2.3 Meteorology

The U.S. EPR design is based on meteorological parameters (e.g., air temperature extremes, humidity, precipitation such as rainfall, snow and ice, maximum wind speeds, tornado wind speeds, and atmospheric stability characteristics) provided in Section 2.1, Table 2.1-1—U.S. EPR Site Design Envelope. If a COL applicant that references the U.S. EPR design certification identifies site-specific meteorology values outside the range of the site parameter in Table 2.1-1, then the COL applicant will demonstrate the acceptability of the site-specific values in the appropriate sections of the Combined License application.

2.3.1 Regional Climatology

The following information is provided in Section 2.1, Table 2.1-1:

- Sum of normal winter precipitation event and extreme frozen winter precipitation event ground load.
- 100-year, 3-second gust wind speed.
- Tornado parameters.
- Dry bulb and wet bulb temperatures.

2.3.1.1 Basis for Meteorological Parameters

The site parameters for the dry-bulb and wet-bulb temperatures are based on the EPRI ALWR Utility Requirements Document (Reference 1) and available Early Site Permit applications. The two percent annual exceedance dry and wet bulb temperature values, as recommended by RG 1.206 and SRP 2.3.1, are not provided in Table 2.1-1. However, the two percent annual exceedance dry and wet bulb temperature values are bounded by the provided zero percent annual exceedance and one percent annual exceedance dry and wet bulb temperature values.

SRP 2.3.1 and RG 1.206 also recommend that the 100-year maximum dry bulb and coincident wet bulb temperature values, the 100-year maximum non-coincident wet bulb temperature value, and the 100-year minimum dry bulb temperature values be provided. Instead, the zero percent exceedance values for these parameters have been provided. Zero percent exceedance values are based on conservative estimates of 100-year return period values and historic extreme values, whichever is bounding.

The prescribed loads included in the combination of normal live loads are based on the weight of the normal winter precipitation event recorded at ground level. Winter precipitation loads to be included in the combination of extreme live loads is based on the addition of the weight of the extreme frozen or liquid precipitation event,

whichever is greater. Snow pack and snowfall are adjusted for density differences and ground level values are adjusted to represent appropriate weights on roofs.

A COL applicant that references the U.S. EPR design certification will provide site-specific characteristics for regional climatology.

2.3.1.2 Meteorological Data for Evaluating the Ultimate Heat Sink

As described in Section 9.2.5, the ultimate heat sink (UHS) is designed to operate for a nominal 30 days following a LOCA without requiring any makeup water to the source, or it must be demonstrated that replenishment or use of an alternate or additional water supply can provide continuous capability of the heat sink to perform its safety-related functions. The tower basin contains a minimum 72-hour supply of water.

Meteorological conditions resulting in the maximum evaporative and drift loss of water for the UHS over a 72 hour period are presented in Table 9.2.5-3. The UHS cooling tower basin is designed considering the wet bulb temperature in Table 9.2.5-2 and maintains its cooling function for the Table 9.2.5-3 meteorological conditions.

Water makeup to the UHS cooling tower basin beyond 72 hours is site-specific. As described in Section 9.2.5.3, the COL applicant will describe the means for providing UHS makeup sufficient to meet the maximum evaporative and drift water loss after 72 hours through the remainder of the 30 day period consistent with RG 1.27.

Meteorological conditions resulting in minimum water cooling are presented in Table 9.2.5-4. These conditions reflect a 1 day period where evaporative cooling is at a minimum. The UHS heat loads peak and decline within the first day, such that extending the 1 day meteorological profile for 5 consecutive days does not cause the UHS cooling tower basin water temperature to exceed the maximum temperature of 95°F listed in Table 9.2.5-2. The potential for water freezing in the UHS water storage facility is addressed in Section 2.4.

2.3.2 Local Meteorology

A COL applicant that references the U.S. EPR design certification will provide site-specific characteristics for local meteorology.

2.3.3 Onsite Meteorological Measurement Program

A COL applicant that references the U.S. EPR design certification will provide the site-specific, onsite meteorological measurement program.

2.3.4 Short-Term Atmospheric Dispersion Estimates for Accident Releases

Atmospheric dispersion factors (χ/Q values) considered to be representative of potential future nuclear plant sites in the U.S. were used to calculate the consequences from postulated accidental releases of radioactive and hazardous materials.

χ/Q values for ground-level releases were calculated at the exclusion area boundary (EAB) and at the low population zone (LPZ) for appropriate time periods up to 30 days after an accident. The accident χ/Q values were either extracted from Reference 1 or were calculated following the methodology in NRC RG 1.145. The ground-level χ/Q values used for short-term atmospheric dispersion dose analyses at the EAB and LPZ receptor locations are provided in Table 2.1-1.

In addition to the offsite accident consequences evaluated at the EAB and LPZ, onsite accident dose consequences at the Main Control Room (MCR) and Technical Support Center (TSC) were evaluated. MCR and TSC χ/Q values, provided in Table 2.1-1 for the main air supply and the unfiltered inleakage, are used for these analyses from potential post-accident release points. These multiple potential release points affecting the MCR and the TSC include:

- The vent stack.
- Main steam relief train (MSRT) releases for steam generator overpressure protection.
- Safeguard Building roofs via the Safeguard Building canopies.
- An open equipment hatch.
- Safeguard Building depressurization shaft.

The information in these tables conforms to the guidance in RG 1.23, RG 1.145, and RG 1.194. Conformance with RG 1.78 is addressed in Sections 2.2, 6.4, 9.4, and 9.5.

The input variables used in calculating the accident χ/Q values are shown in Table 2.3-1—ARCON96 Input Parameters for Control Room χ/Q Values and Table 2.3-2—ARCON96 Input Parameters for Unfiltered Inleakage Control Room χ/Q Values.

Figure 2.3-1—U.S. EPR Release Points and Control Room Air Intakes provides the relative locations of the release points and the control room air intakes. Section 15.0.3 addresses the dose calculation methodology for accident analyses.

A COL applicant that references the U.S. EPR design certification will confirm that site-specific χ/Q values, based on site-specific meteorological data, are bounded by those specified in Table 2.1-1 at the EAB, LPZ, and the control room.

For site-specific χ/Q values that exceed the bounding χ/Q values, a COL applicant that references the U.S. EPR design certification will demonstrate that the radiological consequences associated with the controlling design basis accident continue to meet the dose reference values given in 10 CFR 50.34 and the control room operator dose limits given in GDC 19 using site-specific χ/Q values.

A COL applicant that references the U.S. EPR design certification will provide a description of the atmospheric dispersion modeling used in evaluating potential design basis events to calculate concentrations of hazardous materials (e.g., flammable or toxic clouds) outside building structures resulting from the onsite and/or offsite airborne releases of such materials.

2.3.5 Long-Term Atmospheric Dispersion Estimates for Routine Releases

A COL applicant that references the U.S. EPR design certification will provide the site-specific, long-term diffusion estimates for routine releases. In developing this information, the COL applicant should consider the guidance provided in RG 1.23, RG 1.109, RG 1.111, and RG 1.112. The maximum annual average χ/Q value at the site boundary, provided in Table 2.1-1, is used to calculate radionuclide concentrations associated with routine gaseous effluent releases, addressed in Section 11.3 11.3, for comparison with environmental release limits and dose limits given in 10 CFR 20. If a reactor site has an annual average χ/Q value that exceeds the reference value, then a site-specific evaluation will be performed.

A COL applicant that references the U.S EPR design certification will also provide estimates of annual average atmospheric dispersion (χ/Q values) and deposition (D/Q values) for 16 radial sectors to a distance of 50 miles from the plant as part of its environmental assessment.

2.3.6 References

1. EPRI ALWR Utility Requirements Document, “Electric Power Research Institute Advanced Light Water Reactor Utility Requirements Document,” Volume II-Revision 8, March 1999.

Table 2.3-1—ARCON96 Input Parameters for Control Room χ/Q Values
Sheet 1 of 2

Parameter	Value(s)
Wind instrument heights	Site specific
Wind speed units of measure	Site specific
Release mode	Ground level (used for each pathway)
Building area	Assumed to be zero for each pathway
Vertical velocity	Assumed to be zero for each pathway
Stack flow	Assumed to be zero for each pathway
Stack radius	Assumed to be zero for each pathway
Terrain elevation difference	Assumed to be zero for each pathway
Direction to source	Site specific; EPR FSAR used the direction that produced the highest χ/Q values
Initial diffusion coefficients	Assumed to be zero for each pathway
Minimum wind speed value for ARCON96	0.5 m/sec
Surface roughness for ARCON96	0.2
Sector averaging constant for ARCON96	4.3
Wind direction window for ARCON96	90 degrees
Control Room air intake location employed in analysis	Intake closest to stack
Control Room air intake elevation	32.1 meters (Mid-point of intake)
Control Room air intake horizontal distance to stack base	69.0 meters
Control Room air intake horizontal distance to Main Steam Relief Train, via Silencer: SG-4 Silencer to MCR Div. 3 Air Intake (AI) SG-3 Silencer to MCR Div. 3 AI SG-1 Silencer to MCR Div. 3 AI SG-2 Silencer to MCR Div. 3 AI	 53.0 meters 46.0 meters 78.0 meters 71.0 meters
Control Room air intake horizontal distances to Canopy exhausts (referred to as the Canopy release point in the present application) 1) Near depressurization shaft (Safeguard Building Div. 4) 2) Southeast side of SAB Div. 4	 30.1 meters 65.3 meters

Table 2.3-1—ARCON96 Input Parameters for Control Room χ/Q Values
Sheet 2 of 2

Parameter	Value(s)
Control Room air intake horizontal distance to Material Lock (for the Equipment Hatch release)	97.5 meters
Control Room air intake horizontal distance to the depressurization shaft of Safeguard Building Div. 4	31.4 meters
Release heights	Silencer – 33.9 meters Stack – 32.1 meters(1) Canopy Pt. 1 – 15.5 meters Canopy Pt. 2 – 11.5 meters elevation Material Lock (for Equipment Hatch release) – 32.1 meters Depressurization Shaft – 7 meters

Note:

1. Stack release height assumed to be the same as the mid-point of the control room air intake.

**Table 2.3-2—ARCON96 Input Parameters for Unfiltered Inleakage Control Room χ/Q Values
Sheet 1 of 2**

Parameter	Value(s)
Wind instrument heights	Site specific
Wind speed units of measure	Site specific
Release mode	Ground level (used for each pathway)
Building area	Assumed to be zero for each pathway
Vertical velocity	Assumed to be zero for each pathway
Stack flow	Assumed to be zero for each pathway
Stack radius	Assumed to be zero for each pathway
Terrain elevation difference	Assumed to be zero for each pathway
Direction to source	Site specific; EPR FSAR used the direction that produced the highest χ/Q values
Initial diffusion coefficients	Assumed to be zero for each pathway
Minimum wind speed value for ARCON96	0.5 m/sec
Surface roughness for ARCON96	0.2
Sector averaging constant for ARCON96	4.3
Wind direction window for ARCON96	90 °F
Unfiltered inleakage air intake elevation	32.1 meters
Unfiltered inleakage air intake horizontal distance to stack base	46.0 meters (same distance as SG-3 Silencer to MCR Div. 3 Air Intake)
Unfiltered inleakage air intake horizontal distance to Main Steam Relief Train, via Silencer:	
SG-1 Silencer	70.0 meters
SG-2 Silencer	62.0 meters
SG-3 Silencer	22.0 meters
SG-4 Silencer	32.0 meters
Unfiltered inleakage air intake horizontal distances to Canopy exhausts (referred to as the Canopy release point in the present application)	
1) Near depressurization shaft (Safeguard Building Div. 4)	12.7 meters
2) Southeast side of SAB Div. 4	45.3 meters

Table 2.3-2—ARCON96 Input Parameters for Unfiltered Inleakage Control Room χ/Q Values
Sheet 2 of 2

Parameter	Value(s)
Unfiltered inleakage air intake horizontal distance to Material Lock (for the Equipment Hatch release)	75.2 meters
Unfiltered inleakage air intake horizontal distance to the depressurization shaft of Safeguard Building Div. 4	17.3 meters
Release heights	Silencer – 33.9 meters Stack – 33.9 meters(1) Canopy Pt. 1 – 15.5 meters Canopy Pt. 2 – 11.5 meters elevation Material Lock (for Equipment Hatch release) – 32.1 meters Depressurization Shaft – 7.0 meters

Note:

1. The slant distance from the stack to the ingress point is approximately the same as the slant distance from the SG-3 silencer to the control room air intake; therefore, the SG-3 run, with a release height of 33.9 meters is also used for the stack scenario.