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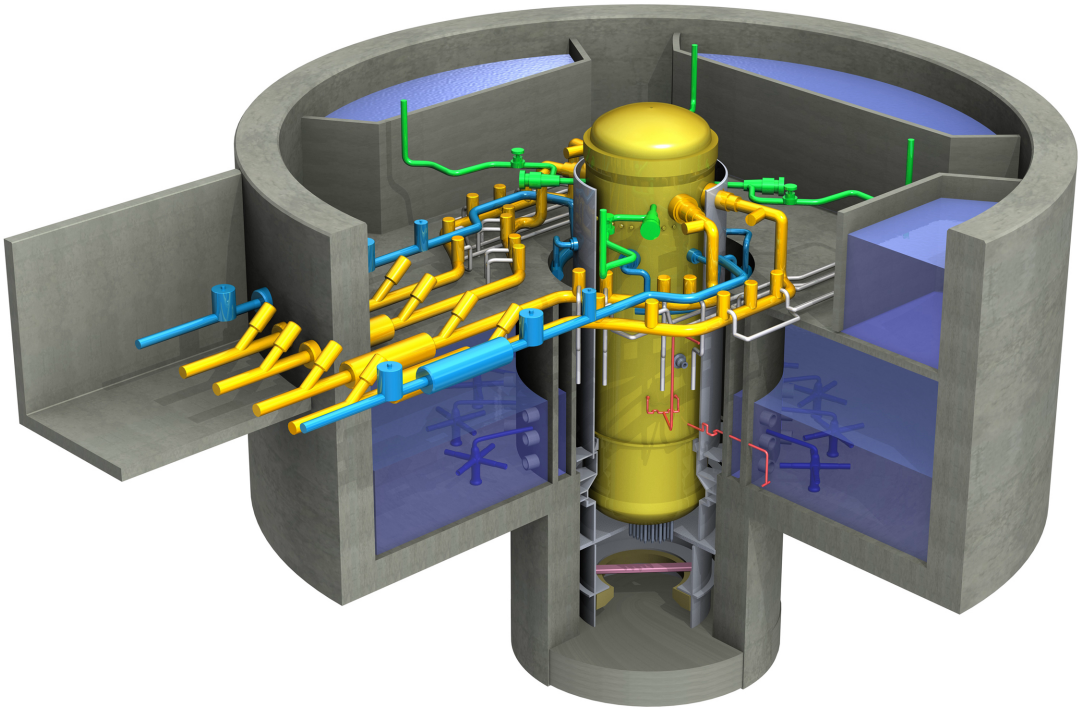

ESBWR Design Control Document
Tier 2

Chapter 2
Site Characteristics

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2. SITE CHARACTERISTICS

2.0 INTRODUCTION

This chapter defines the envelope of site-related parameters that the ESBWR Standard Plant is designed to accommodate. These parameters envelope most potential sites in the U.S. A list of the site envelope design parameters is given in Table 2.0-1.

Table 2.0-2 references the guidance in NUREG-0800 Standard Review Plan (SRP). Table 2.0-2 defines the limits imposed on the acceptance criteria in Section II of the various SRPs by (1) the envelope of site-related parameters that the ESBWR plant is designed to accommodate, and (2) the assumptions, both implicit and explicit, related to site parameters that were employed in the evaluation of the ESBWR design.

The requirements for site parameters for a standard design are contained in 10 CFR 52.47(a)(1). A design certification applicant provides postulated site parameters for the design, and an analysis and evaluation of the design in terms of such parameters. The following demonstrate that the standard design meets the above criteria.

The specified site parameters are the top-level bounding site parameters useful in the selection of a suitable site for a facility referencing the ESBWR certified design. Because they were used in bounding evaluations of the certified design, they define the envelope of site parameters used for the design that must be considered for a site. When the site characteristics fall within the site parameter values, a facility built on the site is in conformance with the design certification. Appropriate values for site parameters have been selected that make the design suitable for many sites. All site parameters specified in Tier 1 have the same values as those presented in this chapter.

The analyses and evaluations of the design, considering the site parameters of Table 2.0-1, are contained in the various sections of this document. For example, the safe shutdown earthquake (SSE) parameters are used in structural and piping analyses in various sections of Chapter 3, atmospheric dispersion parameters are used in radiological analyses throughout Chapter 15, and the elevation parameter is used in the flooding analyses in Section 3.4.

Site parameters are specified for the following parameters:

- Maximum Ground Water Level
- Maximum Flood (or Tsunami) Level
- Precipitation (for roof design)
- Ambient Design Temperature
- Extreme Wind
- Tornado (maximum speed, pressure drop, missile spectrum, etc.)
- Maximum Settlement Values for Seismic Category I Buildings
- Soil Properties (maximum static bearing demand, maximum dynamic bearing demand, minimum shear wave velocity, liquefaction potential, angle of internal friction)
- Seismology (SSE response spectra, using figures)

- Hazards in Site Vicinity
- Required Stability of Slopes
- Meteorological Dispersion (Values at exclusion area boundary [EAB] and low population zone [LPZ] at appropriate time intervals for short and long term)

The site parameters include a requirement that liquefaction not occur underneath Seismic Category I structures, systems, and components resulting from a site-specific SSE. In addition, although the ESBWR design is independent of a particular site and takes into consideration the 0.3g Regulatory Guide 1.60 spectra and representative high frequency ground spectra in Central and Eastern U.S., the evaluation of each site for liquefaction potential and slope stability uses the site-specific SSE.

The design basis for protection against missiles is specified in the DCD Tier 2 Section 3.5, such that external missiles are adequately addressed in the design for buildings and structures, and the building/structure design is verified by appropriate Inspections, Tests, Analyses and Acceptance Criteria (ITAAC).

The site characteristics information for each site is addressed in the Combined License (COL) Applicant's final safety analysis report (FSAR) in accordance with 10 CFR 52.79. A COL Applicant referencing the ESBWR DCD demonstrates that site characteristics for a given site fall within the ESBWR DCD site parameter values per 10 CFR 52.79 (COL 2.0-1-A). Appendix 2A provides ARCON96 source/receptor inputs for use by COL Applicants in the confirmation of site-specific X/Q values. Appendix 2B provides the ventilation stack gaseous effluent release pathway information used in calculating the standard plant long term X/Q values.

The guidance in NUREG-0800 identifies information needed for evaluation of a proposed site (COL 2.0-2-A through 2.0-30-A).

2.0.1 COL Information

2.0-1-A Site Characteristics Demonstration

A COL Applicant referencing the ESBWR DCD demonstrates that site characteristics for a given site fall within the ESBWR DCD site parameter values per 10 CFR 52.79 (Section 2.0).

2.0-2-A through 2.0-30-A Standard Review Plan Conformance

A COL Applicant will provide information in accordance with NRC guidance in NUREG-0800, Standard Review Plan (SRP) sections for site characteristics. A COL Applicant follows applicable NRC guidance for preparing the COL application, depending upon whether the applicant will reference an Early Site Permit or not. (Section 2.0 and Table 2.0-2 – see Table 2.0-2 for detailed COL item numbering by SRP section)

2.0.2 References

2.0-1 GE Hitachi Nuclear Energy, "ESBWR Certification Probabilistic Risk Assessment," NEDO-33201, Class I (Non-proprietary), Revision 4, June 2009.

2.0-2 (Deleted)

2.0-3 National Weather Service Publication Hydrometeorology Report No. 52 (HMR-52)

2.0-4 Electric Power Research Institute, “Advanced Light Water Reactor Utility Requirements Document,” Revision 6, May 1997.

2.0-5 U. S. Nuclear Regulatory Commission, "A Risk-Informed Approach to Defining the Design Basis Tornado for New Reactor Licensing," SECY 04-0200, October 26, 2004.

2.0-6 (Deleted)

2.0-7 U. S. Nuclear Regulatory Commission, "Interim Staff Guidance on Seismic Issues Associated with High Frequency Ground Motion in Design Certification and Combined License Applications," COL/DC-ISG-1, May 2008.

2.0-8 Nuclear Energy Institute, “Consistent Site-Response/ Soil-Structure Interaction Analysis and Evaluation,” White Paper, June 12, 2009.

2.0-9 U. S. Nuclear Regulatory Commission, “Interim Staff Guidance on Assessment of Normal and Extreme Winter Precipitation Loads on the Roofs of Seismic Category I Structures,” COL/DC-ISG-7.

Table 2.0-1

Envelope of ESBWR Standard Plant Site Parameters[1]

[***Maximum Ground Water Level:***	*0.61 m (2 ft) below plant grade*
Extreme Wind:	***Seismic Category I, II and Radwaste Building Structures*** *- 100-year Wind Speed (3-sec gust): [13]* — *67.1 m/s (150 mph)* *- Exposure Category:* — *D* ***Other Seismic Category NS Standard Plant Structures*** *- 50-year Wind Speed (3-sec gust):* — *58.1 m/s (130 mph)*
Maximum Flood (or Tsunami) Level: [2]	*0.3 m (1 ft) below plant grade*
Tornado:	*- Maximum Tornado Wind Speed:* [3] — *147.5 m/s (330 mph)* *- Maximum Rotational Speed:* — *116.2 m/s (260 mph)* *- Translational Speed:* — *31.3 m/s (70 mph)* *- Radius:* — *45.7 m (150 ft)* *- Pressure Drop:* — *16.6 kPa (2.4 psi)* *- Rate of Pressure Drop:* — *11.7 kPa/s (1.7 psi/s)* *- Missile Spectrum:* [3] — *Spectrum I of SRP 3.5.1.4, Rev 2 applied to full building height.*
Precipitation (for Roof Design):	*- Maximum Rainfall Rate:* [4] — *49.3 cm/hr (19.4 in/hr)* *- Maximum Short Term Rate:* — *15.7 cm (6.2 in) in 5 minutes* *- Maximum Ground Snow Load* [5] *for normal winter precipitation event:* — *2394 Pa (50 lbf/ft^2)* *- Maximum Ground Snow Load* [5] *for extreme winter precipitation event:* — *7757 Pa (162 lb/ft^2)*
Ambient Design Temperature: [6]	***2% Annual Exceedance Values*** *- Maximum: 35.6°C (96°F) dry bulb* *26.1°C (79°F) wet bulb (mean coincident)* *27.2°C (81°F) wet bulb (non-coincident)* *- Minimum: -23.3°C (-10°F)* ***1% Annual Exceedance Values*** *- Maximum: 37.8°C (100°F) dry bulb* *26.1°C (79°F) wet bulb (mean coincident)* *27.8°C (82°F) wet bulb (non-coincident)* *- Minimum: -23.3°C (-10°F)* ***0% Exceedance Values*** *- Maximum: 47.2°C (117°F) dry bulb* *26.7°C (80°F) wet bulb (mean coincident)* *31.1°C (88°F) wet bulb (non-coincident)* *- Minimum: -40°C (-40°F)*

Table 2.0-1

Envelope of ESBWR Standard Plant Site Parameters[1] (continued)

Soil Properties: [16]	*- Maximum Static Bearing Demand:* [7] *Reactor/Fuel Building: 699 kPa (14,600 lbf/ft^2)* *Control Building: 292 kPa (6,100 lbf/ft^2)* *Firewater Service Complex: 165 kPa (3,450 lbf/ft^2)* *- Maximum Dynamic Bearing Demand (SSE + Static):* [7] *Reactor/Fuel Building:* *Soft: 1100 kPa (23,000 lbf/ft^2)* *Medium: 2700 kPa (56,400 lbf/ft^2)* *Hard: 1100 kPa (23,000 lbf/ft^2)* *Control Building:* *Soft: 500 kPa (10,500 lbf/ft^2)* *Medium: 2200 kPa (46,000 lbf/ft^2)* *Hard: 420 kPa (8,800 lbf/ft^2)* *Firewater Service Complex (FWSC):* *Soft: 460 kPa (9,600 lbf/ft^2)* *Medium: 690 kPa (14,400 lbf/ft^2)* *Hard: 1200 kPa (25,100 lbf/ft^2)* *- Minimum Shear Wave Velocity:* [8] *300 m/s (1000 ft/s)* *- Liquefaction Potential:* *Seismic Category I Structures: None under footprint of Seismic Category I structures resulting from site-specific SSE.* *Other than Seismic Category I Structures: See Note (14)* *- Angle of Internal Friction (in-situ and backfill): ≥ 35 degrees* *- Backfill on sides of and underneath Seismic Category I structures (not applicable if the fill material is concrete)* *Product of peak ground acceleration α (in g), Poisson's ratio ν and density γ:* *$\alpha(0.95\nu+0.65)\gamma$: 1220 kg/m^3 (76 lbf/ft^3) maximum* *Product of at-rest pressure coefficient k_0 and density:* *$k_0\gamma$: 750 kg/m^3 (47 lbf/ft^3) minimum* *At-rest pressure coefficient:* *k_0: 0.36 minimum* *Soil density:* *γ: 1900 kg/m^3 (119 lbf/ft^3) minimum*
Seismology:	*- SSE Horizontal Ground Response Spectra:* [9] *See Figure 2.0-1* *- SSE Vertical Ground Response Spectra:* [9] *See Figure 2.0-2*

Table 2.0-1

Envelope of ESBWR Standard Plant Site Parameters[1] (continued)

Hazards in Site Vicinity:	*- Site Proximity Missiles and Aircraft:*	*< about 10^{-7} per year*
	- Volcanic Activity:	*None*
	- Toxic Gases:	*None **
* *Maximum toxic gas concentrations at the Main Control Room (MCR) HVAC intakes:*	*< toxicity limits*	
Required Stability of Slopes: [10]	*- Factor of safety for static (non-seismic) loading*	*1.5*
	- Factor of safety for dynamic (seismic) loading due to site-specific SSE	*1.1*
Maximum Settlement Values for Seismic Category I Buildings : [15]		
Maximum Settlement at any corner of basemat	*- Under Reactor/Fuel Building*	*103 mm (4.0 inches)*
	- Under Control Building	*18 mm (0.7 inches)*
	- Under FWSC Structure	*17 mm (0.7 inches)*
Averaged Settlement at four corners of basemat	*- Under Reactor/Fuel Building*	*65 mm (2.6 inches)*
	- Under Control Building	*12 mm (0.5 inches)*
	- Under FWSC Structure	*10 mm (0.4 inches)*
Maximum Differential Settlement along the longest mat foundation dimension	*- within Reactor/Fuel Building*	*77 mm (3.0 inches)*
	- within Control Building	*14 mm (0.6 inches)*
	- Under FWSC Structure	*12 mm (0.5 inches)*
Maximum Differential Displacement between Reactor/Fuel Buildings and Control Building		*85 mm (3.3 inches)*

Table 2.0-1

Envelope of ESBWR Standard Plant Site Parameters(1) (continued)

Meteorological Dispersion (X/Q): *(11)*	*EAB X/Q:*			
		0-2 hours:	*2.00E-03 s/m³*	
	LPZ X/Q:			
		0-8 hours:	*1.90E-04 s/m³*	
		8-24 hours:	*1.40E-04 s/m³*	
		1-4 days:	*7.50E-05 s/m³*	
		4-30 days:	*3.00E-05 s/m³*	
* *First value is for unfiltered inleakage. Second value is for air intakes (emergency and normal)*	*Control Room X/Q: **			
	Reactor Building			
		0-2 hours:	*1.90E-03 s/m³*	*1.50E-03 s/m³*
		2-8 hours:	*1.30E-03 s/m³*	*1.10E-03 s/m³*
		8-24 hours:	*5.90E-04 s/m³*	*5.00E-04 s/m³*
		1-4 days:	*5.00E-04 s/m³*	*4.20E-04 s/m³*
		4-30 days:	*4.40E-04 s/m³*	*3.80E-04 s/m³*
	Passive Containment Cooling System / Reactor Building Roof			
		0-2 hours:	*3.40E-03 s/m³*	*3.00E-03 s/m³*
		2-8 hours:	*2.70E-03 s/m³*	*2.50E-03 s/m³*
		8-24 hours:	*1.40E-03 s/m³*	*1.20E-03 s/m³*
		1-4 days:	*1.10E-03 s/m³*	*9.00E-04 s/m³*
		4-30 days:	*7.90E-04 s/m³*	*7.00E-04 s/m³*
	Blowout Panels / Reactor Building Roof			
		0-2 hours:	*7.00E-03 s/m³*	*5.90E-03 s/m³*
		2-8 hours:	*5.00E-03 s/m³*	*4.70E-03 s/m³*
		8-24 hours:	*2.10E-03 s/m³*	*1.50E-03 s/m³*
		1-4 days:	*1.70E-03 s/m³*	*1.10E-03 s/m³*
		4-30 days:	*1.50E-03 s/m³*	*1.00E-03 s/m³*
	Turbine Building			
		0-2 hours:	*1.20E-03 s/m³*	*1.20E-03 s/m³*
		2-8 hours:	*9.80E-04 s/m³*	*9.80E-04 s/m³*
		8-24 hours:	*3.90E-04 s/m³*	*3.90E-04 s/m³*
		1-4 days:	*3.80E-04 s/m³*	*3.80E-04 s/m³*
		4-30 days:	*3.20E-04 s/m³*	*3.20E-04 s/m³*

Table 2.0-1

Envelope of ESBWR Standard Plant Site Parameters[1] (continued)

Meteorological Dispersion (X/Q): [11] ***(continued)***	*Fuel Building*		
	0-2 hours:	*2.80E-03 s/m^3*	*2.80E-03 s/m^3*
	2-8 hours:	*2.50E-03 s/m^3*	*2.50E-03 s/m^3*
	8-24 hours:	*1.25E-03 s/m^3*	*1.25E-03 s/m^3*
	1-4 days:	*1.10E-03 s/m^3*	*1.10E-03 s/m^3*
	4-30 days:	*1.00E-03 s/m^3*	*1.00E-03 s/m^3*
* *First value is for unfiltered inleakage. Second value is for air intakes (emergency and normal)*	*Technical Support Center X/Q:**		
	Reactor Building		
	0-2 hours:	*1.00E-03 s/m^3*	*1.00E-03 s/m^3*
	2-8 hours:	*6.00E-04 s/m^3*	*6.00E-04 s/m^3*
	8-24 hours:	*3.00E-04 s/m^3*	*3.00E-04 s/m^3*
	1-4 days:	*2.00E-04 s/m^3*	*2.00E-04 s/m^3*
	4-30 days:	*1.00E-04 s/m^3*	*1.00E-04 s/m^3*
	Turbine Building		
	0-2 hours:	*2.00E-03 s/m^3*	*2.00E-03 s/m^3*
	2-8 hours:	*1.50E-03 s/m^3*	*1.50E-03 s/m^3*
	8-24 hours:	*8.00E-04 s/m^3*	*8.00E-04 s/m^3*
	1-4 days:	*6.00E-04 s/m^3*	*6.00E-04 s/m^3*
	4-30 days:	*5.00E-04 s/m^3*	*5.00E-04 s/m^3*
	Passive Containment Cooling System / Reactor Building Roof		
	0-2 hours:	*2.00E-03 s/m^3*	*2.00E-03 s/m^3*
	2-8 hours:	*1.10E-03 s/m^3*	*1.10E-03 s/m^3*
	8-24 hours:	*5.00E-04 s/m^3*	*5.00E-04 s/m^3*
	1-4 days:	*4.00E-04 s/m^3*	*4.00E-04 s/m^3*
	4-30 days:	*3.00E-04 s/m^3*	*3.00E-04 s/m^3*
Long Term Dispersion Estimates: [12]	***X/Q:***		
	Reactor/Fuel Building Ventilation Stack		*3.0E-07 s/m^3*
	Turbine Building Ventilation Stack		*2.0E-07 s/m^3*
	Radwaste Building Ventilation Stack		*2.0E-05 s/m^3*
	D/Q:		
	Reactor/Fuel Building Ventilation Stack		*1.0E-08 m^{-2}*
	Turbine Building Ventilation Stack		*6.0E-09 m^{-2}*
	Radwaste Building Ventilation Stack		*3.0E-08 m^{-2}*

Notes for Table 2.0-1:

(1) The site parameters defined in this table are applicable to Seismic Category I, II, and Radwaste Building structures, unless noted otherwise.

(2) Probable maximum flood level, as defined in Table 1.2-6 of Volume III of Reference 2.0-4.

(3) Maximum speed selected is based on Attachment 1 of Reference 2.0-5, which summarizes the NRC Interim Position on Regulatory Guide 1.76. Concrete structures designed to resist Spectrum I missiles of SRP 3.5.1.4, Rev. 2, also resist missiles postulated in Regulatory Guide 1.76, Revision 1. Tornado missiles do not apply to Seismic Category II buildings. For the Radwaste building, the tornado missiles defined in Regulatory Guide 1.143, Table 2, Class RW-IIa apply.

(4) Based on probable maximum precipitation (PMP) for one hour over 2.6 km^2 (one square mile) with a ratio of 5 minutes to one hour PMP of 0.32 as found in Reference 2.0-3. See also Table 3G.1-2.

(5) See Reference 2.0-9 for the definition of normal winter precipitation and extreme winter precipitation events. The maximum ground snow load for extreme winter precipitation event includes the contribution from the normal winter precipitation event. See also Table 3G.1-2.

(6) Zero percent exceedance values are based on conservative estimates of historical high and low values for potential sites. Consistent with Reference 2.0-4, they represent historical limits excluding peaks of less than two hours. One and two percent annual exceedance values were selected in order to bound the values presented in Reference 2.0-4 and available Early Site Permit applications.

(7) At the foundation level of Seismic Category I structures. The static bearing pressure is the average pressure. The dynamic bearing pressure is the toe pressure. To compare with the maximum bearing demand, the allowable bearing pressure is developed from the site-specific bearing capacity divided by a factor of safety appropriate for the design load combination. The maximum dynamic bearing demand to be compared with the site-specific allowable dynamic bearing pressure is the larger value or a linearly interpolated value of the applicable range of shear wave velocities at the foundation level. The shear wave velocities of soft, medium and hard soils are 300 m/sec (1000 ft/sec), 800 m/sec (2600 ft/sec) and greater than or equal to 1700 m/sec (5600 ft/sec), respectively.

(8) This is the minimum shear wave velocity of the supporting foundation material associated with seismic strains for lower bound soil properties at minus one sigma from the mean. The ratio of the largest to the smallest shear wave velocity over the mat foundation width of the supporting foundation material does not exceed 1.7.

(9) Safe Shutdown Earthquake (SSE) design ground response spectra of 5% damping, also termed Certified Seismic Design Response Spectra (CSDRS), are defined as free-field outcrop spectra at the foundation level (bottom of the base slab) of the Reactor/Fuel and Control Building structures. For the Firewater Service Complex, which is essentially a surface founded structure, the CSDRS is 1.35 times the values shown in Figures 2.0-1 and

2.0-2 and is defined as free-field outcrop spectra at the foundation level (bottom of the base slab) of the Firewater Service Complex structure.

(10) Values reported here are actually design criteria rather than site design parameters. They are included here because they do not appear elsewhere in the DCD.

(11) If a selected site has a X/Q value that exceeds the ESBWR reference site value, the COL Applicant will address how the radiological consequences associated with the controlling design basis accident continue to meet the dose reference values provided in 10 CFR 52.79(a)(1)(vi) and control room operator dose limits provided in General Design Criterion 19 using site-specific X/Q values.

(12) If a selected site has X/Q values that exceed the ESBWR reference site values, the release concentrations in Table 12.2-17 would be adjusted proportionate to the change in X/Q values using the stack release information in Table 12.2-16. In addition, for a site selected that exceeds the bounding X/Q or D/Q values, the COL Applicant will address how the resulting annual average doses (Table 12.2-18b) continue to meet the dose reference values provided in 10 CFR 50 Appendix I using site-specific X/Q and D/Q values.

(13) Value was selected to comply with expected requirements of southeastern coastal locations.

(14) Localized liquefaction potential under other than Seismic Category I structures is addressed per SRP 2.5.4 in Table 2.0-2.

(15) Settlement values are long-term (post-construction) values except for differential settlement within the foundation mat. The design of the foundation mat accommodates immediate and long-term (post-construction) differential settlements after the installation of the basemat.

(16) For sites not meeting the soil property requirements, a site-specific analysis is required to demonstrate the adequacy of the standard plant design.]*

Text sections and table that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

Table 2.0-2

Limits Imposed on Acceptance Criteria in Section II of SRP by ESBWR Design

Subsection	Subject	ESBWR DCD Parameters, Considerations and/or Limits	COL Information
2.1.1	Site Location and Description	None.	COL Applicant to supply site-specific information in accordance with SRP 2.1.1 (COL 2.0-2-A).
2.1.2	Exclusion Area Authority and Control	None.	COL Applicant to supply site-specific information in accordance with SRP 2.1.2 (COL 2.0-3-A).
2.1.3	Population Distribution	ESBWR Probabilistic Risk Assessment offsite consequence analysis in Reference 2.0-1 considers a population density of 305 people per square kilometer (790 per square mile), but that is not a limitation for plant siting considerations.	COL Applicant to describe the population distribution in accordance with SRP 2.1.3. (COL 2.0-4-A).

Table 2.0-2

Limits Imposed on Acceptance Criteria in Section II of SRP by ESBWR Design

Subsection	Subject	ESBWR DCD Parameters, Considerations and/or Limits	COL Information
2.2.1 – 2.2.2	Identification of Potential Hazards in Site Vicinity	Per Table 2.0-1.	COL Applicant to identify and evaluate potential hazards in the site vicinity, in accordance with SRP 2.2.1 – 2.2.2. Potential hazards include manufacturing plants, chemical plants, refineries, storage facilities, mining and quarrying operations, military bases, missile sites, transportation routes (air, land and water), transportation facilities (docks, anchorages, airports), oil and gas pipelines, drilling operations and wells, and underground gas storage facilities. See also Subsection 9.4.1.6 (COL 2.0-5-A).
2.2.3	Evaluation of Potential Accidents	None considered in vicinity of plant.	COL Applicant to identify and evaluate potential accidents emanating from those potential hazards identified in SRP 2.2.1 – 2.2.2 above, that have a probability of occurrence > 10^{-7} per year which involve: (1) missiles more energetic than the tornado missile spectrum, or (2) pressure effects in excess of the design basis tornado, or (3) explosions, or (4) fires, or (5) aircraft impacts, or (6) release of flammable vapor clouds, or (7) release of toxic chemicals (COL 2.0-6-A).

Table 2.0-2

Limits Imposed on Acceptance Criteria in Section II of SRP by ESBWR Design

Subsection	Subject	ESBWR DCD Parameters, Considerations and/or Limits	COL Information
2.3.1	Regional Climatology	Per Table 2.0-1.	COL Applicant to supply site-specific information in accordance with SRP 2.3.1 (COL 2.0-7-A).
2.3.2	Local Meteorology	None.	COL Applicant to supply site-specific information in accordance with SRP 2.3.2 (COL 2.0-8-A).
2.3.3	Onsite Meteorological Measurements Programs	None.	COL Applicant to supply site-specific information in accordance with the SRP 2.3.3 (COL 2.0-9-A).
2.3.4	Short-Term Dispersion Estimates for Accidental Atmospheric Releases	Per Table 2.0-1. See also Chapter 15.	COL Applicant to supply site-specific information in accordance with the SRP 2.3.4 to show that the site meteorological dispersion values as calculated in accordance with Regulatory Guides 1.145 and 1.194, and compared to dispersion values given in Chapter 15, result in doses less than stipulated in 10 CFR 52.79(a)(1)(vi) and the applicable portions of SRP Sections 11 and 15 (COL 2.0-10-A).
2.3.5	Long-Term Diffusion Estimates	Per Table 2.0-1. See Subsection 12.2.2.1 for a discussion of the generation of these values.	COL Applicant to supply site-specific information in accordance with the SRP 2.3.5 (COL 2.0-11-A).

Table 2.0-2

Limits Imposed on Acceptance Criteria in Section II of SRP by ESBWR Design

Subsection	Subject	ESBWR DCD Parameters, Considerations and/or Limits	COL Information
2.4.1	Hydraulic Description Maximum Ground Water Level	Per Table 2.0-1.	COL Applicant to supply site-specific information in accordance with SRP 2.4.1 (COL 2.0-12-A)
2.4.2	Floods	Per Table 2.0-1.	COL Applicant to supply site-specific information in accordance with SRP 2.4.2 (COL 2.0-13-A).
2.4.3	Probable Maximum Flood on Streams and Rivers	Probable maximum flooding level on streams and rivers does not exceed the maximum flood level defined in Table 2.0-1.	COL Applicant to supply site-specific information in accordance with SRP 2.4.3 (COL 2.0-14-A).
2.4.4	Potential Dam Failures	Potential dam failures do not cause flooding to exceed the maximum flood level defined in Table 2.0-1.	COL Applicant to supply site-specific information in accordance with SRP 2.4.4. COL Applicant to demonstrate that failure of existing and potential upstream or downstream water control structures will not cause flooding to exceed 0.3 m (1 ft) below plant grade (COL 2.0-15-A).
2.4.5	Probable Maximum Surge and Seiche Flooding	Probable maximum surge and seiche flooding level does not exceed the maximum flood level defined in Table 2.0-1.	COL Applicant to supply site-specific information in accordance with SRP 2.4.5 (COL 2.0-16-A).
2.4.6	Probable Maximum Tsunami Flooding	Probable maximum tsunami flooding level does not exceed the maximum flood level defined in Table 2.0-1.	COL Applicant to supply site-specific information in accordance with SRP 2.4.6 (COL 2.0-17-A).

Table 2.0-2

Limits Imposed on Acceptance Criteria in Section II of SRP by ESBWR Design

Subsection	Subject	ESBWR DCD Parameters, Considerations and/or Limits	COL Information
2.4.7	Ice Effects	None.	COL Applicant to supply site-specific information in accordance with SRP 2.4.7 (COL 2.0-18-A).
2.4.8	Cooling Water Canals and Reservoirs	None.	COL Applicant to supply site-specific information in accordance with SRP 2.4.8 (COL 2.0-19-A).
2.4.9	Channel Diversions	None.	COL Applicant to supply site-specific information in accordance with SRP 2.4.9 (COL 2.0-20-A).
2.4.10	Flooding Protection Requirements	None.	COL Applicant to supply site-specific information in accordance with SRP 2.4.10 (COL 2.0-21-A).
2.4.11	Cooling Water Supply	None.	COL Applicant to supply site-specific information in accordance with SRP 2.4.11 (COL 2.0-22-A).
2.4.12	Groundwater	Per Table 2.0-1.	COL Applicant to supply site-specific information in accordance with SRP 2.4.12 (COL 2.0-23-A).
2.4.13	Accidental Releases of Liquid Effluents in Ground and Surface Waters	The source term provided in Table 12.2-13a, "Liquid Waste Management System Equipment Drain Collection Tank Activity," is used in the effects analysis.	COL Applicant to address SRP 2.4.13 (COL 2.0-24-A).

Table 2.0-2

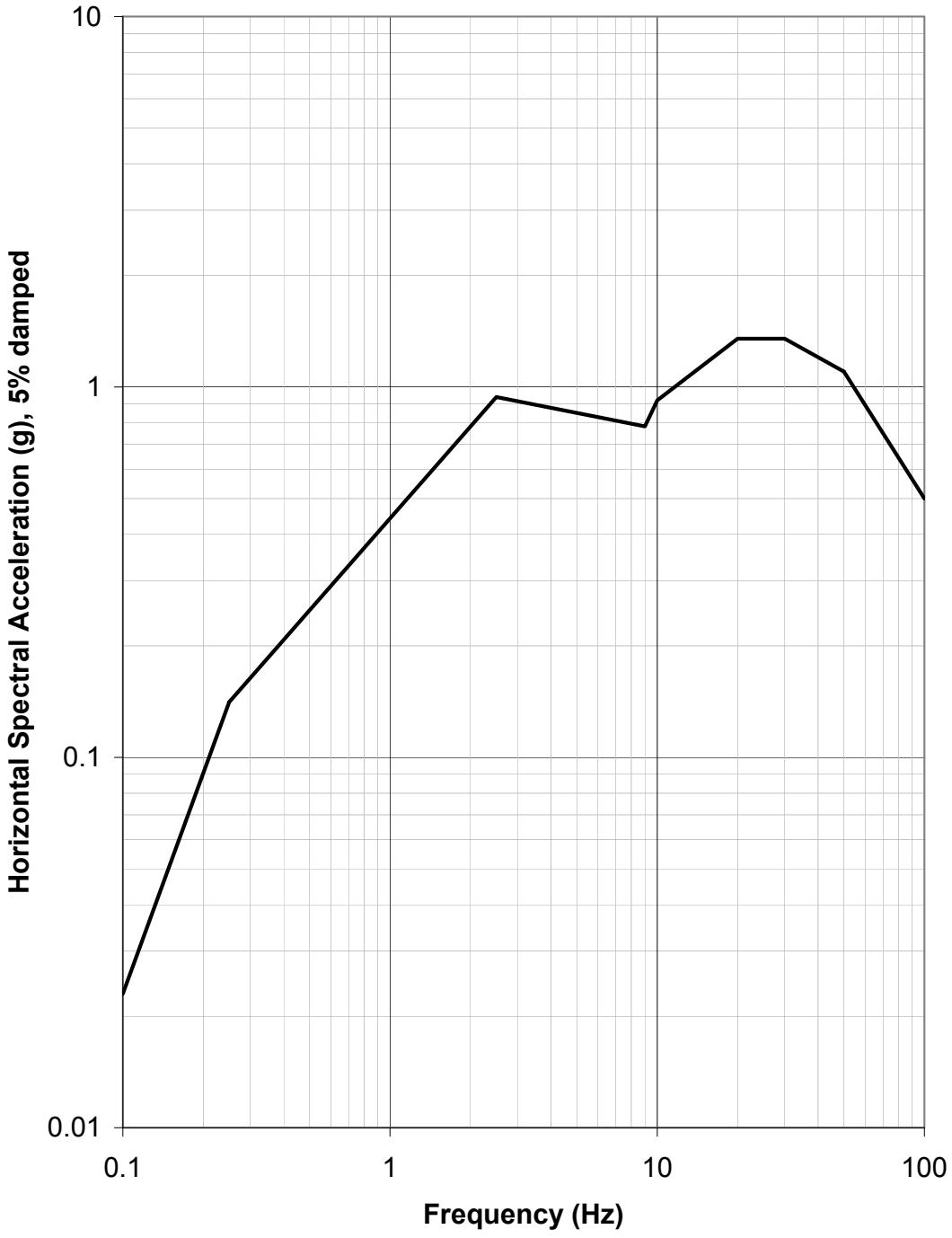
Limits Imposed on Acceptance Criteria in Section II of SRP by ESBWR Design

Subsection	Subject	ESBWR DCD Parameters, Considerations and/or Limits	COL Information
2.4.14	Technical Specifications and Emergency Operation Requirements	None.	COL Applicant to provide site-specific information in accordance with SRP 2.4.14 (COL 2.0-25-A).
2.5.1	Basic Geologic and Seismic Information	None.	COL Applicant to provide site-specific information in accordance with SRP 2.5.1 (COL 2.0-26-A).
2.5.2	Vibratory Ground Motion	Per Table 2.0-1 (and Figures 2.0-1 and 2.0-2).	COL Applicant to provide site-specific information in accordance with SRP 2.5.2 and confirm that the site-specific Foundation Input Response Spectra developed in accordance with Reference 2.0-7 guidance as implemented per Reference 2.0-8 is enveloped by the ESBWR design response spectra referenced at the foundation level (COL 2.0-27-A).
2.5.3	Surface Faulting	ESBWR design assumes no permanent ground deformation from tectonic or non-tectonic faulting.	COL Applicant to provide site-specific information in accordance with SRP 2.5.3 (COL 2.0-28-A).

Table 2.0-2

Limits Imposed on Acceptance Criteria in Section II of SRP by ESBWR Design

Subsection	Subject	ESBWR DCD Parameters, Considerations and/or Limits	COL Information
2.5.4	Stability of Subsurface Materials and Foundations	Per Table 2.0-1.	COL Applicant to provide site-specific information in accordance with SRP 2.5.4 and address: (1) localized liquefaction potential under other than Seismic Category I structures, and (2) settlement and differential settlements (COL 2.0-29-A).
2.5.5	Stability of Slopes	Per Table 2.0-1.	COL Applicant to provide site-specific information in accordance with SRP 2.5.5 (COL 2.0-30-A).



[ ]*

Figure 2.0-1. ESBWR Horizontal SSE Design Ground Spectra at Foundation Level

Figures that are bracketed with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

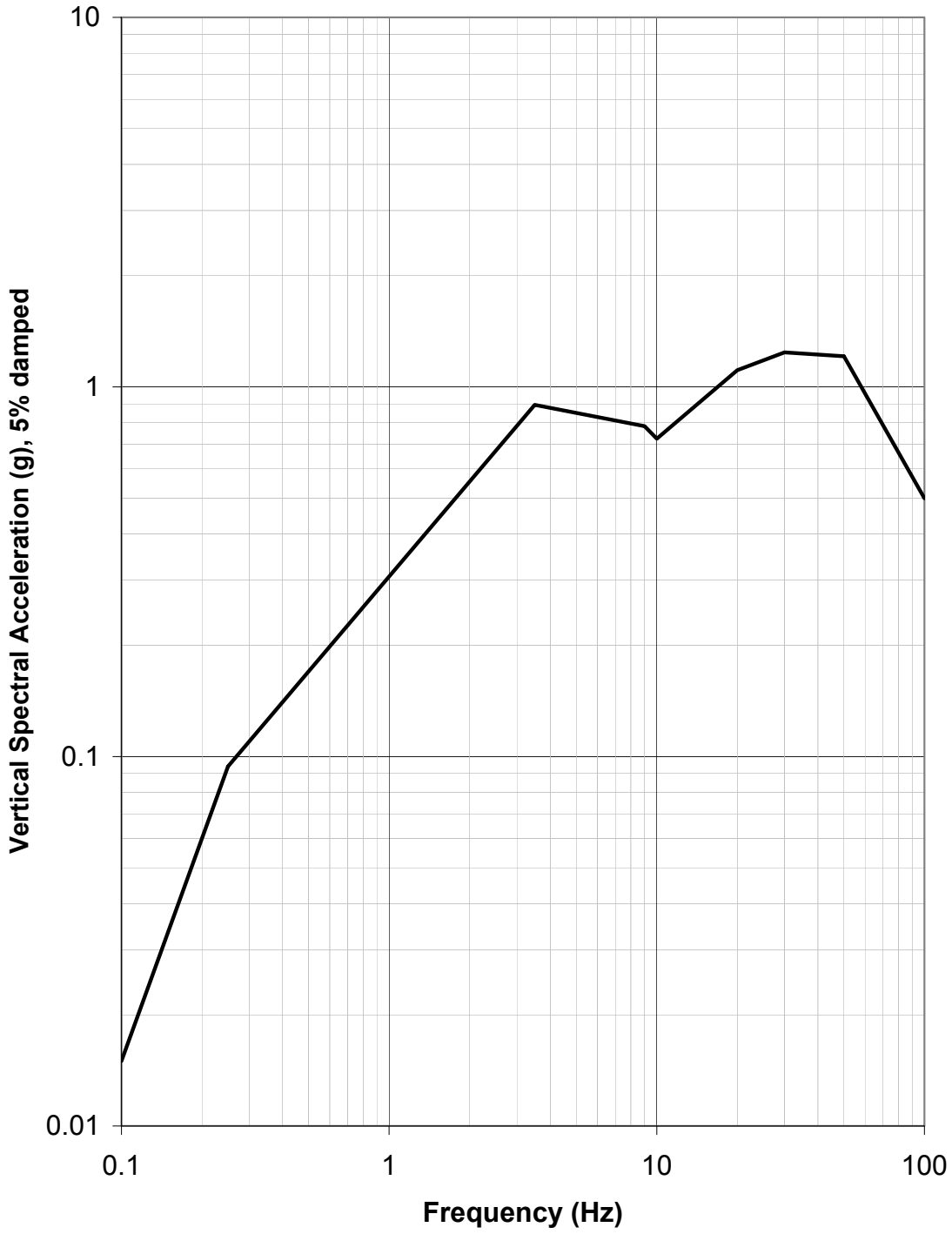


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Figure 2.0-2. ESBWR Vertical SSE Design Ground Response Spectra at Foundation Level

Figures that are bracketed with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

APPENDIX 2A ARCON96 SOURCE/RECEPTOR INPUTS

2A.1 Scope

This appendix provides ARCON96 source/receptor inputs for use in the confirmation of site-specific X/Q values per 10 CFR 52.79 (as required by COL 2.0-1-A).

2A.2 Methodology

On-site X/Q values, such as those for the Control Room, are typically determined using the ARCON96 computer code. Acceptable guidance and methodology for use with ARCON96 are documented in Regulatory Guide (RG) 1.194 (Reference 2A-1). In order to determine bounding X/Q values, various nuclear plant sites have provided GE Hitachi Nuclear Energy (GEH) with the meteorological data in the required ARCON96 format. Additionally, raw meteorological data was obtained for sites pursuing early site permits. Control Room X/Q values were calculated with the ARCON96 computer code using the ESBWR plant layout and the available site meteorological data. Once completed, the results were reviewed and the X/Q values provided in Table 2.0-1 were selected to bound those results.

2A.2.1 Meteorological Data

The meteorological data sets used as ARCON96 inputs for the ESBWR X/Q determination were taken from various published meteorological data sets. ARCON96 also requires the height of the instruments used for input in conjunction with the meteorological data. The heights of the upper and lower instruments used to record the raw data are unique to any meteorological data set taken at a nuclear power site.

2A.2.2 ARCON96 Default Values

Many of the ARCON96 inputs used for the determination were constant for each plant site evaluated. Table 2A-1 provides a list of the standard ARCON96 inputs applicable for the ESBWR that are constant for all the source receptor pairs evaluated.

2A.2.3 ARCON96 ESBWR Inputs

Table 2A-2 provides a list of the onsite receptor and source locations considered. Table 2A-3 provides the ARCON96 inputs that are specific for ESBWR. The values presented in Table 2A-3 have been determined in accordance with RG 1.194 and are described as follows. The values provided in Table 2A-4 are the ARCON96 inputs for directions from the receptors to the sources in degrees from ESBWR Plant North. During the confirmation of X/Q values, these directions must be adjusted by the difference in angle between ESBWR Plant North and the "Site North" associated with any given site-specific meteorological data set.

Source Type

Indication of whether the source associated with a line item in Table 2A-1 should be considered a point source or a diffuse source. This has been determined based on the nature of the postulated releases in accordance with RG 1.194.

Distance

These distances are the source-to-receptor distances and are the shortest horizontal distances between the release points and the intakes.

Release Height

For diffuse sources in Table 2A-1, the release height is set at the vertical center of the projected diffuse source plane above grade. For point sources the release heights are taken to be the vertical distance from plant grade to the center of the release points.

Building Area

Areas are provided for the buildings that have the largest impact on the building wakes within the wind direction window for a given source/receptor pair.

Intake Height

The actual intake heights are provided in Table 2A-1, and are taken to be the vertical distance from plant grade to the center of the intakes.

Total Height

The total heights are the above grade heights of the buildings where diffuse sources are modeled. Building heights are not directly used by ARCON96. They are used to calculate the initial vertical plume spread parameter (σ_{Y0}) as well as to determine the diffuse source area and release heights.

Total Width

The "total width" column of Table 2A-3 provides widths of the area sources that are the maximum horizontal dimensions of the above-grade building cross-sectional areas perpendicular to the lines of sight from the building centers to the receptors. For point sources this parameter is not applicable (N/A).

σ_{Y0} and σ_{Z0}

These values are the initial lateral and vertical plume spread parameters calculated using Formulas 3 and 4 of RG 1.194.

2A.2.4 Confirmation of the ESBWR X/Q Values

When referencing the ESBWR DCD to confirm that site characteristics at a given site are bounded by the ESBWR DCD site parameter values per 10 CFR 52.79, the COL Applicant shall perform ARCON96 determinations for all source/receptor pairs listed in Tables 2A-3 and 2A-4 using site-specific meteorological data (as defined in Regulatory Guide 1.23, Reference 2A-2) (COL 2A.2-1-A). Figure 2A-1 shows the locations of the sources and receptors for ESBWR Control Room determinations. The dimensions of the diffuse source planes provided in Table 2A-3 were determined as directed by Regulatory Position 3.2.4.5 of Regulatory Guide 1.194 for the nearest receptor locations.

2A.2.5 Confirmation of the Fuel Building and Reactor Building X/Q Values

The COL applicant shall confirm that during movement of irradiated fuel bundles none of the doors or personnel air locks on the East sides of the Reactor Building or Fuel Building could act

as a point source with control room X/Q values that would result in doses greater than the bounding dose consequence reported for the Fuel Handling Accident (Table 15.4-4). If the X/Q values for a release from any door or personnel air lock on the East sides of the Reactor Building or Fuel Building have X/Q values that generate dose consequences greater than the bounding dose consequence reported in Table 15.4-4, the affected doors or personnel air locks are administratively controlled to remain closed during movement of irradiated fuel bundles. (COL 2A.2-2-A).

2A.3 COL Information

2A.2-1-A Confirmation of the ESBWR X/Q Values

When referencing the ESBWR DCD to confirm that site characteristics at a given site are bounded by the ESBWR DCD site parameter values per 10 CFR 52.79, the COL Applicant shall perform ARCON96 determinations for all source/receptor pairs listed in Tables 2A-3 and 2A-4 using site-specific meteorological data (as defined in Regulatory Guide 1.23, Reference 2A-2) (Subsection 2A.2.4).

2A.2-2-A Confirmation of the Reactor Building X/Q Values

If the X/Q values for a release from any door or personnel air lock on the East sides of the Reactor Building or Fuel Building have X/Q values that would result in doses greater than the bounding dose consequence reported for the Fuel Handling Accident (Table 15.4-4), the affected doors or personnel air locks are administratively controlled to remain closed during movement of irradiated fuel bundles (Subsection 2A.2.5).

2A.4 References

2A-1 US Nuclear Regulatory Commission, “Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants,” Regulatory Guide 1.194.

2A-2 US Nuclear Regulatory Commission, "Onsite Meteorological Programs," Regulatory Guide 1.23.

Table 2A-1

ARCON96 Assumed Inputs Used for the Determination of On-Site X/Q Values

Parameter	**Source of Input (or Reasoning)**	Value
Wind Speed Units Flag (1=m/s, 2=mph, 3=knots)	RG 1.194, App. A	Varies with input
Vertical Velocity (m/s)	RG 1.194, App. A (default value/conservatism)	0
Stack Flow (m/s)	RG 1.194, App. A (default value/conservatism)	0
Stack Radius (m)	RG 1.194, App. A (default value/conservatism)	0
Wind Direction Window (degrees)	RG 1.194, App. A (default value)	90
Elevation Difference (m)	RG 1.194, App. A (All information was normalized to the plant grade elevation, therefore no adjustments for elevation differences are required for ARCON96 input)	0
Surface Roughness Length (m)	RG 1.194, App. A (default value)	0.2
Minimum Wind Speed (m/s)	RG 1.194, App. A (default value)	0.5
Averaging Sector Width Constant	RG 1.194, App. A (default value)	4.3
Hours in Averages	RG 1.194, App. A (default value)	ARCON96 Default
Minimum Number of Hours	RG 1.194, App. A (default value)	ARCON96 Default

Table 2A-2

Onsite Receptor/Source Locations

Receptors	***Designation***
Control Building Louvers on the West face of the Control Building	CBL
Emergency Air Intakes on the East face of Control Building near the North end	EN
Emergency Air Intakes on the East face of Control Building near the South end	ES
Normal Air Intake on South face of Control Building	N
Intake for Train A of the Technical Support Center (TSC) HVAC on East face of Electrical Building near the North end	TSCA
Intake for Train B of the Technical Support Center (TSC) HVAC on North face of Electrical Building near the East end	TSCB
Sources	***Designation***
Reactor Building	RB
Passive Containment Cooling System (Vent on Reactor Building Roof)	PCCS
Turbine Building	TB
Turbine Building Truck Doors on the West side of the TB near the North end	TB-TD
Fuel Building	FB
Radwaste Building	RW
Reactor Building/Fuel Building Ventilation Stack	RB-VS
Turbine Building Ventilation Stack	TB-VS
Radwaste Building Ventilation Stack	RW-VS
North RB blowout panel near the East edge of the Reactor Building Roof [1]	BPN
South RB blowout panel near the East edge of the Reactor Building Roof [1]	BPS

Note:

[1] There are four blowout panels near the corners of the Reactor Building roof. ARCON96 parameters for the two blowout panels nearest to the Control Building are included in Table 2A-3 as they are bounding based on the minimum distance criterion with respect to the receptors.

Table 2A-3

ARCON96 Design Inputs Used for the Determination of On-Site X/Q Values

Source/Receptor	Source Type	Distance (m)	Release Height (m)	Building Area (m^2) [2]	Intake Height (m)	Total Height (m) [3]	Total Width (m) [3]	σ_{Y0} [4]	σ_{Z0} [4]
RB to CBL	Diffuse	10	24.0	2945	2.5	48.1	49.0 [1]	8.17	8.01
RB to EN	Diffuse	33	24.0	2945	7.5	48.1	54.5 [1]	9.08	8.01
RB to ES	Diffuse	33	24.0	2945	7.5	48.1	54.5 [1]	9.08	8.01
RB to N	Diffuse	29	24.0	2945	7.5	48.1	59.7 [1]	9.95	8.01
RB to TSCB	Diffuse	131	24.0	2726	22.4	48.1	67.9 [1]	11.32	8.01
RB to TSCA	Diffuse	127	24.0	2726	22.4	48.1	68.5 [1]	11.42	8.01
PCCS to CBL	Point	38	47.8	2945	2.5	N/A	N/A	N/A	N/A
PCCS to EN	Point	54	47.8	2945	7.5	N/A	N/A	N/A	N/A
PCCS to ES	Point	63	47.8	2945	7.5	N/A	N/A	N/A	N/A
PCCS to N	Point	62	47.8	2945	7.5	N/A	N/A	N/A	N/A
PCCS to TSCB	Point	138	47.8	2726	22.4	N/A	N/A	N/A	N/A
PCCS to TSCA	Point	135	47.8	2726	22.4	N/A	N/A	N/A	N/A
TB to CBL	Diffuse	31	24.7	5513	2.5	49.4	93.2 [1]	15.53	8.23
TB to EN	Diffuse	29	24.7	5513	7.5	49.4	111.6 [1]	18.60	8.23
TB to ES	Diffuse	46	24.7	5513	7.5	49.4	108.5 [1]	18.08	8.23
TB to N	Diffuse	49	24.7	5513	7.5	49.4	102.9 [1]	17.15	8.23
TB to TSCB	Diffuse	40	24.7	3853	22.4	49.4	130.9 [1]	21.82	8.23

Table 2A-3

ARCON96 Design Inputs Used for the Determination of On-Site X/Q Values

Source/Receptor	Source Type	Distance (m)	Release Height (m)	Building Area (m^2) [2]	Intake Height (m)	Total Height (m) [3]	Total Width (m) [3]	σ_{Y0} [4]	σ_{Z0} [4]
TB to TSCA	Diffuse	45	24.7	3853	22.4	49.4	132.5 [1]	22.08	8.23
TB-TD to CBL	Point	156	3.6	7320	2.5	N/A	N/A	N/A	N/A
TB-TD to EN	Point	159	3.6	7320	7.5	N/A	N/A	N/A	N/A
TB-TD to TSCB	Point	97	3.6	7320	22.4	N/A	N/A	N/A	N/A
FB to CBL	Diffuse	28	11.4	2945	2.5	22.9	52.3 [1]	8.72	3.81
FB to EN	Diffuse	51	11.4	2945	7.5	22.9	49.3 [1]	8.22	3.81
FB to ES	Diffuse	40	11.4	2945	7.5	22.9	44.4 [1]	7.40	3.81
FB to N	Diffuse	34	11.4	2945	7.5	22.9	41.3 [1]	6.88	3.81
RW to N	Point	112	7.5	2945	7.5	N/A	N/A	N/A	N/A
RB-VS to CBL	Point	66	52.6	2945	2.5	N/A	N/A	N/A	N/A
RB-VS to ES	Point	86	52.6	2945	7.5	N/A	N/A	N/A	N/A
RB-VS to N	Point	81	52.6	2945	7.5	N/A	N/A	N/A	N/A
TB-VS to CBL	Point	122	71.3	5513	2.5	N/A	N/A	N/A	N/A
TB-VS to EN	Point	118	71.3	5513	7.5	N/A	N/A	N/A	N/A
TB-VS to N	Point	141	71.3	5513	7.5	N/A	N/A	N/A	N/A
RW-VS to CBL	Point	96	18.2	2945	2.5	N/A	N/A	N/A	N/A
RW-VS to EN	Point	111	18.2	2945	7.5	N/A	N/A	N/A	N/A
RW-VS to N	Point	120	18.2	2945	7.5	N/A	N/A	N/A	N/A

Table 2A-3

ARCON96 Design Inputs Used for the Determination of On-Site X/Q Values

Source/Receptor	Source Type	Distance (m)	Release Height (m)	Building Area (m^2) [2]	Intake Height (m)	Total Height (m) [3]	Total Width (m) [3]	σ_{Y0} [4]	σ_{Z0} [4]
BPN to CBL	Point	27	47.8	2945	2.5	N/A	N/A	N/A	N/A
BPN to EN	Point	40	47.8	2945	7.5	N/A	N/A	N/A	N/A
BPN to ES	Point	49	47.8	2945	7.5	N/A	N/A	N/A	N/A
BPN to N	Point	50	47.8	2945	7.5	N/A	N/A	N/A	N/A
BPS to CBL	Point	27	47.8	2945	2.5	N/A	N/A	N/A	N/A
BPS to EN	Point	49	47.8	2945	7.5	N/A	N/A	N/A	N/A
BPS to ES	Point	41	47.8	2945	7.5	N/A	N/A	N/A	N/A
BPS to N	Point	36	47.8	2945	7.5	N/A	N/A	N/A	N/A

Notes for Table 2A-3:

[1] These are diffuse source widths determined in accordance with Regulatory Position 3.2.4.5 of Regulatory Guide 1.194 and are used to calculate σ_{Y0}.

[2] The building vertical cross-sectional areas perpendicular to the wind for the building that has the largest impact on building wakes as described in the fifth item listed in Table A-2 of Regulatory Guide 1.194.

[3] Building heights and widths are not directly used by ARCON96. They are used to calculate the lateral and vertical plume spread parameters (σ_{Y0} and σ_{Z0}).

[4] Values calculated using Formulas 3 and 4 of RG 1.194.

Table 2A-4

ARCON96 Direction Design Inputs Used for the Determination of On-Site X/Q Values

Source/Receptor	Direction (degrees from plant North)
RB to CBL	270
RB to EN	260
RB to ES	280
RB to N	284
RB to TSCB	212
RB to TSCA	216
PCCS to CBL	309
PCCS to EN	285
PCCS to ES	304
PCCS to N	308
PCCS to TSCB	214
PCCS to TSCA	217
TB to CBL	343
TB to EN	324
TB to ES	331
TB to N	336
TB to TSCB	232
TB to TSCA	236
TB-TD to CBL	341
TB-TD to EN	331
TB-TD to TSCB	277
FB to CBL	228
FB to EN	234
FB to ES	248
FB to N	252

Table 2A-4

ARCON96 Direction Design Inputs Used for the Determination of On-Site X/Q Values

Source/Receptor	Direction (degrees from plant North)
RW to N	304
RB-VS to CBL	247
RB-VS to ES	261
RB-VS to N	262
TB-VS to CBL	356
TB-VS to EN	341
TB-VS to N	348
RW-VS to CBL	302
RW-VS to EN	290
RW-VS to N	304
BPN to CBL	322
BPN to EN	285
BPN to ES	306
BPN to N	315
BPS to CBL	219
BPS to EN	229
BPS to ES	255
BPS to N	259

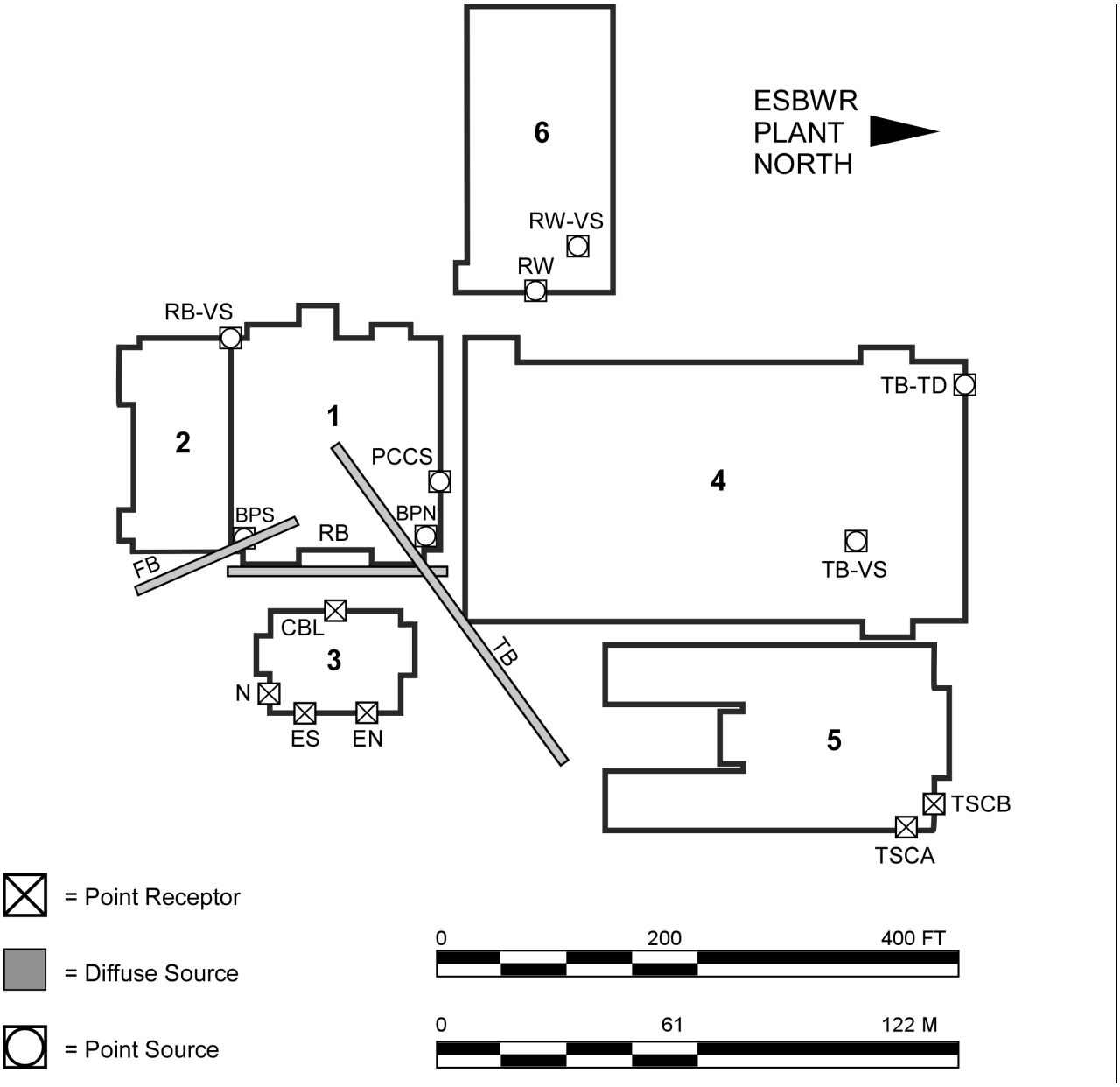

Figure 2A-1. Potential Radiological Sources and Receptors for the ESBWR Control Room

(see next page for explanation of designations used on figure)

The following designations are shown on Figure 2A-1.

Plant Structures

1 Reactor Building

2 Fuel Building

3 Control Building

4 Turbine Building

5 Electrical Building

6 Radwaste Building

Control Building Receptor Locations

CBL Control Building Louvers on the west face of the Control Building (CB)

EN Normal and Emergency Air Intakes on the east face of CB near the north end

ES Normal and Emergency Air Intakes on the east face of CB near the south end

N Normal Air Intake on the south face of Control Building

TSCA Intake for Train A of the Technical Support Center HVAC on the east face of Electrical Building near the north end

TCSB Intake for Train B of the Technical Support Center HVAC on the north face of Electrical Building near the east end

Source Locations

RB Reactor Building[1]

TB Turbine Building[1]

FB Fuel Building[1]

PCCS Passive Containment Cooling System (Vents from the Reactor Building Roof)

RW Radwaste Building (Assumed on the Radwaste Building Roof)

RB-VS Reactor Building/Fuel Building Ventilation Stack

TB-VS Turbine Building Ventilation Stack

RW-VS Radwaste Building Ventilation Stack

BPN Blowout panel on the northeast corner of Reactor Building Roof

BPS Blowout panel on the southeast corner of Reactor Building Roof

TB-TD Turbine Building Truck Doors on the north side of the TB near the west end

[1] There are 16 unique diffuse source/receptor pairs in Table 2A-3 all of which cannot be represented on Figure 2A-1. The planes shown in Figure 2A-1 are only graphical representations of typical ESBWR diffuse source planes.

APPENDIX 2B VENTILATION STACK PATHWAY INFORMATION FOR LONG-TERM X/Q VALUES

2B.1 Discussion

This appendix provides the gaseous effluent release pathway information for each of the three ventilation stacks used in calculating the standard plant long term X/Q values; this gaseous effluent release pathway information may also be used in generating site-specific long term X/Q values. Table 2B-1 provides the relevant ventilation stack parameters for use with the XOQDOQ computer code (Reference 2B-1).

2B.2 COL Information

None.

2B.3 References

2B-1 U.S. Nuclear Regulatory Commission, "XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations," NUREG/CR-2919, September 1982.

Table 2B-1

Ventilation Stack Parameters

Building Stack (Release Point)	Stack Average Velocity m/sec (ft/min)	Stack Inside Diameter m (ft)	Stack Release Height Above Grade m (ft)	Height of Building Above Grade m (ft)	Building Dimensions m
Reactor/ Fuel Building Stack	17.78 (3,500)	2.40 (7.9)	52.62 (172.6)	48.05 (157.6)	Reactor Building: X-Z plane: 49 x 48.05 Y-Z plane: 49 x 48.05 Fuel Building: X-Z plane: 21 x 22.85 Y-Z plane: 49 x 22.85
Turbine Building Stack	17.78 (3,500)	1.95 (6.4)	71.3 (234.0)	52.0 (170.6)	X-Z plane: 115 x 52 Y-Z plane: 59 x 52
Radwaste Building Stack	17.78 (3,500)	1.34 (4.4)	18 (59.1)	12.0 (39.4)	X-Z plane: 32.8 x 12 Y-Z plane: 65 x 12