FINAL SAFETY ANALYSIS REPORT

CHAPTER 2

SITE CHARACTERISTICS

2.0 SITE CHARACTERISTICS

{This Chapter of the U.S. EPR FSAR is incorporated by reference with the following departures and/or supplements.

Chapter 2 describes the geological, seismological, hydrological, and meteorological characteristics of the Bell Bend Nuclear Power Plant (BBNPP) site and vicinity. The site characteristics are described in conjunction with present and projected population distribution, land use, and site activities and controls. The BBNPP site characteristics were developed in accordance with the relevant requirements of Title 10 CFR Part 20, Subpart D (CFR, 2007a); Title 10 CFR Part 50 (CFR, 2007b); Title 10 CFR Part 100 (CFR, 2007c); and Regulatory Guide 1.206 (NRC, 2007).}

The U.S. EPR FSAR includes the following COL Item in Section 2.0:

> A COL applicant that references the U.S. EPR design certification will compare site-specific data to design parameter data in Table 2.1-1. If the specific data for the site falls within the assumed design parameter data and characteristics in Table 2.1-1, then the U.S. EPR standard design is bounding for the site. For site-specific design parameter data or characteristic that are outside the bounds of the assumptions presented in Table 2.1-1, the COL applicant will confirm that the U.S. EPR design acceptably meets any additional requirements that may be imposed by the more limiting site-specific design parameter data or characteristic, and that the design maintains conformance to the design commitments and acceptance criteria described in this FSAR.

This COL Item is addressed as follows:

{The BBNPP site-specific parameters and characteristics have been reviewed and compared to determine if they are within the bounds of the assumed parameters and characteristics for a U.S. EPR. This comparison is provided in Table 2.0-1 and Table 2.0-2. For the BBNPP site-specific parameters or characteristics that are outside the bounds of the conservative limiting assumptions presented in Table 2.0-1 and Table 2.0-2, justification of the acceptability of these conditions is provided in the associated section of Chapter 3, Design of Structures, Components, Equipment and Systems or as specified in the table.}

Table 2.0-1—{U.S. EPR Site Design Envelope Comparison}

(Page 1 of 4)

	U.S. EPR FSAR Design Parameter Value/Characteristic	BBNPP Design Parameter Value/Characteristic
Precipitation		
Rainfall rate	<19.4 in/hr	17.5 in/hr (44.5 cm/hr) (See Section 2.4.3)
Normal ground precipitation load	≤100 psf (100-year MRI)	40.7 lb/ft^2 (198.7 kg/m^2)
Normal roof precipitation load	≤70 psf (100-year MRI)	29.9 lb/ft^2 (146.0 kg/m^2 32.9 lb/ft^2 (160.6 kg/m^2) (ESWEMS Pumphouse)
48-hour PMWP liquid roof load	0 psf (note c)	0 lb/ft^2 (note d) 62.4 lb/ft^2 (304.7 kg/m^2) (ESWEMS Pumphouse)
48-hour PMWP frozen ground load	≤43 psf (based on 55 inches)	25.0 lb/ft^2 (122.1 kg/m^2)
48-hour PMWP frozen roof load	≤30 psf	17.5 lb/ft^2 (85.4 kg/m^2) 19.3 lb/ft^2 (465.3 kg/m^2) (ESWEMS Pumphouse)
Extreme winter precipitation roof load	≤100 psf (100-year MRI)	47.4 lb/ft^2 (231.4 kg/m^2) 95.3 lb/ft^2 (465.3 kg/m^2) (ESWEMS Pumphouse)
Seismology		
Horizontal SSE Acceleration	0.3g Peak (CSDRS shapes – See Section 3.7.)	Exceeds 0.3 g primarily in the high frequency region (note a) (See Sections 2.5.2 and 3.7)
Vertical SSE Acceleration	0.3g Peak (CSDRS shapes – See Section 3.7.)	Exceeds 0.3 g primarily in the high frequency region (note a) (See Sections 2.5.2 and 3.7)
Fault Displacement Potential	No fault displacement is considered for safety-related SSCs in U.S. EPR design certification.	No fault displacement potential (See Section 2.5.3)
Soil		
Minimum Static Bearing Capacity	22 ksf in localized areas at the bottom of the Nuclear Island basemat and 15 ksf on average across the total area of the bottom of the Nuclear Island basemat.	22 ksf in localized areas of the NI Basemat and 15 ksf on the average across the total area of the bottom of the NI basemat (See section 2.5.4.10)
Minimum Shear Wave Velocity (Low strain best estimate average value at bottom of basemat)	1000 fps	>1000 fps (See Section 2.5.4)
Liquefaction	None	None (See section 2.5.4)
Slope Failure Potential	No slope failure potential is considered in the design of safety-related SSCs for U.S. EPR design certification.	No slope failure potential that would adversely affect the safety of the proposed BBNPP (See Section 2.5.5)

Table 2.0-1—{U.S. EPR Site Design Envelope Comparison}

(Page 2 of 4)

	U.S. EPR FSAR Design Parameter Value/Characteristic	BBNPP Design Parameter Value/Characteristic
Maximum Differential Settlement (across the basemat)	1/2 inch in 50 feet in any direction	< 0.1 in 50 ft for common Basemat in any direction (See Section 2.5.4) <0.1 inch in 50 ft in any direction for both EPGB and ESWB (See Section 2.5.4)
Maximum Ground Water	3.3 ft below grade	Groundwater ranges between 12.9 and 19.0 ft (3.9-5.8 m) below grade for all safety-related structures in the power block area. Groundwater ranges between 7.0 and 18.0 ft (2.1-5.5 m) below grade near the ESWEMS Pumphouse. These values are all within design parameters.
Inventory of Radionuclides Which Could Potentially Seep Into the Groundwater		
Bounding Values for Component Radionuclide Inventory	See Table 2.0-2	See Table 2.0-2
Flood Level		
Maximum Flood (or Tsunami)	1 ft below grade	Approximately 3 ft (0.9 m) below grade except for the pumpwell structure of the ESWEMS Pumphouse which is normally submerged (note a) (See Sections 2.4.1 and 2.4.2, 2.4.10, 3.4.2, 3.4.3.10, 3.8.4.1.11, 3.8.4.3, and 9.2.5)
Wind		
Maximum Speed (Other than Tornado)	145 mph (Based on 3-sec gust at 33 ft above ground level and factored for 50-yr mean recurrence interval.)	90 mph (0.45 m/s) (parameter referred to as Wind Gust in this FSAR) (based on 3 second gust at 33 feet for 50 year recurrence interval) (See Section 2.3.1)
Importance Factor	1.15 (Safety-related structures for 100-year mean recurrence interval.)	1.07 (safety related structures for 100 year mean recurrence interval) (See Section 2.3.1)
Tornado		
Maximum Pressure and rate of Drop	1.2 psi at 0.5 psi/sec	1.2 psi (83 mb) at 0.5 psi/sec (34.5 mb/sec) (See Section 2.3.1)
Maximum Rotational Speed	184 mph	184 mph (82 m/s) (See Section 2.3.1)
Maximum Translational Speed	46 mph	46 mph (21 m/s) (See Section 2.3.1)
Maximum Wind Speed	230 mph	230 mph (103 m/s) (See Section 2.3.1)
Radius of Maximum Rotational Speed	150 ft	150 feet (45.7 m) (See Section 2.3.1)

Table 2.0-1—{U.S. EPR Site Design Envelope Comparison}

(Page 3 of 4)

	U.S. EPR FSAR Design Parameter Value/Characteristic			BBNPP Design Parameter Value/Characteristic
	6 in Schedule 40 pipe, 6.625 in diameter x 15 ft long, 287 lb, 34.5 in^2 impact area, impact velocity of 135 ft/sec horizontal and 90 ft/sec vertical.			Design values are enveloped (See Section 3.5)
Missile Spectra	Automobile, 16.4 ft x 6.6 ft x 4.3 ft, 4000 lb, 4086.7 in^2 impact area, impact velocity of 135 ft/sec horizontal & 90 ft/sec vertical. (Automobile missile is considered at elevations up to 30.0 ft above grade elevation.)			Design values are enveloped (See Section 3.5)
	Solid steel sphere, 1 in diameter, 0.147 lb, 0.79 in^2 impact area, impact velocity of 26 ft/sec horizontal & 17 ft/sec Vertical.			Design values are enveloped (See Section 3.5)
Temperature				
Air	0% Exceedance Values	Maximum	115°F Dry Bulb / 80°F Wet Bulb (coincident)	100°F (37.8°C) Dry Bulb /71.7°F (22.1°C) Wet Bulb (coincident) (See Section 9.2.1)
			81°F Wet Bulb (non-coincident) UHS Design only	78.9°F (26.1 °C) Wet Bulb (non-coincident) for UHS Design only (See Section 9.2.1)
		Minimum	-40°F	-23.7°F (-30.9°C) (See Section 2.3.1)
	1% Exceedance Values	Maximum	100°F Dry Bulb / 77°F Wet Bulb (coincident)	85.8°F (29.9°C)
			80°F Wet Bulb (non-coincident) UHS Design only	76.2°F (24.6°C)
		Minimum	-10°F	-15.1°F (-26.2°C)
UHS Meteorological Conditions				
Conditions resulting in Maximum Evaporation and Drift Loss of Water from the UHS (Section 2.3.1)			As presented in Table 2.1-3 – Design Values for Maximum Evaporation and Drift Loss of Water from the UHS	85.8°F (29.9°C) Dry Bulb /76.2°F (24.6°C) Wet Bulb (See Section 9.2.1.1)
Conditions resulting in Minimum Water Cooling in the UHS (Section 2.3.1)			As presented in Table 2.1-4 – Design Values for Minimum Water Cooling in the UHS.	73°F (22.8°C) (See Sections 9.2.1.1 and 2.3.1)
Potential for Water Freezing in the UHS Water Storage Facility (Sections 2.4.7 and 9.2.5)			As presented in Section 2.4.7 and 9.2.5	27.9°F (-2.3°C) - See Sections 2.4.7 and 9.2.5
UHS Design Parameters				

Table 2.0-1—{U.S. EPR Site Design Envelope Comparison}

(Page 4 of 4)

	U.S. EPR FSAR Design Parameter Value/Characteristic	BBNPP Design Parameter Value/Characteristic
Maximum UHS Evaporative Water Loss	571 gpm	571 gpm (2.16 cm/min) (See Section 9.2.1.1)
Maximum Drift Water Loss	≤0.005%	<0.005% (See Section 2.3.1.2)
Design Cold (outlet) Water Temperature	≤95°F (max ESWS supply design limit)	<95 °F (52.8°C) (See Sections 2.3.1 and 9.2.1.1)
Atmospheric Dispersion Factors (χ/Q)		
Maximum Annual Average (0.5 mile - limiting sector)	≤4.973E-6 sec/m^3	9.672E-06 sec/m^3 (note b) (See Section 2.3.5)
Accident		
0-2 hr (Exclusion Area Boundary, (EAB), 0.5 miles)	≤1E-3 sec/m^3	1.029E-03 sec/m^3(note b) (See Section 2.3.4)
0-2 hr (Low Population Zone (LPZ, 1.5 miles)	≤1.75E-4 sec/m^3	2.766E-04 sec/m^3 (note b) (See Section 2.3.4)
2-8 hr (Low Population Zone (LPZ, 1.5 miles)	≤1.35E-4 sec/m^3	1.648E-04 sec/m^3 (note b) (See Section 2.3.4)
8-24 hr (Low Population Zone (LPZ, 1.5 miles)	≤1.00E-4 sec/m^3	1.038E-04 sec/m^3 (note b) (See Section 2.3.4)
1-4 day (Low Population Zone (LPZ, 1.5 miles)	≤5.40E-5 sec/m^3	5.106E-05 sec/m^3 (See Section 2.3.4)
4-30 day (Low Population Zone (LPZ, 1.5 miles)	≤2.20E-5 sec/m^3	1.845E-05 sec/m^3 (See Section 2.3.4)

Table 2.0-1—{U.S. EPR Site Design Envelope Comparison}

Main Control Room and Technical Support Center Intake Atmospheric Dispersion Factors for Onsite Accident Dose Analysis (χ/Q) (note e)									
Time Period	**Vent Stack Base**	**Releases via Safeguard Building Canopy #1**	**Releases via Safeguard Building Canopy #2**	**Equipment Hatch Releases via Material Lock**	**Depressurization Shaft Releases**	**Main Steam Relief Train Silencer #1**	**Main Steam Relief Train Silencer #2**	**Main Steam Relief Train Silencer #3**	**Main Steam Relief Train Silencer #4**
0–2 hours (s/m^3)	1.93E-03 / 1.41E-03	6.52E-03 / 4.86E-03	1.66E-03 / 1.28E-03	1.01E-03 / 7.36E-04	4.45E-03 / 3.46E-03	1.57E-03 / 1.09E-03	1.88E-03 / 1.31E-03	4.30E-03 / 2.99E-03	3.28E-03 / 2.28E-03
2–8 hours (s/m^3)	1.73E-03 / 1.16E-03	5.68E-03 / 3.88E-03	1.47E-03 / 1.01E-03	8.97E-04 / 6.06E-04	3.95E-03 / 2.72E-03	1.36E-03 / 9.42E-04	1.63E-03 / 1.12E-03	3.71E-03 / 2.53E-03	2.83E-03 / 1.94E-03
8–24 hours (s/m^3)	6.74E-04 / 4.83E-04	2.34E-03 / 1.64E-03	6.28E-04 / 4.35E-04	3.53E-04 / 2.55E-04	1.70E-03 / 1.15E-03	5.44E-04 / 3.84E-04	6.47E-04 / 4.56E-04	1.46E-03 / 1.03E-03	1.12E-03 / 7.90E-04
1–4 days (s/m^3)	5.12E-04 / 3.66E-04	1.63E-03 / 1.20E-03	4.19E-04 / 3.12E-04	2.66E-04 / 1.92E-04	1.11E-03 / 8.27E-04	4.11E-04 / 2.94E-04	4.93E-04 / 3.51E-04	1.12E-03 / 7.93E-04	8.57E-04 / 6.07E-04
4–30 days (s/m^3)	4.72E-04 / 2.86E-04	1.50E-03 / 9.23E-04	3.81E-04 / 2.45E-04	2.46E-04 / 1.52E-04	1.00E-03 / 6.37E-04	3.78E-04 / 2.30E-04	4.52E-04 / 2.75E-04	1.03E-03 / 6.26E-04	7.86E-04 / 4.78E-04
Main Control Room/Technical Support Center Unfiltered Inleakage Atmospheric Dispersion Factors for Onsite Accident Dose Analysis (χ/Q) (notes e & f)									
Time Period	**Vent Stack Base**	**Releases via Safeguard Building Canopy #1**	**Releases via Safeguard Building Canopy #2**	**Equipment Hatch Releases via Material Lock**	**Depressurization Shaft Releases**	**Main Steam Relief Train Silencer #1**	**Main Steam Relief Train Silencer #2**	**Main Steam Relief Train Silencer #3**	**Main Steam Relief Train Silencer #4**
0–2 hours (s/m^3)	4.30E-03 / 4.30E-03	1.67E-02 / 1.67E-02	3.03E-03 / 3.03E-03	1.65E-03 / 1.65E-03	7.52E-03 / 7.52E-03	1.93E-03 / 1.93E-03	2.43E-03 / 2.43E-03	1.76E-02 / 1.76E-02	8.65E-03 / 8.65E-03
2–8 hours (s/m^3)	3.71E-03 / 3.71E-03	1.47E-02 / 1.47E-02	2.68E-03 / 2.68E-03	1.47E-03 / 1.47E-03	6.67E-03 / 6.67E-03	1.66E-03 / 1.66E-03	2.12E-03 / 2.12E-03	1.48E-02 / 1.48E-02	7.21E-03 / 7.21E-03
8–24 hours (s/m^3)	1.46E-03 / 1.46E-03	5.96E-03 / 5.96E-03	1.15E-03 / 1.15E-03	5.74E-04 / 5.74E-04	2.88E-03 / 2.88E-03	6.69E-04 / 6.69E-04	8.28E-04 / 8.28E-04	5.88E-03 / 5.88E-03	2.96E-03 / 2.96E-03
1–4 days (s/m^3)	1.12E-03 / 1.12E-03	4.28E-03 / 4.28E-03	7.59E-04 / 7.59E-04	4.37E-04 / 4.37E-04	1.89E-03 / 1.89E-03	5.02E-04 / 5.02E-04	6.38E-04 / 6.38E-04	4.55E-03 / 4.55E-03	2.22E-03 / 2.22E-03
4–30 days (s/m^3)	1.03E-03 / 1.03E-03	3.89E-03 / 3.89E-03	6.89E-04 / 6.89E-04	4.00E-04 / 4.00E-04	1.71E-03 / 1.71E-03	4.65E-04 / 4.65E-04	5.85E-04 / 5.85E-04	4.16E-03 / 4.16E-03	2.06E-03 / 2.06E-03

Notes:

a. Value is a departure from a design parameter and is listed in Part 7 of the COL Application. Justification is provided in Chapter 3.

b. Value is a departure from a design parameter and is listed in Part 7 of the COL Application. Justification is provided in Part 7 of the COL Application.

c. The maximum 48-hour PMWP liquid of 32 inches is based on data obtained from National Oceanic and Atmospheric Administration Hydrometeorological report No. 53 "Seasonal Variation of 10-square-mile Probable Maximum Percipitation Estimates, United States East of the 105th Meridian" for three winter months - December through February.

d. The effect of rainfall events on roof loads is negligible, due to the lack of parapets, except for the ESWEMS Pumphouse.
e. First value for U.S. EPR/second value for BBNPP
f. The same meterological data are used to calculate unfiltered χ/Q values. Since the site-specific control room χ/Q values were demonstrated to be bounded by the U.S. EPR χ/Q values, the calculation of site-specific atmospheric dispersion factors for unfiltered inleakage was not necessary. BBNPP incorporates by reference the doses for the main control room presented in the U.S. EPR FSAR.

Table 2.0-2—{Comparison of Inventory of Radionuclides Which Could Potentially Seep Into the Groundwater (Page 1 of 2)}

	U.S. EPR FSAR Design Parameter Value/Characteristic	BBNPP Design Parameter Value/Characteristic (See Section 2.4.13)
Nuclide	**Activity (Ci/g)**	**Activity (Ci/g)**
Br-83	3.2E-02	3.2E-02
Br-84	1.7E-02	1.7E-02
Br-85	2.0E-03	2.0E-03
I-129	4.6E-08	4.6E-08
I-130	5.0E-02	5.0E-02
I-131	7.4E-01	7.4E-01
I-132	3.7E-01	3.7E-01
I-133	1.3E+00	1.3E+00
I-134	2.4E-01	2.4E-01
I-135	7.9E-01	7.9E-01
Cs-134	1.7E-01	1.7E-01
Cs-136	5.3E-02	5.3E-02
Cs-137	1.1E-01	1.1E-01
Cs-138	2.2E-01	2.2E-01
Cr-51	2.0E-03	2.0E-03
Mn-54	1.0E-03	1.0E-03
Fe-55	7.6E-04	7.6E-04
Fe-59	1.9E-04	1.9E-04
Co-58	2.9E-03	2.9E-03
Co-60	3.4E-04	3.4E-04
Na-24	3.7E-02	3.7E-02
Zn-65	3.2E-04	3.2E-04
W-187	1.8E-03	1.8E-03
Rb-88	1.0E+00	1.0E+00
Rb-89	4.7E-02	4.7E-02
Sr-89	6.3E-04	6.3E-04
Sr-90	3.3E-05	3.3E-05
Sr-91	1.0E-03	1.0E-03
Sr-92	1.7E-04	1.7E-04
Y-90	7.7E-06	7.7E-06
Y-91m	5.2E-04	5.2E-04
Y-91	8.1E-05	8.1E-05
Y-92	1.4E-04	1.4E-04
Y-93	6.5E-05	6.5E-05
Zr-95	9.3E-05	9.3E-05
Nb-95	9.3E-05	9.3E-05
Mo-99	1.1E-01	1.1E-01
Tc-99m	4.6E-02	4.6E-02
Ru-103	7.7E-05	7.7E-05
Ru-106	2.7E-05	2.7E-05
Rh-103m	6.8E-05	6.8E-05
Rh-106	2.7E-05	2.7E-05
Ag-110m	2.0E-07	2.0E-07
Te-127m	4.4E-04	4.4E-04
Te-129m	1.5E-03	1.5E-03

Table 2.0-2—{Comparison of Inventory of Radionuclides Which Could Potentially Seep Into the Groundwater (Page 2 of 2)}

	U.S. EPR FSAR Design Parameter Value/Characteristic	BBNPP Design Parameter Value/Characteristic (See Section 2.4.13)
Te-129	2.4E-03	2.4E-03
Te-131m	3.7E-03	3.7E-03
Te-131	2.6E-03	2.6E-03
Te-132	4.1E-02	4.1E-02
Te-134	6.7E-03	6.7E-03
Ba-137m	1.0E-01	1.0E-01
Ba-140	6.2E-04	6.2E-04
La-140	1.6E-04	1.6E-04
Ce-141	8.9E-05	8.9E-05
Ce-143	7.6E-05	7.6E-05
Ce-144	6.9E-05	6.9E-05
Pr-143	8.8E-05	8.8E-05
Pr-144	6.9E-05	6.9E-05
Np-239	8.7E-04	8.7E-04