AREVAEPRDCPEm Resource

From: BRYAN Martin (EXT) [Martin.Bryan.ext@areva.com]
Sent: Friday, February 26, 2010 5:17 PM
To: Tesfaye, Getachew
Cc: DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); ROMINE Judy (AREVA NP INC); WILLIFORD Dennis C (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 256, FSAR Ch. 2
Attachments: RAI 256 Response US EPR DC.pdf

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 256 Response US EPR DC.pdf" provides technically correct and complete responses to 3 of the 7 questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 256 Questions 02.03.01-15, 02.03.04-7, and 02.03.04-8.

The following table indicates the respective pages in the response document, "RAI 256 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 256 — 02.03.01-13	2	2
RAI 256 — 02.03.01-14	3	4
RAI 256 — 02.03.01-15	5	6
RAI 256 — 02.03.04-7	7	9
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RAI 256 — 02.03.05-6	12	12
RAI 256 — 02.03.05-7	13	13

A complete answer is not provided for 4 of the 7 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 256 — 02.03.01-13	April 2, 2010
RAI 256 — 02.03.01-14	April 2, 2010
RAI 256 — 02.03.05-6	April 2, 2010
RAI 256 — 02.03.05-7	April 2, 2010

Sincerely,

Martin (Marty) C. Bryan
Licensing Advisory Engineer
AREVA NP Inc.
Tel: (434) 832-3016
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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Friday, July 24, 2009 4:19 PM
To: ZZ-DL-A-USEPR-DL

Cc: Harvey, Brad; Hart, Michelle; Patel, Jay; Lauron, Carolyn; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 256 (2937, 2938,2940), FSAR Ch. 2

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on July 7, 2009, and discussed with your staff on July 23, 2009. No changes were made to the Draft RAI Questions as a result of that discussion. As we informed you during our discussion, the questions in this RAI are considered potential open items for Phases 2 and 3 reviews. As such, the schedule we have established for your application assumes technically correct and complete responses prior to the start of Phase 4 review. For any RAIs that cannot be answered prior to the start of Phase 4 review, it is expected that a date for receipt of this information will be provided so that the staff can assess how this information will impact the published schedule.

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 1187

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Response to

Request for Additional Information No. 256 (2937, 2938, 2940) Revision 0

7/24/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 02.03.01 - Regional Climatology
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 Ch. 2

QUESTIONS for Siting and Accident Conseq Branch (RSAC)

Question 02.03.01-13:

POTENTIAL OPEN ITEM

Clarify the definitions of the 0% and 1% exceedance air temperature site parameter values presented in FSAR Tier 2 Table 2.1-1. In particular, revise the FSAR as necessary to:

1. Indicate in Tier 2 Table 2.1-1 whether the maximum and minimum 1% air temperature site parameters represent annual or seasonal 1 percent exceedances.
2. Indicate in Tier 2 Table 2.1-1 whether the maximum 0% and 1% exceedance coincident wet bulb temperatures represent mean or maximum values.
3. Indicate in Tier 2 Table 2.1-1 that the definition of zero percent exceedance excludes peaks of temperatures less than two hours in duration (per the response to RAI 02.03.01-7).

Indicate in Tier 2 Section 2.3.1.1 that the zero percent exceedance air temperature values in Table 2.1-1 are based on conservative estimates of 100-year return period values and historic extreme values, whichever is bounding. General Design Criterion (GDC) 2 to Appendix A to 10 CFR Part 50 states, in part, that the design bases for structures, systems, and components important to safety shall reflect appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated. In order to be compliant with GDC 2, the ambient design temperature site characteristics should be based on the higher of either historic or 100-year return period values. Temperatures based on a 100-year return period are considered to provide sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated as required by the regulation.

Response to Question 02.03.01-13:

A response to this question will be provided by April 2, 2010.

Question 02.03.01-14:

POTENTIAL OPEN ITEM

This question is related to the applicant's supplement 1 response to RAI 02.03.01-10 and supplement 1 response to RAI 02.03.02-11.

FSAR Tier 2 Table 2.1-1 presents a set of site parameters which are the postulated physical, environmental, and demographic features of an assumed site which the U.S. EPR standard design is based. FSAR Section 2.0 states that these site parameters represent more demanding conditions than normally expected for most U.S. nuclear power plant sites.

U.S. EPR Combined License Information Item 2.0-1 (from FSAR Table 1.8-2) states 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. If the characteristics for the site fall within the assumed site parameter values in Table 2.1-1, then the U.S. EPR standard design is bounding for the site. For site 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 characteristics, and that the design maintains conformance to the design commitments and acceptance criteria described in the FSAR.

The response to RAI 02.03.01-10 states that although the 81 °F zero percent exceedance non-coincident wet bulb design point may be exceeded at locations throughout the U.S, it was used as design point for the ultimate heat sink (UHS) cooling towers. The U.S. EPR UHS design was also evaluated using site specific meteorological data for several COL applicants referencing the U.S. EPR design to verify that the site-specific data yield acceptable UHS basin temperatures. Similarly, the response to RAI 02.03.01-11 states the UHS cooling tower basins are design based on zero percent exceedance coincident wet bulb and dry bulb temperatures such that no makeup to the basin is required for three days following the initiation of a design basis accident under the worst case environmental conditions. The sizing of the U.S. EPR UHS cooling tower basins was also evaluated using site-specific meteorological data for several COL applicants referencing the U.S. EPR design.

There are several site design parameters listed in Table 2.1-1 that can be deleted from FSAR Tier 2 Table 2.1-1 because (1) comparison with site characteristic values will not be particularly meaningful and/or (2) there are (or can be) Combined License Information Items providing more specific details regarding demonstrating that the design of the U.S EPR is acceptable at a proposed COL site. In particular:

1. Consider deleting the hourly wet bulb temperature and concurrent dry bulb temperature values presented in FSAR Tier 2 Table 2.1-3 (containing the design values for maximum evaporation and drift loss of water from the UHS) as site parameters. It is not clear how COL applicants can demonstrate that the wet bulb temperature and concurrent dry bulb temperature characteristics for their site are bounded by the 72 sets of hourly wet bulb temperature and concurrent dry bulb temperature site parameter values presented in Table 2.1-3.
2. Consider adding a Combined License Information Item to FSAR Tier 2 Table 1.8-2 stating that a COL applicant that references the U.S. EPR design certification will demonstrate that

no makeup water to the UHS cooling tower basin is required for three days following the initiation of a design basis accident under the worst case site-specific environmental conditions pursuant to Regulatory Guide (RG) 1.27, “Ultimate Heat Sink for Nuclear Power Plants.”

3. Consider deleting the 81 °F zero percent exceedance non-coincident wet bulb air temperature as a site parameter. The supplement 1 response to RAI 02.03.01-10 states that although this site parameter value (which is used solely as a design point for the sizing of the UHS cooling towers) may be exceeded at locations throughout the U.S., the UHS design was evaluated using site-specific meteorological data from COL applicant referencing the U.S. EPR design. There is no benefit specifying a site parameter value that is known to be exceeded at number of locations.
4. Consider deleting the hourly wet bulb temperature and concurrent dry bulb temperature values presented in FSAR Tier 2 Table 2.1-4 (containing the design values for minimum water cooling from the UHS) as site parameters. It is not clear how COL applicants can demonstrate that the wet bulb temperature and concurrent dry bulb temperature characteristics for their site fall within the 24 sets of hourly wet bulb temperature and concurrent dry bulb temperature site parameter values presented in Table 2.1-4.
5. Consider adding a Combined License Information Item to FSAR Tier 2 Table 1.8-2 stating that a COL applicant that references the U.S. EPR design certification will demonstrate that the UHS cooling tower design is validated with site-specific time dependent wet bulb temperature profiles to verify that the site-specific data yield acceptable maximum UHS basin temperatures pursuant to RG 1.27.

Consider deleting the potential for water freezing in the UHS water storage facility as a UHS meteorological condition site parameter. Combined License Information Item 2.4-8 in FSAR Tier 2 Table 1.8-2 already directs a COL applicant that references the U.S. EPR design certification to evaluate the potential for freezing temperatures that may affect the performance of the ultimate heat sink makeup, including the potential for frazil and anchor ice, maximum ice thickness, and maximum cumulative degree-days below freezing.

Response to Question 02.03.01-14:

A response to this question will be provided by April 2, 2010.

Question 02.03.01-15:

POTENTIAL OPEN ITEM

This question is related to the applicant’s response to RAI 02.03.01-12.

Revise the snow load site parameters proposed for FSAR Tier 1 Table 5.0-1 and Tier 2 Table 2.1-1 as follows:

1. Change “Normal ground precipitation load: <100 psf (100-yr MRI)” to “Normal winter precipitation event ground load: <100 psf”

   Change “Normal roof precipitation load: <70 psf (100-yr MRI)” to “Normal winter precipitation event roof load: <70 psf”

   These revisions will clarify that the loads being discussed are winter precipitation (e.g., snow) loads. Also, the normal winter precipitation event loads are not limited to a 100-yr MRI. ISG-07 states that the normal winter precipitation event used to determine the normal winter precipitation live roof load should be the highest weight among (1) the 100-yr return period snowpack, (2) the historical maximum snowpack, (3) the 100-year return period snowfall event, or (4) the historical maximum snowfall event.

2. Change “48-hour PMWP liquid roof load:0 psf” to “Extreme liquid winter precipitation event roof load:0 psf”

   This revision will implement terminology consistent with ISG-07 and the other snow load site parameters.

3. Change “48-hour PMWP frozen ground load: <43 psf (based on 55 inches)” to “Extreme frozen winter precipitation event ground load: <43 psf (based on 55 inches of snow)”

   Change “48-hour PMWP frozen roof load: <30 psf” to “Extreme frozen winter precipitation event roof load: <30 psf”

   This revision will implement terminology consistent with ISG-07 and the other snow load site parameters. Also, the extreme frozen winter precipitation event loads are not associated with the 48-hr PMWP. ISG-07 states that the extreme frozen winter precipitation event used to determine the extreme winter precipitation live roof load should be the highest weight between (1) the 100-yr return period snowfall event, and (2) the historical maximum snowfall event.

Response to Question 02.03.01-15:

1. The labels for the snow load site parameters in U.S. EPR FSAR Tier 1, Table 5.0-1 and Tier 2, Table 2.1-1 will be revised to change “Normal ground precipitation load: <100 psf (100-yr MRI)” to “Normal winter precipitation event ground load: <100 psf” and “Normal roof precipitation load: <70 psf (100-yr MRI)” to “Normal winter precipitation event roof load: <70 psf.”
2. The label for the 48-hour probable maximum winter precipitation (PMWP) liquid roof load in U.S. EPR FSAR Tier 1, Table 5.0-1 and Tier 2, Table 2.1-1 will be revised to change “48-hour PMWP liquid roof load:0 psf” to “Extreme liquid winter precipitation event roof load:0 psf.”

3. The label for the 48-hour PMWP frozen roof load in U.S. EPR FSAR Tier 1, Table 5.0-1 and Tier 2, Table 2.1-1 will be revised to change “48-hour PMWP frozen roof load: <30 psf” to “Extreme frozen winter precipitation event roof load: <30 psf.”

FSAR Impact:

U.S. EPR FSAR Tier 1, Table 5.0-1 and Tier 2, Table 2.1-1 will be revised as described in the response and indicated on the enclosed markup.

Question 02.03.04-7:

POTENTIAL OPEN ITEM

This question is related to the applicant's response to RAI 02.03.04-4. The staff finds the response to RAI 02.03.04-4 incomplete.

The response to RAI 02.03.01-4 provided a table titled "Input Parameters for Control Room χ/Q values." The intent of this table should be to provide all future COL applicants that reference the U.S. EPR design certification values for all the input parameters required to execute the ARCON96 atmospheric dispersion model for generating main control room (MCR) and technical support center (TSC) χ/Q values. In reviewing this table, the staff has the following comments:

1. Delete the parameter "temperature sensor separation." This is not an input parameter to ARCON96.
2. Delete the parameter "Annual average mixing layer height." This is not an input parameter to ARCON96.
3. Add an input parameter titled "release mode" along with a corresponding input values (i.e., ground-level) for each release pathway.
4. Revised the parameter "wind instrument heights" value to indicate that this is a site-specific input.
5. Revised the parameter "meteorological channel units of measure" title to "wind speed units" and revise the corresponding value to indicate that this is a site-specific input.
6. Add an input parameter titled "building area" along with corresponding input values for each modeled source-receptor combination.
7. Add an input parameter titled "vertical velocity" along with corresponding input values for each release pathway.
8. Add an input parameter titled "stack flow" along with corresponding input values for each release pathway.
9. Add an input parameter titled "stack radius" along with corresponding input values for each release pathway.
10. Add an input parameter titled "elevation difference" along with corresponding input values for each modeled source-receptor combination.
11. Add an input parameter titled "direction to source" along with corresponding input values (i.e., degrees from plant north) for each modeled source-receptor combination.
12. Add an input parameter titled "initial diffusion coefficients" along with corresponding input values for each modeled source-receptor combination.

Staff guidance on the input values for each of the input parameters identified above is provided in Appendix A to RG 1.194. Identify and justify any deviations from the guidance provided in RG 1.194.

Response to Question 02.03.04-7:

U.S. EPR FSAR Tier 2, Table 2.3-1 will be replaced with the following table:

Table 2.3-1—ARCON96 Input Parameters for Control Room χ/Q values (2 Sheets)

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
Control Room air intake horizontal distance to Material Lock (for the Equipment Hatch release)	97.5 meters

Table 2.3-1—ARCON96 Input Parameters for Control Room χ/Q values (2 Sheets)

Parameter	Value(s)
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 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

FSAR Impact:

U.S. EPR FSAR Tier 2, Table 2.3-1 will be revised as described in the response and indicated on the enclosed markup.

Question 02.03.04-8:

POTENTIAL OPEN ITEM

This question is related to the applicant's response to RAI 02.03.04-4. The staff finds the response to RAI 02.03.04-4 incomplete.

The response to RAI 02.03.04-4 provided a table which was intended to list values for all the ARCON96 atmospheric dispersion input parameters for generating main control room (MCR)/technical support center (TSC) intake χ/Q values. Provide another similar table for FSAR Tier 2 Section 2.3.4 which list values for all the ARCON96 atmospheric dispersion input parameters for generating MCR/TSC unfiltered inleakage χ/Q values. The issues identified in RAI 02.03.04-7 should also be addressed in responding to this RAI.

Response to Question 02.03.04-8:

The following table will be added to U.S. EPR FSAR Tier 2, Section 2.3.4 as Table 2.3-2, and a corresponding reference to the table provided in Section 2.3.4:

Table 02.03.04-8-1—ARCON96 Input Parameters for Unfiltered Inleakage Control Room χ/Q Values (2 Sheets)

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 SG-2 Silencer SG-3 Silencer SG-4 Silencer	 70.0 meters 62.0 meters 22.0 meters 32.0 meters

Table 02.03.04-8-1—ARCON96 Input Parameters for Unfiltered Inleakage Control Room χ/Q Values (2 Sheets)

Parameter	Value(s)
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) 2) Southeast side of SAB Div. 4	 12.7 meters 45.3 meters
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 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

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 2.3.4 will be revised and Table 2.3-2 will be added as described in the response and indicated on the enclosed markup.

Question 02.03.05-6:

POTENTIAL OPEN ITEM

This question is related to the applicant's response to RAI 02.03.05-4.

Include the annual average ground deposition (D/Q) value of 5.0E-08 m^{-2} (which is listed as an input to the GASPAR II computer code in FSAR Tier 2 Table 11.3-4) as a site parameter in FSAR Tier 2 Table 2.1-1.

Table 1 in Appendix A to SRP 2.0 lists routine release D/Q values at the site boundary as an example of a site parameter that should be listed in a design certification.

Response to Question 02.03.05-6:

A response to this question will be provided by April 2, 2010.

Question 02.03.05-7:

POTENTIAL OPEN ITEM

This question is related, in part, to the applicant's response to RAI 02.03.04-4.

The legend in FSAR Tier 2 Figure 1.2-3 (Plant Configuration) defines location "UKH" as the "vent stack."

1. Confirm that this is the same release location for the gaseous waste management system which is referred to as the "nuclear auxiliary building ventilation stack" in FSAR Tier 2 Section 11.3.1.2.3 and the "plant stack" in FSAR Tier 2 Section 11.3.3.3.
2. Confirm that this is the same release location for several design-basis accidents which is referred to as the "main stack" throughout FSAR Tier 2 Section 15.0.3.
3. Compare and explain the bases for the assumptions that (1) the release point for the gaseous waste management system is at the top of the plant stack (i.e., release height of 211 feet (64.3 meters) per FSAR Tier 2 Section 11.3.3.3) versus (2) one of the release points for many of the design-basis accidents is at the base of the main stack (i.e., release height of 32.1 meters per Table 2.3-3 provided in the response to RAI 02.03.04-4).
4. Confirm that the release point for the gaseous waste management system is uncapped and vertically oriented.

Response to Question 02.03.05-7:

1. The vent stack defined as "UKH" in U.S. EPR FSAR Tier 2, Figure 1.2-3 is the same release location as the "Nuclear Auxiliary Building (NAB) ventilation stack" in U.S. EPR FSAR Tier 2, Section 11.3.1.2.3 and the "plant stack" in Tier 2, Section 11.3.3.3.
2. The vent stack defined as "UKH" in U.S. EPR FSAR Tier 2, Figure 1.2-3 is the same release location as the "main stack" referred to for several design-basis accidents in U.S. EPR FSAR Tier 2, Section 15.0.3.
3. Normal effluent releases (non-safety-related) are via the vent stack. Design basis accident releases (safety-related) assume that the vent stack is not standing, i.e, it is conservatively assumed that the stack height cannot be credited for atmospheric dispersion.
4. A response to this question will be provided by April 2, 2010.

FSAR Impact:

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

U.S. EPR Final Safety Analysis Report Markups

Table 5.0-1—Site Parameters for the U.S. EPR Design
(4 3 Sheets)

Precipitation	
Parameter	**Value(s)**
Rainfall rate	≤19.4 in/hr
Normal winter precipitation event ground loadNormal ground precipitation load	≤100 psf (100-year Mean Recurrence Interval)
Normal winter precipitation event roof loadNormal roof precipitation load	≤70 psf (100-year Mean Recurrence Interval)
Extreme liquid winter precipitation event roof load48-hour PMWP liquid roof load	0 psf (1)
Extreme frozen winter precipitation event ground load48-hour PMWP frozen ground load	≤43 psf (based on 55 inches)
Extreme frozen winter precipitation event roof load48-hour PMWP frozen roof load	≤30 psf
Extreme roof winter precipitation load	≤100 psf (100-year Mean Recurrence Interval)
Seismology	
Parameter	**Value(s)**
Seismology (SSE response spectra)	Horizontal design ground motion shall be the certified seismic design response spectra shapes anchored to a peak ground acceleration of 0.3 g (see Figure 5.0-1). Vertical spectra shall be the same as the horizontal spectra (see Figure 5.0-1).
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.

02.03.01-15

Table 2.1-1—U.S. EPR Site Design Envelope
Sheet 1 of 7

U.S. EPR Site Design Envelope	
Precipitation (Refer to Section 2.4)	
02.03.01-15	
Rainfall rate	≤19.4 in/hr
Normal winter precipitation event ground loadNormal ground precipitation load	≤100 psf (100-year MRI)
Normal winter precipitation event roof loadNormal roof precipitation load	≤70 psf (100-year MRI)
Extreme liquid winter precipitation event roof load48-hour PMWP liquid roof load	0 psf(1)
Extreme frozen winter precipitation event ground load48-hour PMWP frozen ground load	≤43 psf (based on 55 inches)
Extreme frozen winter precipitation roof ground load48-hour PMWP frozen roof load	≤30 psf
Extreme winter precipitation roof load	≤100 psf (100-year MRI)
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 SSC in U.S. EPR design certification.

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.

02.03.04-7

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

02.03.04-8

Table 2.3-2—ARCON96 Input Parameters for Unfiltered Inleakage Control Room χ/Q ValuesTable—Table 2.3-1Input Parameters for 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.

Table 2.3-1—ARCON 96 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—ARCON 96 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 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

Table 2.3-1Input 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)
Meteorological 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 required 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

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

Parameter	Value(s)
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 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 SG-2 Silencer SG-3 Silencer SG-4 Silencer	 70.0 meters 62.0 meters 22.0 meters 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) 2) Southeast side of SAB Div. 4	 12.7 meters 45.3 meters
Unfiltered inleakage air intake horizontal distance to Material Lock (for the Equipment Hatch release)	75.2 meters

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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 the depressurization shaft of Safeguard Building Div. 4	17.3 meters
Release heights	Silencer – 33.9 meters Stack – 33.9 meters 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

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