CHAPTER 2

SITE CHARACTERISTICS

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CHAPTER 2
SITE CHARACTERISTICS

2.0 SITE CHARACTERISTICS

This Chapter of the referenced DCD is incorporated by reference with the following departure(s) and/or supplement(s).

Insert the following sections following the introduction to Chapter 2 of the DCD.

VCS DEP 2.0-1 Section numbering of portions of this Chapter are based on Regulatory Guide 1.206 down to the X.Y.Z level, rather than following the AP1000 DCD numbering and organization. Left-hand margin annotations indicate where DCD COL Items (VCS COL X.Y-#) have been responded to, departures (VCS DEP X.Y-#) are taken, or supplementary information (VCS SUP X.Y-#) has been added.

VCS SUP 2.0-1 Chapter 2.0 describes the characteristics of the VCSNS Units 2 and 3 site and site-related design parameters. The site location, characteristics, and parameters are presented in the following five sections:

Section 2.1	Geography and Demography
Section 2.2	Nearby Industrial, Transportation, and Military Facilities
Section 2.3	Meteorology
Section 2.4	Hydrologic Engineering
Section 2.5	Geology, Seismology, and Geotechnical Engineering

The sections of this chapter where departures to the numbering and organization of the DCD are taken include Sections 2.1, 2.4, and portions of Section 2.5. The introductions of the sections or subsections note where departures from the DCD numbering and organization are taken.

The AP1000 convention throughout the DCD for plant orientation is that north is along the axis of the turbine shaft away from the containment building. For VCSNS Units 2 and 3, the plant orientation is rotated with respect to true north. VCSNS Unit 2 and 3 plant north is 68 degrees counter clockwise from true north. To differentiate between the site-specific and DCD orientation systems, orientations in the site-specific portions of the FSAR will be preceded with the word “plant” (as in “plant north”) or, in some Subsections, true north will be used. When true north is used it will be specified in the Subsection.

The AP1000 convention throughout the DCD is that design plant grade is given a reference elevation of 100 ft; see, for example, DCD Figure 1.2-13. For VCSNS

Units 2 and 3, this plant elevation of 100 ft correlates to the North American Vertical Datum 1988 (NAVD88) elevation of 400 ft. Site specific elevations are given in NAVD88. To differentiate between the DCD and site-specific elevations, elevations provided in the site-specific portions of the FSAR include the acronym SEL preceding the elevation unless it is otherwise specified in the FSAR Section or Subsection.

This chapter addresses the site-related parameters for which the AP1000 plant is designed. The DCD site parameters in DCD Table 2-1 are compared to the site-specific site parameters in Table 2.0-201. In addition, the FSAR subsection that discusses the site-specific parameter is provided in Table 2.0-201.

The DCD states: “The site is acceptable if the site characteristics fall within the AP1000 plant site design parameters in Table 2-1.” Except as noted in Table 2.0-201, the DCD value envelopes the site-specific site value.

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VCS SUP 2.0-2

Table 2.0-201
Comparison of AP1000 DCD Site Parameters and V. C. Summer Nuclear Station, Units 2 and 3

VCS DEP 2.0-2

	DCD Value	Plant Specific Value	FSAR Section
Air Temperature			
Maximum Safety[a]	115°F dry bulb/86.1°F coincident wet bulb[g] 86.1°F wet bulb (noncoincident)	112.4°F dry bulb/74.5°F coincident wet bulb 87.3°F wet bulb (noncoincident)[k]	2.3.1.5
Minimum Safety[a]	–40°F	–8.9°F	
Maximum Normal[b]	101°F dry bulb/80.1°F coincident wet bulb 80.1°F wet bulb (noncoincident)[d]	97°F dry bulb/76°F coincident wet bulb 78°F wet bulb (noncoincident)	
Minimum Normal[b]	–10°F	–5°F	
Wind Speed			
Operating Basis	145 mph (3-second gust); importance factor 1.15 (safety), 1.0 (nonsafety); exposure C; topographic factor 1.0	102 mph (100-year return period 3-second gust) (exposure category “C”)[h]	2.3.1.3.1
Tornado	300 mph	230 mph	2.3.1.3.2
Seismic			
SSE	0.30g peak ground acceleration[c, f]	0.23g peak ground acceleration[i]	2.5.2.6
Fault Displacement Potential	Negligible	Negligible	2.5.1.2
Soil			
Average Allowable Static Bearing Capacity	The allowable bearing capacity, including a factor of safety appropriate for the design load combination, shall be greater than or equal to the average bearing demand of 8,900 lb/ft^2 over the footprint of the nuclear island at its excavation depth.	Greater than 8,900 lb/ft^2 over the footprint of the nuclear island at its excavation depth	2.5.4.10
Maximum Allowable Dynamic Bearing Capacity for Normal Plus SSE	The allowable bearing capacity, including a factor of safety appropriate for the design load combination, shall be greater than or equal to the maximum bearing demand of 35,000 lb/ft^2 at the edge of the nuclear island at its excavation depth, or site-specific analyses demonstrate factor of safety appropriate for normal plus safe shutdown earthquake loads.	Greater than 35,000 lb/ft^2 at the edge of the nuclear island at its excavation depth	2.5.4.10

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VCS SUP 2.0-2

Table 2.0-201
Comparison of AP1000 DCD Site Parameters and V. C. Summer Nuclear Station, Units 2 and 3

DCD Value		Plant Specific Value	FSAR Section
Soil (continued)			
Shear Wave Velocity	Greater than or equal to 1,000 ft/sec based on minimum low-strain soil properties over the footprint of the nuclear island at its excavation depth.	Units 2 and 3 are founded on hard rock.	2.5.4.8
Lateral Variability	Soils supporting the nuclear island should not have extreme variations in subgrade stiffness. This may be demonstrated by one of the following: 1. Soils supporting the nuclear island are uniform in accordance with Regulatory Guide 1.132 if the geologic and stratigraphic features at depths less than 120 feet below grade can be correlated from one boring or sounding location to the next with relatively smooth variations in thicknesses or properties of the geologic units, or 2. Site specific assessment of subsurface conditions demonstrates that the bearing pressures below the nuclear island do not exceed 120% of those from the generic analyses of the nuclear island at a uniform site, or 3. Site specific analysis of the nuclear island basemat demonstrates that the site specific demand is within the capacity of the basemat. As an example of sites that are considered uniform, the variation of shear wave velocity in the material below the foundation to a depth of 120 feet below finished grade within the nuclear island footprint and 40 feet beyond the boundaries of the nuclear island footprint meets the criteria in the case outlined below:	Units 2 and 3 are founded on hard rock, and meet conditions 1 and 3.	2.5.4.8

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VCS SUP 2.0-2

Table 2.0-201
Comparison of AP1000 DCD Site Parameters and V. C. Summer Nuclear Station, Units 2 and 3

	DCD Value	Plant Specific Value	FSAR Section
Soil (continued)			
Lateral Variability (continued)	Case 1: For a layer with a low strain shear wave velocity greater than or equal to 2500 feet per second, the layer should have approximately uniform thickness, should have a dip not greater than 20 degrees, and should have less than 20 percent variation in the shear wave velocity from the average velocity in any layer.	Units 2 and 3 are founded on hard rock.	
Liquefaction Potential	Negligible	Negligible	2.5.4.8
Minimum Soil Angle of Internal Friction	Greater than or equal to 35 degrees below footprint of nuclear island at its excavation depth	Units 2 and 3 are founded on hard rock.	2.5.4.8
Missiles			
Tornado	4000-lb automobile at 105 mph horizontal, 74 mph vertical 275-lb, 8-in. shell at 105 mph horizontal, 74 mph vertical 1-inch diameter steel ball at 105 mph horizontal and vertical	The Units 2 and 3 design is based on these DCD required limits.	DCD 3.5.4
Flood Level	Less than plant elevation 100′	378.9 ft (NAVD88) (equals DCD elevation 78.9 ft)	2.4.2.2
Groundwater Level	Less than plant elevation 98′	380 ft (NAVD88) (equals DCD elevation 80 ft)	2.4.12.5
Plant Grade Elevation	Less than plant elevation 100′ except for portion at a higher elevation adjacent to the annex building	Plant floor elevation is at 400 ft (NAVD88). Plant grade elevation is less than the plant floor elevation. 400 ft (NAVD88) equals DCD elevation 100 ft.	2.4.1.1
Precipitation			
Rain	20.7 in./hr [1-hr 1-mi^2 PMP]	19.0 in./hr (6.2 in./5 min)	2.4.2.3
Snow/Ice	75 pounds per square foot on ground with exposure factor of 1.0 and importance factors of 1.2 (safety) and 1.0 (non-safety)	100-year return period ground-level snowpack of 12.2 pounds per square foot	2.3.1.3.4

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VCS SUP 2.0-2

Table 2.0-201
Comparison of AP1000 DCD Site Parameters and V. C. Summer Nuclear Station, Units 2 and 3

DCD Value		Plant Specific Value	FSAR Section
Atmospheric Dispersion Values — X/Q[(e)]			
Site boundary (0-2 hr)	$\leq 5.1 \times 10^{-4}$ sec/m^3	$\leq 3.57 \times 10^{-4}$ sec/m^3	2.3.4.2.1.1
Site boundary (annual average)	$\leq 2.0 \times 10^{-5}$ sec/m^3	$\leq 5.8 \times 10^{-6}$ sec/m^3 routine releases	2.3.5.2
Low population zone boundary			
0–8 hr	$\leq 2.2 \times 10^{-4}$ sec/m^3	$\leq 1.16 \times 10^{-4}$ sec/m^3	2.3.4.2.1.1
8–24 hr	$\leq 1.6 \times 10^{-4}$ sec/m^3	$\leq 7.45 \times 10^{-5}$ sec/m^3	
24–96 hr	$\leq 1.0 \times 10^{-4}$ sec/m^3	$\leq 2.84 \times 10^{-5}$ sec/m^3	
96–720 hr	$\leq 8.0 \times 10^{-5}$ sec/m^3	$\leq 7.13 \times 10^{-6}$ sec/m^3	
Population Distribution			
Exclusion area (site)	0.5 mi	> 0.5 mi[(j)]	2.1.3

(a) Maximum and minimum safety values are based on historical data and exclude peaks of less than 2 hours duration.
(b) The maximum normal value is the 1-percent seasonal exceedance temperature. The minimum normal value is the 99-percent seasonal exceedance temperature. The minimum temperature is for the months of December, January, and February in the northern hemisphere. The maximum temperature is for the months of June through September in the northern hemisphere. The 1-percent seasonal exceedance is approximately equivalent to the annual 0.4-percent exceedance. The 99-percent seasonal exceedance is approximately equivalent to the annual 99.6-percent exceedance.
(c) With ground response spectra as given in DCD Figures 3.7.1-1 and 3.7.1-2. Seismic input is defined at finished grade except for sites where the nuclear island is founded on hard rock.
(d) The noncoincident wet bulb temperature is applicable to the cooling tower only.
(e) For AP1000, the terms “site boundary” and “exclusion area boundary” are used interchangeably. Thus, the X/Q specified for the site boundary applies whenever a discussion refers to the exclusion area boundary.
(f) Sites that fall within the hard rock high frequency GMRS given in DCD Figures 3I.1-1 and 3I.1-2 are acceptable.
(g) The containment pressure response analysis is based on a conservative set of dry-bulb and wet-bulb temperatures. These results envelop any conditions where the dry-bulb temperature is 115° F or less and wet-bulb temperature of less than or equal to 86.1° F.
(h) Importance factor is not a property of the wind speed.
(i) Figures 2.0-201 and 2.0-202 show a comparison of the VCSNS horizontal and vertical site-specific ground motion response spectra (GMRS) to the hard rock high frequency (HRHF) spectra and the certified seismic design response spectra (CSDRS); see also DCD Figures 3I.1-1 and 3I.1-2. Appendix 3I provides the criteria for addressing potential high frequency sensitive components for plant locations where there is CSDRS exceedance in the high frequency region; the HRHF spectra in Appendix 3I are alternative spectra for evaluation of site specific GMRS in the high frequency region. The VCSNS GMRS were developed at the top of a hypothetical outcrop of competent material at the elevation of the AP1000 basemat as described in Section 2.5.2.5.
(j) The exclusion area is defined as the area within approximately 1 mile of Unit 1 combined with the area 3,390 feet from the center of Units 2 and 3, as shown in Figure 2.1-203.
(k) See COLA Part 7 for the exemption and departure justification for Maximum Safety Wet Bulb Temperature (Noncoincident).

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VCS SUP 2.0-2

Table 2.0-201
Comparison of AP1000 DCD Site Parameters and V. C. Summer Nuclear Station, Units 2 and 3

VCSNS X/Q Values are from Tables 2.3-222 and 2.3-223. These are used for comparison to the DCD values and have not been used for the calculation of control room doses.

Control Room Atmospheric Dispersion Factors (X/Q) for Accident Dose Analysis

X/Q (sec/m³) at HVAC Intake for the Identified Release Points(1)

	Plant Vent or PCS Air Diffuser(3)	Plant Vent	PCS Air Diffuser	**Ground Level Containment Release Points(4),(8)**	Ground Level Containment Release Points	**PORV and Safety Valve Releases(5)**	PORV and Safety Valve Releases	**Steam Line Break Releases**	Steam Vent	**Fuel Handling Area(6)**	Fuel Building Blowout Panel	Fuel Building Truck Bay Door	**Condenser Air Removal Stack(7)**	Condenser Air Removal Stack
	DCD	VCSNS	VCSNS	**DCD**	VCSNS	**DCD**	VCSNS	**DCD**	VCSNS	**DCD**	VCSNS	VCSNS	**DCD**	VCSNS
0 – 2 hours	**3.0E-3**	1.90E-03	1.65E-03	**6.0E-3**	2.72E-03	**2.0E-2**	1.35E-02	**2.4E-2**	1.54E-02	**6.0E-3**	1.53E-03	1.12E-03	**6.0E-3**	1.58E-03
2 – 8 hours	**2.5E-3**	1.39E-03	1.24E-03	**3.6E-3**	1.66E-03	**1.8E-2**	1.10E-02	**2.0E-2**	1.27E-02	**4.0E-3**	1.13E-03	8.20E-04	**4.0E-3**	1.20E-03
8 –24 hours	**1.0E-3**	4.82E-04	4.71E-04	**1.4E-3**	6.58E-04	**7.0E-3**	4.87E-03	**7.5E-3**	5.54E-03	**2.0E-3**	4.05E-04	3.10E-04	**2.0E-3**	4.90E-04
1 – 4 days	**8.0E-4**	3.52E-04	3.46E-04	**1.8E-3**	5.36E-04	**5.0E-3**	3.45E-03	**5.5E-3**	3.90E-03	**1.5E-3**	3.03E-04	2.18E-04	**1.5E-3**	3.16E-04
4 – 30 days	**6.0E-4**	2.59E-04	2.66E-04	**1.5E-3**	4.10E-04	**4.5E-3**	2.64E-03	**5.0E-3**	3.11E-03	**1.0E-3**	2.28E-04	1.88E-04	**1.0E-3**	2.65E-04

X/Q (sec/m³) at Annex Building Door for the Identified Release Points(2)

	Plant Vent or PCS Air Diffuser(3)	Plant Vent	PCS Air Diffuser	**Ground Level Containment Release Points(4)**	Ground Level Containment Release Points	**PORV and Safety Valve Releases(5)**	PORV and Safety Valve Releases	**Steam Line Break Releases**	Steam Vent	**Fuel Handling Area(6)**	Fuel Building Blowout Panel	Fuel Building Truck Bay Door	**Condenser Air Removal Stack(7)**	Condenser Air Removal Stack
	DCD	VCSNS	VCSNS	**DCD**	VCSNS	**DCD**	VCSNS	**DCD**	VCSNS	**DCD**	VCSNS	VCSNS	**DCD**	VCSNS
0 – 2 hours	**1.0E-3**	4.15E-04	4.25E-04	**1.0E-3**	3.94E-04	**4.0E-3**	9.97E-04	**4.0E-3**	9.47E-04	**6.0E-3**	3.81E-04	3.46E-04	**2.0E-2**	3.89E-03
2 – 8 hours	**7.5E-4**	3.12E-04	3.16E-04	**7.5E-4**	3.21E-04	**3.2E-3**	7.78E-04	**3.2E-3**	7.44E-04	**4.0E-3**	2.93E-04	2.64E-04	**1.8E-2**	3.09E-03
8 – 24 hours	**3.5E-4**	1.09E-04	1.11E-04	**3.5E-4**	1.10E-04	**1.2E-3**	2.62E-04	**1.2E-3**	2.48E-04	**2.0E-3**	1.01E-04	9.18E-05	**7.0E-3**	1.18E-03
1 – 4 days	**2.8E-4**	7.97E-05	8.22E-05	**2.8E-4**	8.43E-05	**1.0E-3**	2.10E-04	**1.0E-3**	2.01E-04	**1.5E-3**	7.78E-05	7.10E-05	**5.0E-3**	9.11E-04
4 – 30 days	**2.5E-4**	5.80E-05	6.24E-05	**2.5E-4**	6.78E-05	**8.0E-4**	1.56E-04	**8.0E-4**	1.52E-04	**1.0E-3**	6.20E-05	5.52E-05	**4.5E-3**	6.92E-04

Notes:

(1). These dispersion factors are to be used 1) for the time period preceding the isolation of the main control room and actuation of the emergency habitability system, 2) for the time after 72 hours when the compressed air supply in the emergency habitability system would be exhausted and outside air would be drawn into the main control room, and 3) for the determination of control room doses when the non-safety ventilation system is assumed to remain operable such that the emergency habitability system is not actuated.

(2). These dispersion factors are to be used when the emergency habitability system is in operation and the only path for outside air to enter the main control room is that due to ingress/egress.

(3). These dispersion factors are used for analysis of the doses due to a postulated small line break outside of containment. The plant vent and PCS air diffuser are potential release paths for other postulated events (loss of-coolant accident, rod ejection accident, and fuel handling accident inside the containment); however, the values are bounded by the dispersion factors for ground level releases.

(4). The listed values represent modeling the containment shell as a diffuse area source, and are used for evaluating the doses in the main control room for a loss-of-coolant accident, for the containment leakage of activity following a rod ejection accident, and for a fuel handling accident occurring inside the containment.

(5). The listed values bound the dispersion factors for releases from the steam line safety & power-operated relief valves. These dispersion factors would be used for evaluating the doses in the main control room for a steam generator tube rupture, a main steam line break, a locked reactor coolant pump rotor, and for the secondary side release from a rod ejection accident.

(6). The listed values bound the dispersion factors for releases from the fuel storage and handling area. The listed values also bound the dispersion factors for releases from the fuel storage area in the event that spent fuel boiling occurs and the fuel building relief panel opens on high temperature. These dispersion factors are used for the fuel handling accident occurring outside containment and for evaluating the impact of releases associated with spent fuel pool boiling.

(7). This release point is included for information only as a potential activity release point. None of the design basis accidental radiological consequences analyses model release from this point.

(8). The LOCA dose analysis models the ground level containment release point HVAC intake atmospheric dispersion factors. Other analyses model more conservative values.

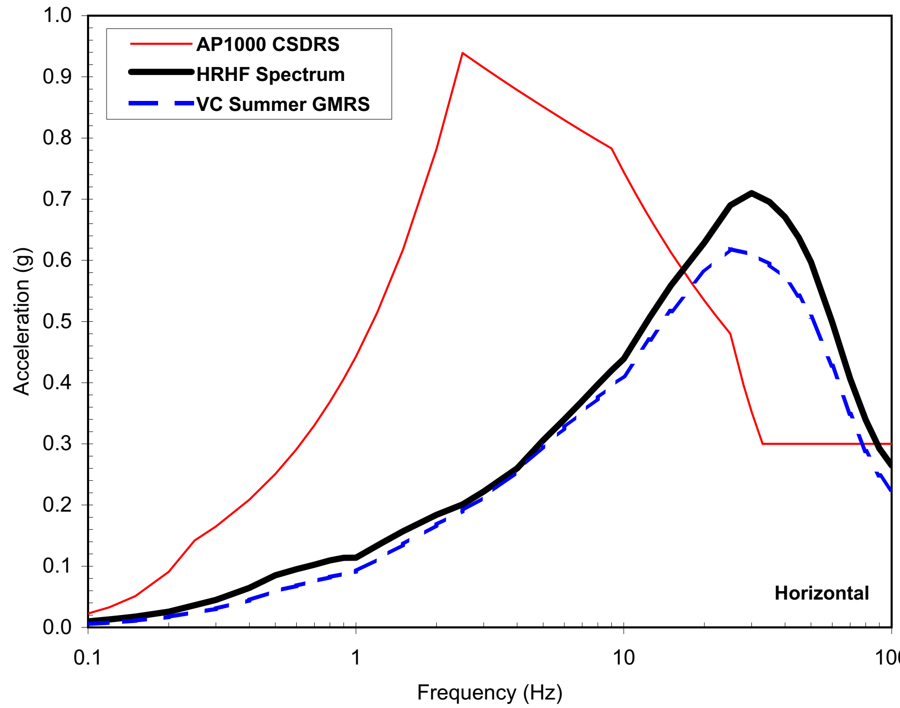

Figure 2.0-201. Comparison Plot of V. C. Summer GMRS and HRHF Spectra for the Horizontal Component of Motion

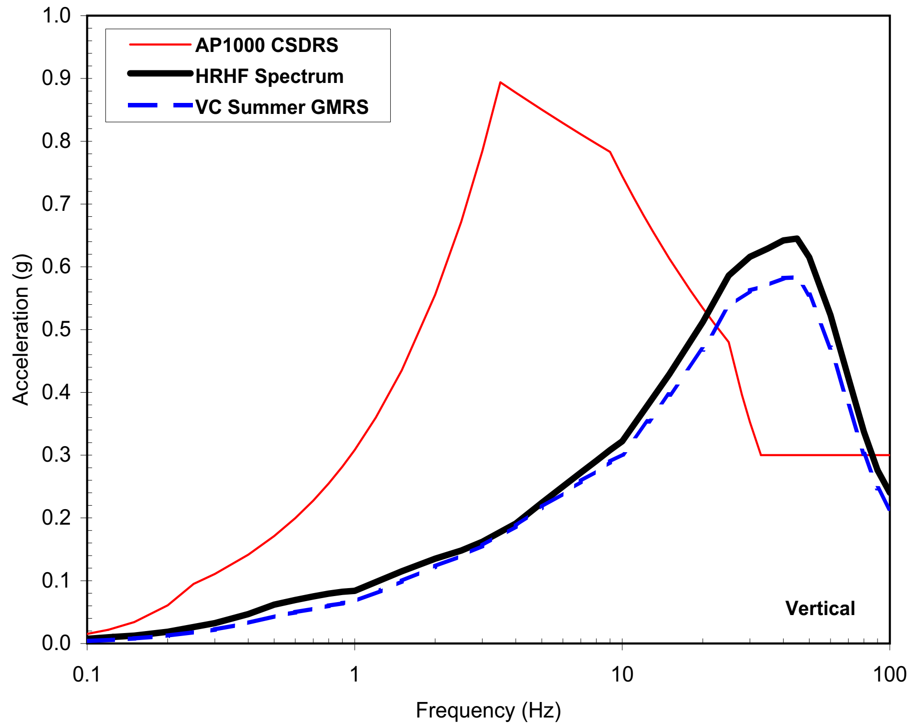

Figure 2.0-202. Comparison Plot of V. C. Summer GMRS and HRHF Spectra for the Vertical Component of Motion