water system cooling tower basins. Saltwater would be used in instances where sufficient supply and/or quality of reclaimed water from the MDWASD would be unavailable to Units 6 & 7.

The MDWASD potable water supply would provide makeup water for the service water cooling towers of each unit. Additionally, the MDWASD potable water supply would also provide water for the potable water system, fire protection system, the demineralized water system, and other miscellaneous users for each unit. Water balances for this arrangement are provided by data listed in Tables 3.3-1 and 3.3-2 in conjunction with Figure 3.3-1. Hydrologic and water use impacts of this arrangement are addressed in Section 5.2.

Tables 3.3-1 and 3.3-2 define normal and maximum water use for two units based on AP1000 design parameters and site-specific characteristics. Table 3.3-1 assumes reclaimed water is supplied as the source of makeup to the circulating water system. Table 3.3-2 assumes reclaimed water is unavailable and, therefore, saltwater is supplied as the source of makeup to the circulating water system. Evaporation and drift estimates for the circulating water and service water cooling towers are based on site characteristics and AP1000 design parameters for the cooling systems included in Tables 3.4-1 and 3.4-2.

3.3.1.1 Plant Water Demand

Tables 3.3-1 and 3.3-2 provide the total water use estimate for Units 6 & 7. These tables include normal and maximum flows for corresponding streams defined in Figure 3.3-1. Water demand includes makeup water for the circulating water and service water systems and water supply for potable water, fire protection, and the demineralized water system. Normal values listed are expected values for normal plant operation with the two units in operation. Maximum values are those expected for extreme conditions with the two units in operation. The maximum values would not be concurrent. Fire water usage is based on monthly average use required to maintain fire protection system availability.

3.3.1.2 Plant Water Discharges

Tables 3.3-1 and 3.3-2 also provide cooling water and wastewater discharge estimates for the two units. These include losses from both the service water and circulating water systems of each unit through cooling tower water evaporation and drift, as well as rejection of blowdown from the cooling towers. The water balances provided by the data listed in Tables 3.3-1 and 3.3-2 in conjunction with Figure 3.3-1 include estimates for the wastewater flows from the two units, including radiological effluent discharges, sanitary waste, miscellaneous drains, and demineralizer waste discharges. Normal values listed are expected values for normal plant operation with two units in operation. Maximum values are those expected for extreme conditions with two units in operation. Flow rates given are not necessarily concurrent.

The cooling tower blowdown and wastewater from Units 6 & 7 would be discharged to the Boulder Zone via deep injection wells. A blowdown sump serving Units 6 & 7 would collect effluent streams including cooling tower blowdown, wastewater retention basin effluents, and raw

water required for liquid radwaste dilution for discharge to the Boulder Zone. Processed liquid radioactive effluents would be batch-discharged to the Boulder Zone through the blowdown sump effluent stream.

During the construction phase, the wastewater system collects system wastes produced during miscellaneous system flushing. Wastes would be treated to meet permit limits before discharge to the blowdown sump for subsequent discharge to the Boulder Zone. Alternatively, drain wastes may be released to an existing suitable site facility or collected in tanks and disposed of in accordance with local regulation using appropriate licensed haulers.

3.3.2 WATER TREATMENT

Water treatment would be performed to maintain satisfactory water quality for plant use and discharge from the plant to the environment as permitted by state and local regulations. Representative chemicals for water treatment to control biofouling and algae, to adjust pH, inhibit corrosion and scale formation, for disinfection and for dechlorination are identified in Section 3.6. The effluent from water treatment would be within the limits of the FDEP underground injection control program.

3.3.2.1 Cooling Tower Makeup

Reclaimed water from the MDWASD would be treated at the FPL reclaimed water treatment facility and used as circulating water system cooling tower makeup. This treatment would occur before storage in the makeup water reservoir. The makeup water for the circulating water cooling towers would be treated to prevent biofouling in the raw water supply piping to the circulating water cooling towers. Reclaimed water and saltwater would have separate chemical treatments for use in the cooling towers.

Additional treatment for biofouling, scaling, and suspended matter, with biocides, antiscalants, and dispersants would be performed as needed for the circulating water system and service water system. Treatment for the circulating water system (reclaimed water and saltwater) would occur through injection of chemicals from a local chemical feed system into system piping. Treatment for the service water system would occur through injection of chemicals from the turbine island chemical feed system into system piping. Cooling water chemistry would be controlled by the addition of chemicals and maintaining the proper cycles of concentration.

3.3.2.2 Demineralized Water

The MDWASD potable water supply would provide water for the demineralized water system of each unit. This water would be treated by filtration and primary and secondary demineralization processes, which produces in highly purified water for various plant systems. Reverse osmosis would be the primary demineralization treatment process designed to reduce dissolved solids,

salts, and organics. In the secondary stage of purification, the treated water would pass through an electrodeionization system where dissolved carbon dioxide and most of the remaining ions would be removed. Spent resin would be removed and replaced.

Discharges from systems using demineralized water for makeup would be routed to the wastewater retention basin or the liquid radwaste system before discharge.

3.3.2.3 Potable Water System

The potable water system would provide a water supply for domestic use and human consumption. Water provided from the MDWASD potable water supply would be supplied to the potable water distribution system for each unit. This water would meet federal, state, and local water quality standards and would not need to be pretreated.

3.3.2.4 Fire Protection Water System

The fire protection water system of each unit would be used for fire suppression and as a backup supply of water to other water systems, including the passive containment cooling system. The system would consist of storage tanks, pressure maintenance equipment, and a distribution system. The MDWASD potable water supply would be the source of water for the fire protection water system. This water would meet federal, state and local water quality standards and would not need to be pretreated.

Section 3.3 References

Florida Administration Code 62-610.668, Florida Department of Environmental Protection, July 2007. Available at http://www.dep.state.fl.us/legal/Rules/wastewater/62-610.doc (accessed on March 10, 2009).

WEC 2011. Westinghouse Electric Company, LLC*. AP1000 Design Control Document*, Document No. APP-GW-GL-700, Tier 2 Material, Rev. 19, June 13, 2011.

Table 3.3-1 (Sheet 1 of 2)
Plant Water Use 100% Reclaimed Water

Stream Number	Stream Description[(a)]	Normal Case[(b),(c)]	Maximum Case[(b), (c)]	Notes
1	MDWASD Potable Water Supply	936	2553	
2	MDWASD Potable Water Supply to Power Plant Users	448	889	
3	Potable Water Influent	35	70	
4	Potable Water Effluent	35	70	
5	Sanitary Waste to Blowdown Sump	48	95	
6	MDWASD Potable Water Supply to Demineralized Water Treatment/ Miscellaneous Users	413	819	
7	MDWASD Potable Water Supply to Fire Water and Equipment/ Floor Washdown	20	20	
8	Equipment/Floor Washdown Influent	10	10	
9	Equipment/Floor Washdown Effluent	10	10	
10	Fire Water Influent	10	10	(d)
11	Fire Water Effluent	10	10	
12	Ultrafiltration Unit Influent	393	799	
13	Ultrafiltration Unit Effluent/Reverse Osmosis Influent	353	719	
14	Reverse Osmosis Effluent/Electrodeionization Unit Influent	247	503	
15	Electrodeionization Unit Effluent/Demineralized Water Tank Influent	234	477	
16	Demineralized Water Tank Effluent/Demineralized Water Users Influent	234	477	
17	Ultrafiltration Reject	40	80	
18	Reverse Osmosis Unit Reject	106	216	
19	Electrodeionization Unit Reject	13	26	
20	Demineralized Water Treatment Combined Reject Stream	159	322	
21	Liquid Radwaste Effluent	3	150	(e)
22	Treated Liquid Radwaste Effluent	3	150	(e)
23	Not used			
24	Not used			
25	Demineralized Water User Effluent to Turbine Building Drain System	231	327	
26	Turbine Building Drain System Effluent	251	347	
27	Oil/Water Separator Effluent	251	347	
28	Miscellaneous Low Volume Waste	410	669	
29	MDWASD Potable Water Supply Makeup to Service Water System	488	1664	(f)
30	Service Water System Cooling Tower Evaporation	366	1248	(f)
31	Service Water System Cooling Tower Drift	1	1	(g)
32	Service Water System Cooling Tower Blowdown	121	415	(f),(h)
33	Alternate Blowdown from Service Water System Cooling Towers	0	0	
34	Wastewater Retention Basin Effluent to Blowdown Sump	410	669	
35	Service Water System Blowdown to Circulating Water System	121	415	(h)
36	Reclaimed Water to FPL Reclaimed Water Treatment Facility	50,481	50,187	(i)

Table 3.3-1 (Sheet 2 of 2)
Plant Water Use 100% Reclaimed Water

Stream Number	Stream Description[(a)]	Normal Case[(b),(c)]	Maximum Case[(b), (c)]	Notes
37	FPL Reclaimed Water Treatment Facility Effluent to Makeup Water Reservoir	40,686	40,392	(i)
38	Makeup Water Reservoir Effluent	40,686	40,392	(i)
39	Reclaimed Water Makeup to Circulating Water System	38,400	38,400	(j)
40	Saltwater Supply from Radial Collector Wells	0	0	(i)
41	Saltwater Makeup to Circulating Water System	0	0	(j)
42	Circulating Water System Cooling Tower Evaporation	28,800	28,800	(j)
43	Circulating Water System Cooling Tower Drift	7	7	(g)
44	Circulating Water System Cooling Tower Blowdown	9714	10,008	(j)
45	Reclaimed Water Dilution	2286	1992	(i)
46	Saltwater Dilution	0	0	(i)
47	Alternate Dilution Supply for Liquid Radwaste Discharge	2286	1992	(e), (i)
48	FPL Reclaimed Water Treatment Facility Bypass to Blowdown Sump	0	0	
49	FPL Reclaimed Water Treatment Facility Effluent to Future FPL Users	9739	9739	
50	Blowdown Sump Effluent	12,458	12,764	
51	Discharge to Deep Injection Wells	12,461	12,914	
52	FPL Reclaimed Water Treatment Facility Waste	0	0	(k)
53	FPL Reclaimed Water Treatment Facility Solid Waste	56	56	(i)
54	Units 1 Through 5 Sanitary Waste	13	25	

(a) Streams are shown in Figure 3.3-1.
(b) The flow rate values (in gpm) are for two AP1000 units.
(c) Flows are not necessarily concurrent. Maximum case is defined as the maximum overall water use for Units 6 & 7. Some streams are affected by other flow rates and not all streams would be at maximum flow conditions. For example, dilution supply for liquid radwaste discharge flow is inversely proportional to circulating water system cooling tower blowdown. Additional information is provided in Note (e).
(d) Fire water use is based on monthly average use required to maintain fire protection system availability.
(e) The liquid radwaste discharge flow may be up to 150 gpm (for two units). However, given the liquid radwaste activity level, the discharge flow rate would be controlled to be compatible with the available dilution flow.
(f) The service water cooling towers are assumed operating at four cycles of concentration. Flows are determined by weather conditions and water chemistry.
(g) The service water system and circulating water system cooling tower drifts are conservatively assumed to be 0.0005 percent of the cooling tower water flow.
(h) Concentrated blowdown from the service water system would be routed to the circulating water system. The blowdown from the circulating water system will therefore include the additional input from the service water system blowdown.
(i) During maximum flow for overall water use, MDWASD potable water supply makeup to the service water system increases while makeup to CWS is unchanged. This results in more service water system blowdown to CWS and thus, more CWS cooling tower blowdown. Since alternate dilution supply for liquid radwaste discharge is inversely proportional to CWS cooling tower blowdown, there would be less reclaimed water dilution. Additionally, since makeup to CWS is unchanged and the alternate dilution supply for liquid radwaste discharge is decreased, less reclaimed water supply is required.
(j) The circulating water cooling towers are assumed operating at four cycles of concentration. Flows are determined by weather conditions and water chemistry.
(k) Wastewater would be recirculated within the FPL reclaimed water treatment facility. Discharge would occur when facility drains are required.

Table 3.3-2 (Sheet 1 of 2)
Plant Water Use 100% Saltwater

Stream Number	Stream Description[(a)]	Normal Case[(b),(c)]	Maximum Case[(b), (c)]	Notes
1	MDWASD Potable Water Supply	936	2553	
2	MDWASD Potable Water Supply to Power Plant Users	448	889	
3	Potable Water Influent	35	70	
4	Potable Water Effluent	35	70	
5	Sanitary Waste to Blowdown Sump	48	95	
6	MDWASD Potable Water Supply to Demineralized Water Treatment/ Miscellaneous Users	413	819	
7	MDWASD Potable Water Supply to Fire Water and Equipment/ Floor Washdown	20	20	
8	Equipment/Floor Washdown Influent	10	10	
9	Equipment/Floor Washdown Effluent	10	10	
10	Fire Water Influent	10	10	(d)
11	Fire Water Effluent	10	10	
12	Ultrafiltration Unit Influent	393	799	
13	Ultrafiltration Unit Effluent/Reverse Osmosis Influent	353	719	
14	Reverse Osmosis Effluent/Electrodeionization Unit Influent	247	503	
15	Electrodeionization Unit Effluent/Demineralized Water Tank Influent	234	477	
16	Demineralized Water Tank Effluent/ Demineralized Water Users Influent	234	477	
17	Ultrafiltration Reject	40	80	
18	Reverse Osmosis Unit Reject	106	216	
19	Electrodeionization Unit Reject	13	26	
20	Demineralized Water Treatment Combined Reject Stream	159	322	
21	Liquid Radwaste Effluent	3	150	(e)
22	Treated Liquid Radwaste Effluent	3	150	(e)
23	Not used			
24	Not used			
25	Demineralized Water User Effluent to Turbine Building Drain System	231	327	
26	Turbine Building Drain System Effluent	251	347	
27	Oil/Water Separator Effluent	251	347	
28	Miscellaneous Low-Volume Waste	410	669	
29	MDWASD Potable Water Supply Makeup to Service Water System	488	1664	(f)
30	Service Water System Cooling Tower Evaporation	366	1248	(g)
31	Service Water System Cooling Tower Drift	1	1	(g)
32	Service Water System Cooling Tower Blowdown	121	415	(f), (h)
33	Alternate Blowdown from Service Water System Cooling Towers	0	0	
34	Wastewater Retention Basin Effluent to Blowdown Sump	410	669	
35	Service Water System Blowdown to Circulating Water System	121	415	(h)

Table 3.3-2 (Sheet 2 of 2)
Plant Water Use 100% Saltwater

Stream Number	Stream Description[a]	Normal Case[b],[c]	Maximum Case[b], [c]	Notes
36	Reclaimed Water to FPL Reclaimed Water Treatment Facility	0	0	
37	FPL Reclaimed Water Treatment Facility Effluent to Makeup Water Reservoir	0	0	
38	Makeup Water Reservoir Effluent	0	0	(i)
39	Reclaimed Water Makeup to Circulating Water System	0	0	(i)
40	Saltwater Supply from Radial Collector Wells	86,400	86,400	
41	Saltwater Makeup to Circulating Water System	86,400	86,400	(j)
42	Circulating Water System Cooling Tower Evaporation	28,800	28,800	(j)
43	Circulating Water System Cooling Tower Drift	7	7	(g)
44	Circulating Water System Cooling Tower Blowdown	57,714	58,008	(j)
45	Reclaimed Water Dilution	0	0	
46	Saltwater Dilution	0	0	
47	Alternate Dilution Supply for Liquid Radwaste Discharge	0	0	(e)
48	FPL Reclaimed Water Treatment Facility Bypass to Blowdown Sump	0	0	
49	FPL Reclaimed Water Treatment Facility Effluent to Future FPL Users	0	0	
50	Blowdown Sump Effluent	58,172	58,772	
51	Discharge to Deep Injection Wells	58,175	58,922	
52	FPL Reclaimed Water Treatment Facility Waste	0	0	(j)
53	FPL Reclaimed Water Treatment Facility Solid Waste	0	0	
54	Units 1 Through 5 Sanitary Waste	13	25	

(a) Streams are shown in Figure 3.3-1.
(b) The flow rate values (in gpm) are for two AP1000 units.
(c) Flows are not necessarily concurrent. Maximum case is defined as the maximum overall water use for Units 6 & 7. Some streams are affected by other flow rates and not all streams would be at maximum flow conditions. For example, dilution supply for liquid radwaste discharge flow is inversely proportional to circulating water system cooling tower blowdown. Additional information is provided in Note (e).
(d) Fire water use is based on monthly average use required to maintain fire protection system availability.
(e) The liquid radwaste discharge flow may be up to 150 gpm (for two units). However, given the liquid radwaste activity level, the discharge flow rate would be controlled to be compatible with the available dilution flow.
(f) The service water cooling towers are assumed operating at four cycles of concentration. Flows are determined by weather conditions and water chemistry.
(g) The service water system and circulating water system cooling tower drifts are conservatively assumed to be 0.0005 percent of the cooling tower water flow.
(h) Concentrated blowdown from the service water system would be routed to the circulating water system. The blowdown from the circulating water system will therefore include the additional input from the service water system blowdown.
(i) The circulating water cooling towers are assumed operating at one and a half cycles of concentration. Flows are determined by weather conditions and water chemistry.
(j) Wastewater would be recirculated within the FPL reclaimed water treatment facility. Discharge would occur when facility drains are required.

Figure 3.3-1 Water Balance Diagram (Sheet 1 of 2)

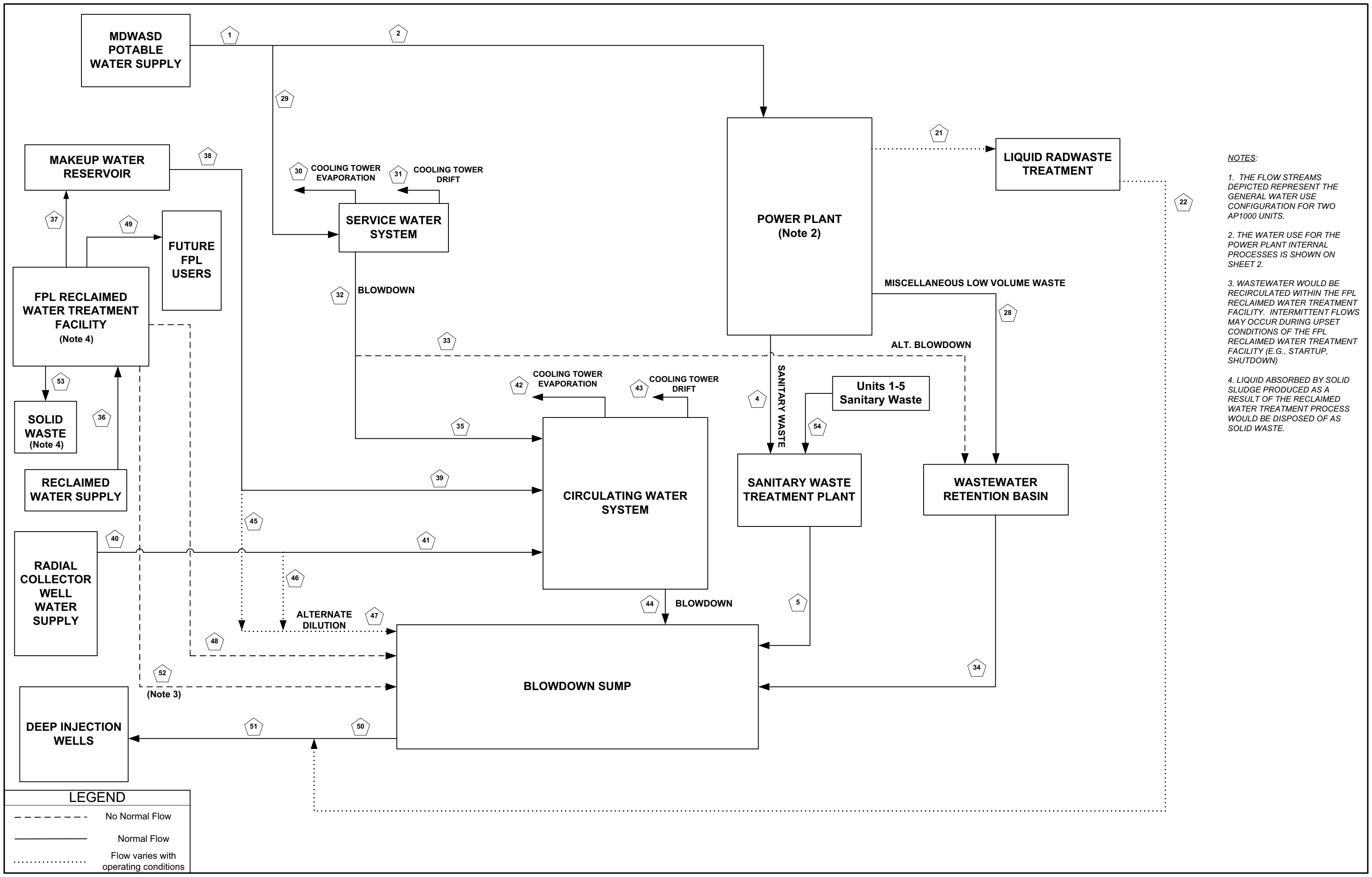
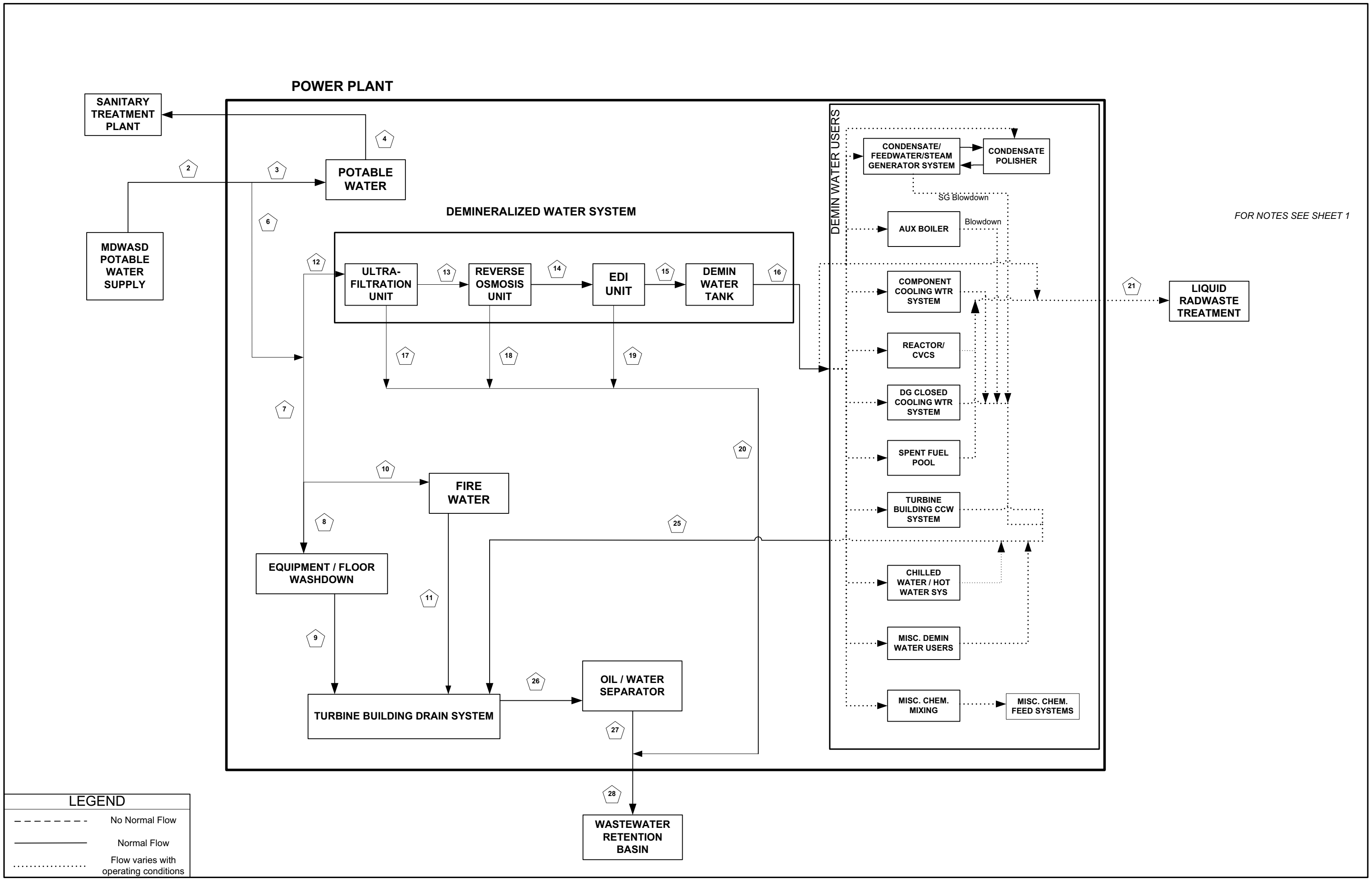


Figure 3.3-1 Water Balance Diagram (Sheet 2 of 2)



3.4 COOLING SYSTEM

Units 6 & 7 cooling systems, operational modes, and components design parameters were determined from the DCD (WEC 2011), site-specific characteristics, and engineering evaluations. The plant cooling systems and the operational modes are described in Subsection 3.4.1. Component descriptions for the raw water system and makeup water supply options are presented in Subsection 3.4.2. These parameters were used to evaluate the environmental impacts from cooling system operation. The plant cooling systems would have makeup water from the reclaimed water supply, potable water supply, and saltwater supply. Blowdown from the plant would ultimately be discharged to the deep injection wells on the plant property. Figure 3.4-1 is a simplified cooling water system flow diagram for Units 6 & 7. The circulating water system and service water system along with associated systems locations are shown in Figure 3.1-3.

3.4.1 DESCRIPTION AND OPERATIONAL MODES

The cooling system selected for Units 6 & 7 will transfer waste heat generated as a by-product of each unit's electrical power generation to the environment. Site-specific characteristics were used in addition to the AP1000 design parameters to evaluate the impacts for Units 6 & 7 to the environment. Units 6 & 7 will be equipped with two cooling systems that transfer heat to the environment from primary and secondary systems during different modes of plant operation for each unit. These systems will be the circulating water system and the service water system. There will be five operational modes:

- Normal operation (full load)
- Cooldown
- Refueling (full core offload)
- Plant startup
- Minimum to support shutdown cooling and spent fuel cooling

3.4.1.1 Normal Plant Cooling

3.4.1.1.1 Circulating Water System

Each AP1000 unit will have a circulating water system that will be used to dissipate 7540E06 Btu/hour as condenser heat load, 86E06 Btu/hour as turbine building cooling water heat load, and 1.61E06 Btu/hour as condenser vacuum pump heat load, for a total of 7628E06 Btu/hour for one unit. The waste heat rejected from the condenser, turbine building closed cooling water heat exchangers, and condenser vacuum pump seal water heat exchangers would be 1.53E10

Btu/hour for two units. The circulating water system for Units 6 & 7 would use a closed cycle, wet cooling system via mechanical draft cooling towers for heat dissipation.

The heated cooling water from the condenser, turbine building closed cooling water system heat exchangers, and condenser vacuum pump seal water heat exchangers would flow through return piping to the distribution header of the mechanical draft cooling towers. The heated cooling water would be circulated to the spray headers of the wet mechanical draft cooling towers, where the heat content of the cooling water would be transferred to the ambient air via evaporative cooling and conduction. Mechanical fans would provide airflow past the water droplets as they fall through the tower fill, rejecting heat to the atmosphere. After passing through the cooling tower, the cooled water collects in the tower basin and would be pumped back to the condenser, turbine building closed cooling water system heat exchangers, and condenser vacuum pump seal water heat exchangers completing the closed cycle cooling water loop.

The circulating water system would consist of three 33-1/3-percent-capacity circulating water pumps, three mechanical draft cooling towers, and associated piping, valves, and instrumentation for each unit. The circulating water pumps flow rate would be approximately 660,100 gpm per unit. The water would be pumped through the condenser, turbine building closed cooling water heat exchangers, and condenser vacuum pump seal water heat exchangers (all in parallel), and then to the mechanical draft cooling towers to dissipate heat to the atmosphere.

Makeup water would compensate for water losses during plant operation from circulating water system evaporation, drift, and blowdown. Three circulating water cooling towers are estimated to have evaporation water losses of approximately 14,400 gpm per unit during normal plant operation. Drift loss for the circulating water system is described in Subsection 5.3.3. The raw water makeup system would supply makeup water that would come from reclaimed water and/or saltwater sources. The design parameters for each makeup water source are addressed in the following paragraphs.

Reclaimed Water

Reclaimed water would be provided from the Miami-Dade Water and Sewer Department (MDWASD) for makeup water to the circulating water system. The maximum reclaimed water makeup rate to the circulating water system would be approximately 19,200 gpm per unit. This is based on maintaining four cycles of concentration in the cooling towers. Blowdown from the circulating water system would be transferred to a common blowdown sump before being discharged to the deep injection wells. The normal operating blowdown rate at four cycles of concentration would be approximately 4860 gpm per unit.

Saltwater

Saltwater would be used as makeup from the radial collector wells for the circulating water system when a sufficient quantity and/or quality of reclaimed water is not available. The maximum saltwater makeup rate to the circulating water system would be approximately 43,200 gpm per unit. This is based on maintaining 1.5 cycles of concentration in the cooling towers. Blowdown from the circulating water system would be transferred to a common blowdown sump before being discharged to the deep injection wells. The normal operating blowdown rate for saltwater at 1.5 cycles of concentration would be approximately 28,860 gpm per unit.

Combination of Reclaimed Water and Saltwater

When reclaimed water is not available in a sufficient quantity, a combination of reclaimed and saltwater would be used as a source of cooling water. The ratio of water supplied by the two makeup water sources would vary based on the availability of reclaimed water from the MDWASD. The makeup water and the blowdown rates for this combined usage would be within the flow rates identified above.

3.4.1.1.2 Service Water System

Each unit will have a nonsafety-related service water system to provide cooling water to the component cooling water system heat exchangers in the turbine building. The system will consist of a dedicated closed cycle system with a mechanical draft cooling tower to dissipate heat. Service water will be pumped to the component cooling water heat exchangers for heat removal.

Heated service water will return to the distribution header of the mechanical draft cooling tower. Mechanical fans will provide airflow past the water droplets as they fall through the tower fill, rejecting heat from the service water to the atmosphere. The cooled water will be collected in the tower basin and returned to the pump suction for recirculation through the system. Table 3.4-1 provides nominal service water flows and heat loads at the various operating modes for the service water system.

The service water cooling towers are estimated to have evaporation water losses of approximately 366 gpm during normal conditions and approximately 1248 gpm during cooldown conditions for two units. Blowdown flow from the service water towers would be discharged to the circulating water system cooling tower basin at a maximum flow rate of up to approximately 415 gpm for two units. The blowdown would be directed to the wastewater retention basin as necessary. A maximum makeup water flow rate of approximately 1664 gpm for two units will be required to accommodate a maximum of approximately 624 gpm per unit

evaporation rate and approximately 208 gpm per unit blowdown rate. Makeup water to the service water cooling towers would be potable water from the MDWASD.

Drift loss would be minimal for the service water system cooling tower. Maximum service water system blowdown and makeup rates are based on maintaining four cycles of concentration in the cooling tower.

3.4.1.2 Operational Modes

The circulating water system would be used to provide plant cooling during plant startup, normal plant operations, and plant cooldown. The maximum heat load removed by the circulating water system would be during normal plant operation mode and would bound the water makeup, evaporation, and discharge rates for the other operational modes.

The service water system would be used to provide heat removal from the component cooling water system during modes of normal operation, including startup, normal plant operations, cooldown, minimum to support shutdown cooling and spent fuel cooling, and refueling. The maximum heat load removed by the service water system would be during the cooldown mode and would bound the water makeup, evaporation, and discharge rates for the other operational modes.

3.4.1.3 Additional information

3.4.1.3.1 Station Load Factor

The units are expected to operate at a maximum capacity factor of 93 percent, taking into consideration scheduled outages and other plant maintenance. On a long-term basis, an average heat load of approximately 1.26E14 Btu/year (annualizing 93 percent of the maximum rated heat load of 1.55E10 Btu/hour) would be dissipated to the atmosphere.

3.4.1.3.2 Antifouling Treatment

Circulating water chemistry would be maintained by a local chemical feed system. The local chemical feed equipment will inject the required chemicals into the circulating water at the circulating water system cooling tower basin. This would be in an effort to maintain a noncorrosive, nonscale-forming condition and would limit the biological film formation that reduces the heat transfer rate in the cooling towers, condenser, and the heat exchangers supplied by the circulating water system. Additional biocide and algaecide would be provided at the cooling towers to allow for local treatment in the cooling towers, as required. Addition of biocide treatment chemicals would also be provided by chemical feed injection metering pumps into the makeup water pipelines to control biological fouling.

The plant service water system chemistry would be maintained by the turbine island chemical feed system. The turbine island chemical feed system equipment would inject the required chemicals into the service water system in an effort to maintain a noncorrosive, nonscale-forming condition. This would also limit the biological film formation that reduces the heat transfer rate in the cooling towers, condenser, and the heat exchangers supplied by the service water system. Chemicals and biocides would be injected into service water pump discharge piping in the turbine building.

The chemicals and biocides used in the circulating water and service water systems are presented in Table 3.6-1.

3.4.2 COMPONENT DESCRIPTIONS

3.4.2.1 Raw Water System

The raw water system for Units 6 & 7 would be the source of makeup water for the circulating water system, service water system, and other systems demand as described in detail in Section 3.3. The raw water would be supplied from different sources depending on the availability of each source and the makeup water requirements for each system. The raw water supplies for the circulating water system makeup would be from reclaimed water and/or saltwater sources. The raw water for the service water system makeup would be potable water provided by the MDWASD.

The following paragraphs describe the different raw water system supplies for makeup water for the circulating water system and the service water system.

3.4.2.1.1 Circulating Water System Makeup Water

3.4.2.1.1.1 Raw Water Makeup Supply from Reclaimed Water

Reclaimed water would be provided for use as makeup water to the circulating water system from the MDWASD. In accordance with FDEP regulations (Florida Administrative Code 62-610.668), MDWASD would be required to provide high-level disinfection of reclaimed water before industrial use in open cooling towers.

The reclaimed water would be further treated at the FPL reclaimed water treatment facility to further reduce levels of iron, magnesium, oil and grease, total suspended solids, nutrients, and silica to suitable levels for the circulating water system. The treated reclaimed water would then be supplied to the makeup water reservoir. The makeup water reservoir would be used as storage for the circulating water systems. Three 50-percent capacity pumps for each unit would transfer reclaimed water from the makeup water reservoir to the circulating water systems providing the required makeup.

3.4.2.1.1.2 Raw Water Makeup Supply from Saltwater

Saltwater would be supplied by radial collector wells, with caissons located on the Turkey Point peninsula, east of the existing units.

Each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with laterals projecting from the caisson. The well laterals would be advanced horizontally a distance of up to 900 feet and installed at a depth of approximately 25 to 40 feet below the bottom of Biscayne Bay. The design for a typical radial collector well is illustrated in Figure 3.4-2. The wells would be designed and located to induce recharge from Biscayne Bay. The general location of the radial collector wells are shown in Figure 3.1-3.

There would be four 33 1/3 percent radial collector wells (30,000 gpm capacity per well). Three wells would meet the makeup water requirements for the circulating water systems; the fourth would be an installed spare. Two 50 percent pumps (15,000 gpm capacity per pump) in each well caisson would transfer the saltwater to the circulating water systems.

3.4.2.1.2 Service Water System Makeup Water

The MDWASD potable water system would provide water to the raw water storage tank. The raw water storage tank is common for the two units. Two 100 percent raw water ancillary transfer pumps for each unit would transfer the required makeup water to the service water system. The demineralized water system, potable water system, and firewater system would use potable water supplied from the MDWASD.

3.4.2.2 Final Plant Discharge

The cooling towers blowdown and other site wastewater streams would be collected in a common blowdown sump and injected through the deep injection wells. Biocides and chemical additives in the discharge stream are addressed in detail in the Section 3.6. The deep injection wells would meet the requirements established in the underground injection control program permits. Treated liquid radwaste would be diluted with the blowdown sump discharge flow, as depicted in Figure 3.4-1, at a rate required to maintain the required dilution rate. Additional information on liquid radwaste is addressed in Section 3.5. The maximum sump discharge flow for two units when 100 percent reclaimed water is used would be approximately 12,764 gpm, and the maximum sump discharge flow for two units when 100 percent saltwater is used would be approximately 58,922 gpm. The treated radwaste stream would be mixed with the blowdown sump pump discharge before being discharged in the deep injection wells. Figure 3.4-3 is a typical Class I injection well design.

3.4.2.3 Heat Dissipation System

3.4.2.3.1 Circulating Water System

The circulating water system would use three mechanical draft cooling towers as a normal heat sink for each unit. The cooling towers would use fiberglass-reinforced plastic structural members and casing. The circulating water system cooling towers would be octagonal and would rise approximately 67 feet above the top of the basin curb. Internal construction materials could include fiberglass-reinforced plastic or polyvinyl chloride for piping laterals, reinforced thermosetting resin for spray nozzles, and polyvinyl chloride for fill and drift eliminator materials. Mechanical draft towers use mechanical fans to generate airflow across sprayed water to reject heat to the atmosphere. Six mechanical draft cooling towers would be required to dissipate a maximum waste heat load of up to 1.53E10 Btu/hour from the two units, would operate with approximately a 7.1°F approach temperature, and would provide a less than 91°F return temperature at design ambient conditions. Table 3.4-2 provides specifications of the circulating water system cooling towers.

3.4.2.3.2 Service Water System

The service water system will have a cooling tower that is a rectilinear mechanical draft structure for each unit. The cooling tower is a counterflow-induced draft tower and is divided into two cells. Each cell uses one fan, located in the top portion of the cell, to draw air upward through the fill counter to the downward flow of water. Each fan is driven by a two-speed electrical motor through a gear reducer. During normal power operation, one cell is inactive and water flow to that cell is shut off by a motor-operated isolation valve. One operating service water pump supplies flow to the operating cell. When the service water system is used to support plant shutdown cooling, both tower cells are normally placed in service along with both service water pumps for increased cooling capacity.

Table 3.4-1 provides system flow rates and the expected heat duty for various operating modes of the service water tower. The service water tower will maintain a maximum 93.5°F return temperature to the component cooling water system heat exchangers during normal operation mode. Temperature rise through the component cooling water system heat exchangers would be approximately 20°F during normal operation and approximately 33°F during cooldown operation based on the heat transfer rates defined in Table 3.4-1. Each unit's service water system cooling tower would be adjacent to the turbine building occupying an area of approximately 0.5 acre.

Section 3.4 References

Florida Administration Code 62-610.668, Florida Department of Environmental Protection, July 2007. Available at: http://www.dep.state.fl.us/legal/Rules/wastewater/62-610.doc (accessed March 4, 2009).

WEC 2011. Westinghouse Electric Company, LLC*.* *AP1000 Design Control Document*, Document No. APP-GW-GL-700, Tier 2 Material, Rev. 19, June 13, 2011.

Table 3.4-1
Nominal Service Water Flows and Heat Loads at Different Operational Modes per Unit

Operational Mode	Flow (gpm)	Heat Transferred (Btu/hour)
Normal Operation (Full Load)	10,500	103E06
Cooldown	21,000	346E06
Refueling (Full Core Offload)	10,500	74.9E06
Plant Startup	21,000	75.8E06
Minimum to Support Shutdown Cooling and Spent Fuel Cooling	10,000	170E06

Table 3.4-2
Circulating Water System Cooling Tower Design Specifications per Unit

Design Condition	Value
Number of Towers (per Unit)	3
Circulating Water Flow (per Tower)	210,367 gpm
Cycle of Concentration[(a)]	1.5 to 4
Approximate Height (above Basin Curb)	67 feet
Approximate Base Diameter	246 feet
Number of Cells (per Tower)	12
Number of Fans per Cell	1
Exit Air Delivery per Fan	1,764,500 acfm
Design Wet Bulb Temperature[(b)]	83.9°F
Design Range	24.4°F
Design Approach	7.1°F
Drift Rate	0.0005% (of the flow rate)
Predicted Sound Level at 3 Feet	85 dBA

(a) Cycles of concentration for reclaimed water is 4 and for saltwater is 1.5.
(b) Includes 3.3°F interference allowance

Figure 3.4-1 Simplified Cooling System Flow Diagram

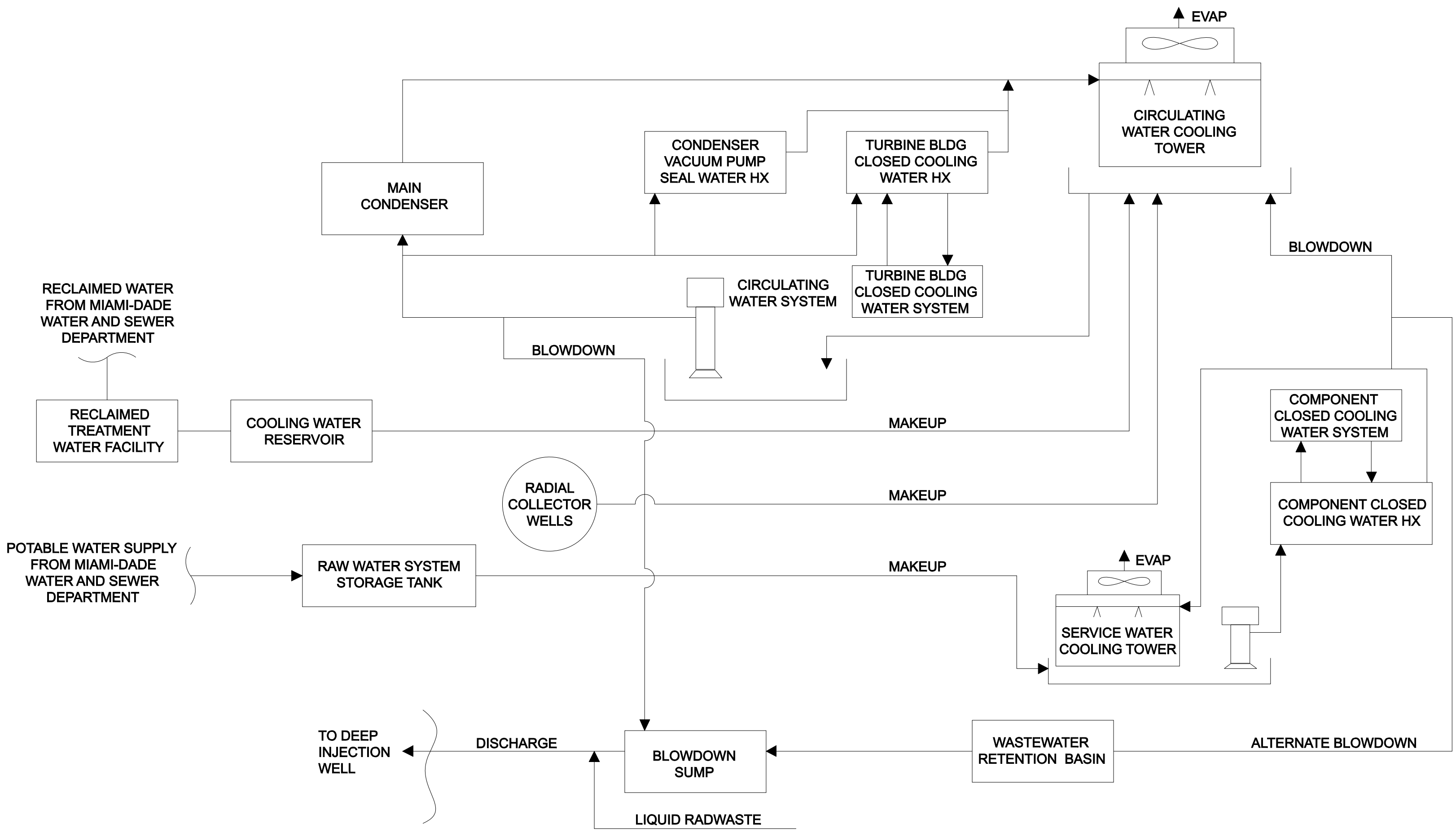


Figure 3.4-2 Typical Radial Collector Well Design

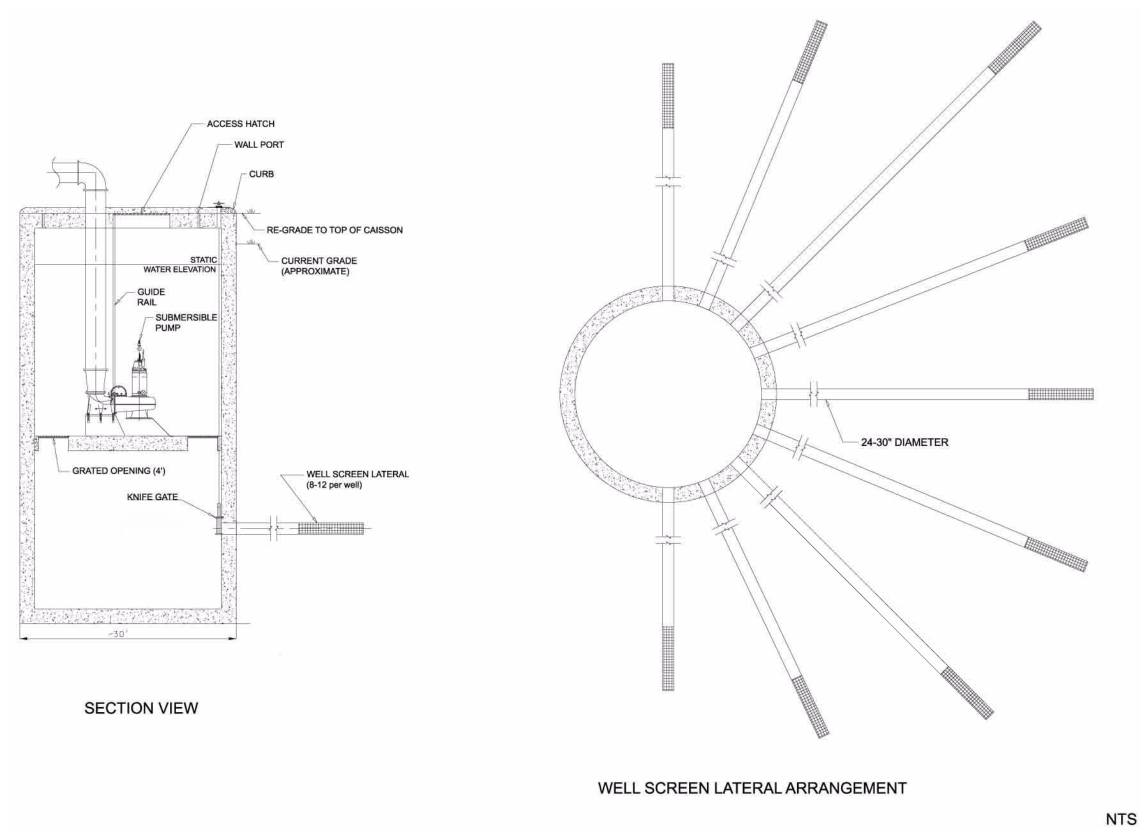
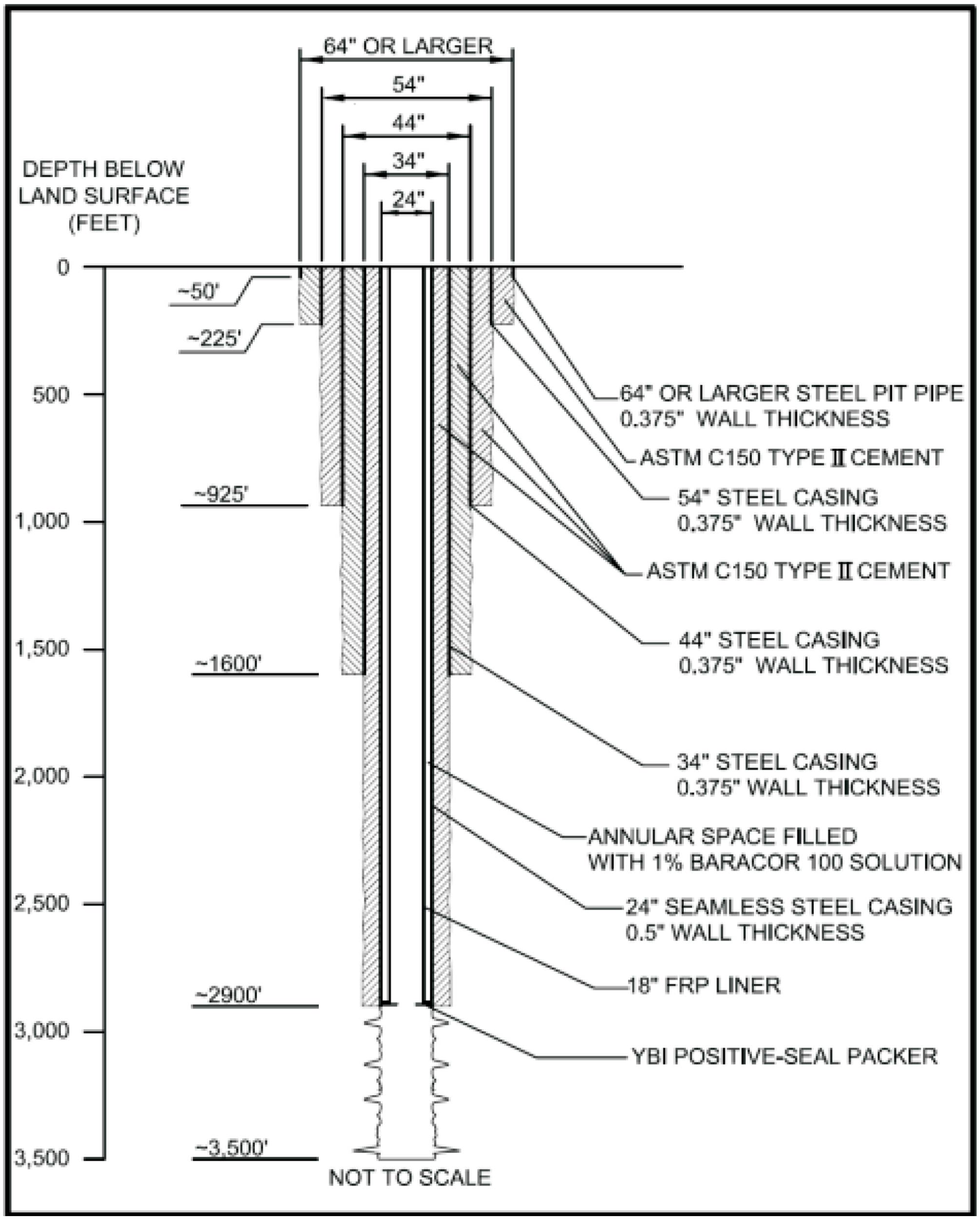


Figure 3.4-3 Typical Injection Well Design



3.5 RADIOACTIVE WASTE MANAGEMENT SYSTEM

Radioisotopes are produced during the operation of nuclear reactors, through the processes of fission and activation. Fission products have the potential to enter the reactor coolant system by diffusion or by way of defects in the fuel cladding. The primary cooling water may contain dissolved or suspended corrosion products and nonradioactive materials from plant components that can be activated in the reactor core as the water passes through the core. These radioisotopes can exit the reactor coolant either by plant systems designed to remove impurities, by small leaks that occur in the reactor coolant system (RCS) and auxiliary systems, or by breaching of systems for maintenance. Therefore, each plant generates radioactive waste that can be liquid, solid, or gaseous.

Radioactive waste management systems will be designed to minimize releases from reactor operations to values ALARA. These systems will be designed and maintained to meet the requirements of 10 CFR Part 20 and 10 CFR Part 50, Appendix I. Requirements for the design of these systems, and the plant effluents used to determine the maximum individual population doses from normal plant operations, are provided in Section 5.4. Lastly, environmental impacts resulting from management of low-level wastes are expected to be bounded by the NRC's findings in 10 CFR 51.51 (b).

The information presented in this section is for a single unit. The design for a second unit would be the same and the data given in this section would double for a second unit.

3.5.1 LIQUID RADIOACTIVE WASTE MANAGEMENT SYSTEM

The liquid radioactive waste management systems for each unit include the systems that will be used to process and dispose of liquids containing radioactive material. These include:

- Steam generator blowdown processing system
- Radioactive waste drain system
- Liquid radioactive waste system

The liquid radioactive waste system will be designed to control, collect, process, handle, store, and dispose of liquid radioactive waste generated as the result of normal operation, including anticipated operational occurrences.

The liquid radioactive waste system will provide holdup capacity as well as permanently installed processing capacity of 75 gpm through the ion exchange/filtration train. This will be adequate capacity to meet the anticipated processing requirements of the plant. The projected flows of

various liquid waste streams to the liquid radioactive waste system under normal conditions are identified in DCD Table 11.2-1 (WEC 2011).

The liquid radioactive waste system design could accept equipment malfunctions without affecting the capability of the system to handle both anticipated liquid waste flows and possible surge load due to excessive leakage.

The liquid radioactive waste system, shown in DCD Figure 11.2-1, will include tanks, pumps, ion exchangers, and filters. The liquid radioactive waste system is designed to process, or store for processing by mobile equipment, radioactively contaminated wastes in four major categories:

- Borated, reactor-grade, wastewater — this input will be collected from the RCS effluents received through the chemical and volume control system (CVS), primary sampling system sink drains, and equipment leakoffs and drains.
- Floor drains and other wastes with potentially high suspended solids content — this input will be collected from various building floor drains and sumps.
- Detergent wastes — this input will come from the plant hot sinks and showers, and some cleanup and decontamination processes. It generally has low concentrations of radioactivity.
- Chemical wastes — this input will come from the laboratory and other relatively small volume sources. It may be mixed hazardous and radioactive wastes or other radioactive wastes with high dissolved solids content.

Nonradioactive secondary-system waste normally would not be processed by the liquid radioactive waste system. Secondary system effluent will be handled by the steam generator blowdown processing system and by the turbine building drain system. However, radioactivity could enter the secondary systems from steam generator tube leakage. If significant radioactivity were detected in secondary side systems, blowdown would be diverted to the liquid radioactive waste system for processing and disposal.

3.5.1.1 Waste Input Streams

3.5.1.1.1 RCS Effluents

The effluent subsystem will receive borated and hydrogen-bearing liquid from two sources: the reactor coolant drain tank and the CVS. The reactor coolant drain tank will collect leakage and drainage from various primary systems and components inside containment. Effluent from the CVS will be produced mainly as a result of RCS heatup, boron concentration changes, and RCS level reduction for refueling.

Input collected by the effluent subsystem would normally contain hydrogen and dissolved radioactive gases. Therefore, it will be routed through the liquid radioactive waste system vacuum degasifier before being stored in the effluent holdup tanks.

The liquid radioactive waste system vacuum degasifier could also be used to degas the RCS before shutdown by operating the CVS in an open loop configuration. This would be done by taking one of the effluent holdup tanks out of normal waste service and draining it. Then normal CVS letdown would be directed through the degasifier to the dedicated effluent holdup tank. From there, it would be pumped back to the suction of the CVS makeup pumps with the effluent holdup tank pump. The makeup pumps would return the fluid to the RCS in the normal fashion. This process would be continued as necessary for degassing the RCS.

The input to the reactor coolant drain tank would potentially be at high temperature. Therefore, provisions will be made for recirculation through a heat exchanger for cooling. The tank will be inerted with nitrogen and vented to the gaseous radwaste system (WGS). Transfer of water from the reactor coolant drain tank will be controlled to maintain an essentially fixed tank level to minimize tank pressure variation.

RCS effluents from the CVS letdown line or the reactor coolant drain subsystem will pass through the vacuum degasifier, where dissolved hydrogen and fission gases will be removed. These gaseous components will be sent via a water separator to the WGS. A degasifier discharge pump will then transfer the liquid to the currently selected effluent holdup tank. If flows from the letdown line and the reactor coolant drain tank are routed to the degasifier concurrently, the letdown flow would have priority and the drain tank input would be automatically suspended. In the event of abnormally high degasifier water level, inputs would be automatically stopped by closing the letdown control and containment isolation valves.

The effluent holdup tanks will vent to the radiologically controlled area ventilation system and, in abnormal conditions, may be purged with air to maintain a low hydrogen gas concentration in the tanks' atmosphere. Hydrogen monitors are included in the tanks' vent lines to alert the operator of elevated hydrogen levels.

The contents of the effluent holdup tanks will be recirculated and sampled, recycled through the degasifier for further gas stripping, returned to the RCS via the CVS makeup pumps, discharged to the mobile treatment facility, processed through the ion exchangers, or directed to the monitor tanks for discharge without treatment. Processing through the ion exchangers will be the normal mode.

The liquid radioactive waste system will process waste with an upstream filter followed by four ion exchange resin vessels in series. Any of these vessels could be manually bypassed and the order of the last two can be interchanged to provide complete usage of the ion exchange resin.

The top of the first vessel will normally be charged with activated carbon, to act as a deep bed filter and remove oil from floor drain wastes. Moderate amounts of other wastes could also be routed through this vessel. It could be bypassed for processing of relatively clean waste streams. This vessel will be somewhat larger than the other three, with an extra sluice connection to allow the top bed of activated carbon to be removed. This feature will be associated with the deep bed filter function of the vessel; the top layer of activated carbon collects particulates, and the ability to remove it without disturbing the underlying zeolite bed minimizes solid waste production.

The second, third, and fourth beds will be in identical ion exchange vessels that will be selectively loaded with resin depending on prevailing plant conditions.

After deionization, the water will pass through an after-filter where radioactive particulates and resin fines will be removed. The processed water will then enter one of the monitor tanks. When one of the monitor tanks is full, the system will automatically realign to route processed water to another tank.

The contents of the monitor tank will be recirculated and sampled. In the unlikely event of radioactivity in excess of operational targets, the tank contents would be returned to a waste holdup tank for additional processing.

Normally, however, the radioactivity will be well below the discharge limits, and the dilute boric acid will be discharged for dilution to the circulating water blowdown. The discharge flow rate will be set to limit the boric acid concentration in the circulating water blowdown stream to an acceptable concentration for local requirements. Detection of high radiation in the discharge stream will stop the discharge flow and operator action will be required to reestablish discharge. The raw water system, which provides makeup for the circulating water system, will be used as a backup source for dilution water when cooling tower blowdown is not available for the discharge path.

3.5.1.1.2 Floor Drains and Other Wastes with Potentially High Suspended Solid Contents

Potentially contaminated floor drain sumps and other sources that tend to be high in particulate loading will be collected in the waste holdup tank. Additives may be introduced to the tank to improve filtration and ion exchange processes. Tank contents may be recirculated for mixing and sampling. The tanks will have sufficient holdup capability to allow time for realignment and maintenance of the process equipment.

The wastewater will be processed through the waste pre-filter to remove the bulk of the particulate loading. Next, it will pass through the ion exchangers and the waste after-filter before entering a monitor tank. The monitor tank contents will be sampled and, if necessary, returned to a waste holdup tank or recirculated directly through the filters and ion exchangers.

Wastewater meeting the discharge limits will be discharged to the circulating water blowdown through a radiation detector that will stop the discharge if high radiation is detected.

3.5.1.1.3 Detergent Wastes

The detergent wastes from the plant hot sinks and showers will contain soaps and detergents. These wastes are generally not compatible with the ion exchange resins. The detergent wastes will not be processed and will be collected in the chemical waste tank. If the detergent waste activity is low enough, the wastes will be discharged without processing.

When sufficient detergent wastes are produced and processing is necessary, mobile processing equipment is brought into one of the radwaste building mobile systems facility truck bays provided for this purpose.

3.5.1.1.4 Chemical Wastes

Inputs to the chemical waste tank normally will be generated at a low rate. These wastes will be only collected; no internal processing will be provided. Chemicals could be added to the tank for pH or other adjustment. Because the volume of these wastes will be low, they can be treated using mobile equipment or by shipment offsite.

3.5.1.1.5 Steam Generator Blowdown

Steam generator blowdown will normally be accommodated within the steam generator blowdown system. If steam generator tube leakage results in significant levels of radioactivity in the steam generator blowdown stream, this stream would be redirected to the liquid radioactive waste system for treatment before discharge. In this event, one of the waste holdup tanks would be drained to prepare it for blowdown processing. The blowdown stream will be brought into that holdup tank, and continuously or in batches pumped through the waste ion exchangers. The number of ion exchangers in service will be determined by the operator to provide adequate purification without excessive resin usage. The blowdown will then be collected in a monitor tank, sampled, and discharged in a monitored fashion.

3.5.1.2 Radioactive Releases

Liquid waste will be produced both on the primary side (primarily from adjustment of reactor coolant boron concentration and from reactor coolant leakage) and the secondary side (primarily from steam generator blowdown processing and from secondary side leakage). Primary and secondary coolant activity levels will be based on operating plant experience.

Except for RCS degasification in anticipation of shutdown, primary side effluents will not be recycled for reuse. Primary side effluents will be routed to the liquid radwaste system for

processing. Fluid recycling will be provided for the steam generator blowdown fluid which is normally returned to the condensate system.

The liquid waste will be discharged from the monitor tank in a batch operation, and the discharge flow rate will be restricted as necessary to maintain an acceptable concentration when diluted by the circulating water discharge flow.

The annual average release of radionuclides from the plant is determined using the PWR-GALE code. The PWR-GALE code models releases that use source terms derived from data obtained from the experience of operating PWRs. The code input parameters used in the analysis are listed in DCD Table 11.2-6. The annual releases for a single unit are presented in DCD Table 11.2-7.

The total releases include an adjustment factor of 0.16 curies per year to account for anticipated operational occurrences. The adjustment uses the same distribution of nuclides as the calculated releases.

3.5.1.3 Doses

As described in Subsection 5.4.1.1, the maximum individual and population doses due to normal plant operation are not evaluated.

3.5.1.4 Cost Benefit Analysis of Population Doses

As described in FSAR Subsection 11.2.3.5, the liquid effluent pathways are not evaluated and no cost benefit analysis has been performed.

3.5.2 GASEOUS RADIOACTIVE WASTE MANAGEMENT SYSTEM

During reactor operation, radioactive isotopes of xenon, krypton, and iodine will be created as fission products. Some of these radionuclides will be released to the reactor coolant. Subsequent leakage of reactor coolant results in a release to the containment atmosphere of these noble gases. Airborne releases will be limited both by restricting reactor coolant leakage and by limiting the concentrations of radioactive noble gases and iodine in the RCS.

Iodine will be removed by ion exchange in the CVS. Removal of the noble gases from the RCS would not normally be necessary because the gases would not build up to unacceptable levels when fuel defects are within normally anticipated ranges. If noble gas removal were required because of high RCS concentration, the CVS can be operated in conjunction with the liquid radwaste system degasifier to remove the gases.

The WGS will be designed to perform the following major functions:

- Collect gaseous wastes that are radioactive or hydrogen-bearing
- Process and discharge the waste gas, keeping offsite releases of radioactivity within acceptable limits

In addition to the WGS release pathway, release of radioactive material to the environment will occur through the various building ventilation systems. The estimated annual release includes contributions from the major building ventilation pathways.

The WGS will be designed to receive hydrogen-bearing and radioactive gases generated during process operation. The radioactive gas flowing into the WGS will enter as trace contamination in a stream of hydrogen and nitrogen.

WGS inputs are:

- Letdown diversion for dilution, RCS with maximum hydrogen concentration
- Letdown diversion for RCS degassing
- Reactor coolant drain tank liquid transfer to maintain proper reactor coolant drain tank level
- Reactor coolant drain tank gas venting

3.5.2.1 System Description

3.5.2.1.1 General Description

The WGS, as shown on DCD Figures 11.3-1 and 11.3-2, will be a once-through, ambient temperature, activated carbon delay system. The system will include a gas cooler, a moisture separator, an activated carbon-filled guard bed, and two activated carbon-filled delay beds. Also included in the system will be an oxygen analyzer subsystem and a gas sampling subsystem.

DCD Table 11.3-2 lists the key design parameters for the WGS components.

The radioactive fission gases entering the system will be carried by hydrogen and nitrogen gas. The primary influent source will be the liquid radwaste system degasifier. The degasifier will extract both hydrogen and fission gases from the CVS letdown flow that is diverted to the liquid radwaste system or from the reactor coolant drain tank discharge.

Reactor coolant degassing will not be required during power operation with fuel defects at or below the design basis level of 0.25 percent. However, the WGS will periodically receive influent when CVS letdown is processed through the liquid radwaste system degasifier during RCS dilution and volume control operations. Because the degasifier is a vacuum type and

requires no purge gas, the maximum gas influent rate to the WGS from the degasifier will equal the rate that hydrogen enters the degasifier (dissolved in liquid).

The other major source of input to the WGS will be the reactor coolant drain tank. Hydrogen dissolved in the influent to the reactor coolant drain tank will enter the WGS either via the tank vent or the liquid radwaste system degasifier discharge.

The tank vent would normally be closed, but can be periodically opened on high pressure to vent the gas that has come out of solution. The reactor coolant drain tank liquid would normally discharge to the liquid radwaste system via the degasifier, where the remaining hydrogen would be removed.

The reactor coolant drain tank will be purged with nitrogen gas to discharge hydrogen and fission gases to the WGS before operations requiring tank access. The reactor coolant drain tank will also be purged with nitrogen gas to dilute and discharge oxygen after tank servicing or inspection operations which allow air to enter the tank.

Influents to the WGS will first pass through the gas cooler where they will be cooled to about 40°F by the chilled water system. Moisture formed due to gas cooling will be removed in the moisture separator.

After leaving the moisture separator, the gas will flow through a guard bed that protects the delay beds from abnormal moisture carryover or chemical contaminants. The gas will then flow through two delay beds in series where the fission gases undergo dynamic adsorption by the activated carbon and are thereby delayed relative to the hydrogen or nitrogen carrier gas flow. Radioactive decay of the fission gases during the delay period significantly reduces the radioactivity of the gas flow leaving the system.

The activated carbon volume will be twice the theoretical amount required to achieve the holdup times given in DCD Table 11.3-1.

The effluent from the delay bed will pass through a radiation monitor and discharges to the ventilation exhaust duct. The radiation monitor will be interlocked to close the WGS discharge isolation valve on high radiation. The discharge isolation valve will also close on low ventilation system exhaust flow rate to prevent the accumulation of hydrogen in the aerated vent.

3.5.2.1.2 System Operation

During normal operation, the WGS will usually not be in operation. When there is no waste gas inflow to the system, the discharge isolation valve closes which will maintain the WGS at a positive pressure, preventing the ingress of air during the periods of low waste gas flow. When

the WGS is in use, its operation will be passive, using the pressure provided by the influent sources to drive the waste gas through the system.

The largest input to the WGS will be from the liquid radwaste system degasifier, which processes the CVS letdown flow when diverted to the liquid radwaste system and the liquid effluent from the liquid radwaste system reactor coolant drain tank.

The CVS letdown flow will be diverted to the liquid radwaste system only during dilutions, borations, and RCS degassing in anticipation of shutdown. The design basis influent rate from the liquid radwaste system degasifier will be the full diversion of the CVS letdown flow, when the RCS is operating with maximum allowable hydrogen concentration. Because the liquid radwaste system degasifier is a vacuum type that operates without a purge gas, this input rate will be very small, approximately 0.5 standard cubic feet per minute (scfm).

The liquid radwaste system degasifier will also be used to degas liquid pumped out of the reactor coolant drain tank. The amount of fluid pumped out, and therefore the gas sent to the WGS, will depend on the input into the reactor coolant drain tank. This will be smaller than the input from the CVS letdown line.

The final input to the WGS will be from the reactor coolant drain tank vent. A nitrogen cover gas will be maintained in the reactor coolant drain tank. This input will consist of nitrogen, hydrogen, and radioactive gases. The tank operates at nearly constant level, with its vent line normally closed, so this input will be minimal. Venting will be required only after enough gas has evolved from the input fluid to increase the reactor coolant drain tank pressure.

The influent will first pass through a gas cooler. Chilled water will flow through the gas cooler at a fixed rate to cool the waste gas to about 40°F regardless of waste gas flow rate. Moisture formed due to gas cooling will be removed in the moisture separator, and collected water will be periodically discharged automatically. To reduce the potential for waste gas bypass of the gas cooler in the event of valve leakage, a float-operated drain trap will be provided that automatically closes on low water level.

The gas leaving the moisture separator will be monitored for temperature, and a high alarm will alert the operator to an abnormal condition requiring attention. Oxygen concentration will also be monitored. On a high oxygen alarm, a nitrogen purge will be automatically injected into the influent line.

The waste gas then will flow through the guard bed, where iodine and chemical (oxidizing) contaminants will be removed. The guard bed will also remove any remaining excessive moisture from the waste gas. The waste gas will flow through the two delay beds where xenon and krypton will be delayed by a dynamic adsorption process. The discharge line will be equipped with a

valve that automatically closes on either high radioactivity in the WGS discharge line or low ventilation exhaust duct flow.

The adsorption of radioactive gases in the delay bed will occur without reliance on active components or operator action. Operator error or active component failure will not result in an uncontrolled release of radioactivity to the environment. Failure to remove moisture before the delay beds (due to loss of chilled water or other causes) will result in a gradual reduction in WGS performance. Reduced performance will be indicated by high temperature and discharge radiation alarms. A high-high radiation signal will automatically terminate a discharge.

3.5.2.2 Radioactive Releases

Releases of radioactive effluent by way of the atmospheric pathway will occur due to:

- Venting of the containment that contains activity as a result of leakage of reactor coolant and as a result of activation of naturally occurring Ar-40 in the atmosphere to form radioactive Ar-41
- Ventilation discharges from the auxiliary building that contain activity as a result of leakage from process streams
- Ventilation discharges from the turbine building.
- Condenser air removal system (gaseous activity entering the secondary coolant as a result of primary to secondary leakage is released via this pathway).
- WGS discharges

These releases will be ongoing throughout normal plant operations and will be within the NRC release limits provided in 10 CFR Part 20 and 10 CFR Part 50, Appendix I. There will be no gaseous waste holdup capability in the gaseous waste management system and thus no criteria are required for determining the timing of releases or the release rates to be used.

3.5.2.2.1 Estimated Annual Releases

The annual average airborne releases of radionuclides from the plant are determined using the PWR-GALE code. The PWR-GALE code models releases using realistic source terms derived from data obtained from the experience of many operating pressurized water reactors. The code input parameters used in the analysis are provided in DCD Table 11.2-6. The expected annual releases for a single unit are presented in DCD Table 11.3-3.

3.5.2.2.2 Release Points

Airborne effluents will normally be released through the plant vent or the turbine building vent. The plant vent will provide the release path for containment venting releases, auxiliary building ventilation releases, annex building releases, radwaste building releases, and WGS discharge. The turbine building vents will provide the release path for the condenser air removal system, gland seal condenser exhaust and the turbine building ventilation releases.

3.5.2.3 Doses

The calculated maximum individual and population doses for normal plant operation are addressed in Section 5.4.

3.5.2.4 Cost Benefit Analysis of Population Doses

The site-specific cost-benefit analysis regarding population doses due to gaseous effluents during normal plant operation is addressed in FSAR Subsection 11.3.3.4. This FSAR subsection applies to the cost-benefit analysis for each unit. The dollar/person millirem reduction is included in the calculation for the cost-benefit analysis in the FSAR subsection.

3.5.3 SOLID RADIOACTIVE WASTE MANAGEMENT SYSTEM

Solid radioactive wastes will be produced in multiple ways at a nuclear power station. The waste could be either dry or wet solids, and the source could be an operational activity or maintenance function.

The solid radioactive waste management system will collect, process, and package solid radioactive wastes generated as a result of normal plant operation, including anticipated operational occurrences. The system will be designed to have sufficient capacity, based on normal waste generation rates, to ensure that maintenance or repair of the equipment does not impact power generation.

Operating procedures would encourage plant operators to segregate wastes to keep mixed wastes at a minimum. However, the waste handling system will be designed to allow handling and disposal of mixed waste, if it is created, as described below.

For each unit, the solid waste management system will be designed to collect and accumulate spent ion exchange resins and deep bed filtration media, spent filter cartridges, dry active wastes, and mixed wastes generated as a result of normal plant operation, including anticipated operational occurrences. The system will be located in the auxiliary and radwaste buildings. Processing and packaging of wastes will be by mobile systems in the auxiliary building truck bay and in the mobile systems facility part of the radwaste building. The packaged waste will be

stored in the auxiliary and radwaste buildings until it is shipped offsite to a licensed disposal facility.

The use of mobile systems for the processing functions will permit the use of the latest technology and avoid the equipment obsolescence problems experienced with installed radwaste processing equipment. The most appropriate and efficient systems could be used as they become available.

This system will not handle large, radioactive waste materials such as core components or radioactive process wastes from the plant's secondary cycle. However, the volumes and activities of the secondary cycle wastes are provided in this subsection.

3.5.3.1 System Description

The waste management system will include the spent resin system. The flows of wastes through the solid waste management system are shown in DCD Figure 11.4-1. The radioactivity of influents to the system will depend on reactor coolant activities and the decontamination factors of the processes in the CVS, spent fuel cooling system, and the liquid waste processing system.

The parameters used to calculate the estimated activity of the influents to the solid waste management system are listed in DCD Table 11.4-1. The AP1000 design has sufficient radwaste storage capacity to accommodate the maximum generation rate.

The radioactivity of the dry active waste would be expected to normally range from 0.1 curies per year to 8 curies per year with a maximum of about 16 curies per year. This waste will include spent HVAC filters, compressible trash, noncompressible components, mixed wastes, and solidified chemical wastes. These activities will be produced by relatively long-lived radionuclides (such as Cr-51, Fe-55, Co-58, Co-60, Nb-95, Cs-134 and Cs-137), and therefore, radioactivity decay during processing and storage will be minimal. These activities apply to the waste as generated and to the waste as shipped.

The estimated expected and maximum annual quantities of waste influents by source and form are listed in DCD Table 11.4-1 with disposal volumes. The annual radwaste influent rates are derived by multiplying the average influent rate (e.g., volume per month, volume per refueling cycle) by 1 year of time. The annual disposal rate is determined by applying the radwaste packaging efficiency to the annual influent rate. The influent volumes are conservatively based on an 18-month refueling cycle. Annual quantities based on a 24-month refueling cycle will be less than those for an 18-month cycle.

All radwaste that is packaged and stored will be shipped offsite for disposal. The AP1000 design does not include provisions for permanent storage of radwaste. Radwaste will be stored ready for shipment. Shipped volumes of radwaste for disposal are estimated in DCD Table 11.4-1 from the

estimated expected or maximum influent volumes by making adjustments for volume reduction processing and the expected container filling efficiencies. For drum compaction, the overall volume reduction factor, including packaging efficiency, is 3.6. For box compaction, the overall volume reduction factor is 5.4. These adjustments result in a packaged internal waste volume for each waste source, and the number of containers required to hold this volume is based on the container's internal volume. The disposal volume is based on the number of containers and the external (disposal) volume of the containers.

The disposal volumes of wet and dry wastes are approximately 547 and 1417 cubic feet/year, respectively as shown in DCD Table 11.4-1. The wet wastes shipping volumes include 510 cubic feet/year of spent ion exchange resins and deep bed filter activated carbon, approximately 20 cubic feet/year of volume reduced liquid chemical wastes and 17 cubic feet/year of mixed liquid wastes. The spent resins and activated carbon will be initially stored in the spent resin storage tanks located in the truck bay of the auxiliary building. When a sufficient quantity has accumulated, the resin will be sluiced into high-integrity containers in anticipation of transport for offsite disposal. Liquid chemical wastes will be reduced in volume and packaged into drums (20 cubic feet/year) and will be stored in the packaged waste storage room of the radwaste building. The estimated mixed liquid wastes will fill less than three drums per year (about 17 cubic feet/year) and will be stored on containment pallets in the waste accumulation room of the radwaste building until shipped offsite for processing.

The two spent resin storage tanks (275 cubic feet usable, each) and one high-integrity container in the spent resin waste container fill station at the west end of the truck bay of the auxiliary building will provide more than a year of spent resin storage at the expected rate, and several months of storage at the maximum generation rate. The expected radwaste generation rate is based on the following assumptions:

- All ion exchange resin beds are disposed of and replaced every refueling cycle
- The WGS activated carbon guard bed is replaced every refueling cycle
- The WGS delay beds are replaced every 10 years
- All wet filters are replaced every refueling cycle
- Rates of compactible and non-compactible radwaste, chemical waste, and mixed wastes are estimated using historical operating plant data

The maximum radwaste generation rate is based on:

- The ion exchange resin beds are disposed of based on operation with 0.25 percent fuel defects

- The WGS activated carbon guard bed is replaced twice every refueling cycle
- The WGS delay beds are replaced every 5 years
- All wet filters are replaced based upon operation with 0.25 percent fuel defects
- Expected rates of compactible and noncompactible radwaste, chemical waste, and mixed wastes are increased by about 50 percent
- Primary to secondary system leakage contaminates the condensate polishing system and blowdown system resins and membranes, and are replaced

The dry solid radwaste will include approximately 1383 cubic feet/year of compactible and non-compactible waste packed into about 14 boxes (90 cubic feet each) and about 10 drums per year. Drums will be used for higher activity compactible and noncompactible wastes. Compactible waste will include HVAC exhaust filter, ground sheets, boot covers, hairnets, etc. Noncompactible waste will include about 60 cubic feet/year of dry activated carbon and other solids such as broken tools and wood. Solid mixed wastes will occupy 7.5 cubic feet/year (one drum). The low activity spent filter cartridges may be compacted to about 3 cubic feet/year and will be stored in the packaged waste storage room. Compaction will be performed by mobile equipment or offsite. The volume of high activity filter cartridges will be about 22.5 cubic feet/ year and will be stored in portable processing or storage casks in the truck bay of the auxiliary building.

The total volume of radwaste to be stored in the radwaste building packaged waste storage room will be 1417 cubic feet/year at the expected rate and 2544 cubic feet/year at the maximum rate. The compactible and noncompactible dry wastes, packaged in drums or steel boxes, will be stored with the mixed liquid and mixed solid, volume reduced liquid chemical wastes, and the lower activity filter cartridges. The quantities of liquid radwaste stored in the packaged waste storage room of the radwaste building will consist of approximately 20 cubic feet of chemical waste and approximately 17 cubic feet of mixed liquid waste. The useful storage volume in the packaged waste storage room will be approximately 3900 cubic feet (10 feet deep, 30 feet long, and 13 feet high), which will accommodate more than one full offsite waste shipment using a tractor trailer truck. The packaged waste storage room will provide storage for more than 2 years at the expected rate of generation and more than a year at the maximum rate of generation. One four-drum containment pallet will provide more than 8 months of storage capacity for the liquid mixed wastes and the volume reduced liquid chemical wastes at the expected rate of generation and more than 4 months at the maximum rate.

FPL expects that, consistent with its current commercial agreements, a third-party contractor will process, store, own, and ultimately dispose of low-level waste generated as a result of

operations. Activities associated with the transportation, processing, and ultimate disposal of low-level waste are expected to comply with all applicable laws and regulations in order to assure the public's health and safety. In particular, the third-party contractor would conduct its operations consistent with NRC regulations (e.g., 10 CFR Part 20), which will assure that the radiological impacts from these activities would be small. Lastly, environmental impacts resulting from management of low-level wastes are expected to be bounded by he NRC's findings in 10 CFR 51.51 (b).

If needed, FPL would construct additional waste storage facilities onsite. Such facilities would be designed and operated pursuant to the guidance in Appendix 11.4-A of the Standard Review Plan, NUREG-0800.

A conservative estimate of solid wet waste includes blowdown material based on continuous operation of the steam generator blowdown purification system, with leakage from the primary to secondary system. The volume of radioactively contaminated material from this source is estimated to be 540 cubic feet/year. Although included here for conservatism, this volume of contaminated resin will be removed from the plant within the contaminated electrodeionization unit and not stored as wet waste.

The condensate polishing system will include mixed bed ion exchanger vessels for purification of the condensate as described in DCD Section 10.4.6. If the resins become radioactive, the resins would be transferred from the condensate polishing vessel directly to a temporary processing unit or to the temporary processing unit via the spent resin tank. The processing unit, located outside of the turbine building, would dewater and process the resins as required for offsite disposal. Radioactive condensate polishing resin would have very low activity. It would be packaged in containers as permitted by U.S. DOT regulations. After packaging, the resins may be stored in the radwaste building. Based on a typical condensate polishing system operation of 30 days per refueling cycle with leakage from the primary system to the secondary system, the volume of radioactively contaminated resin is estimated to be 206 cubic feet/year (one 309-cubic-foot bed per refueling cycle).

The parameters used to calculate the activities of the steam generator blowdown solid waste and condensate polishing resins are given in DCD Table 11.4-1. Based on the above volumes, the disposal volume is estimated to be 939 cubic feet/year.

DCD Tables 11.4-4 and 11.4-8 list the expected principal radionuclides in primary wastes and secondary wastes, respectively. These values represent the radionuclide content in these wastes as shipped.

The spent fuel storage facility is located in the auxiliary building fuel handling area and will house pools that provide storage space for the irradiated fuel. Each unit will have a separate pool with

capacity for 889 fuel assemblies. All portions of the spent fuel transfer operation will be completed underwater and the waterways will be deep enough to maintain adequate shielding above the fuel. The spent fuel pools will have access to a cask-loading pit for loading the spent fuel assemblies into transportation casks. The fuel-handling building will also house equipment for the decontamination of the shipping cask before it leaves the building. The DOE is responsible for the acceptance of title, subsequent transportation, and disposal of spent fuel in accordance with the Nuclear Waste Policy Act of 1982, as amended. FPL has executed a standard spent nuclear fuel disposal contract with DOE for Units 6 & 7.

Section 3.5 References

WEC 2011. Westinghouse Electric Company, LLC*. AP1000 Design Control Document*, Document No. APP-GW-GL-700, Tier 2 Material, Rev. 19, June 13, 2011.

3.6 NONRADIOACTIVE WASTE SYSTEMS

The following section provides descriptions of nonradioactive waste streams that would be expected from the operation of Units 6 & 7.

This section is divided into three subsections that evaluate these nonradioactive waste systems as follows:

- Effluents containing chemicals or biocides
- Sanitary system effluents
- Other effluents

3.6.1 EFFLUENTS CONTAINING CHEMICALS OR BIOCIDES

Proper water chemistry for plant operation requires the treatment of potable water, reclaimed water, and saltwater that would be used in the various plant water systems such as circulating water, service water, potable water, and demineralized water systems.

The waste effluent from the station demineralized water system, sanitary waste treatment plant, FPL reclaimed water treatment facility, filter backwash wastewater, and other nonradioactive drains throughout the station would be collected in the blowdown sump along with the blowdown from the circulating water and service water systems. The combined stream would be pumped to the deep injection wells. The combined stream would be controlled through engineering design and operational procedures to meet the requirements established in the underground injection control permits.

The effluent waste stream constituents and concentrations in the blowdown sump are identified in Table 3.6-2 for a reclaimed water supply as makeup to the circulating water system and Table 3.6-3 for a saltwater supply as makeup to the circulating water system. The characterization of the circulating water system blowdown is based on two makeup water cases that use either 100 percent reclaimed or 100 percent saltwater supply as makeup water. Saltwater from the radial collector wells would be used as makeup for the circulating water system when an adequate quantity and/or quality of reclaimed water is not available. Constituents in effluent discharge in the case of combined reclaimed and saltwater supply would be within the rates and limits described for each individual water supply.

The water treatment chemicals used in the circulating water system, service water system, FPL reclaimed water treatment facility, steam generator blowdown system, and demineralized water system are identified in Table 3.6-1. Table 3.6-1 shows the chemicals that would be used in each system, the estimated amount used per year, the frequency of use, and the chemical

concentration. The circulating water system chemicals are based on two cases of makeup water supply: 100 percent reclaimed or 100 percent saltwater. The quantity of chemical additives to the plant systems in the case of combined reclaimed and saltwater supply would be within the concentration of chemicals described for each individual water supply.

The systems that treat the water for plant operation are described in Subsection 3.3.2. The concentration factors for the CWS and service water system cooling systems are addressed in Section 3.4. The concentrations of material in the reclaimed water, saltwater, and potable water supplies are presented in Section 2.3. A description of the sources of reclaimed and saltwater supply is provided in Section 3.4. The airborne concentration of chemicals and solids in spray is addressed in Subsection 5.3.3. The discharge limits are presented in Subsection 5.5.1.1.

3.6.2 SANITARY SYSTEM EFFLUENTS

A sanitary waste system would be maintained onsite during the preconstruction, construction, and operation of Units 6 & 7. During construction, portable sanitary waste facilities would be used until the permanent sanitary waste treatment facility is functional, and as needed during the peak construction or outage activities to augment the permanent system. These temporary facilities may include centralized restroom and hand wash trailers in addition to single restroom units placed throughout the site, as necessary. The waste collected in these temporary facilities would be disposed of by a licensed sanitary waste disposal contractor.

Sanitary treatment would be provided by a packaged sanitary treatment plant located on the Units 6 & 7 plant area. The sanitary treatment plant would be designed to process sanitary effluent from Units 1 through 7 and would operate in compliance with applicable FDEP rules.

Units 6 & 7 will have a sanitary drainage system. The sanitary drainage system will collect sanitary waste from plant restrooms and locker room facilities and carries this waste to the sanitary treatment plant where it will be processed. The sanitary drainage system will not service facilities in radiologically controlled areas.

For Units 6 & 7, the sanitary treatment plant would be designed to accommodate 50 gallons per person per day for 500 people during normal operation per unit and 1000 people during plant shutdown per unit. The sanitary treatment plant would also be designed to accommodate the sanitary effluent from Units 1 through 5. The design flows for the sanitary system are provided in Tables 3.3-1 and 3.3-2.

The waste sludge generated by the sanitary treatment plant, estimated at 1300 gallons per day at 1.5—2 percent solids content, would be disposed of offsite via contract with a licensed waste transportation and disposal company. Offsite disposal methods may include land filling, incineration, land application, and/or further treatment at licensed facilities. The treated liquid effluent from the sanitary drainage system would be pumped to the blowdown sump where it

would be combined with other effluent streams, as described in Subsection 3.6.1. The combined effluent would be discharged to the deep injection wells.

3.6.3 OTHER EFFLUENTS

This subsection describes the other miscellaneous nonradioactive gaseous, liquid, and solid effluents not addressed in Subsection 3.6.1 or 3.6.2 that are discharged to the environment. The applicable state permits for the gaseous, liquid, and solid effluents are described in Section 1.2.

3.6.3.1 Gaseous Effluents

Each unit contains two standby diesel generators, two ancillary diesel generators, and one diesel-driven fire pump. During normal operation of the plant, the operation of this equipment is infrequent and typically limited to periodic testing. Plant operation would result in small amounts of nonradioactive gaseous emissions to the environment from the equipment associated with the plant auxiliary system. Table 3.6-4 shows the projected annual emissions (tons/year) from the diesel generators and the diesel-driven fire pumps. The standby diesel generators are located in the diesel generator building. The diesel-driven fire pump is located in the diesel-driven fire pump enclosure. The ancillary diesel generators are located in the annex building. Each standby diesel generator has a 60,000-gallon fuel oil storage tank and a 1300-gallon fuel oil storage day tank. The two ancillary diesel generators have a common 650-gallon fuel oil storage tank, and the diesel-driven fire pump has a 240-gallon fuel oil storage tank. The projected annual hydrocarbon emissions from the diesel storage tanks at Turkey Point Units 6 & 7 are shown in Table 3.6-5.

3.6.3.2 Liquid Effluents

The wastewater system collects and processes liquid effluent from equipment and floor drains from nonradioactive building areas, and is capable of handling the anticipated flow of wastewater during normal plant operation and during plant outages. A process diagram and flow rates of the water system are addressed in Section 3.3. The wastewater system:

- Removes oil and/or suspended solids from miscellaneous waste streams generated from the plant
- Collects system flushing wastes during startup before treatment and discharge
- Collects and processes fluid drained from equipment or systems during maintenance or inspection activities

- Directs nonradioactive equipment and floor drains that may contain oily waste to the building sumps and transfer their contents for disposal in accordance with applicable regulations and permit specifications

Wastes from the turbine building floor and equipment drains (which include laboratory and sampling sink drains, oil storage room drains, the main steam isolation valve compartment, auxiliary building penetration area, and the auxiliary building HVAC room) are collected in the two turbine building sumps. Drainage from the diesel generator building sumps, the auxiliary building nonradioactive sump, and the annex building sump is also collected in the turbine building sumps. The turbine building sumps provide a temporary storage capacity and a controlled source of fluid flow to the oil separator. A radiation monitor located on the common discharge piping of the sump pumps alarms upon detection of radioactivity in the wastewater. The radiation monitor also trips the sump pumps on detection of radioactivity to isolate the contaminated wastewater. Provisions are included for sampling the sumps. If necessary, the wastewater from the turbine building sumps will be diverted to the liquid radwaste system for processing and disposal.

The turbine building sump pumps route the wastewater from either of the two sumps to the oil separator for removal of oily waste. The diesel fuel oil area sump pump also discharges wastewater to the oil separator. A bypass line allows for the oil separator to be out of service for maintenance. The oil separator has a small reservoir for storage of the separated oily waste that flows by gravity to the waste oil storage tank. The waste oil storage tank provides temporary storage before shipment for offsite disposal.Turkey Point Units 3 & 4 generated approximately 1550 gallons of used oil in 2010. Based on this generation rate, Turkey Point Units 6 & 7 would produce approximately 1550 gallons of used oil. The used oil was transported offsite by a licensed contractor and recycled for heat reclamation. It is anticipated that similar practices would be followed for Units 6 & 7.

The wastewater from the oil separator and the condenser water box drains by gravity to the wastewater retention basin for settling of suspended solids and any required treatment before discharge. The wastewater basin transfer pumps route the basin effluent to the blowdown sump where it would be combined with the cooling tower blowdown streams as part of the final plant effluent described in Subsection 3.6.1.

Stormwater would be routed to the industrial wastewater facility.

3.6.3.3 Solid Effluents

Nonradioactive solid waste includes typical industrial wastes such as metal, wood, and paper, as well as process wastes such as nonradioactive resins, filters, and sludge. Solid waste debris would also be collected from cleaning cooling basin forebay screens and catch basin screens. A solid waste minimization program would be employed as described in Subsection 5.5.1. To the

extent practicable, scrap metal, lead acid batteries, paper, and other recyclable material would be recycled offsite at an approved recycling facility. The nonradioactive wastes that cannot be recycled would be disposed of in a permitted landfill. Based on FPL's current operating experience for the existing units, Units 6 & 7 would be expected to produce approximately 1000 tons annually of nonradioactive, nonhazardous solid waste per year.

The solid waste collected from the periodic cleaning of cooling basin forebay screens and catch basin screens would be disposed of in a permitted landfill.

Approximately 4800 pounds of nonradioactive hazardous waste was generated from Turkey Point Units 3 & 4 in 2010. The majority of this waste was expired paint and laboratory chemicals. Based on this current waste generation rate, Turkey Point Units 6 & 7 would be expected to generate approximately 4800 pounds annually of nonradioactive hazardous waste. These wastes would be collected and stored onsite until disposed of at an offsite licensed commercial waste facility or recovered at an offsite permitted recycling facility. Currently, the majority of the nonradioactive hazardous waste is incinerated at a permitted offsite facility.

The reclaimed water from the Miami-Dade Water and Sewer Department (MDWASD) would be processed through the FPL reclaimed water treatment facility before it can be used as makeup water to the circulating water cooling system**.** The FPL reclaimed water treatment facility would generate solid waste (i.e., sludge) from the treatment of reclaimed water from the MDWASD. Assuming a continuous supply of reclaimed water from the MDWASD and Units 6 & 7 are in normal operation, the estimated amount of sludge produced would be approximately 435 tons per day. If the reclaimed water is not available, the estimated amount of sludge would be less. A description of the FPL reclaimed water treatment facility is provided in Section 3.3. Sludge from the FPL reclaimed water treatment facility would be disposed of in a permitted landfill.

Table 3.6-1
Estimated Chemicals Added to Liquid Effluent Streams from Two Units

System	Chemical-Type/Specific	Amount Used (gallon/year)	Frequency of Use	Chemical Concentrations
FPL Reclaimed Water Treatment Facility	Ferric Chloride	2,190,000	Continuous	50 ppm
	Polymer	20,500	Continuous	1 ppm
	Lime	42,400[c]	Continuous	383 ppm
	Sulfuric Acid	380,000	Continuous	26.2 ppm
	Methanol	1,794,000	Continuous	30.61 ppm
	Sodium Bisulfite	85,500	Continuous	1.46 ppm
Circulating Water System[a]	Proprietary Scale Inhibitor, High Stress Polymer, Phosphinosuccinic Oligomer	244,400	Continuous	60 ppm
	Sodium Hypochlorite	214,500	Shock treatment 30 minutes per day	2 ppm
Circulating Water System[b]	Sodium Hypochlorite	215,000	Shock treatment 30 minutes per day	2 ppm
	Sodium Hypochlorite	352,000	Continuous	1 ppm
	Sulfuric Acid	883,000	Continuous	53 ppm
	Proprietary scale Inhibitor, High Stress Polymer	591,500	Continuous	25 ppm
	Proprietary Scale Inhibitor, Sodium Salt of Phosphonomethylate Diamine	472,500	Continuous	20 ppm
	Proprietary Scale Inhibitor, Silicate Inhibiting Polymer	6460[d]	Intermittent — during transition	35 ppm
Demineralizer Water System	Sulfuric Acid	10,800	Continuous	172.5 ppm
	Proprietary Scale Inhibitor, Phosphoric Acid	1,790	Continuous	6 ppm
	Sodium Bisulfite	2,740	Continuous	2.92 ppm
Service Water	Sodium Hypochlorite	7,130	Shock treatment 30 minutes per day	2 ppm
	Sulfuric Acid	78,200	Continuous	649 ppm
	Proprietary Phosphoric Acid Scale Inhibitor	1,020	Continuous	6 ppm
	Proprietary Dispersant, High Stress Polymer	510	Continuous	3 ppm
Steam Generator Blowdown System	Oxygen Scavenging/ Morpholine	800	Used as needed	To be determined during detailed design
	pH Adjustment/ Carbohydrazide	800	Used as needed	To be determined during detailed design
	pH Adjustment/ Hydrazine	800	Used as needed	To be determined during detailed design

(a) The chemicals provided are based on the case of makeup water for the circulating system of 100 percent reclaimed water from the Miami-Dade Water and Sewer Department.
(b) The chemicals provided are based on the case of makeup water for the circulating system of 100 percent saltwater from the radial collector wells.
(c) Lime quantity is tons per year instead of gallons per year.
(d) Proprietary Scale Inhibitor Polymer is gallons per transition instead of gallons per year.

Table 3.6-2
Reclaimed Water Estimated Constituents and Concentrations Discharged to Deep Injection Wells[(a)]

Constituent Name	Concentration (mg/L)
Ammonia as N	Not Calculated
BOD	Not Calculated
Boron	No Data
Bromide	No Data
Hexavalent Chromium	0.065
Fluoride	2.46
Alkalinity, total as $CaCO_3$	72
Nitrate as N	16.1
Sulfate	484.0
Total Organic Carbon	118
Total Dissolved Solids	2721
Total Suspended Solids	33.6
Phosphorous	0.73
Phosphate	2.40
Aluminium	3.02
Antimony	0.0245
Arsenic	0.0131
Barium	1.86
Beryllium	0.0933
Cadmium	0.00718
Chromium	0.0653
Copper	0.0433
Iron	1.63
Lead	0.112
Nickel	0.088
Selenium	0.0359
Silver	0.0163
Zinc	0.646
Calcium	355
Magnesium	63
Manganese	0.379
Sodium	426
Silica as SiO_2	26.4
Chloride	1247
Nitrite as N	4.02
Conductivity (μmhos/cm)	5577
pH (standard units)	7.89
Total Residual Chlorine	2
Thallium	0.00620
Mercury	0.00653
Heptachlor	0.000023[(b)]
Ethylbenzene	[(b)(c)]
Toluene	0.00174[(b)]
Tetrachloroethylene	0.00359[(b)]

(a) The information provided is based on the case of makeup water for the circulating system of 100 percent reclaimed water from the Miami-Dade Water and Sewer Department.

(b) These chemicals were not included in the original evaluation used in the development of the table but have now been evaluated using recent data and added to the table to address issues raised in Contention NEPA 2.1 in LBP-11-06.

(c) Makeup water constituents were below method detection limits.

Table 3.6-3
Saltwater Estimated Constituents and Concentrations Discharged to Deep Injection Wells[a]

Constituent Name	Concentration(mg/L)
Ammonia as N	Not Calculated
BOD	Not Calculated
Boron	8.65
Bromide	166
Hexavalent Chromium	No Data
Fluoride	0.00162
Alkalinity, total as $CaCO_3$	149
Nitrate as N	4.19
Sulfate	4,272
Total Organic Carbon	7.0
Total Dissolved Solids	39,506-53,168[c]
Total Suspended Solids	13.3
Phosphorous	1.05
Phosphate	1.110
Aluminium	[b]
Antimony	[b]
Arsenic	[b]
Barium	0.1214
Beryllium	[b]
Cadmium	0.00107
Chromium	0.00441
Copper	0.0144
Iron	0.281
Lead	0.00496
Nickel	0.0260
Selenium	0.019
Silver	[b]
Zinc	10.8
Calcium	787
Magnesium	2,615
Manganese	0.0400
Sodium	19,164
Silica as SiO_2	15.4
Chloride	30,009
Nitrite as N	0.0966
Conductivity (µmhos/cm)	23,027-31,639[c]
pH (standard units)	7.89
Total Residual Chlorine	No Data
Thallium	[b]
Mercury	[b]

(a) The information provided is based on the case of makeup water for the circulating system of 100 percent saltwater from the radial collector wells.
(b) Makeup water constituent values were below method detection limits.
(c) Ranges for saltwater are presented for TDS and Conductivity. Maximum values presented for other constituents.

Table 3.6-4
Annual Estimated Emissions from Diesel Generators and Diesel-Driven Fire Pumps for Two Units[a]

Pollutant Discharged	Four 4000 KW Standby Diesel Generators (ton/yr)[b]	Four 35 KW Ancillary Diesel Generators (ton/yr)[b]	Two Diesel-Driven Fire Pumps (ton/yr)[b]
Sulfur Oxides	6.06E-03	8.09E-05	2.08E-04
Nitrogen Oxides + Nonmethanol Hydrocarbons[c]	—	0.050	0.122
Total Hydrocarbons + Nitrogen Oxides [c]	11.83	—	—
Particulate Matter[c]	0.599	4.25E-03	6.10E-03
Carbon Monoxide[c]	5.99	0.052	0.106[d]

(a) Assumes fuel oil Grade No. 2-D S15, sulfur content 15 ppm.
(b) Based on 4 hours of operation per month for each diesel-driven fire pump and diesel generator. There are two standby diesel generators, two ancillary diesel generators, and one diesel-driven fire pump, per unit.
(c) Emissions factors for standby diesel generator, ancillary diesel engine, and diesel-driven fire pump are based on information from 40 CFR Part 60.
(d) Based on 2008 CO exhaust emissions for a diesel-driven fire pump.

Table 3.6-5
Annual Estimated Emissions from Diesel Fuel Oil Storage Tanks for Two Units

Pollutant Discharged	Four 60,000 Gallon Standby Diesel Generator Fuel Oil Storage Tanks[a]	Four 1300 Gallon Standby Diesel Generator Fuel Oil Storage Day Tanks[a]	Two 650 Gallon Ancillary Diesel Generator Fuel Oil Storage Tanks[b]	Two 240 Gallon Diesel-Driven Fire Pump Fuel Oil Storage Tanks[c]
Hydrocarbons[d] (lbs/yr)	17.32	7.44	0.74	0.44

(a) Based on total fuel throughput of 27,802 gal/yr for each tank.
(b) Based on total fuel throughput of 278 gal/yr for each tank.
(c) Based on total fuel throughput of 1650 gal/yr for each tank.
(d) Hydrocarbon emissions from the diesel fuel oil storage tanks were calculated using the EPA TANKS Program (Version 4.0.9d).

3.7 POWER TRANSMISSION SYSTEM

This section provides a description of the design characteristics and interfaces of the power transmission system for Units 6 & 7. The FPL power transmission system consists of transmission lines and substations that link the various generation facilities, load centers, and grid interties within the FPL service territory at various voltages ranging from 69 kV to 500 kV. In Miami-Dade County at the location of Units 6 & 7, the existing transmission lines are 230 kV. The transmission lines, substation/switchyard, and associated structures and equipment for the new nuclear units are rated at transmission voltages of 230 kV and 500 kV. FPL owns and operates the transmission system for the new nuclear units. A description of the components and activities necessary to connect between Units 6 & 7 and the FPL transmission system is presented in this section.

3.7.1 SWITCHYARD INTERFACES

A new switchyard/substation on the Units 6 & 7 plant area would be used to transmit electrical power output from Units 6 & 7 to the FPL transmission system. The new substation would be known as the Clear Sky substation. The substation would consist of two sections, a 230 kV section and a 500 kV section. Units 6 & 7 would be connected to the 230 kV section of Clear Sky substation section via onsite underground transmission facilities. The plot plan (Figure 3.1-3) shows the location of the new substation.

The Clear Sky substation would be a "breaker-and-a-half" bus configuration. The breaker-and-a-half bus configuration enhances reliability by providing multiple current flow paths between the units and the transmission lines, allowing continued transmission with a bus out of service due to a fault or for maintenance.

The 500 kV section of the substation would be configured to accommodate two new transmission lines and two 230 kV/500 kV autotransformers. The 230 kV section of the substation would be connected to the 500 kV transmission lines through the autotransformers. The bus breakers on both sides of the autotransformers would provide protection.

The 230 kV section of the substation would be configured to accept four new 230 kV lines interconnecting to the transmission system with two new 230 kV transmission lines and a normally open (NO) line to supply an alternate feed of offsite power to the Turkey Point substation. This alternate feed would provide a path for offsite power between the substations in the event of loss of transmission either at the Clear Sky substation or the Turkey Point substation. The Turkey Point substation is the existing substation for Units 1 through 5. The fourth position would be available for any future requirements.

The 230 kV section of the substation will include one terminal for the Unit 6 generator step-up transformer connection, one terminal for the Unit 7 generator step-up connection, two terminals

for connection to the Unit 6 reserve auxiliary transformers, and two terminals for connection to the Unit 7 reserve auxiliary transformers.

3.7.2 TRANSMISSION SYSTEM

The Clear Sky substation would be connected to the FPL transmission system through two new 500 kV and three new 230 kV transmission lines. The details of these transmission lines and their termination points to the FPL transmission system are summarized below:

Transmission Line (kV)	Termination Point	Approximate Length (miles)	Thermal Rating (MVA)
Clear Sky-Levee # 1 (500 kV)	Levee 500 kV	43	3464
Clear Sky-Levee # 2 (500 kV)	Levee 500 kV	43	3464
Clear Sky-Davis (230 kV)	Davis 230 kV	19	1191
Clear Sky-Pennsuco (230 kV)	Pennsuco 230 kV	52	1191
Clear Sky-Turkey Point (230 kV)	Turkey Point (NO)	0.5	1191
Davis-Miami (230 kV)	Miami 230 kV	18	915

See Figures 9.4-13 and 9.4-14 for a general location map of these transmission lines.

3.7.2.1 Design Parameters

The 230 kV lines would be rated at 2990 amps. These lines would be constructed with a two-conductor bundle of 954-thousand-circular-mils aluminum conductor aluminum-clad steel reinforced (ACSR/AW) conductor and optical ground wire or overhead ground wire sized based on the available fault current.

The 230 kV transmission tower structures would be single pole concrete (a gray/white color), approximately 80–90 feet high above ground depending on span length and other design factors. The substation pulloff towers would be galvanized steel or concrete.

The 500 kV transmission lines would be constructed using guyed single-circuit concrete, tubular steel or galvanized lattice steel structures. Heights would range from 140-160 feet depending on span length and other design factors. If tubular steel structures are used, similar structures with larger gauge steel would be used where the transmission lines turn light angles (2–15 degree). Similarly, where the lines turn heavy angles (55–90 degrees), three-pole structures with guys and anchors would be used. Structures would be galvanized steel (silver-gray color) or concrete (gray/white color).

The 500 kV lines would be framed in a triangular configuration. The conductor for these lines would be a three-conductor bundle of 1272-thousand-circular-mils ACSR/AW conductor with a

nominal operating voltage of 500,000 volts. The maximum current rating for this conductor would be 4215 amperes. Span distance between structures would be approximately 900–1000 feet. Site-specific conditions during detailed design may require some variance from this distance to avoid and minimize impacts to wetlands or cultural resources.

The transmission lines would be designed to meet or exceed the clearance-to-ground requirements of C2-2007, the National Electrical Safety Code (NESC) (IEEE 2007). The 230 kV and 500 kV lines would be designed to keep the electric field at the conductor surface below corona inception. The electric field induced current from transmission lines would meet the allowable NESC code (IEEE 2007) and Florida Department of Environmental Protection Florida Administrative Code (F.A.C.) requirements.

3.7.3 TRANSMISSION LINE CORRIDORS

Approval of the proposed transmission line corridors is under the authority of the Florida Power Plant Siting Act. A route study and corridor selection process was performed for the new units under the requirements of this act. Specifically, the study area was defined, candidate routes were delineated, and routes evaluated using both qualitative and quantitative criteria. There are land use constraints and opportunities in the corridor selection. Examples of land use constraints in the selection of transmission corridors include airports. Examples of land use opportunities include roads, canals and other existing linear facilities. The corridor selection process involves both public meetings and meetings with various state agencies and affected local municipalities. The end result of the selection process was the identification of a preferred corridor to submit for licensing approval for each transmission line. Selection of transmission line corridors is described in Subsection 9.4.3. The proposed lengths, widths, and area of the preferred corridors (where known), including modification and use of existing rights-of-way where applicable, are also described in Subsection 9.4.3.

3.7.3.1 Transmission Line Corridor Ecological and Cultural Surveys

As part of the transmission corridor selection process, ecological and cultural resource surveys were performed along the proposed corridors. The results of the ecological and cultural or historical surveys are described in Section 2.4 and Subsection 2.5.3, respectively. Subsection 9.4.3 describes the process of corridor selection that minimized impacts to the surrounding environment, as stipulated in the PPSA. This process, which included both qualitative and quantitative criteria in the use of resource mapping and alternate route identification, was used as part of the corridor study area selection and ultimately the selection of the preferred corridor(s).

3.7.3.2 Transmission Corridor Maintenance

The safe and reliable operation of transmission lines and maintenance of the right-of-way and facilities would be achieved through regular inspection of the structures, insulators, access areas, and vegetation management in the rights-of-way. These inspections would consist of ground patrols (truck) and/or aerial (airplane/helicopter) patrols. Transmission lines normally require minimal maintenance. However, FPL would inspect the transmission lines regularly to look for problems caused by weather, vandalism, vegetation growth, etc.

In areas that are not in active agricultural cultivation, FPL would manage vegetation within the rights-of-way using a variety of methods, including trimming, mowing, and the use of growth regulators and herbicides targeting species that are incompatible with the safe access, operation, and maintenance of the transmission system.

FPL's right-of-way maintenance program is site-specific and follows standard industry practices. The exact manner in which maintenance would be performed would depend on location, type of terrain, and the surrounding environment. Vegetation removal would be minimized consistent with safe and reliable operation of the transmission lines. Each area of the right-of-way would be addressed based on site-specific vegetation. Endangered or threatened species, if present, would be considered and accommodated in the maintenance program. Growth regulators and herbicides, when selectively used, would meet federal, state, and local regulations.

3.7.3.3 Transmission System Operation

FPL is the transmission system operator and it constructs, owns, and operates all substation and transmission facilities between the plant and the point of interconnection. An interface agreement exists between FPL Transmission & Substation — Power Supply Department and FPL Turkey Point Units 1 through 5, which establishes the protocol to provide effective monitoring and oversight of all grid, switchyard and plant activities. This agreement would be updated to include Units 6 & 7. Power Supply Department directives implement the agreement. These directives facilitate prompt and effective communications between the transmission system operator and the plant operators. The transmission system operator regularly inspects switchyard(s) and performs regular maintenance and necessary repair or replacement of equipment.

FPL uses a real-time contingency analysis program that is used by FPL's transmission system operators in determining the security level of the transmission system under a number of outage contingency criteria. The program simulates a set of contingencies on the current power system and produces an output of system conditions for each defined contingency. The program provides an updated output every 5 minutes using real-time system conditions (e.g., real time line outages, real time breaker status, etc.). For each defined contingency simulated, specified elements are checked for limit violations (e.g., line overloads, voltage limits, reactive limits at

generator buses). All contingencies that cause violations are output along with the identification of the violations and information and magnitude of the violation. The output of the contingency analysis program is used continuously by the operators to make critical decisions in response to potential severe conditions.

3.7.3.4 Noise

Transmission lines and substations can produce noise from corona discharge (the electrical breakdown of air into charged particles). The noise, referred to as corona noise, occurs when air ionizes near irregularities, such as nicks, scrapes, dirt, or insects on the conductors. Corona noise is composed of both broadband noise, characterized as a crackling noise, and pure tones, characterized as a humming noise. Corona noise, which is greater with increased voltage, is also affected by weather. During dry weather, the noise level is low and often indistinguishable from background noise. In wet conditions, water drops collecting on conductors can cause louder corona discharges.

During rain showers, the corona noise would likely not be readily distinguishable from background noise. During very moist, non-rainy conditions, such as heavy fog, the resulting small increase in the background noise levels would not be expected to result in annoyance to adjacent residents.

Periodic maintenance activities, particularly vegetation management, would produce noise from mowing, bush-hogging, and tree and limb trimming and grinding. This noise, particularly from bush-hogging or helicopter patrol operation, would be loud enough to disturb adjacent residents. However, this would be of short duration during the day and an infrequent occurrence.

The noise levels resulting from transmission system operations would be in accordance with state and local code requirements. Actual decibel noise levels would be held to a minimum by proper sizing of conductors and the use of corona-free hardware.

Additional information regarding noise levels resulting from transmission system operation is provided in Subsections 5.6.3.4 and 5.8.1.1.

3.7.3.5 General Methods of Construction

Transmission line construction would occur as a series of tasks accomplished in sequence by different specialized crews. Construction phases would consist of right-of-way clearing, access road and pad construction (where necessary), line construction, and right-of-way restoration. Construction phases would follow standard industry practices and would be performed sequentially along the right-of-way such that activities in any one area would be short term.

Clearing would be required for construction of the transmission line structures, pads, and roads. In the structure/pad areas, the right-of-way would be cleared across the entire right-of-way width. Upland areas that are not heavily vegetated with trees would be mowed. All vegetation in the right-of-way whose mature height exceeds 14 feet would also be cleared. The machinery required for clearing would include bulldozers, shearing machinery, and chain saws.

The initial step of transmission line construction would be the installation of foundations, if required. Foundations would be either steel or concrete. The actual type would be determined during detailed design. For steel foundations, the caisson would be vibrated into the ground using a vibratory hammer suspended from a crane. For concrete foundations, a hole would be excavated using an augering machine. Reinforcing steel would then be installed, and concrete would be hauled and poured in place by concrete mixing trucks. For precast foundations, a backhoe would be used to excavate the hole. If concrete poles are used, they would be directly embedded without a separate foundation.

The structures would be framed and erected using cranes and other support vehicles. After the structures are set, wire-pulling equipment would be used to install conductors and overhead ground wires. Bulldozers, tractors, trailers, and light vehicles, as required, would also be used to support line construction. Helicopters could also be used as part of the conductor stringing operation.

Section 3.7 References

IEEE, 2007, C2-2007, National Electrical Safety Code (NESC).

F.A.C. 2008. Florida Administrative Code 62-814.450, Florida Department of Environmental Protection, June 2008. Available at http://www.dep.state.fl.us/legal/Rules/62-814/62-814.doc.

3.8 TRANSPORTATION OF RADIOACTIVE MATERIALS

Operation of new Units 6 & 7 would require transportation of unirradiated fuel, irradiated fuel (spent nuclear fuel), and radioactive waste. The subsections that follow describe transportation of these three types of radioactive materials.

Subsection 5.7.2 also addresses the conditions in 10 CFR 51.52 (a) (1) through (a) (5) regarding use of Table S-4 to characterize both the impacts of radioactive materials transportation and to provide an analysis of the radiological impacts from incident-free transportation of these materials. Section 7.4 addresses postulated radiological transportation accidents.

3.8.1 TRANSPORTATION OF UNIRRADIATED FUEL

Transportation of new fuel assemblies to the Turkey Point site from a fuel fabrication facility would be in accordance with DOT (49 CFR Parts 173, 178, and 397) and NRC regulations (10 CFR Part 71). The initial fuel loading will consist of 157 fuel assemblies per unit. On an annualized basis, refueling will require an average of 43 fuel assemblies per unit per year. The fuel assemblies would be fabricated at a fuel fabrication plant and shipped by truck to the Turkey Point site shortly before they would be required. The details of container design, shipping procedures, and transportation routings would be in accordance with DOT and NRC regulations and would depend on the requirements of the suppliers providing the fuel fabrication services. Truck shipments would not exceed 73,000 pounds, as governed by federal and/or state gross vehicle weight restrictions.

3.8.2 TRANSPORTATION OF IRRADIATED FUEL

Spent fuel assemblies would typically be discharged from each unit on an 18-month refueling cycle and would remain in the spent fuel pool at each unit for at least 5 years while short half-life isotopes decay. As described in Subsection 3.5.3, each unit will have a spent fuel pool with capacity for 889 assemblies, which is adequate to support 11 refueling cycles plus margin for one full core offload. After a sufficient decay period, the fuel would be removed from the pool, packaged in spent fuel shipping/storage casks, licensed in accordance with 10 CFR Part 72, and transferred to either an independent spent fuel storage installation facility onsite or an offsite disposal facility. Packaging of the fuel for offsite shipment would comply with applicable DOT (49 CFR Parts 173 and 178) and NRC regulations (10 CFR Part 71) for transportation of radioactive material. By law, the DOE is responsible for spent fuel transportation from reactor sites to a repository (Nuclear Waste Policy Act of 1982, as amended). DOE would determine the transport mode.

3.8.3 TRANSPORTATION OF RADIOACTIVE WASTE

As described in Subsection 3.5.3, low-level radioactive waste would be packaged to meet transportation and disposal site acceptance requirements. Packaging of waste for offsite shipment would comply with applicable DOT (49 CFR Parts 173 and 178) and NRC regulations (10 CFR Part 71) for transportation of radioactive material. The packaged waste would be stored on site on an interim basis before being shipped offsite to a licensed processing, storage, or disposal facility. Onsite storage for more than a year at the maximum rate of generation would be provided in the waste accumulation room of the radwaste building. Radioactive waste would be shipped offsite by truck.

FPL expects that, consistent with its current commercial agreements, a third-party contractor will process, store, own, and ultimately dispose of low-level waste generated as a result of operations. Activities associated with the transportation, processing, and ultimate disposal of low-level waste would comply with applicable laws and regulations in order to ensure the public's health and safety. In particular, the third-party contractor would conduct its operations consistent with NRC regulations (e.g., 10 CFR Part 20), which will ensure that the radiological impacts from these activities would be small. Lastly, environmental impacts resulting from transportation of low-level wastes are expected to be bounded by the NRC's findings in 10 CFR 51.52 (c).

Under 10 CFR 20.2001, reactor licensees may transfer low-level radioactive waste material to another licensee that is specifically licensed to accept and treat waste prior to disposal. Studsvik, Inc., has a licensed low-level radioactive waste treatment facility in Erwin, Tennessee. FPL has signed a letter of intent with Studsvik to enter into negotiations for a contract for the performance of work by Studsvik to include the shipment, processing, storage, and disposal of low-level radioactive waste produced by Units 6 & 7 (FPL 2009). Under the proposed contract, Studsvik would treat the Class B and C waste at its Erwin, Tennessee facility and thereafter take responsibility for storage and final disposal.

Section 3.8 References

FPL 2009. Florida Power & Light Company. Letter of Intent Between Florida Power & Light Company and Studsvik, Inc., May 22, 2009.

3.9 PRECONSTRUCTION AND CONSTRUCTION ACTIVITIES

This section provides a conceptual description of preconstruction and construction activities for new Units 6 & 7. The description of activities pertinent to addressing potential impacts of plant construction and mitigative measures to prevent or minimize impacts, is presented in Chapter 4. Preconstruction and construction activities are addressed in this section. Transmission corridor and transmission line activities are presented in Section 3.7.

Preconstruction Activities

Upon receipt of necessary approvals, preconstruction activities would be initiated at the site before receipt of the COL including, for example, initial site excavation and build up, installing temporary facilities, construction support facilities, service facilities, utilities, upgrading the equipment barge unloading area, cooling water pipelines, bridges, road improvements, and other nonsafety-related structures, systems, and components.

COL Construction

Upon receipt of the COL, the construction activities described in 10 CFR 50.10(a)(1) (i-vii) could begin. Specifically, constructing the structures, systems, and components of the plant, such as the in-place erection of the containment and auxiliary buildings, placement of structure, system, and component equipment, etc., could begin.

Schedule

The construction schedule assumes approximately 69 months for preconstruction activities. Unit 6 construction would begin after receipt of the COL and would have an approximate 66-month duration for construction activities and a 6-month duration for fuel load and startup. Unit 7 safety-related construction would begin approximately 12 months after Unit 6 safety-related construction begins and would follow identical construction and fuel load/startup durations. Units 6 & 7 would initiate electric generation output in 2022 and 2023, respectively. Table 3.9-1 summarizes the projected major milestone dates for the preconstruction activities, COL construction, and startup and operations for Units 6 & 7.

Summary of Land Disturbances

The construction activities would comply with the state site certification conditions and the U.S. Army Corps permit requirements (see Section 1.2). Environmental best management practices would be implemented to minimize impacts during preconstruction and construction activities. Although soil or groundwater contamination is not anticipated at any of the onsite or offsite areas proposed for land disturbance (e.g., excavation, land clearing, grading), applicable guidelines and procedures contained in Florida Administrative Code (F.A.C.) Chapter 62-780

"Contaminated Site Cleanup Criteria" would be followed by FPL, including any required site assessments and other potential remedial actions. A summary of the major land disturbances on the plant property, in the vicinity, and the region is as follows:

Turkey Point Plant Property Land Disturbance

- Units 6 & 7 plant area including power blocks, makeup water reservoir, switchyard, deep injection wells, associated facilities, etc. (218 acres)
- Western laydown areas, including filling of dead-end canal (52 acres)
- Parking and nuclear administration and training buildings (32 acres)
- Security buildings and associated pull-off and parking areas (previously disturbed)
- Improvements/construction of the heavy haul road from the equipment barge unloading area to the Units 6 & 7 plant area (5 acres)
- Transmission infrastructure improvements (e.g., towers and bridges) (previously disturbed)
- Transmission laydown areas (3 acres)
- Sanitary waste pipeline from existing units to Units 6 & 7 plant area (previously disturbed)
- Equipment barge unloading area (0.75 acres)
- "A," "B," and "C" spoils areas (211 acres)
- Radial collector wells and associated facilities (3 acres), radial collector well laydown area (3 acres), and water supply pipelines to the Units 6 & 7 plant area (13 acres)
- FPL reclaimed water treatment facility (44 total acres; 29 acres of undisturbed land; 15 acres of disturbed land as part of west transmission corridor), reclaimed water supply pipelines to the facility from the Miami-Dade Water and Sewer Department South District Wastewater Treatment Plant, and water supply pipelines from the facility to the Units 6 & 7 plant area (zero acres of undisturbed land)
- Potable water pipelines (previously disturbed)

Vicinity Land Disturbance

- FPL-owned fill source (300 acres)

- Improvements to SW 328th Street/N. Canal Drive, SW 344th Street/Palm Drive, SW 359th Street, SW 137th Avenue, and SW 117th Avenue (128 acres, includes improvements on plant property)

Region Land Disturbance

- Corridor for 72-inch diameter (or equivalent) reclaimed water pipelines (1886 acres)
- Corridor for 30-inch diameter (or equivalent) potable water pipelines (327 acres)
- Transmission corridors, access roads, and substation upgrades (approximately 5872 acres). (Disturbed area is based on Tables 2.2-2, 2.2-3, and 2.2-4.)

Table 3.9-2 summarizes the major land disturbances. Section 4.1 further discusses the major land disturbances related to construction activities and mitigation measures.

3.9.1 PRECONSTRUCTION ACTIVITIES

Preconstruction activities would commence in the 2nd quarter of 2013. The activities that could be performed include the following:

- Clearing, grubbing, and spoils area establishment
- Access roads, heavy haul roads, and equipment barge unloading area improvement
- Construction security
- Construction utilities
- Construction facilities and preparation activities
- Site earthwork, including power block
- Makeup water reservoir, cooling towers, and pipelines
- Reclaimed water pipelines
- Potable water pipelines
- FPL reclaimed water treatment facility
- Radial collector wells, associated facilities, and pipelines
- Deep injection wells

- Module assembly areas

The Construction Utilization Plan, as depicted in Figure 3.9-1, (Sheets 1 through 4), illustrates the disturbed land areas and other construction features.

3.9.1.1 Clearing, Grubbing, and Spoils Area Establishment

Clearing would begin with the removal of trees to the minimum extent necessary. Scrub vegetation and brush removal would be accomplished through the use of appropriate and approved techniques. Offsite disposal of any organic materials would be through approved local and state waste disposal techniques.

Spoils areas would be established on the Turkey Point plant property south of the Units 6 & 7 plant area to allow dewatering of materials during construction of Units 6 & 7 from such activities as clearing, grubbing, and excavation (see Subsection 3.9.1.6). Three separate spoils areas, denoted as “A,” “B,” and “C” on Figure 3.9-1 (Sheet 3 of 4), would be established at the southern end of the industrial wastewater facility. Spoils areas “A” and “C” would be located on the western and eastern side of the main return canal, respectively, and each pile would be 4.6 to 5 miles long. Spoils area “B” would be established at the southern end of the industrial wastewater facility and would be approximately 1.8 miles in length. The total area for spoils area “A,” “B,” and “C” would be approximately 77 acres, 18 acres, and 116 acres, respectively, resulting in a total spoils capacity of approximately 2 million cubic yards. The estimated height of the spoils pile will be determined after the spoils storage area has been surveyed and a final dirt road width for the berms has been established. It is anticipated that the final spoils elevation will be approximately 16–20 feet NAVD 88.

Drainage from the spoils piles would be controlled through measures such as berms, riprap, sedimentation filters, and detention ponds before any water drainage to the industrial wastewater facility.

3.9.1.2 Access Road, Heavy Haul Road, and Equipment Barge Unloading Area Improvement

Construction traffic would access the Turkey Point plant property via various routes including SW 117th Avenue, SW 137th Avenue/Tallahassee Road, SW 328th Street/N. Canal Drive, SW 344th Street/Palm Drive, and SW 359th Street. Road improvements would include widening SW 328th Street/N. Canal Drive, SW 344th Street/Palm Drive (west of SW 137th Avenue/Tallahassee Road), and SW 117th Avenue (north of SW 344th Street/Palm Drive) from two lanes to four lanes. SW 359th Street, which is currently an unimproved rock road, will be improved to a three lane road west of SW 117th Avenue and a four lane road east of SW 117th Avenue. SW 137th Avenue/Tallahassee Road is currently an unimproved dirt road and would be improved to a three lane road. SW 117th Avenue (south of SW 344th Street/Palm Drive) is currently an unimproved dirt road and would be improved to a four lane road. Road improvements, including road

widening, additional turn lanes, signalization, etc. are described in Subsection 4.4.2.2.4.4. Figure 3.9-1 (Sheet 4) depicts the location of the roads.

The existing barge turning basin connects Biscayne Bay to the Turkey Point plant property, and would be used for module and component delivery. The turning basin is approximately 300 feet wide and 1200 feet long and is currently used for fuel deliveries for Units 1 & 2. There would be approximately 80 round-trip barge deliveries for modules and components for each unit over an approximately six-year duration. The existing equipment barge unloading area would be extended to approximately 90 feet by 150 feet (0.31 acres) and 9 feet deep, as part of a total disturbed area of 130 feet by 250 feet (0.75 acres), to accommodate heavy component offloading (Figure 3.9-1 [Sheet 2]). Limited dredging would likely be required as part of the upgrade.

The existing heavy haul road, originating at the equipment barge unloading area, would be improved and terminate at three distinct places on the Units 6 & 7 plant area, to facilitate unloading modules and components. The heavy haul road would be approximately 2 miles long and 24 feet wide and would disturb approximately 5 acres. The road would start at the equipment barge unloading area and extend generally west between Unit 5 and Units 1 & 2. The road would then extend generally south and cross over two new heavy haul bridges, one at the main cooling discharge canal and the other at the main cooling return canal. The heavy haul road would then terminate at three locations on the Units 6 & 7 plant area to allow for module and component delivery and placement (See Figure 3.9-1 [Sheet 1 of 4]). Culverts would be installed under the heavy haul road where required to maintain drainage patterns.

Until the heavy haul road bridges are completed, temporary bridge(s) would be installed over the main cooling discharge canal and the L-31E Canal to facilitate construction activities. These bridges would be removed after completion of the heavy haul bridges.

3.9.1.3 Construction Security

Construction security programs and features would be implemented as part of the site preparation activities. Security structures would include access control points and security stations. Temporary security measures would also be used.

Details of the site security plan are described in Part 8 of the COL Application.

3.9.1.4 Construction Utilities

Temporary utilities would include aboveground and underground infrastructure for power, lighting, communications, wastewater and waste treatment facilities, fire protection, and construction gases and air systems. The temporary utilities would support the construction site and associated activities, including construction offices, warehouses, storage and laydown areas, fabrication and

maintenance shops, the power block, the concrete batch plant facility, and test and calibration labs.

3.9.1.5 Construction Facilities and Preparation Activities

The parking lot, laydown, storage and fabrication areas, and the road system to accommodate the site construction traffic would be cleared, grubbed, graded, and appropriately surfaced. Construction facilities, including offices, warehouses, workshops, sanitary facilities, locker rooms, training facilities, storage facilities, and access facilities would be constructed.

The site of the concrete batch plant would be prepared for cement and aggregate unloading and storage. Cement storage silos and the concrete batch plant would be erected. Dry material storage facilities would use dust control measures as necessary to meet the requirements of the applicable permits and guidelines.

Activities to support preparation of the construction facilities include:

- Conducting property surveys to establish local coordinates and the placement of benchmarks for horizontal and vertical control
- Developing laydown areas by grading, stabilizing canals, and surfacing these areas
- Installing construction fencing
- Installing shop and fabrication areas
- Installing concrete work slabs for formwork laydown, module assembly
- Installing equipment maintenance and parking areas
- Installing fuel and lubricant storage areas
- Installing concrete pads for cranes and crane assembly

3.9.1.6 Earthwork — Units 6 & 7 Plant Area

Significant earthwork would be required to establish finish grades at the Units 6 & 7 plant area, especially to raise the power block (i.e., Nuclear Island) to its required finished-floor elevation of 26.0 feet NAVD 88. Approximately 7.7 million cubic yards of general area (Category II) backfill would be required to raise the existing grade elevation of approximately –1.0 feet NAVD 88 to the finished grade elevation adjacent to the power block of 25.5 feet NAVD 88. Also, backfilling around the major power block Seismic Category I (safety-related) embedded structures would

require approximately 130,000 cubic yards of safety-related (Category I) engineered structural backfill.

Approximate estimated fill requirements for the plant area and associated non-linear facilities and conceptual ranges for offsite transmission and access roads, are as follows:

<u>Onsite areas:</u>

- Plant Area (198 acres) 7.8 million cubic yards
- Reclaimed Water Treatment Facility (44 acres) 1.6 million cubic yards
- Laydown Areas (52 acres) 0.7 million cubic yards
- Nuclear Admin/Training/Parking Area (32 acres) 0.6 million cubic yards

<u>Offsite Areas</u>

- Transmission Roads and Pads 2.0–3.0 million cubic yards
- Access Roads 0.4–0.7 million cubic yards

Stabilization of the plant area perimeter to provide protection of the cooling canals of the industrial wastewater facility during excavation and removal of unsuitable material and placement of fill materials would progress in the following manner:

- To minimize potential impacts on the cooling canals, the Units 6 & 7 plant area would first be isolated from the industrial wastewater facility by installing temporary sheet piling. The sheet piling would be installed into the Miami Limestone Formation around the perimeter of the plant area with the top of the sheet piling extending somewhat above the adjacent existing grade elevation. After the area behind the sheet piling is backfilled, the sheet piling would be removed and re-used as this process moves around the perimeter of the plant area. Eventually additional erosion protection such as riprap would be installed along the perimeter of the plant area adjacent to the canals.

- After stabilizing the perimeter of the Units 6 & 7 plant area with sheet piles, the approximately 5-foot thick layer of the existing organic soil material, or “muck,” would be removed from the plant area and replaced with general area backfill to raise the surface above the maximum water levels expected in the industrial wastewater facility. An estimated 1.8 million cubic yards of muck would be removed (de-mucked), starting with a small area (approximately 20-foot wide) adjacent to (and inside of) the entire plant area perimeter. De-mucking would continue until the Miami Limestone Formation is exposed along the interior face of the sheet piling and replaced with backfill. De-mucking and placement of backfill would be carefully coordinated to minimize inflow of groundwater. The backfill would be placed and compacted

to an approximate elevation of 0 feet NAVD 88 to create a working base for a mechanically stabilized earth (MSE) wall. This wall would be constructed around the perimeter of the Units 6 & 7 plant area, excluding the south side of the plant area where the makeup water reservoir would provide the plant area exterior wall. The MSE wall would be designed to retain the interior soil mass while also resisting wave forces resulting from the probable maximum hurricane (PMH). The MSE wall would extend from its base at approximately 0.0 feet NAVD 88 to a height that would range from elevation 20.0 feet to 21.5 feet NAVD 88.

- To establish a dry construction working surface at an approximate elevation of 0.0 feet NAVD 88, the remaining portions of the Units 6 & 7 plant area would be de-mucked and backfill placed and compacted in a manner similar to the perimeter. This process would proceed simultaneously in multiple areas across the plant area, sequenced to facilitate subsequent excavation activities, and would continue until the entire layer of muck is excavated and the plant area is backfilled to elevation 0.0 NAVD 88, except for the designated makeup water reservoir area which would not be backfilled. (See Subsection 3.9.1.7 for a description of construction activities for the makeup water reservoir.) Backfill would be obtained from a combination of an FPL-owned fill source located on a 300-acre plot located near Homestead Air Reserve Base approximately 4.5 miles from the plant area or other regional sources. Reused material excavated from the plant area would be used as Category I structural backfill. Figure 3.9-1 (Sheet 4) depicts the location of the FPL-owned fill source.

- The muck removed during excavation would be transferred to designated spoils areas, as depicted on Figure 3.9-1 (Sheet 2). Material removed from the deeper excavations and evaluated as acceptable for reuse would be stored for common Category II or Category I structural backfill.

3.9.1.7 Makeup Water Reservoir, Cooling Towers, and Makeup Water Supply Pipelines

The makeup water reservoir (a reinforced concrete structure with a footprint of approximately 37 acres) would be located in the south end of the plant area. Six (6) mechanical draft cooling towers (three per unit) would be installed over the reservoir to maximize size of the reservoir. Site preparation, excavation and construction of the reservoir would include the following:

- The south perimeter of the plant area would be stabilized similar to the remainder of the plant area perimeter by driving sheet piles into the Miami Limestone Formation. In addition to restraining the return canals, this sheet piling would function as sacrificial formwork when the reservoir exterior wall is poured and only the exposed portion above approximate elevation 0.0 NAVD 88 would be removed.

- After stabilizing the canals, the muck behind the sheet piles would be excavated to the top of the Miami Limestone Formation and placed in the designated spoils areas.

- General area dewatering would not be required as the surface of the excavated area would be sealed by tremie concrete (if required) to minimize in-leakage of ground water. Local dewatering in the area of the deeper cooling tower foundations would be required and pressure grouting might be required to facilitate this dewatering.

- Concrete would be placed over the excavated area to form the reservoir base slab. The top of the base slab would be at elevation –2.0 feet NAVD 88. Reinforced concrete walls would then be constructed with the top elevation at 24.0 feet NAVD 88.

The circulating water system piping would be routed from the discharge of the circulating water pumps located on the north side of the makeup water reservoir, to the condenser in the turbine building and from the condenser to the cooling towers. The section of the circulating water piping extending beneath the condenser would require a deep excavation and local dewatering. The remaining sections of the circulating water piping would be above the Miami Limestone and would be installed as the plant area is backfilled and would not require dewatering. Completion of the circulating water system piping installation would coincide with the turbine building pedestal basemat placement.

Blowdown piping would be routed from the circulating water discharge header to the blowdown sump on the east side of the plant area. These lines would be installed above the Miami Limestone as the plant area is backfilled.

The reclaimed water pipelines would be routed from the FPL reclaimed water treatment facility to the west side of the makeup water reservoir. Excavation would be required between the FPL reclaimed water treatment facility and the plant area, but the pipelines would be above ground on the plant area.

The pipelines from the radial collector wells would require excavation on the Turkey Point peninsula and the existing berm east of the plant area, but would be above ground on the plant area.

3.9.1.8 Reclaimed Water Pipelines and Potable Water Pipelines

Reclaimed water supply pipelines would be constructed to supply reclaimed water to the FPL reclaimed water treatment facility. The buried pipelines (72-inch diameter or equivalent) would be constructed from the Miami-Dade Water and Sewer Department South District Wastewater Treatment Plant to the FPL reclaimed water treatment facilility on the Turkey Point plant property. The length of the pipelines would be approximately 9 miles. For about 6.5 miles of their length, the pipelines would be collocated with the existing Clear Sky-to-Davis transmission line right-of-way and adjacent road and canal rights-of-way. The remaining approximately 2.5 miles would be

located within a new pipeline corridor. The corridor for this pipeline is approximately 1886 acres. Figure 3.9-1 (Sheet 4 of 4) shows the location of the reclaimed water pipelines.

The FPL reclaimed water treatment facility (29 acres of additional disturbed land and 15 acres of disturbed land from the west transmission corridor) would be located northwest of the Units 6 & 7 plant area, as shown on Figure 3.9-1 (Sheet 2 of 4).

Potable water pipelines would be constructed to supply potable water to Units 6 & 7. The buried pipelines (30-inch diameter or equivalent) would originate from an existing MDWASD supply line at the intersection of SW 288th Street and SW 137th Avenue/Tallahassee Road and proceed south to SW 328th Street/N. Canal Drive. The pipelines would then run east along SW 328th Street/N. Canal Drive to SW 117th Avenue and then south towards SW 359th Street. At the intersection of SW 359th Street, the pipelines would run east to the Turkey Point plant property. The estimated length of the potable water pipelines would be 8 miles to the plant property. The corridor for this pipeline, which will run concurrent with road improvements at several locations, is 327 acres.

3.9.1.9 Radial Collector Wells

Radial collector wells would be constructed to supply approximately 86,400 gpm of makeup water to the circulating water system cooling towers. As shown on Figure 3.9-1 (Sheet 2 of 4), the well caissons would be located on the Turkey Point peninsula, east of the existing units. Each radial collector well would consist of a central reinforced concrete caisson extending below the ground level with laterals projecting from the caisson. The well laterals would be advanced horizontally a distance of up to 900 feet and installed at a depth of approximately 25 to 40 feet below the bottom of Biscayne Bay. The design for a typical radial collector well is illustrated in Figure 3.4-2. The wells would be designed and located to induce recharge from Biscayne Bay. The radial collector well locations are shown in Figure 3.1-3.

3.9.1.10 Deep Injection Wells

Twelve deep injection wells (ten primary and two backup) would be installed, by drilling, in the plant area to provide a means of disposal of treated wastewater, sanitary waste, blowdown, and treated liquid radioactive waste effluent. The deep injection wells would be 24-inch-diameter wells and would extend approximately 2900 to 3500 feet below grade. Six dual-zone monitoring wells would also be installed by drilling to approximately 1900 feet below grade. During the deep injection and monitoring well installation, a recirculation slurry tank will be utilized to separate the drill cuttings and sand from the slurry mixture in order to re-use the slurry and minimize waste. The slurry mixture is composed primarily of bentonite, which is a nonhazardous material that is widely used in water and monitoring well installation.

Upon completion of well installation activities, excess water will be pumped from the recirculation tank, settled, and released to the industrial wastewater facility. The waste slurry mixture will be hauled to the spoils storage area for disposal. The estimated amount of waste slurry for one deep injections well and one dual-zone monitoring well is approximately 600 cubic yards and 260 cubic yards, respectively, or 8,760 cubic yards for the complete system of 12 deep injection wells and 6 dual-zone monitoring wells. A concrete surface pad would complete each deep injection well installation. The location of the deep injection wells are shown on Figure 3.1-3.

3.9.1.11 Module Assembly

The AP1000 design uses a modularization construction approach. Module components would be fabricated offsite, shipped to the site via truck or barge, and assembled into complete modules before being set in the power block. Modules that arrive by barge would be transported to the power block area or offloaded in fabrication assembly areas.

3.9.2 COL CONSTRUCTION ACTIVITIES

The construction activities that would be performed after receipt of the COL, including the structural construction and completion of structures, systems, and components, are presented in the following subsections.

3.9.2.1 Earthwork — Units 6 & 7 Power Block

The power block footprint encompasses the nuclear and turbine island building areas, which include the following major buildings for each unit:

- Containment building
- Auxiliary building
- Annex building
- Radwaste building
- Turbine building

Site preparation, excavation and foundation preparation for the Units 6 & 7 power block areas would include the following:

- The two excavations for the containment and auxiliary buildings would extend to an approximate elevation of –35.0 feet NAVD 88 or to the top of competent rock in the Fort Thompson Formation. To permit construction of the deep foundations and to hydraulically isolate this excavation from horizontal groundwater flow, a permanent reinforced concrete

diaphragm “cutoff” wall would be constructed. It is anticipated that the diaphragm wall would be installed into the Key Largo Formation to a depth of approximately -60.0 feet NAVD 88 or just below a semi-confining layer in the Biscayne Aquifer. The top of the diaphragm wall would be at elevation 2.0 feet NAVD 88 or two feet above the construction working surface elevation of 0.0 feet NAVD 88.

- The cutoff wall will be constructed sequentially by excavating vertical panels, roughly 3 feet wide, by 12 to 14 feet long, by 60 feet deep to form the outer footprint of each deep nuclear island excavation. During excavation, each slot is kept filed with bentonite-base slurry, which counter balances the hydrostatic forces and lateral earth pressure. When the slot is completed, reinforcement is installed and concrete is placed through tremie pipes, displacing the excavation slurry to the top, where it is pumped to a mud pit for re-use. This installation approach, specifically the use of panels and recirculation of slurry material, will minimize the amount of slurry waste at the completion of wall installation. The remaining slurry will be dewatered and disposed of onsite at the spoils piles, located along the cooling canals of the industrial wastewater facility.

- After completion of this diaphragm wall, a horizontal seepage barrier, or grout plug, which prevents vertical seepage, approximately 25 feet thick, will be constructed from elevation -35 feet NAVD 88 to elevation -60 feet NAVD 88 by first drilling from the ground surface, and then grouting. The barrier will be integral with the diaphragm wall so that construction dewatering can be accomplished by use of sump pumps, or similar methodologies, located within the excavation.

- To install the grout plug, vertical boreholes will be drilled in a grid pattern and grouted in an iterative process, which is estimated to consist of four rounds of drilling and grouting, prior to excavation. Successive rounds of grouting will be performed by dividing the spacing of the previous round of boreholes used for grouting. The later rounds of grouting will experience lower grout “take” — that is, as formation voids and flow pathways are filled during the initial grouting rounds, the formation will “take” less grout. The use of this testing and remedial grouting phased approach, in addition to both overlapping criteria and a designed program to indicate completeness of the program — based on such factors as grout injection pressure, volume pumped into the formation, and observable seepage, if any — will determine the adequacy and completeness of the horizontal grouting program.

- A temporary dewatering system would be installed for the two power block area deep excavations. Drainage sumps would be installed at the bottom of the excavations from which surface drainage and/or accumulated groundwater would be pumped to the cooling canals of the industrial wastewater facility. The subsequent dewatering phases, known as the excavation phase and foundation construction, are further discussed in Section 4.2.

- Once construction of the diaphragm wall is completed around the planned deep foundation area, excavation of the existing material within its interior would commence using conventional methods (use of explosives would not be required). Excavated material not suitable for reuse would be transferred to the designated spoils areas, as depicted on Figure 3.9-1 (Sheet 2). Material removed from the excavation and evaluated as acceptable, would be stored on the plant area and used later as common Category II or Category I structural backfill.

- Lean concrete fill would be placed between the excavated surface of the Key Largo Limestone Formation at approximately -35.0 feet NAVD 88 and an approximate elevation of –16.0 feet NAVD 88. At this elevation, additional lean concrete fill, mud mat(s), and a waterproof membrane would provide an interface at –14.0 feet NAVD 88 for construction of the containment and auxiliary building reinforced concrete foundations. Category I structural fill would then be placed to prescribed compaction requirements in the annular space between the power block structures and the diaphragm wall. The Category I structural fill would extend to the top of the wall and additional Category I fill would be placed over Category II fill at a 1.5:1 horizontal to vertical slope past the diaphragm wall perimeter.

Once the power block area has been backfilled to the top of diaphragm wall, backfill of the remaining plant area would be completed in a sequence defined by the construction schedule. Finished grade of the plant area would slope up from an approximate elevation of 19.0 feet NAVD 88 (adjacent to the perimeter retaining wall) to elevation 25.5 feet NAVD 88 at the power block area near the center of the plant area. The slope of the finished grade would be approximately 0.5 percent from the exterior walls to the power block areas with contours and swales to allow drainage into the surrounding canals.

3.9.2.2 Structural Construction

Each AP1000 unit is a series of buildings and structures with systems installed within the structures. Much of the commodity installation would consist of prefabricated civil/structural, electrical, mechanical, and piping modules with field-installed interconnections. The balance of the field installation consists of bulk commodity installation. Power plants are typically constructed with the major mechanical and electrical equipment and piping systems installed in each respective elevation as the civil construction advances upward. Each power block consists of five major buildings. The following is a brief description of each major building, along with the approximate maximum height of each above plant grade. Table 3.9-1 summarizes the estimated durations for major power block construction activities.

As described in Subsection 3.9.2.1, the power block is an AP1000 consisting of the following steel and concrete buildings:

- Containment building
- Auxiliary building
- Annex building
- Radwaste building
- Turbine building

The buildings, including dimensions, are described in the following paragraphs.

Containment Building

The containment building is constructed of steel and concrete with two floor elevations below plant grade and one floor elevation above grade. The containment building is a circular building with a diameter of approximately 142 feet and a height above grade (note: local grade is defined as 25.5 foot NAVD 88) of approximately 229 feet. The major activities associated with the containment building construction following the basemat foundation placement include:

- Erecting the containment vessel modules
- Placing the walls, slabs, platforms, and reactor supports
- Installing the reactor pressure vessel, steam generators, and heat exchangers
- Setting the major mechanical and electrical equipment, piping, and valves
- Installing the fuel transfer tubes
- Setting the refueling machine and the containment building crane
- Setting the upper containment building roof structure

The remaining mechanical, piping, fire sprinklers system, HVAC, and electrical installations begin in the lower elevations and continue to the upper elevations. This is the case with each of the other buildings. The containment building has the longest construction duration.

Auxiliary Building

The auxiliary building abuts the containment building and has five floor elevations (two stories below grade and three stories above grade) and reaches a height of approximately 81 feet above plant grade. The footprint of this building is approximately 254 feet by 116 feet.

Annex Building

The annex building has three main floor elevations (all above grade) and reaches a height of approximately 83 feet above plant grade. The footprint of this building is approximately 285 feet by 132 feet.

Turbine Building

The turbine building has five main floor elevations (one below plant grade and four above) and reaches a height of approximately 146 feet above plant grade. The footprint of this building is approximately 310 feet by 156 feet.

The turbine building construction would begin with the installation of turbine generator pedestal basemat and the buried circulating water pipe, followed by installation of the turbine generator pedestal columns, steam condenser modules, and turbine generator pedestal deck. The turbine generator building would then be erected once the turbine generator pedestal is complete, followed by the turbine building crane. Installation and assembly of the turbine generator would then proceed.

Radwaste Building

The radwaste building has one floor elevation above grade and reaches a height of approximately 36 feet above plant grade. The footprint of this building is approximately 175 feet by 88 feet.

3.9.3 OTHER FACILITIES AND SITE COMPLETION

Other facilities to be constructed/installed include:

- Substation, transformers, and transmission lines
- Warehouses
- Tunnels and pipe chases
- Electrical and diesel generator buildings
- Hot and cold machine shop
- Sewage treatment facility
- Fire protection pump house
- Security stations, sally ports, protected area, and delay fence

- Administration building(s)
- Various yard tanks
- Hydrogen, nitrogen, oxygen, and carbon dioxide storage facilities

The common yard area construction would occur over the full construction duration from the start of site preparation. The necessary permits and authorizations would be acquired to ensure compliance with applicable rules and regulations (see Section 1.2).

After completion of major construction activities, the Units 6 & 7 plant area would be graded to an elevation of approximately 19 feet NAVD 88 at the perimeter, sloping to a finished grade elevation of 25.5 feet NAVD 88 at the power block area.

Table 3.9-1
Construction/Operation Milestones[a]

Activity	Start	Finish
Preconstruction Activities	2Q 2013	4Q 2018
Construction Activities		
• Unit 6	3Q 2016	1Q 2022[b]
• Unit 7	3Q 2017	1Q 2023[b]
Fuel Load/Startup Activities		
• Unit 6	1Q 2022	3Q 2022
• Unit 7	1Q 2023	3Q 2023
Commercial Operation		
• Unit 6	3Q 2022	NA
• Unit 7	3Q 2023	NA

(a) All dates are approximate.
(b) 48 month standard plant construction plus activities under NRC authority (e.g., slurry wall installation)

Table 3.9-2 (Sheet 1 of 2)
Disturbed Area Acreage

Disturbed Area	Acreage
Turkey Point Property	
Units 6 & 7 plant area	218
Western laydown area	52
Training parking	9
Nuclear Administration parking	23
Heavy haul road	5
Access road upgrades	Note (1)
Transmission infrastructure improvements	Note (1)
Transmission laydown areas	3
Sanitary waste pipeline	Note (1)
Equipment barge unloading area	0.75
“A”, “B”, “C” spoils area	211
Radial collector wells and associated facilities	3
Radial collector well laydown area	3
FPL reclaimed water treatment facility	29
Reclaimed water supply pipeline to Units 6 & 7	Note (1)
Radial collector well water supply pipelines	13
Vicinity	
FPL-owned offsite fill source	300
Road Improvements (128 acres total)	
SW 117th Ave. North	9
SW 117th Ave. South	8
SW 137th Ave.	7
SW 328th St.	24
SW 344th St.	2
SW 359th Ave. East	47
SW 359th Ave. West	31
Region	
Reclaimed water pipeline corridor	1886
Potable water pipeline corridor	327
Transmission	
East Preferred Corridor (1635 acres total)	
Clear Sky to Davis	635
Davis to Miami	1000
West Preferred Corridor (3356 acres total)	
Clear Sky to Levee — 1st leg	1379
Clear Sky to Levee — 2nd leg	1413
Clear Sky to Levee — 3rd leg	252
Levee to Pennsuco	312
West Secondary Corridor (2442 acres total)	
Clear Sky to Levee — 1st leg	1379
Clear Sky to Levee — 2nd leg	499
Clear Sky to Levee — 3rd leg	252
Levee to Pennsuco	312
West Corridor Transmission Access Road 1	11

Table 3.9-2 (Sheet 2 of 2)
Disturbed Area Acreage

Disturbed Area	Acreage
West Corridor Transmission Access Road 2	365
Levee substation	2
Pennsuco substation	2
Davis substation	1
Turkey Point substation	1

(1) Previously disturbed land

Figure 3.9-1 Construction Utilization Plan (Sheet 1 of 4)

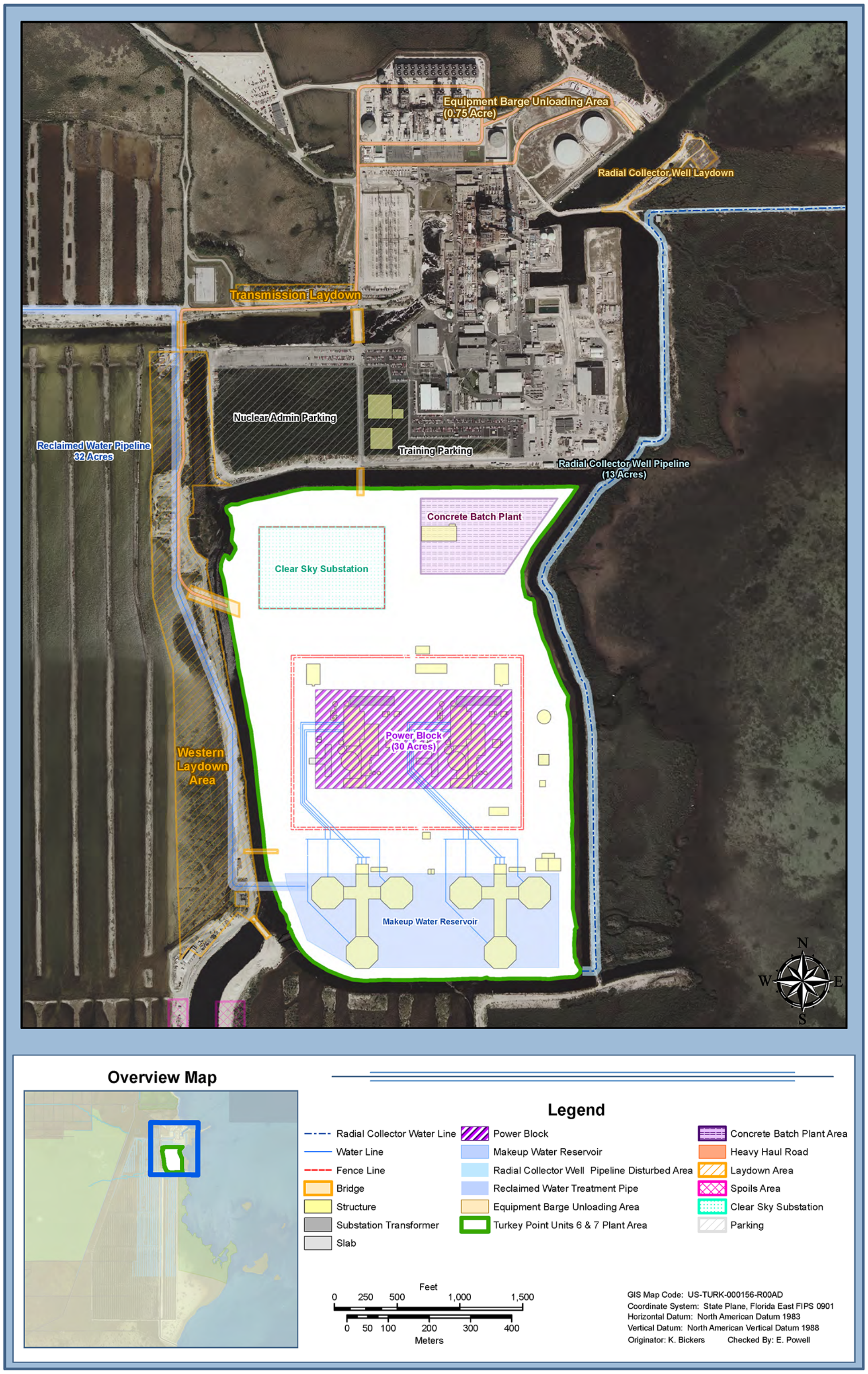


Figure 3.9-1 Construction Utilization Plan (Sheet 2 of 4)

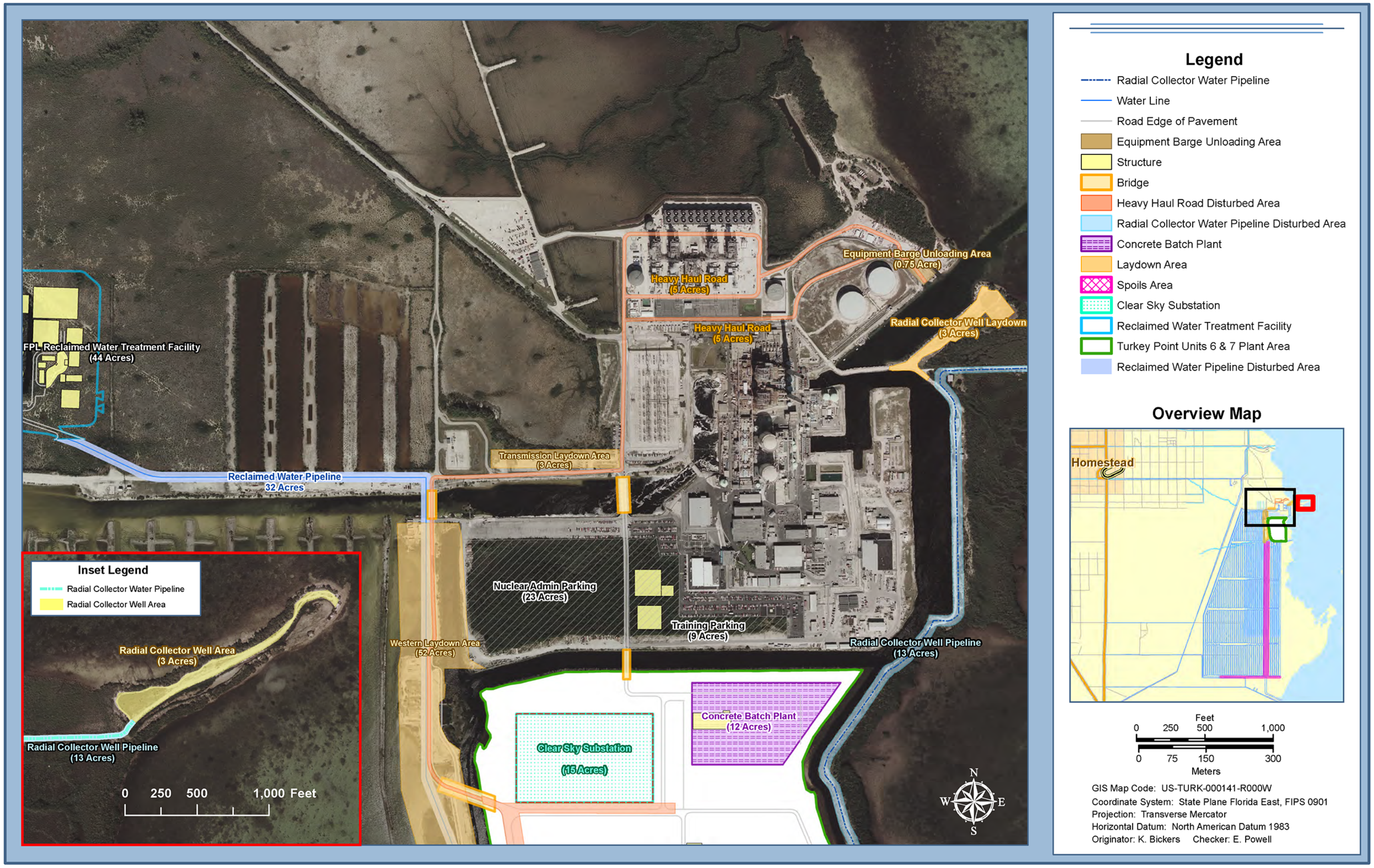


Figure 3.9-1 Construction Utilization Plan (Sheet 3 of 4)

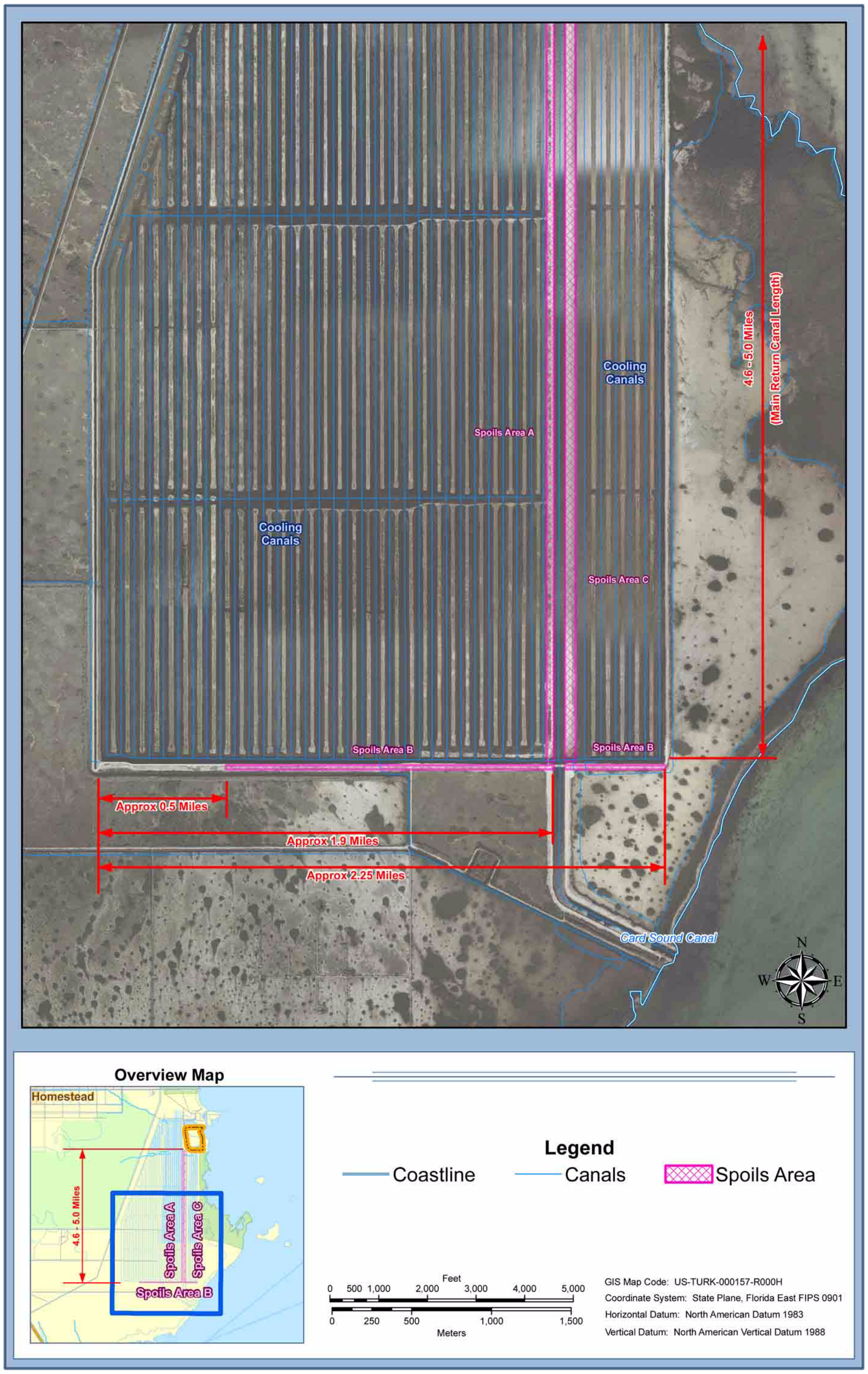
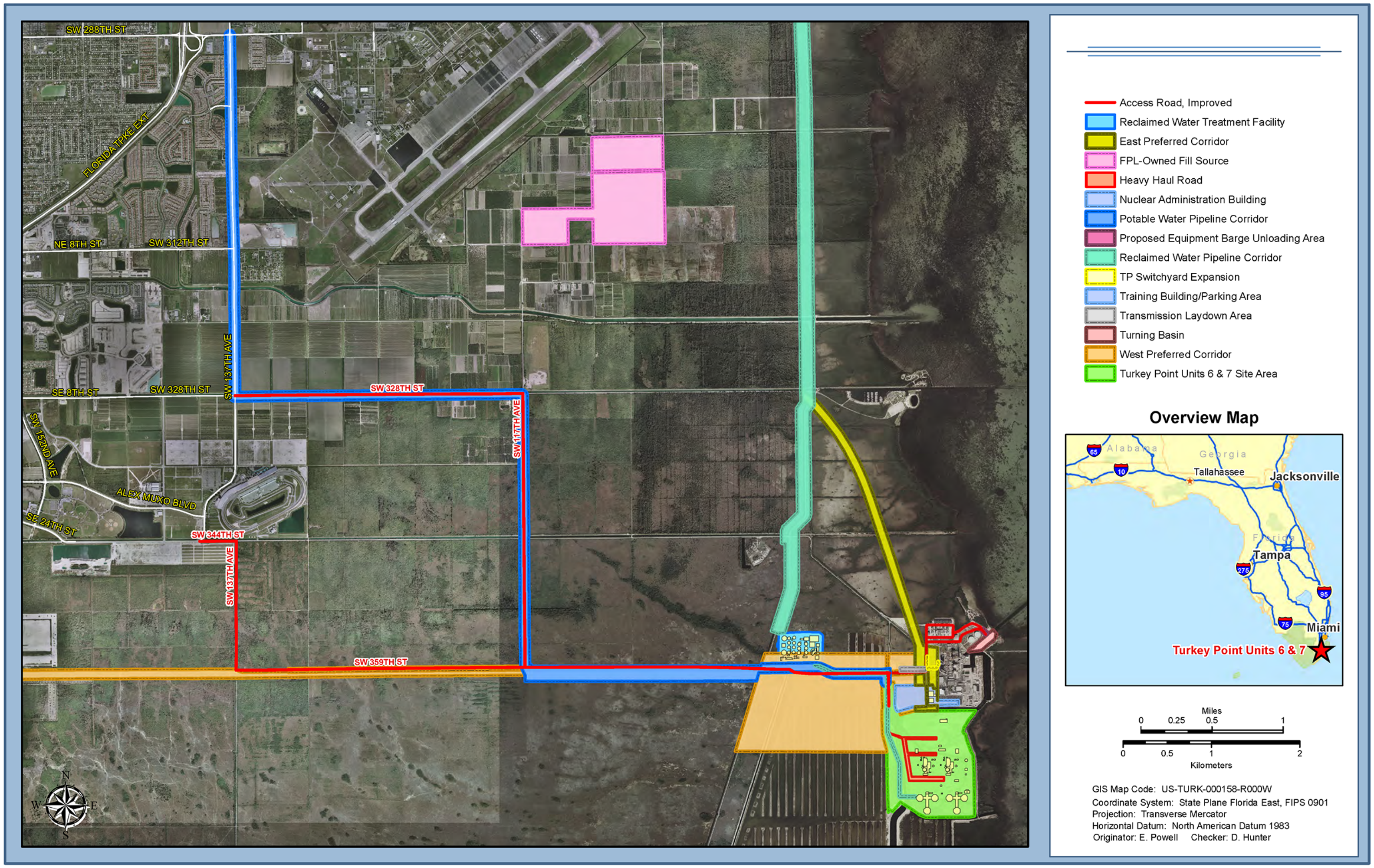


Figure 3.9-1 Construction Utilization Plan (Sheet 4 of 4)



3.10 WORKFORCE CHARACTERIZATION

A characterization of the workforce for the construction and operation of Units 6 & 7 is needed to assess the environmental and socioeconomic impacts of new unit construction and operation, as described in Sections 4.4 and 5.8, respectively. This workforce characterization involves estimating the number of personnel for construction and operation of Units 6 & 7, workforce relocation, and commuting.

As presented in Section 3.9, the construction and operation of Units 6 & 7 would be executed in distinct phases, as summarized below:

- Preconstruction Activities
- Construction Activities
- Operation

The estimated workforce, characterization, and relocation/commuting are described in the following paragraphs.

3.10.1 CONSTRUCTION WORKFORCE CHARACTERIZATION

The construction workforce for preconstruction and Units 6 & 7 construction activities would generally consist of two components: field craft labor and field nonmanual labor. Field craft labor would be the largest component of the construction workforce, consisting of approximately 75 percent of the field workforce based on conventional PWR nuclear plant construction. This labor force would consist of various disciplines, including civil, electrical, mechanical, piping, and instrumentation personnel. This labor force would be used during the construction and startup of the units. Field nonmanual labor would make up the balance of the construction workforce, or approximately 25 percent, with the assumption that design engineering would be performed offsite. The field nonmanual labor workforce would be comprised of field management, field supervision, field engineers, quality assurance/quality control, environmental/safety and health, and administrative/clerical staff.

Table 3.10-1 illustrates the representative percentage ranges for each discipline for the field craft and field nonmanual labor categories for all construction activities. The skill set makeup is representative of conventional PWR nuclear power plant construction.

3.10.1.1 Preconstruction Activities Workforce

As described in Section 3.9, preconstruction activities could occur 39 months (start of 2nd quarter 2013 through end of 2nd quarter 2016) before the start of safety-related construction for Units 6 & 7. The onsite peak construction workforce is estimated to be approximately 1475

personnel during this time period, working 40 hours per week. Table 3.10-2 and Figure 3.10-1 summarize the workforce personnel requirements by month for preconstruction activities.

3.10.1.2 Units 6 & 7 Construction Activities

The AP1000 design uses a modular construction approach. The amount of modularization depends on the characteristics of the site, transportation route restrictions, and methods. Modularization shifts some of the onsite work (and workforce) to another offsite location, thereby decreasing the required onsite construction staff. The construction duration and estimated onsite workforce presented assumes offsite fabrication with onsite module assembly.

The total onsite construction workforce, assuming the sequential construction of two units, per the construction schedule presented in Section 3.9, is based on an estimated 20.5 jobhours per net kW of generating capacity. This estimate is based on conventional non-modular PWR construction projects started after 1974, with an adjustment in jobhours/net kW for offsite modular fabrication. The estimated net generating capacity (MWe) for each unit is 1100 MWe.

In order to begin commercial operation of Units 6 & 7 in 2022 and 2023, respectively, the construction schedule assumes a 66-month duration from the start of activities under NRC authority to Unit 6 fuel load, including 6 months for startup. Unit 7 safety-related construction would begin 12 months after Unit 6 safety-related construction initiation and would follow an identical activity and duration schedule. This results in a total schedule duration of 123 months. Based on this schedule and the jobhour/net kW criteria, the onsite, peak construction workforce for the construction of the two units is estimated to be 3950 people, working 40 hours per week. Table 3.10-2 and Figure 3.10-1 summarize the workforce requirements by month of Units 6 & 7 construction activities.

3.10.2 CONSTRUCTION WORKER RELOCATION AND COMMUTING

Several assumptions are used to bound the construction workforce composition with respect to workforce commuting and relocation. It is assumed that construction workers typically commute up to a maximum of 50 miles to the jobsite. The Units 6 & 7 plant area is within 50 miles of the greater Miami-Dade metropolitan area, a large population center. It is conservatively assumed that 50 percent of the construction field craft labor workforce would be available to the project from within 50 miles, or approximately 1481 local craft personnel (based on a peak construction workforce personnel number of 3950 and 75 percent field craft labor). The balance of the construction workforce (1481 personnel) is assumed to come from outside the 50-mile radius. These personnel would relocate within the 50-mile area to minimize their commute distance and seek temporary housing.

It is further assumed that 50 percent of the field nonmanual labor workforce (494 based on 25 percent field nonmanual labor) would relocate to the area from outside the 50-mile radius and seek permanent housing.

3.10.3 OPERATIONS WORK FORCE

A study commissioned by the U.S. Department of Energy (U.S. DOE May 2004) estimated the additional operations workforce for a new unit constructed at an existing site for various new reactor technologies. Applying the DOE study analysis to Units 6 & 7 for two AP1000 units, it is estimated that the onsite operations workforce would be 403 personnel for each unit, or 806 personnel for the purpose of this ER. Fifty percent of the operations workforce is assumed to be recruited and trained from outside the Miami-Dade metropolitan area.

It is assumed that operations staffing would begin approximately 2 years before fuel load of Unit 6 to allow time for simulator training and startup testing support and increase to the full complement of personnel at the time of Unit 7 operation. Figure 3.10-2 graphically illustrates the operations workforce by month. Figure 3.10-3 illustrates the combined construction and operations workforce, by month, through initiation of Units 6 & 7 commercial operation.

Section 3.10 References

U.S. DOE (U.S. Department of Energy) 2004, S*tudy of Construction Technologies and Schedules, O&M Staffing and Cost, Decommissioning Costs and Funding Requirements for Advanced Reactor Designs*, Volume 1. Prepared under Cooperative Agreement DE-FC07-03ID14492, Prepared by Dominion Energy, Inc., Bechtel Power Corporation, TLG, Inc., and MPR Associates, May 27, 2004. Available at: http://www.ne.doe.gov/np2010/reports/1dominionstudy52704.pdf.

Table 3.10-1
Estimated Percent of Onsite Construction Labor Force by Category for Units 6 & 7

Labor Category	Installation Items/Responsibility	Estimated Percent of Total Workforce
Mechanical Equipment	NSSS, Turbine Generator, Condenser, Process Equipment, HVAC	3–4
Electrical	Equipment, Cable, Cable Tray, Conduit, Wire, Connections	10–12
Concrete	Concrete and Reinforcing Steel	10–15
Structural steel	Structural and Miscellaneous Steel	2–4
Other civil	Piling, Architectural Items, Painting, Yard Pipe, Earthwork	2–5
Piping/instrumentation	Pipe, Tubing, Valves, Hangers/ Supports	14–20
Site support	Scaffolding, Equipment Operation, Transport, Cleaning, Maintenance, etc.	25–30
Specialty labor	Fireproofing, Insulation, Rigging, etc.	7–13
Nonmanual labor	Management, Supervision, Field Engineering, QA/QC, Safety and Health, Administration	25–30

Table 3.10-2
Estimated Construction Workforce by Month for Turkey Point Units 6 & 7

Month	Number of Employees	Month	Number of Employees	Month	Number of Employees
Preconstruction Activities begin month -39		2	1525	43	3925
-39	40	3	1550	44	3900
-38	45	4	1600	45	3870
-37	55	5	1625	46	3850
-36	60	6	1650	47	3825
-35	70	7	1675	48	3800
-34	75	8	1700	49	3775
-33	90	9	1725	50	3750
-32	100	10	1750	51	3725
-31	110	11	1775	52	3700
-30	130	12	1800	53	3675
-29	150	Unit 7 Construction begins month 13		54	3650
-28	180	13	1825	55	3625
-27	230	14	1850	56	3600
-26	280	15	1900	57	3575
-25	320	16	1950	58	3550
-24	390	17	2000	59	3525
-23	465	18	2100	60	3500
-22	540	19	2250	61	3450
-21	575	20	2350	62	3400
-20	650	21	2450	63	3300
-19	740	22	2600	64	3200
-18	825	23	2750	65	3100
-17	900	24	2900	66	3000
-16	1000	25	3050	67	2900
-15	1020	26	3200	68	2800
-14	1090	27	3350	69	2700
-13	1180	28	3500	70	2600
-12	1200	29	3650	71	2500
-11	1220	30	3850	72	2400
-10	1240	31	3950	73	2300
-9	1300	32	3950	74	2200
-8	1320	33	3950	75	2100
-7	1340	34	3950	76	1900
-6	1350	35	3950	77	1700
-5	1375	36	3950	78	1500
-4	1400	37	3950	79	1300
-3	1425	38	3950	80	1100
-2	1450	39	3950	81	800
-1	1475	40	3950	82	550
Unit 6 construction begins month 1		41	3950	83	450
1	1500	42	3950	84	375

Table 3.10-3
Estimated Operational Workforce by Month for Turkey Point Units 6 & 7

Month	Unit 6	Unit 7	Total Operations Workforce
41	16	–	16
42	33	–	33
43	49	–	49
44	66	–	66
45	82	–	82
46	99	–	99
47	115	–	115
48	132	–	132
49	148	–	148
50	164	–	164
51	181	–	181
52	197	–	197
53	214	16	230
54	230	33	263
55	247	49	296
56	263	66	329
57	280	82	362
58	296	99	395
59	313	115	428
60	329	132	461
61	345	148	493
62	362	164	526
63	378	181	559
64	395	197	592
65	403	214	617
66	403	230	633
67	403	247	650
68	403	263	666
69	403	280	683
70	403	296	699
71	403	313	716
72	403	329	732
73	403	345	748
74	403	362	765
75	403	378	781
76	403	395	798
77	403	403	806
78	403	403	806
79	403	403	806
80	403	403	806
81	403	403	806
82	403	403	806
83	403	403	806
84	403	403	806

Figure 3.10-1 Projected Onsite Construction Workforce by Month for Units 6 & 7

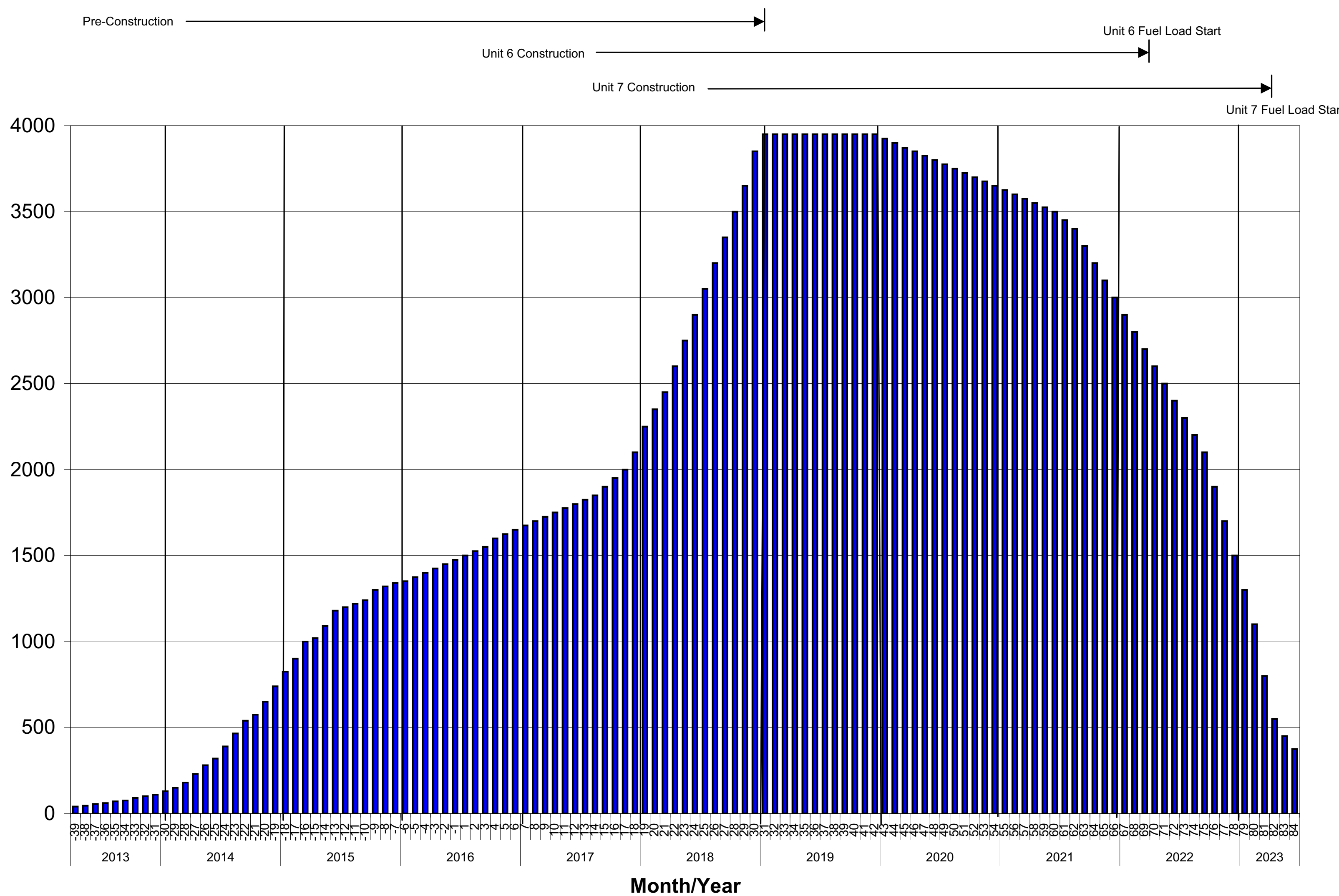


Figure 3.10-2 Projected Onsite Operations Workforce by Month for Units 6 & 7

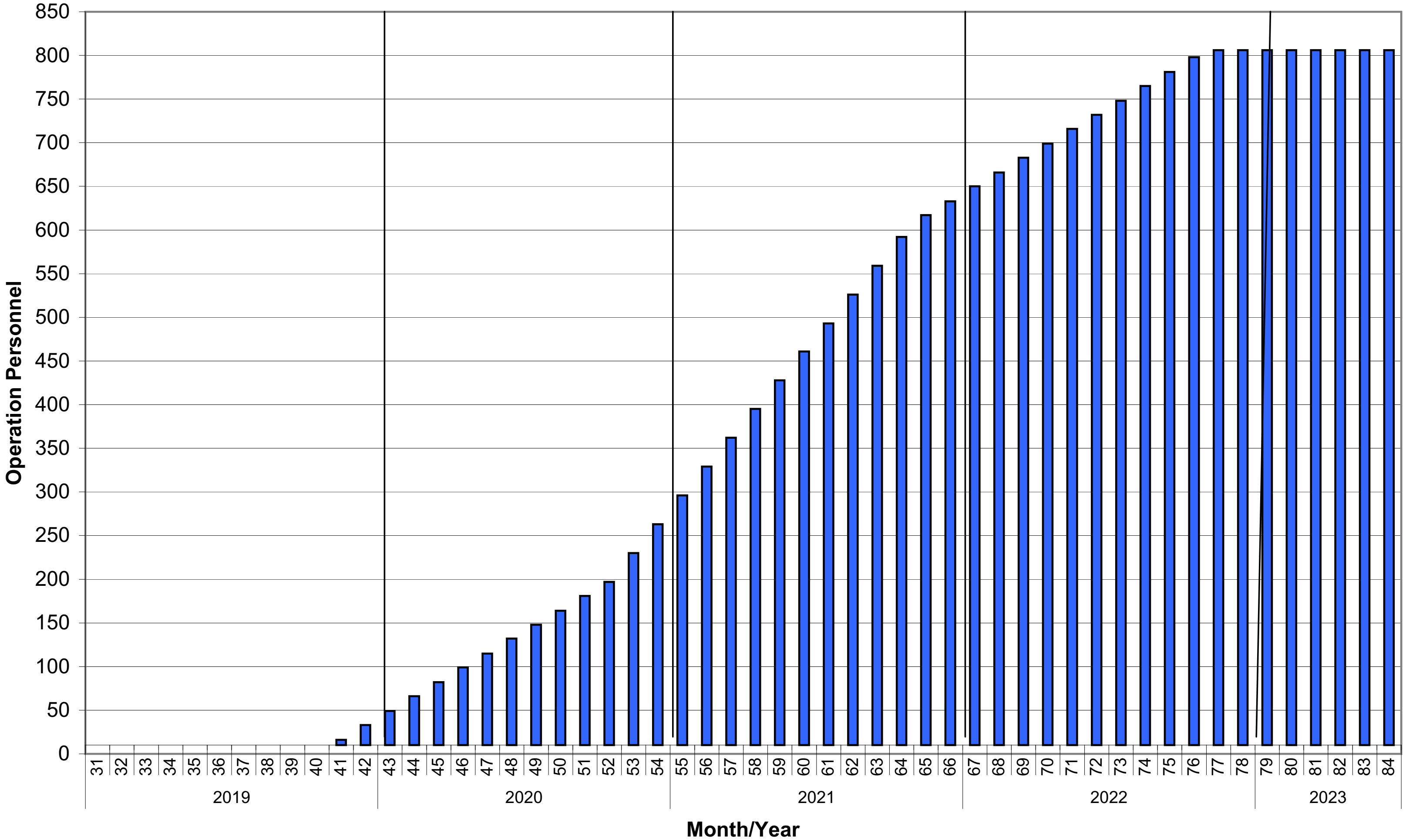


Figure 3.10-3 Projected Onsite Construction and Operations Workforce by Month for Units 6 & 7