Response to

Request for Additional Information No. 10, Revision 0

5/16/2008
U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 02.03.01 - Regional Climatology
SRP Section: 02.03.02 - Local Meteorology
SRP Section: 02.03.03 - Onsite Meteorological Measurements Programs
SRP Section: 02.03.04 - Short Term Atmospheric Dispersion Estimates for Accident Releases
SRP Section: 02.03.05 - Long-Term Atmospheric Dispersion Estimates for Routine Releases
Application Section: FSAR Chapter 2
RSAC BRANCH

Question 02.03.01-1:

NUREG-0800, Section 2.3.1, states that both normal and extreme live loads should be considered for the design of a nuclear power plant. The normal live load is based on the weight of the 100-year snowpack or snowfall, whichever is greater, recorded at ground level. The extreme live load is based on the normal live load plus the weight of the 48-hour probable maximum winter precipitation (PMWP). Tier 1 Table 5.0-1 and FSAR Table 2.1-1 list an extreme live load site parameter of 100 pounds per square foot (psf). Please explain if a normal live load should be included as a site parameter.

Response to Question 02.03.01-1:

RG 1.206, Section C.I.2.3.1.2, Regional Meteorological Conditions for Design and Operating Bases, states:

> "The applicant should provide:
>
> (1) estimates of the weight of the 100-year return period snowpack and the weight of the 48-hour probable maximum winter precipitation for the site vicinity for use in determining the weight of snow and ice on the roof of each safety-related structure."

Additionally, SRP Section 2.3.1.I.6a states:

> "The weight of the 100-year return period snowpack and the weight of the 48-hour probable maximum winter precipitation (PMWP) for use in determining the weight of snow and ice on the roofs of safety-related structures."

As noted in the question, the information requested in RG 1.206 and the SRP is the extreme live load. Thus, there is no requirement to provide separate values for the normal and extreme live loads in the FSAR. FSAR Tier 2 Section 2.3.1.1 states:

> "The prescribed loads included in the combination of normal live loads are based on the weight of the 100-year snow pack or snowfall, whichever is greater, 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 100-year snow pack at ground level plus the weight of the 48-hour PMWP at ground level for the month corresponding to the selected snow pack. Snow pack and snowfall are adjusted for density differences and ground level values are adjusted to represent appropriate weights on roofs."

FSAR Impact:

The FSAR will not be changed as a result of this question.

Question 02.03.01-2:

Please consider changing the name of the site parameter for extreme wind, “Maximum Sustained Speed,” in Tier 1 Table 5.0-1 and FSAR Table 2.1-1 since the value is based on a 3-second gust. The National Weather Service defines a sustained wind as the wind speed determined by averaging observed values over a two-minute period.

Response to Question 02.03.01-2:

FSAR Tier 1, Table 5.0-1 and Tier 2, Table 2.1-1 will be revised to change the title for the wind parameter from “Maximum Sustained Speed” to “Maximum Speed (Other than Tornado).”

FSAR Impact:

FSAR, Tier 1, Table 5.0-1 and Tier 2, Table 2.1-1 will be revised as indicated in the enclosed FSAR markup.

Question 02.03.01-3:

Please include a reference to FSAR Section 3.3 in FSAR Section 2.3.1 for the 100-year, 3-second gust wind speed because this section provides the technical basis for the site parameter value.

Response to Question 02.03.01-3:

See FSAR Tier 2 Table 2.1-1—U.S. EPR Site Design Envelope for reference to FSAR Tier 2 Section 3.3 for wind speed.

FSAR Impact:

The FSAR will not be changed as a result of this question.

Question 02.03.01-4:

Please include a reference to FSAR Section 3.3 in FSAR Section 2.3.1 for the tornado design parameters because this section provides the technical basis for the site parameter values.

Response to Question 02.03.01-4:

See FSAR Tier 2 Table 2.1-1—U.S. EPR Site Design Envelope for reference to FSAR Tier 2 Section 3.3 for the tornado design parameters.

FSAR Impact:

The FSAR will not be changed as a result of this question.

Question 02.03.01-6:

Please provide a technical basis for the extreme live snow load site parameter of 100 psf provided in Tier 1 Table 5.0-1 and FSAR Table 2.1-1.

Response to Question 02.03.01-6:

As noted in FSAR Tier 2 Section 3.8.4.3.1, the extreme live snow load of 100 psf on the ground is postulated as a meteorological site parameter for the extreme winter precipitation load. The 100 psf includes both the weight of the 100-year return period snow pack and the weight of the 48-hour probable maximum winter precipitation. This value is obtained by evaluating the combination of the snow pack and the probable maximum winter precipitation data throughout the United States and concluding that 100 psf covers most of the potential sites.

As noted in FSAR Tier 2 Section 3.8.4.3.1, the roof snow and ice loads are then determined using Chapter 7 of ASCE/SEI 7-05, “Minimum Design Loads for Buildings and Other Structures.” In the U.S. EPR design, a 100 psf roof load is used to conservatively address precipitation loads including rain, ice, and snow.

FSAR Impact:

The FSAR will not be changed as a result of this question.

Question 02.03.01-7:

NUREG-0800, Section 2.3.1, states that the staff shall verify that the postulated site parameters are representative of a reasonable number of sites that have been or may be considered for a COL application. To consider if the proposed zero percent exceedance non-coincident wet bulb temperature site parameter is representative of a reasonable number of potential COL sites, the staff considered wet bulb temperature data for 672 available weather stations from the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.'s (ASHRAE) Weather Data Viewer, Version 3.0. The staff compared the proposed site parameter against ASHRAE's extreme annual maximum wet bulb temperature at each station. Attachment 1 shows the percentage of weather stations in each state that have exceeded the zero percent maximum non-coincident wet bulb temperature of 81ºF. The proposed site parameter is exceeded throughout the majority of the U.S., 67 percent of the time, especially in the Southeast U.S., where the proposed site parameter is exceeded nearly 96 percent of the time. Please justify that the zero percent maximum non-coincident wet bulb temperature of 81ºF is representative of a reasonable number of sites that may be considered for a COL application.

Response to Question 02.03.01-7:

As noted in FSAR Tier 2 Section 2.3.1.1, the zero percent maximum non-coincident wet bulb temperature of 81ºF was based on the EPRI ALWR Utility Requirements Document and available Early Site Permit applications. This temperature value was used solely in the design and engineering of the essential service water cooling tower structures which serve as the ultimate heat sink (UHS) for the U.S. EPR plant design. This was also indicated in footnote 1 to FSAR Table 2.1-1. Inherent to the definition of zero percent exceedance is to exclude peaks of temperatures less than two hours in duration. The purpose of the EPRI ALWR Utility Requirements Document is to provide a set of utility design requirements for a standardized plant which are reflected in individual reactor and plant supplier certification designs. Section 2.3.1.8 of the EPRI document notes that the meteorological parameters provided are intended to allow siting at most sites available in the U.S. but does not encompass all worst-case conditions. The UHS cooling towers for the U.S. EPR are designed to satisfy the guidance of RG 1.27 and to the requirements of the U.S. EPR standard plant design (including the zero percent exceedance temperatures).

Additionally, as noted in FSAR Tier 2 Section 2.0, a COL applicant that references the U.S. EPR design certification will compare site specific data to the design parameter data in FSAR Tier 2 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 characteristics 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 the FSAR. Furthermore, FSAR Tier 2 Section 2.3 states that if a COL applicant that references the U.S. EPR design certification identifies site-specific meteorology values outside the range of the design parameters 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. Alternatively, the applicant may depart from the U.S. EPR design and propose an alternate design consistent with the site-specific design parameter or characteristic.

Additional information is provided in AREVA NP's response to NRC RAI No. 13, Question 09.02.05-1 dated June 20, 2008 (e-mail from Ronda Pederson (AREVA NP Inc) to Getachew Tesfaye (NRC), "RE: U.S. EPR Design Certification Application RAI No. 13").

FSAR Impact:

The FSAR will not be changed as a result of this question.

Question 02.03.01-8:

Please provide a technical basis for the site parameter values used to calculate the maximum evaporation and drift loss of water from the ultimate heat sink provided in FSAR Table 2.1-3 and the site parameter values used to calculate the minimum water cooling in the ultimate heat sink provided in FSAR Table 2.1-4. Also, please justify that the site parameter values are representative of a number of potential COL sites.

Response to Question 02.03.01-8:

See AREVA NP's response to NRC RAI No. 13, Question 09.02.05-1 dated June 20, 2008 (e-mail from Ronda Pederson (AREVA NP Inc) to Getachew Tesfaye (NRC), "RE: U.S. EPR Design Certification Application RAI No. 13").

FSAR Impact:

The FSAR will not be changed as a result of this question.

Question 02.03.01-9:

For each of the U.S. EPR regional climatology site parameters, as presented in Tier 1 Table 5.0-1 and FSAR Table 2.1-1, please list the structures, systems, and components (SSCs) that make use of this information and the corresponding FSAR sections where the SSCs are discussed.

Response to Question 02.03.01-9:

The regulatory basis for this question is unclear. Neither RG 1.206, SRP 2.0, or SRP 2.3.1 request a list of SSCs that apply to the information in the site parameters table. Rather, SRP 2.3.1.6 states "All references to FSAR sections in which these conditions are used should be identified by the applicant." Accordingly, FSAR Tier 2 Table 2.1-1 provides references to the appropriate FSAR sections.

FSAR Impact:

The FSAR will not be changed as a result of this question.

Question 02.03.04-1:

FSAR Section 2.3.4 states that the accident χ/Q values were either extracted from the EPRI ALWR URD or were calculated following the methodology in NRC Regulatory Guide (RG) 1.145. Please provide further discussion regarding the χ/Q values based on RG 1.145, such as the meteorological data used, release characteristics, and locations considered. Also, please explain how the proposed accident χ/Q values could be considered representative of a reasonable number of potential COL sites.

Response to Question 02.03.04-1:

The atmospheric dispersion factors (χ/Q) for design basis accidents (DBAs) include the Control Room (CR), the Exclusion Area Boundary (EAB), and the Low Population Zone (LPZ). For the offsite effects of the DBAs (EAB/LPZ), a ground level release with no credit for increased atmospheric dispersion due to building wake was analyzed; this encompasses the post-accident potential release points from the site. For the onsite effects of the DBAs [CR/ technical support center (TSC)], the following releases were analyzed: Stack (with no credit taken for release height), Main Steam Relief Train (MSRT) releases for steam-generator over-pressure protection, releases from the Safeguard Building (SAB) roofs (via the SAB Canopy, two release points), releases from the open Equipment Hatch via the Material Lock, and releases via the SAB depressurization shaft.

The EAB and LPZ χ/Q values were determined by first calculating χ/Q values utilizing meteorological data from the Calvert Cliffs (CCNPP) and Nine Mile Point (NMP) sites and comparing these to the EPRI URD χ/Q values. The maximum of these values were selected for the FSAR (see Table 02.03.04-1).

The EAB value of 1.0E-03 s/m^3 was taken from the ALWR EPRI URD since it bounded the site derived values. The CCNPP site LPZ χ/Q value for the 0-2 hour bounded the URD χ/Q and the URD 0-8 hour χ/Q as used for the 2-8 hour χ/Q. The 8-24 hour, 1-4 days, and 4-30 days χ/Q values were obtained from the URD since these values bound the site data.

The atmospheric dispersion factors for design basis accidents were determined using methodologies from RG 1.145, as implemented in AEOLUS3, and RG 1.194, as implemented in ARCON96. The following input/assumptions were used:

- EAB/LPZ atmospheric dispersion factors for DBAs, all post-accident release points were based on the ground level release model with no dispersion credit for building wake effects. However, plume meander, which predominates building wake effects during short time intervals, is accounted for.
- For the offsite receptors, accident atmospheric dispersion factors were calculated for a set of distances ranging from 0.25 mile to 5 miles. Bounding distances should be selected based on actual site characteristics.

As noted in FSAR Tier 2 Section 2.0, a COL applicant that references the U.S. EPR design certification will compare site specific data to the design parameter data in Table 2.1-1 (which includes the accident χ/Q values). For site-specific design parameter data or characteristics 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 the FSAR.

Table 02.03.04-1
Input Data for Accident x/Q values

Parameter	Value(s)
Met Data Used	2001 – 2005 (NMP) 2000 – 2004 (CCNPP)
Wind speed group upper limits for AEOLUS3	XX, 0.75, 1.0, 1.5, 2.0, 3.0, 5.0, 7.0, 10.0, 13.0, 18.0, 50.0 meters/second Note: XX = 0.27 for NMP, 0.23 for CCNPP; listed in same units as in RG 1.23, Rev. 1
AEOLUS3 wind speed assigned to calms	0.3 miles/hour (NMP) 0.25 miles/hour (CCNPP)
Anemometer starting speed for the AEOLUS3 runs	0.6 miles/hour (NMP) 0.5 miles/hour (CCNPP)
Temperature sensor separation	168 feet (51.21 meters) (NMP) 164 feet (50 meters) (CCNPP)
Wind instrument heights	30 feet, 100 feet, and 200 feet (NMP) 33 and 197 feet (10 meters and 60 meters) (CCNPP)
The annual average mixing layer height at NMP and CCNPP	2953 feet (900 meters)
Meteorological channel units of measure	Wind speed: miles per hour Wind direction: degrees from True North Delta-Temperature: degrees Fahrenheit per sensor separation in feet

FSAR Impact:

The FSAR will not be changed as a result of this question.

Question 02.03.04-2:

Please provide the technical basis for the control room accident χ/Q values presented in FSAR Tables 2.3-1 and 2.3-2.

Response to Question 02.03.04-2:

The atmospheric dispersion factors were determined using the methodologies from RG 1.194, as implemented in ARCON96. There are two redundant outside air intakes for the CR/TSC envelope located in the corners farthest away from the containment building (on the northwest corner of Division 2 and the northeast corner of Division 3). In addition, there could be multiple/alternative release points for any given accident, such as four Main Steam Relief Trains for a postulated Steam Generator Tube Rupture accident. The radiological analyses assumed that the outside air for the CR/TSC envelope was from a single intake.

Since the actual alignment of the plant may vary at each site, ARCON96 runs for the CR/TSC and the stack release point were made by aligning the release-to-intake direction with each of the sixteen cardinal compass directions (N, NNE, NE, ENE, E, ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW, NNW) (i.e., sixteen cases were run for the stack release point, and the bounding case was selected). Since the meteorology was the same for all release points, the bounding wind direction from the sixteen stack cases was used for the other post-accident release points.

For the canopy and depressurization shaft releases, intervening walls, and roof in the line of sight between the release points and the Control Room air intakes were conservatively ignored.

FSAR Impact:

See AREVA NP's response to RAI No. 10 Question 02.03.04-4.

Question 02.03.04-3:

Please consider including the control room accident χ/Q values in either Tier 1 Table 5.0-1 or FSAR Table 2.1-1.

Response to Question 02.03.04-3:

The control room accident χ/Q values are provided in FSAR Tier 2 Tables 2.3-1 and 2.3-2. SRP Section 2.0 provides the guidance for determining which information is to be provided in the site parameter table (i.e., Table 2.1-1). Specifically, Section III.2 of SRP Section 2.0 states: "Examples of site parameters and design characteristics that should be addressed are included in Tables 1 and 2 of Appendix A to this SRP section." The control accident χ/Q values are not listed in Tables 1 and 2 of Appendix A to SRP Section 2.0.

FSAR Impact:

The FSAR will not be changed as a result of this question.

Question 02.03.04-4:

SRP Section 2.3.4 states that the DC application should contain figures and tables showing the design features that would be used by the COL applicant to generate control room χ/Q values (e.g., intake heights, release heights, building cross-sectional areas, distance to receptors). Please include the necessary input assumptions for ARCON96 (RG 1.194) in FSAR Section 2.3.4 for a COL applicant referencing the U.S. EPR DC.

Response to Question 02.03.04-4:

Please refer to the input assumptions in AREVA NP's response to RAI No. 10 Question 02.03.04-2. New FSAR Tier 2 Table 2.3-3, Input Parameters for Control Room χ/Q values, will be added to FSAR Tier 2 Section 2.3, as provided in the enclosed markup.

FSAR Impact:

FSAR Tier 2 Section 2.3 will be revised as described in the response and indicated in the enclosed markup.

Question 02.03.05-1:

Please provide the technical basis for the annual average χ/Q (4.973E-6 sec/m^3) presented in FSAR Section 2.3.5 and FSAR Table 2.1-1.

Response to Question 02.03.05-1:

The atmospheric dispersion factors were determined using the methodologies from RG 1.145 and RG 1.111, as implemented in AEOLUS3. The annual average χ/Q (4.973E-6 sec/m^3) provided in FSAR Tier 2 Section 2.3.5 and FSAR Tier 2 Table 2.1-1 was determined using the meteorological data from the CCNPP site along with the following design inputs used in AEOLUS3:

- A mixed mode release from the stack was modeled to determine normal effluent atmospheric dispersion and deposition factors (including gamma χ/Q values).
- Building wake credit was taken for the normal effluent mixed mode release.
- Stack release was from 62 m above grade for the mixed mode release case (2 meters above Reactor Building).
- For the mixed mode release case, 0.3 MeV was used as the gamma energy spectrum with a relative intensity of 1.0 MeV/sec.
- For downwind distances between points at which terrain height values were derived using USGS topographic maps, the terrain heights at the intermediate distances were set to the values of the closest of the two points at which terrain height values were known.
- AEOLUS3 input variables HINV and HFMX (annual average height of inversion layer and maximum allowable plume centerline height) were set to 748 meters.

Table 02.03.05-1 lists the specific parameters that were used to determine the annual average χ/Q provided in FSAR Tier 2 Section 2.3.5 and FSAR Tier 2 Table 2.1-1.

Table 02.03.05-1
Input Parameter for the Annual Average χ/Q

Parameter	Value(s)
Wind speed group upper limits for AEOLUS3	0.234, 0.75, 1.0, 1.5, 2.0, 3.0, 5.0, 7.0, 10.0, 13.0, 18.0, 50.0 meters/second; listed in same units as in RG 1.23, Rev. 1
AEOLUS3 wind speed assigned to calms	0.25 miles per hour
Anemometer starting speed for the AEOLUS3 runs	0.5 miles per hour
Annual average mixing layer height	2,454 feet (748 meters) (Conservative, low value)
Temperature sensor separation	164 feet (50 meters)
Wind instrument heights	33 and 197 feet (10 meters and 60 meters)

Table 02.03.05-1
Input Parameter for the Annual Average χ/Q

Parameter	Value(s)
Meteorological channel units of measure: Wind speed Wind direction Delta-Temperature	 miles per hour degrees from True North degrees Fahrenheit per sensor separation in feet
Grid receptor distances for normal effluent release	Downwind distances for which atmospheric dispersion factors for normal effluent analyses were determined: 805 meters (0.5 mile), 1208 meters (0.75 mile), 1500 meters (0.93 mile), 1609 meters (1 mile), 2000 meters (1.2 miles), 2414 meters (1.5 miles), 3218 meters (2 miles), 4023 meters (2.5 miles), 4827 meters (3 miles), 5632 meters (3.5 miles), 6436 meters (4 miles), 7241 meters (4.5 miles), 8045 meters (5 miles), 12068 meters (7.5 miles), 16090 meters (10 miles), 24135 meters (15 miles), 32180 meters (20 miles), 40225 meters (25 miles), 48270 meters (30 miles), 56315 meters (35 miles), 64360 meters (40 miles), 72405 meters (45 miles), and 80450 meters (50 miles); in units required by computer code

Table 02.03.05-1
Input Parameter for the Annual Average χ/Q

Parameter	Value(s)
Special receptor sectors, distances (m), and terrain heights (m) (with respect to plant grade)	*SB N 623.4 0.0 NNE 429.4 0.0 NE 443.3 0.0 ENE 471.0 0.0 E 554.1 16.8 SE 1413.0 22.9 SSE 1607.0 22.9 S 1385.0 19.8 SSW 1371.0 29.0 SW 1759.0 29.0 WSW 1662.0 25.9 W 1732.0 32.0 WNW 2313.0 22.9 NW 1662.0 22.9 NNW 761.9 19.8 * RESIDENT SE 2735.0 25.9 SSE 2092.0 22.9 S 2896.0 25.9 SSW 2414.0 29.0 SW 1770.0 29.0 WSW 1931.0 25.9 W 2092.0 32.0 WNW 4023.0 25.9 NW 3379.0 25.9 * GARDEN SE 2735.0 25.9 SSE 2092.0 22.9 S 2896.0 25.9 SSW 2735.0 29.0 SW 1770.0 29.0 WSW 2414.0 25.9 W 2414.0 32.0 WNW 4023.0 25.9 NW 3379.0 25.9 In units required by computer code
Stack flow rate for normal operations	242,458 cfm
Stack inner diameter	3.8 meters; in units required by computer code
Stack height	62 meters (2 meters above Reactor Building); in units required by computer code
Gamma energy spectrum and relative intensity	0.3 MeV and 1.0 MeV/sec; in units required by computer code
Reactor Building height and cross sectional area	60 meters; in units required by computer code 2,940 m^2

Table 02.03.05-1
Input Parameter for the Annual Average χ/Q

Parameter	Value(s)
Maximum Terrain Heights 0.5 miles	Values in meters above plant grade and in units required by computer code. 0.0 0.0 0.0 0.0 16.8 19.8 22.9 22.9 19.8 29.0 29.0 25.9 32.0 22.9 22.9 19.8
0.62 miles	Values in meters above plant grade and in units required by computer code. 0.0 0.0 0.0 0.0 16.8 19.8 22.9 22.9 19.8 29.0 29.0 25.9 32.0 22.9 22.9 19.8

Table 02.03.05-1
Input Parameter for the Annual Average χ/Q

Parameter	Value(s)
1.5 miles	Values in meters above plant grade and in units required by computer code. 0.0 0.0 0.0 0.0 16.8 19.8 25.9 22.9 25.9 29.0 29.0 25.9 32.0 25.9 25.9 19.8
2.5 miles	Values in meters above plant grade and in units required by computer code. 0.0 0.0 0.0 0.0 16.8 19.8 25.9 25.9 25.9 29.0 29.0 25.9 32.0 25.9 25.9 19.8

Table 02.03.05-1
Input Parameter for the Annual Average χ/Q

Parameter	Value(s)
3.5 miles	Values in meters above plant grade and in units required by computer code. 0.0 0.0 0.0 0.0 16.8 19.8 25.9 25.9 26.8 29.0 29.0 25.9 32.0 25.9 25.9 19.8
4.5 miles	Values in meters above plant grade and in units required by computer code. 0.0 0.0 0.0 0.0 16.8 19.8 25.9 25.9 26.8 29.0 29.0 25.9 32.0 29.6 25.9 19.8

Table 02.03.05-1
Input Parameter for the Annual Average χ/Q

Parameter	Value(s)
7.5 miles	Values in meters above plant grade and in units required by computer code. 0.0 0.0 0.0 0.0 16.8 19.8 25.9 25.9 26.8 29.0 29.0 25.9 32.0 32.0 26.3 26.3
15 miles	Values in meters above plant grade and in units required by computer code. 0.0 0.0 0.0 0.0 16.8 19.8 25.9 25.9 26.8 29.0 29.0 26.3 44.3 32.0 27.3 43.3

Table 02.03.05-1
Input Parameter for the Annual Average χ/Q

Parameter	Value(s)
25 miles	Values in meters above plant grade and in units required by computer code. 0.0 0.0 6.3 6.3 19.1 22.4 28.9 28.9 29.9 32.2 31.3 26.3 45.3 49.3 52.3 61.3
35 miles	Values in meters above plant grade and in units required by computer code. 6.3 1.3 6.3 6.3 19.1 22.4 28.9 28.9 29.9 32.2 39.3 46.3 45.3 51.3 66.3 61.3

Table 02.03.05-1 Input Parameter for the Annual Average χ/Q	
Parameter	**Value(s)**
45 miles	Values in meters above plant grade and in units required by computer code. 6.3 6.3 6.3 6.3 19.1 22.4 28.9 28.9 29.9 32.2 46.3 52.3 45.3 78.3 78.3 61.3

FSAR Impact:

The FSAR will not be changed as a result of this question.

Question 02.03.05-3:

NUREG-0800, Section 2.3.5, states that the staff shall verify that the postulated site parameters are representative of a reasonable number of sites that have been or may be considered for a COL application. Please explain how the proposed annual average χ/Q could be considered representative of a reasonable number of potential COL sites.

Response to Question 02.03.05-3:

The χ/Q values in the FSAR were based on information in the EPRI ALWR URD and available early site permits. As noted in FSAR Section 2.3.5, 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, for comparison with environmental release limits and dose limits given in 10 CFR Part 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. Additionally, as noted in FSAR Section 2.3.5, 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 (80 km) from the plant as part of its environmental assessment.

FSAR Impact:

The FSAR will not be changed as a result of this question.

Question 02.03.05-4:

In FSAR Table 11.3-4, “Input Parameters for the GASPAR II Computer Code used in Calculating Annual Offsite Doses to the Maximally Exposed Individual from Gaseous Releases,” the following parameters are listed: (1) an annual average atmospheric dispersion factor of 5.0E-06 sec/m3 and (2) an annual average ground deposition factor of 5.0E-08 m-2. In FSAR Table 11.3-7, “Input Parameters for the GASPAR II Computer Code used in Gaseous Waste Cost-Benefit Analysis,” the following parameters are listed: (1) an average humidity over the growing season of 8.4 g/m3, (2) an average temperature over the growing season of 66.8 ºF, and (3) an atmospheric dispersion factor (highest 0.5 mile value) of 3.2E-06 sec/m3. Please explain why the annual average χ/Q values listed in FSAR Table 11.3-4, FSAR Table 11.3-7, and FSAR Table 2.1-1 all differ. Please explain why the meteorological parameters (e.g., “annual average ground deposition factor,” “average humidity over the growing season,” and “average temperature over the growing season”) listed in FSAR Tables 11.3-4 and 11.3-7 were not included as site parameters in Tier 1 Table 5.0-1 or FSAR Table 2.1-1. Please provide a list of meteorological parameters used in other sections of the FSAR that were not included as site parameters in Tier 1 Table 5.0-1 or FSAR Table 2.1-1. The corresponding FSAR section(s) should be included in this list.

Response to Question 02.03.05-4:

The average χ/Q value listed in FSAR Tier 2 Table 11.3-4 (5.0E-06 sec/m^3) was a rounded value of that contained in FSAR Tier 2 Table 2.1-1 (4.973E-6 sec/m^3 – NE sector, annual average, undecayed, undepleted χ/Q). Thus, no changes to FSAR Tier 2 Tables 11.3-4 or 2.1-1 are required.

The values listed in FSAR Tier 2 Table 11.3-7 represent a portion of the data used as input to GASPAR II, such as the totals for population and production data, where the actual GASPAR II calculation used sector/distance specific data. To calculate the dose benefit for the gaseous waste system, the atmospheric dispersion factors at each location for which exposures were evaluated were input, which includes the undecayed/undepleted χ/Q for H3/C14/nondepositing radionuclides; decayed/undepleted χ/Q for inhalation doses for H3/C14/noble gases; decayed/depleted χ/Q for inhalation doses other than H3/ C14/noble gases, and deposition D/Q for ground concentrations. The χ/Q value listed in FSAR Tier 2 Table 11.3-7 (3.2E-06 sec/m3 – highest 0.5 mile value) represents the undecayed/undepleted data for the NNE sector, but this was not the most limiting value.

FSAR Tier 2 Table 11.3-7 χ/Q will be modified to match FSAR Tier 2 Tables 11.3-4 and 2.1-1. Results of GASPAR II analysis (Table 11.3-8) are not affected, as entire χ/Q set was utilized as GASPAR II input.

The parameters “annual average ground deposition factor,” “average humidity over the growing season,” and “average temperature over the growing season” are not identified as parameters to be included in FSAR Tier 2 Table 2.1-1, per SRP Section 2.0, Table 1, or Table 2. The information that is provided in FSAR Tier 1 Table 5.0-1 and FSAR Table 2.1-1 is consistent with information identified in RG 1.206 and the SRP.

FSAR Impact:

FSAR, Tier 2, Table 11.3-7 will be revised as described in the response and indicated in the enclosed markup.

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02.03.01-2

Table 5.0-1—Site Parameters for the U.S. EPR Design (5 Sheets)

Parameter	Value(s)
Precipitation	
Rainfall rate ~~(for roof design)~~	Maximum site rainfall rate of 19.4 inches per hour.
Snow & Ice Load ~~(for roof design)~~	Maximum snow and ice load of 100 psf extreme live load.
Seismology	
Parameter	**Value(s)**
Seismology (SSE response spectra using figures)	Horizontal design ground motion shall be the certified seismic design response spectra shapes anchored to a peak ground acceleration of 0.3 g. Vertical spectra shall be the same as the horizontal spectra.
Flood Level	
Parameter	**Value(s)**
Maximum flood or tsunami	Maximum flood or tsunami level is no more than 1 ft below grade.
Temperature	
Parameter	**Value(s)**
Design ambient temperature	The 0% exceedance maximum ambient temperature is 115°F Dry Bulb and 80°F Wet Bulb coincident. The 0% exceedance minimum ambient temperature is -40°F. The 1% exceedance maximum ambient temperature is 100°F Dry Bulb and 77°F Wet Bulb, coincident. The 1% exceedance minimum ambient temperature is -10°F.
Wind	
Parameter	**Value(s)**
Maximum ~~sustained speed~~Speed (Other than Tornado)	The normal maximum wind speed is 145 mph.

Table 2.1-1—U.S. EPR Site Design Envelope
Sheet 1 of 3

U.S. EPR Site Design Envelope	
Precipitation (Refer to Section 2.4)	
Rainfall	≤19.4 in/hr
Snow (design: extreme live load, including 48-hour probable maximum winter precipitation)	≤100 psf
Seismology (Refer to Sections 2.5 & 3.7)	
Horizontal SSE Acceleration	0.3g Peak (CSDRS shapes – See Section 3.7.)
Vertical SSE Acceleration	0.3g Peak (CSDRS shapes – See Section 3.7.)
Fault Displacement Potential	No fault displacement is considered for safety-related SSCs in U.S. EPR design certification.
Soil (Refer to Section 2.5)	
Minimum Bearing Capacity (Static)	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.
Minimum Shear Wave Velocity (Low strain best estimate average value at bottom of basemat)	1000 fps
Liquefaction	None
Maximum Differential Settlement (across the basemat)	1/2 inch in 50 feet in any direction
Slope Failure Potential	No slope failure potential is considered in the design of safety-related SSCs for U.S. EPR design certification.
Maximum Ground Water	3.3 ft below grade
Inventory of Radionuclides Which Could Potentially Seep Into the Groundwater	
See Table 2.1-2—Bounding Values for Component Radionuclide Inventory	
Flood Level (Refer to Section 2.4)	
Maximum Flood (or Tsunami)	1 ft below grade
Wind (Refer to Section 3.3)	
02.03.01-2 Maximum ~~Sustained Speed~~Speed (Other than Tornado)	145 mph (Based on 3-second gust at 33 ft above ground level and factored for 50-yr mean recurrence interval.)
Importance Factor	1.15 (Safety-related structures for 100-year mean recurrence interval.)

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 2.3-1 for the main air supply and Table 2.3-2 for 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.

02.03.04-4

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 2.3-3.

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 and LPZ and by Table 2.3-1 at the control room.

**Table 2.3-3—Input Parameters for Control Room χ/Q Values
Sheet 1 of 2**

Parameter	Value(s)
Temperature sensor separation	168 ft (51.21 m) 164 ft (50 m)
Wind instrument heights	30 ft, 100 ft, and 200 ft 33 and 197 ft (10 m and 60 m
Annual average mixing layer height	2953 ft (900 m) (Conservative, low value applicable to both sites)
Meterological channel units of measure	Wind speed, miles per hour Wind direction, degrees from true north delta-temperature, degrees fahrenheit per sensor separation in ft
Minimum wind speed value for ARCON96	0.5 m/s as listed in RG 1.194
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 m (mid-point of intake) in units required by ARCON96
Control room intake horizontal distance to stack base	69.0 m in units requred by ARCON96
Control room air intake horizontal distance to MSRT via Silencer (referred to as the Silencer release point in the present application): SG-4 Silencer to MCR Division 3 air intake SG-3 Silencer to MCR Division 3 air intake SG-1 Silencer to MCR Division 3 air intake SG-2 Silencer to MCR Division 3 air intake	 53.0 m 46.0 m 78.0 m 71.0 meters in units required by ARCON96
Control room air intake horizontal distances to Canopy exhausts (referred to as the Canopy release point in the present application) 1) Near depressurization shaft (SB Division 4) 2) Southeast side of SB Division 4	 30.1 m 65.3 m in units required by ARCON96
Control room air intake horizontal distance to material lock (for the equipment hatch release)	97.5 m in units required by ARCON96

Table 2.3-3—Input Parameters for Control Room χ/Q Values
Sheet 2 of 2

Control room air intake horizontal distance to the depressurization shaft of SB Division 4 (referred to as the depressurization shaft release point in the present application)	31.4 m in units required by ARCON96
Release heights used in ARCON96	Silencer - 33.9 m Stack - 32.1 m Canopy Pt. 1 - 15.5 m Canopy Pt. 2 - 11.5 m elevation Material lock (equipment hatch release) - 32.1 m Depressurization shaft - 7 m in units required by ARCON96

Table 11.3-7—Input Parameters for the GASPAR II Computer Code used in Gaseous Waste Cost-Benefit Analysis

Parameter	Value
Source Term	GALE (Table 11.2-4, "Total as Adjusted")
50-Mile Population	8.1E+06
Production Data	
Cow Milk	2.3E+08[1] kg/yr
Meat	3.6E+07 kg/yr
Vegetable	1.7E+09 kg/yr
Fraction of Year that Animals are on Pasture	0.583
Average Humidity over Growing Season	8.4 g/m^3
Average Temperature over Growing Season	66.8°F
Atmospheric Dispersion Factors (highest 0.5 mile value)	~~3.2~~5.0E-06 s/m^3

02.03.05-4

Note:

1. All other values are GASPAR II default values.

Table 11.3-8—Obtainable Dose Benefits for Gaseous Waste System Augment

	Population Total Body Dose (Person-rem)	Population Thyroid Dose (Person-rem)
Baseline Configuration	5.52	5.80
Extra Carbon Delay Bed	5.49	5.77
Obtainable dose benefit by augment	0.03	0.03