Chapter 3 Plant Description

3.0 Introduction

This chapter describes the proposed construction and operation of two additional nuclear generating units at the Vogtle Electric Generating Plant (VEGP) site. The design proposed for construction at the VEGP site is the Westinghouse Electric Company, LLC (Westinghouse) AP1000. Chapter 3 presents detailed information about the proposed AP1000 units in the following sections:

- External Appearance and Plant Layout (Section 3.1)
- Reactor Power Conversion System (Section 3.2)
- Plant Water Use (Section 3.3)
- Cooling System (Section 3.4)
- Radioactive Waste Management System (Section 3.5)
- Non-radioactive Waste Systems (Section 3.6)
- Power Transmission System (Section 3.7)
- Transportation of Radioactive Materials (Section 3.8)
- Pre-Construction and Construction Activities (Section 3.9)
- Work Force Characterization (Section 3.10)

This environmental report identifies and evaluates the design parameters, site characteristics, and site interface values for the two proposed units that provide the basis for the NRC's issuance of an ESP. Plant-specific design parameters are based on the AP1000 Design Control Document **(Westinghouse 2005)** and AP1000 Siting Guide **(Westinghouse 2003)**. Site characteristics and site interface values were determined from site investigation, data collection, and analyses. Table 3.0-1 provides a consolidated list of site characteristics, design parameters, and site interface values used in assessing the environmental impacts of operating two additional nuclear plants at the VEGP site.

Table 3.0-1 is divided into three parts. Part I, Site Characteristics, includes the data that are specific to the VEGP site. Part II, Design Parameters, includes information supplied by Westinghouse for the AP1000 plant design. Part III, Site Interface Values, includes the values that have been determined based on the interrelationships between certain site characteristics and design parameters. The table includes a summary description of each item and a reference to the applicable ER section(s) providing more detailed information. Where a two-unit value differs from single-unit value, the two-unit value is included in brackets [ ] in the table.

Table 3.0-1 VEGP Site Characteristics, AP1000 Design Parameters and Site Interface Values

Part I Site Characteristics			
Item	**Value**		**Description and Reference**
Airborne Effluent Release Point			
Minimum Distance to EAB	½ mi (~800 m)		The lateral distance from the release point (power block area) to the modeled EAB for dose analysis. Refer to Section 2.7.6, Table 2.7-14
Atmospheric Dispersion (χ/Q) (Accident)	*The atmospheric dispersion coefficients used to estimate dose consequences of accident airborne releases.* *Values used in analyses presented in Section 7.1*		
	Time (hour)	Site χ/Q	Atmospheric dispersion coefficients used to estimate dose consequences of accident airborne releases.
EAB (χ/Q)	0 - 2	6.62E-5 sec/m^3	
LPZ (χ/Q)	0 - 8	1.25E-5 sec/m^3	
	8 - 24	1.10E-5 sec/m^3	
	24 - 96	8.40E-6 sec/m^3	
	96 - 720	5.75E-6 sec/m^3	Refer to Section 2.7.5, Tables 2.7-12 and 2.7-13, Section 7.1 and Table 7.1-2
Gaseous Effluents Dispersion, Deposition (Annual Average)			
Atmospheric Dispersion (χ/Q)	χ/Q values in Table 2.7-15		The atmospheric dispersion coefficients used to estimate dose consequences of normal airborne releases. Refer to Section 2.7.6, Table 2.7-15
Population Density			
Population density over the lifetime of the new units until 2090	Population density meets the guidance of RS-002, Attachment 3		Refer to Section 2.5.1, Figures 2.5.1-1 and 2.5.1-2, Table 2.5.1-1
Exclusion Area Boundary (EAB)	The EAB is as defined on Drawing No. AR01-0000-X2-2002. Refer to Figure 3.1-3		The exclusion area boundary generally follows the plant property line and is defined on Drawing No. AR01-0000-X2-2002. Refer to Section 2.7.5
Low Population Zone (LPZ)	A 2-mile-radius circle from the midpoint between the containment buildings of Units 1 and 2		The LPZ is a 2-mile-radius circle from the midpoint between Unit 1 and Unit 2 containment buildings. Refer to Section 2.7.5

Table 3.0-1 (cont.) VEGP Site Characteristics, AP1000 Design Parameters and Site Interface Values

Part II Design Parameters		
Item	**Single Unit [Two Unit] Value**	**Description and Reference**
Facility Characteristics		
Height	234 ft 0 in	The height from finished grade to the top of the tallest power block structure, excluding cooling towers Section 5.3.3.2.5 discusses potential for avian collisions, and Section 5.8.1.3 discusses visual impacts.
Foundation Embedment	39 ft 6 in *to bottom* of basemat from plant grade	The depth from finished grade to the bottom of the basemat for the most deeply embedded power block structure. Sections 4.2.2 and 5.2.2 discuss impacts to groundwater from installing the foundation
Max Inlet Temp Condenser / Heat Exchanger	91°F	The maximum acceptable design circulating water temperature at the inlet to the condenser or cooling water system heat exchangers. Refer to Section 3.4.2.3
Condenser / Heat Exchanger Duty	7.54E9 BTU/hr [1.51E10 BTU/hr]	Design value for the waste heat rejected to the circulating water system across the condensers. Selected value includes part of the service water system heat duty (from turbine equipment heat exchanger). Refer to Sections 3.4.1 and 3.4.2, and Table 3.4-2
Cooling Tower Temperature Range	25.2°F	The temperature difference between the hot water entering the tower and the cold water leaving the tower. Refer to Table 3.4-2
Cooling Tower Cooling Water Flow Rate	600,000 gpm [1,200,000 gpm]	The total nominal cooling water flow rate through the condenser/heat exchangers. Refer to Sections 3.3.1 and 3.4.1, and Table 3.4-2

Table 3.0-1 (cont.) VEGP Site Characteristics, AP1000 Design Parameters and Site Interface Values

Part II Design Parameters		
Item	**Single Unit [Two Unit] Value**	**Description and Reference**
Auxiliary Heat Sink		
CCW Heat Exchanger Duty	8.3E7 BTU/hr normal 2.96E8 BTU/hr shutdown [1.66E8 BTU/hr normal 5.92E8 BTU/hr shutdown]	The heat transferred from the CCW heat exchangers to the service water system for rejection to the environment. Refer to Section 3.3.1 and Table 3.4-1
SWS Cooling Tower Cooling Water Flow Rate	9,000 gpm normal 18,000 gpm shutdown [18,000 gpm normal 36,000 gpm shutdown]	The total nominal cooling water flow rate through the SWS. Refer to Section 3.3.1 and Table 3.4-1
Plant Characteristics		
Rated Thermal Power (RTP)	3,400 MWt	The thermal power generated by the core. Refer to Section 3.2
Rated NSSS Thermal Output	3,415 MWt [6,830 MWt]	The thermal power generated by the core plus heat from the reactor coolant pumps. Refer to Section 3.2
Average Fuel Enrichment	2.35 wt % to 4.45 wt % 4.51 wt %	Concentration of U-235 in fuel - Initial load. Refer to Section 3.2. Average concentration, in weight percent, of U-235 in reloads; see Section 5.11.1; used in analysis presented in Section 5.11.2
Fuel Burn-up	60,000 MWd/MTU (design max) 48,700 MWd/MTU (expected)	Value derived by multiplying the reactor thermal power by time of irradiation divided by fuel mass (expressed in megawatt - days per metric ton of uranium fuel). Refer to Section 3.2 and 5.11.1; average discharge burnup used in analysis presented in Section 5.11.2
Normal Releases		
Liquid Source Term	See Table 3.5-1 0.26 curies total nuclides except tritium [0.52 curies]	The annual activity, by isotope, contained in routine liquid effluent streams. Used in analyses presented in Section 5.4

Table 3.0-1 (cont.) VEGP Site Characteristics, AP1000 Design Parameters and Site Interface Values

Part II Design Parameters		
Item	**Single Unit [Two Unit] Value**	**Description and Reference**
Tritium (liquid)	1,010 curies [2,020 curies]	The annual activity of tritium contained in routine liquid effluent streams. Section 5.4 analyses account for tritium releases
Gaseous Source Term	See Table 3.5-2 11,000 curies total nuclides except tritium [22,000] [Double values in Table 3.5-2]	The annual activity, by isotope, contained in routine plant airborne effluent streams. Used in analysis presented in Section 5.4
Tritium (gaseous)	See Table 3.5-2 350 curies [700 curies]	The annual activity of tritium contained in routine plant airborne effluent streams. Section 5.4 analyses account for tritium releases
Solid Waste Activity	See Tables 3.5-4 and 3.5-5 1,764 curies [3,528 curies]	The annual activity contained in solid radioactive wastes generated during routine plant operations. Refer to Sections 3.5.3 and 5.5.4
Dry Active (“Solid”) Waste Volume	4,9994 ft^3 [9.988 ft^3]	The expected volume of solid radioactive wastes generated during routine plant operations. Refer to Section 3.5.3
Accident Releases		
Elevation (Post Accident)	Ground level	The elevation above finished grade of the release point for accident sequence releases. Used to calculate impacts of accidents in Sections 2.7.5, 7.1 and 7.2
Gaseous Source Term (Post-Accident)	See Tables 7.1-4 to 7.1-12	The activity, by isotope, contained in post-accident airborne effluents. Refer to Section 7.1 and Tables 7.1-4 to 7.1-12.

Table 3.0-1 (cont.) VEGP Site Characteristics, AP1000 Design Parameters and Site Interface Values

Part III Site Interface Values		
Item	**Single Unit [Two Unit] Value**	**Description and Reference**
Normal Plant Heat Sink (condenser and turbine auxiliary cooling)		
CWS Cooling Tower Acreage	38 acres [69.3 acres]	The land required for CWS natural draft cooling towers, including support facilities such as equipment sheds, basins, or canals. Refer to Sections 3.1.2 and 3.4.2
CWS Cooling Tower Approach Temperature	11°F	The difference between the cold water temperature leaving the tower and the ambient wet bulb temperature. Refer to Section 3.4.2
CWS Cooling Tower Blowdown Temperature	91°F	The design maximum expected blowdown temperature at the point of discharge to the receiving water body. Refer to Section 5.3
CWS Cooling Tower Evaporation Rate	13,950 gpm (14,440 gpm) [27,900 gpm (28,880 gpm)]	The expected (and maximum) rate at which water is lost by evaporation from the cooling water systems. Refer to Section 3.3.1 and Table 3.3-1; used as basis for analyses in Section 5.3.3.1
CWS Cooling Tower Drift Rate	12 gpm [24 gpm]	The maximum rate at which water is lost by drift from the cooling water systems. Refer to Section 3.3.1, and Table 3.3-1; used as basis for analyses in Section 5.3.3.1
CWS Cooling Tower Height	600 ft	The vertical height above finished grade of the natural draft cooling tower. Refer to Table 3.4-2; used as basis for analysis in Section 5.3.3.1
CWS Cooling Tower Make-up Flow Rate	18,612 gpm (28,892 gpm) [37,224 gpm (57,784 gpm)]	The expected (and maximum) design rate of removal of water from the Savannah River to replace water losses from circulating water systems. The make-up flow rate is a calculated value based on the sum of the evaporation rate plus the blowdown flow rate plus drift. Refer to Sections 3.3.1, 3.4.1 and 3.4.2 and Table 3.3-1 Used as basis for analysis in Section 5.3.1 and 5.3.2

Table 3.0-1 (cont.) VEGP Site Characteristics, AP1000 Design Parameters and Site Interface Values

Part III Site Interface Values		
Item	**Single Unit [Two Unit] Value**	**Description and Reference**
CWS Cooling Tower Offsite Noise Levels	<30 to ≤40 dBa	The maximum expected sound level at the site boundary. Refer to Table 2.7-26.
CWS Cooling Tower Heat Rejection Rate (Blowdown)	4,650 gpm (expected), 14,440 gpm (max) @91°F [9,300 gpm (expected) 28,880 gpm (max)] @ 91°F	The expected heat rejection rate to a receiving water body, expressed as flow rate in gallons per minute at a temperature in degrees Fahrenheit. Refer to Sections 2.3.2, 3.3.2; used as basis for analyses in Sections 5.3.1 and 5.3.2
CWS Cooling Tower Maximum Consumption of Raw Water	14,452 gpm [28,904 gpm]	The expected maximum short-term consumptive use of water by the circulating water systems (evaporation and drift losses). Refer to Sections 3.3.1 and 3.4.1, and Table 3.3-1
CWS Cooling Tower Expected Consumption of Raw Water	13,962 gpm [27,924 gpm]	The expected normal operating consumption of water by the circulating water system (evaporation and drift losses). Refer to Sections 3.3 and 3.4, and Table 3.3-1
Auxiliary Heat Sink (nuclear island cooling)		
SWS Cooling Tower Acreage	0.5 acre [1 acre]	The land required for SWS mechanical draft cooling towers, including support facilities such as equipment sheds and basins. Refer to Section 3.1.2
SWS Cooling Tower Makeup Rate	269 gpm (1,177 gpm) [537 gpm (2,353 gpm)]	The expected (maximum) rate of removal of water from wells to replace water losses from auxiliary heat sink. Refer to Sections 3.3 and 3.4.1
Airborne Effluent Release Point		
Normal Dose Consequences to the Maximally Exposed Individual	Total body: 0.05 mrem [0.1 mrem]	The estimated annual design radiological dose consequences due to gaseous releases from normal operation of the plant. Refer to Section 5.4
Post-Accident Dose Consequences	See Tables 7.1-13 to 7.1-22	The estimated design radiological dose consequences due to gaseous releases from postulated accidents. Refer to Section 7.1

Table 3.0-1 (cont.) VEGP Site Characteristics, AP1000 Design Parameters and Site Interface Values

Part III Site Interface Values		
Item	**Single Unit [Two Unit] Value**	**Description and Reference**
Liquid Radwaste System		
Normal Dose Consequences	10 CFR 50, App I, 10 CFR 20 40 CFR 190	The estimated design radiological dose consequences due to liquid effluent releases from normal operation of the plant. Refer to Section 5.4.2.1
Plant Characteristics		
Total Acreage	310 acres for 2 units	The land area required to provide space for all plant facilities, including power block, switchyard, spent fuel storage, and administrative facilities. Refer to Section 4.1.1.1
Groundwater Consumptive Use	376 gpm (1,570 gpm) [762 gpm (3,140 gpm)]	The Rate of withdrawal of groundwater to serve the new units. Used in analysis in 5.2.2
Plant Population		
Operation	345 [660]	The number of people required to operate and maintain the plant. Refer to Section 3.10.3; used in analyses in Section 5.8
Refueling / Major Maintenance	1,000	The additional number of temporary staff required to conduct refueling and major maintenance activities. Refer to Section 5.8
Construction	1,576 people monthly average [3,152 people monthly average]	The monthly average estimated construction workforce staffing for two AP1000 units being constructed simultaneously. This assumes a site preparation schedule of 18 months, 48 months from first concrete to fuel load, with 6 months from fuel load to commercial operation and 12 months between commercial operation of each unit. This assumes 20.5 job hours per net kilowatt installed, giving credit for offsite modular construction. The peak number of construction workforce personnel could reach the 4,400 range. Refer to Section 3.10.1; used in analyses in Section 4.7

Section 3.0 References

(Westinghouse 2003) Westinghouse Electric Company, LLC, *AP1000 Siting Guide: Site Information for an Early Site Permit Application*, APP-0000-X1-001, Revision 3, April 24, 2003.

(Westinghouse 2005) Westinghouse Electric Company, LLC, *AP1000 Design Control Document*, Revision 15, AP1000 Document APP-GW-GL-700, November 11, 2005.

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