RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.:	**174-8211**
SRP Section:	**02.03.04 - Short Term Atmospheric Dispersion Estimates for Accident Releases**
Application Section:	**02.03.04**
Date of RAI Issue:	**08/26/2015**

Question No. 02.03.04-4

As stated in SRP Section 2.3.4, 10 CFR 50 Appendix A, GDC 19 provides the requirements related to the meteorological considerations used to evaluate the personnel exposures inside the control room during radiological and airborne hazardous material accident conditions. Regulatory Guide 1.183 discusses the need to provide an evaluation of the radiological consequences of design basis-accidents at the Emergency Response Facility, otherwise known as the Technical Support Center (Paragraph IV.E.8 of Appendix E to 10 CFR Part 50).

FSAR Section 2.3.4 provides a description of short-term atmospheric dispersion estimates for onsite locations such as the main control room (MCR) and the auxiliary building (AB) air intakes. FSAR Section 15.0.3.5, “Atmospheric Dispersion Factor,” states, “The MCR and TSC χ/Q values are described in Subsection 2.3.4 and given in Tables 2.3-2 through 2.3-12.” FSAR Section 15.1.5.5.2 states, “The χ/Q values used in the analysis for EAB, LPZ, MCR, and TSC are described in Subsection 2.3.4 and are given in Tables 2.3-2 through 2.3-12.” This implies that the intakes for the MRC are the same receptors used for the Technical Support Center (TSC). However, there is no mention of the TSC in Tier 2, Section 2.3.4 or any of the associated tables and figures.

(1) Update the text in FSAR Tier 2, Section 2.3.4, to clarify that the short-term atmospheric dispersion factors (χ/Qs) for onsite locations related to the MCR and AB also apply to the TSC.

(2) Update any applicable descriptions in FSAR Tables 2.3-2 through 2.3-13 and Figure 2.3-1 to clarify that the short-term atmospheric dispersion factors (χ/Qs) for onsite locations related to the MCR and AB also apply to the TSC.

Response

(1) Since the Technical Support Center (TSC) of APR1400 is located in the same control room envelope with the MCR, the radiological impact on the TSC is considered to be the same as the one for the MCR. This is indicated in DCD Subsection 6.4.2.1. For clarity, DCD Section 2.3.4 will be updated to add TSC as indicated in Attachment 1.

(2) DCD Tables 2.3-2, 2.3-4, 2.3-5, 2.3-7 through 2.3-9, 2.3-10 and 2.3-12 will be updated to clearly indicate that the short-term onsite atmospheric dispersion factors for MCR also apply to TSC as indicated in the markups in Attachment 2.

Impact on DCD

DCD section 2.3.4 will be revised as indicated in Attachment 1 and 2.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Reports.

influence of the plant and its facilities on local meteorology, and local meteorological conditions for design and operating bases.

2.3.3 Onsite Meteorological Measurements Program

Preoperational and operational programs for measuring meteorological conditions at the site, including offsite satellite facilities, are provided in this subsection in accordance with NRC RG 1.23 (Reference 4). A meteorological tower and instrumentation for onsite meteorological measurements are described in these programs.

2.3.4 Short-Term Atmospheric Dispersion Estimates for Accident Releases

The short-term atmospheric dispersion factors (χ/Qs) for offsite locations, such as the exclusion area boundary (EAB) and the outer boundary of the low-population zone (LPZ), and onsite locations such as the main control room (MCR) and auxiliary building (AB) air intakes, are conservatively determined as follows:

and technical support center (TSC),

a. The offsite χ/Qs used for the APR1400 design are listed in Table 2.3-1. In particular, the 2-hour EAB χ/Q of 1.0×10^{-3} sec/m^3 is the conservative value recommended in the Electric Power Research Institute (EPRI) Utility Requirements Document (URD) (Reference 5) for enveloping U.S. sites. The χ/Qs for the outer boundary of the LPZ are also selected to be conservative values applicable to U.S. sites.

b. Onsite χ/Qs for the APR1400 are calculated using the guidance in NRC RG 1.194 (Reference 6), NRC-approved ARCON96 computer code (Reference 7), and representative meteorological data selected from the publicly available meteorological data for some U.S. sites. The results from these analyses were used to establish the χ/Qs for the APR1400 design.

c. The 95th percentile onsite χ/Qs for the MCR and auxiliary building normal air intakes due to post-accident releases from various potential post-accident release locations are summarized in Tables 2.3-2 through 2.3-12. The input variables including post-accident gaseous vent and intake locations used in calculating the accident χ/Qs are shown in Table 2.3-13 and Figure 2.3-1, respectively.

and TSC,

Table 2.3-2

Onsite χ/Q for Reactor Containment Building Release to ~~MCR~~ North and South Intakes and MCR Roof Centerline

Time Interval (hr)	Onsite χ/Q (s/m^3) Containment Building to ~~MCR~~ North Intake	~~MCR~~ South Intake	MCR Roof Centerline
0–2	3.73E-04	3.39E-04	3.92E-04
2–8	3.17E-04	1.91E-04	3.00E-04
8–24	1.38E-04	8.42E-05	1.29E-04
24–96	1.02E-04	5.59E-05	9.11E-05
96–720	7.84E-05	3.94E-05	7.05E-05

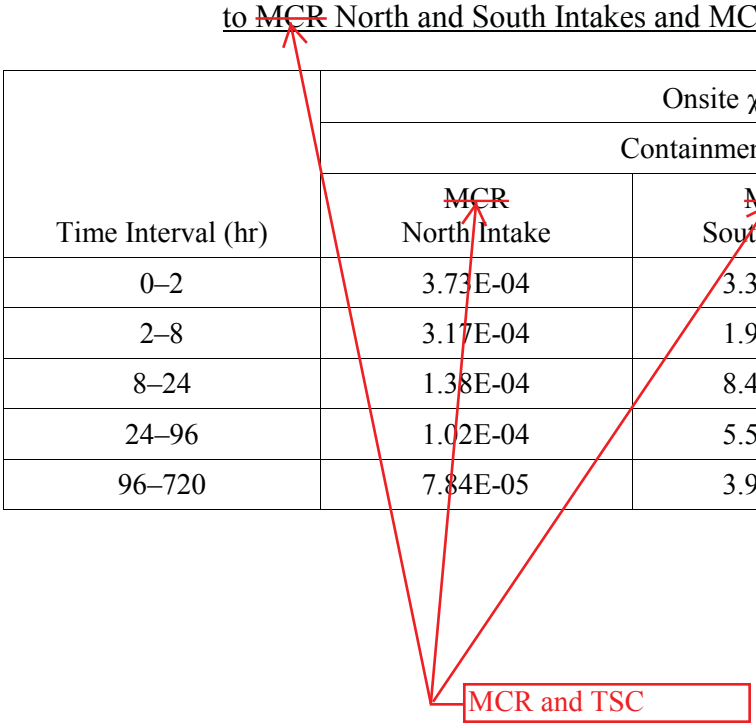

Table 2.3-4

Onsite χ/Q for North and South Main Steam Valve Room
Direct Releases to ~~MCR~~ North and South Intakes

Time Interval (hr)	Onsite χ/Q (s/m^3)	
	North Main Stream Valve Room to ~~MCR~~ North Intake	South Main Stream Valve Room to ~~MCR~~ South Intake
0–2	2.68E-03	5.63E-03
2–8	2.10E-03	4.43E-03
8–24	9.17E-04	1.93E-03
24–96	6.38E-04	1.29E-03
96–720	5.06E-04	1.01E-03

Table 2.3-5

Onsite χ/Q for North and South Main Steam Valve Room Cross Releases to ~~MCR~~ North and South Intakes

Time Interval (hr)	Onsite χ/Q (s/m^3)	
	North Main Stream Valve Room to ~~MCR~~ South Intake	South Main Stream Valve Room to ~~MCR~~ North Intake
0–2	2.33E-04	2.57E-04
2–8	1.32E-04	2.10E-04
8–24	5.48E-05	9.21E-05
24–96	3.58E-05	5.79E-05
96–720	2.72E-05	4.54E-05

Table 2.3-7

Onsite χ/Q for North and South Atmospheric
Dump Valve Releases to ~~MCR~~ North and South Intakes

Time Interval (hr)	Onsite χ/Q (s/m^3)	
	North ADV to ~~MCR~~ North Intake	South ADV to ~~MCR~~ South Intake
0–2	1.46E-03	2.61E-03
2–8	1.14E-03	2.01E-03
8–24	4.99E-04	8.79E-04
24–96	3.43E-04	5.76E-04
96–720	2.68E-04	4.63E-04

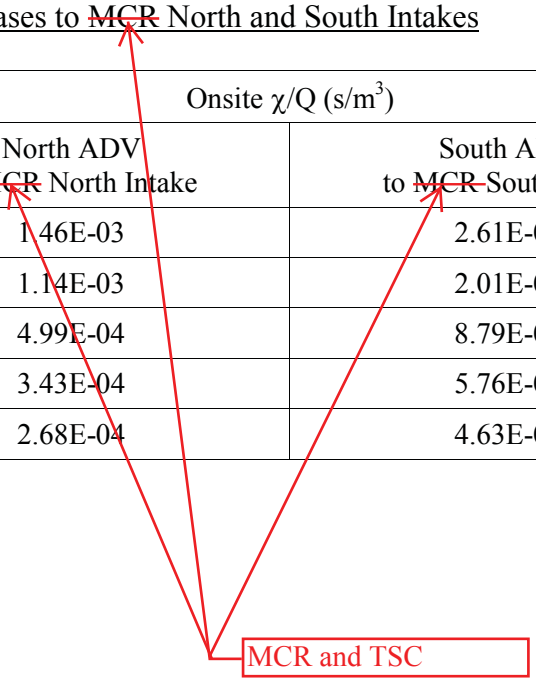

Table 2.3-8

Onsite χ/Q for North and South Main Steam
Safety Valve Releases to ~~MCR~~ North and South Intakes

Time Interval (hr)	Onsite χ/Q (s/m^3)	
	North Main Steam Safety Valves to ~~MCR~~ North Intake	South Main Steam Safety Valves to ~~MCR~~ South Intake
0–2	1.18E-03	1.88E-03
2–8	9.08E-04	1.52E-03
8–24	3.99E-04	6.60E-04
24–96	2.72E-04	4.29E-04
96–720	2.12E-04	3.45E-04

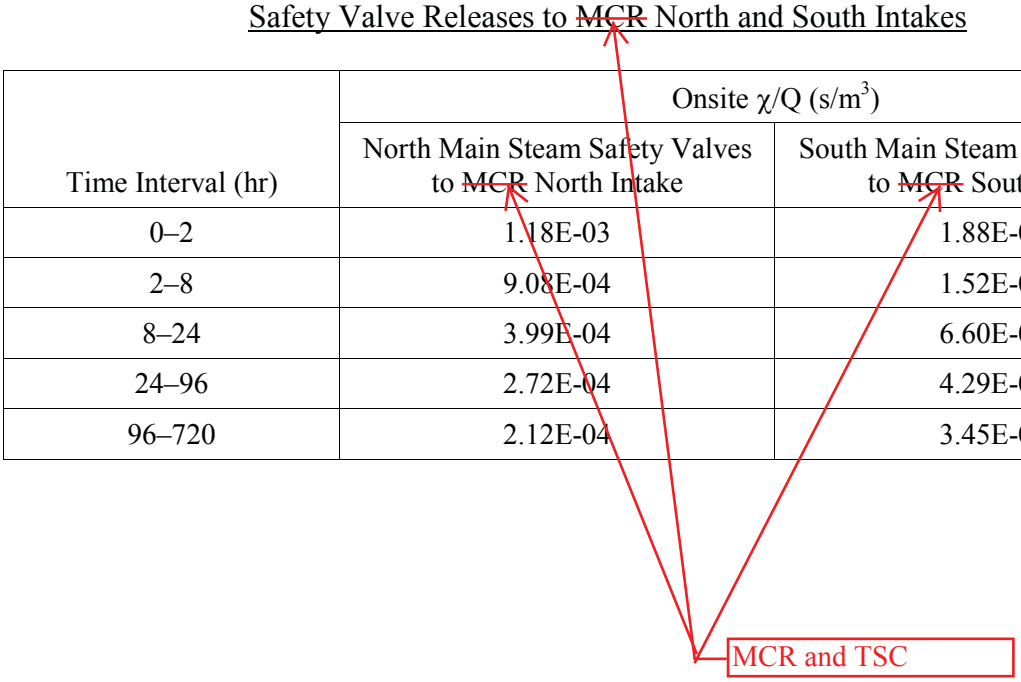

Table 2.3-9

Onsite χ/Q Values for Auxiliary Building
North Exhaust Release to ~~MCR~~ North and South Intakes

Time Interval (hr)	Onsite χ/Q (s/m^3)	
	Auxiliary Building North Exhaust To	
	~~MCR~~ North Intake	~~MCR~~ South Intake
0–2	6.88E-04	1.79E-04
2–8	5.16E-04	9.04E-05
8–24	2.27E-04	4.01E-05
24–96	1.58E-04	2.91E-05
96–720	1.25E-04	2.14E-05

Table 2.3-10

Onsite χ/Q for Auxiliary Building South Exhaust Release to ~~MCR~~ North and South Intakes

Time Interval (hr)	Onsite χ/Q (s/m^3)	
	Auxiliary Building South Exhaust To	
	~~MCR~~ North Intake	~~MCR~~ South Intake
0–2	1.05E-04	2.12E-04
2–8	8.79E-05	1.68E-04
8–24	3.96E-05	7.37E-05
24–96	2.76E-05	5.04E-05
96–720	2.14E-05	3.92E-05

MCR and TSC

Table 2.3-12

Onsite χ/Q for Fuel Handling Area Exhaust Release to ~~MCR~~ North and South Intakes

Time Interval (hr)	Onsite χ/Q (s/m^3) Fuel Handling Area To ~~MCR~~ North Intake	Onsite χ/Q (s/m^3) Fuel Handling Area To ~~MCR~~ South Intake
0–2	1.52E-04	2.59E-04
2–8	1.31E-04	2.04E-04
8–24	6.02E-05	8.98E-05
24–96	4.01E-05	5.93E-05
96–720	3.19E-05	4.58E-05

MCR and TSC

Table 2.3-13 (1 of 6)

Design Input for ARCON96 Calculation

Parameter		Value
Meteorological Data		Prairie Island (1993–1997)
Source Release Category		
< From >	< To >	< Source Type >
Reactor Containment Building	~~MCR~~ Intakes MCR Roof Centerline Auxiliary Building Intakes	Diffuse area source Diffuse area source Diffuse area source
North and South Main Steam Valve Room	~~MCR~~ Intakes Auxiliary Building Intakes	Ground level point sources Ground level point sources
North and South Atmospheric Dump Valves	~~MCR~~ Intakes	Ground level point sources
North and South Main Steam Valves	~~MCR~~ Intakes	Ground level point sources
North Auxiliary Building South Auxiliary Building South Auxiliary Building	~~MCR~~ Intakes ~~MCR~~ Intakes Auxiliary Building Intakes	Ground level point sources Ground level point sources Ground level point sources
Fuel Handling Area	~~MCR~~ Intakes	Ground level point sources
~~MCR~~ Intake (Receptor)		
Characteristics ~~MCR~~ intakes MCR roof Auxiliary building intakes (infiltration path way) Reduction of χ/Qs ~~MCR~~ intakes Auxiliary building intakes (infiltration path way)		 Dual ~~MCR~~ intakes Single point at roof center Dual AB intakes Factor of 8 Factor of 2

"~~MCR~~" in Table 2.3-13 should be replaced with "MCR and TSC"

APR1400 DCD TIER 2

Table 2.3-13 (2 of 6)

Parameter		Value
Source – Receptor Horizontal Distance		
< From >	< To >	< Distance (m) >
Reactor Containment Building	~~MCR~~ North Intakes	36.72
	~~MCR~~ South Intakes	33.92
	MCR Roof Centerline	33.76
	Auxiliary Building North Intakes	26.80
	Auxiliary Building South Intakes	26.80
North Main Steam Valve Room	~~MCR~~ North Intakes	19.80
South Main Steam Valve Room	~~MCR~~ South Intakes	12.56
North Main Steam Valve Room	~~MCR~~ South Intakes	64.43
South Main Steam Valve Room	~~MCR~~ North Intakes	66.20
North Main Steam Valve Room	Auxiliary Building North Intakes	22.30
South Main Steam Valve Room	Auxiliary Building South Intakes	22.30
North Atmospheric Dump Valves	~~MCR~~ North Intakes	26.65
South Atmospheric Dump Valves	~~MCR~~ South Intakes	19.36
North Main Steam Valves	~~MCR~~ North Intakes	29.86
South Main Steam Valves	~~MCR~~ South Intakes	22.56
North Auxiliary Building	~~MCR~~ North Intakes	39.10
North Auxiliary Building	~~MCR~~ South Intakes	73.35
South Auxiliary Building	~~MCR~~ South Intakes	109.24
South Auxiliary Building	~~MCR~~ North Intakes	73.53
South Auxiliary Building	Auxiliary Building North Intakes	101.26
South Auxiliary Building	Auxiliary Building South Intakes	84.42
Fuel Handling Area	~~MCR~~ North Intakes	88.21
Fuel Handling Area	~~MCR~~ South Intakes	64.04

"~~MCR~~" in Table 2.3-13 should be replaced with "MCR and TSC"

Table 2.3-13 (3 of 6)

Parameter		Value
Source – Receptor Direction		
< From >	< To >	< Degree (°) >
Reactor Containment Building	~~MCR~~ North Intakes	137.57
	~~MCR~~ South Intakes	35.26
	MCR Roof Centerline	90.00
	Auxiliary Building North Intakes	120.00
	Auxiliary Building South Intakes	60.00
North Main Steam Valve Room	~~MCR~~ North Intakes	99.75
South Main Steam Valve Room	~~MCR~~ South Intakes	74.62
North Main Steam Valve Room	~~MCR~~ South Intakes	10.92
South Main Steam Valve Room	~~MCR~~ North Intakes	162.86
North Main Steam Valve Room	Auxiliary Building North Intakes	73.20
South Main Steam Valve Room	Auxiliary Building South Intakes	106.80
North Atmospheric Dump Valves	~~MCR~~ North Intakes	93.60
South Atmospheric Dump Valves	~~MCR~~ South Intakes	85.03
North Main Steam Valves	~~MCR~~ North Intakes	93.49
South Main Steam Valves	~~MCR~~ South Intakes	85.37
North Auxiliary Building	~~MCR~~ North Intakes	93.80
North Auxiliary Building	~~MCR~~ South Intakes	26.60
South Auxiliary Building	~~MCR~~ South Intakes	132.80
South Auxiliary Building	~~MCR~~ North Intakes	92.52
South Auxiliary Building	Auxiliary Building North Intakes	125.34
South Auxiliary Building	Auxiliary Building South Intakes	101.92
Fuel Handling Area	~~MCR~~ North Intakes	127.85
Fuel Handling Area	~~MCR~~ South Intakes	76.79

"~~MCR~~" in Table 2.3-13 should be replaced with "MCR and TSC"

Table 2.3-13 (4 of 6)

Parameter		Value
Building Wake Area		
< From >	< To >	< Area (m^2) >
Reactor Containment Building	~~MCR~~ North Intakes	3,167
	~~MCR~~ South Intakes	3,167
	MCR Roof Centerline	3,167
	Auxiliary Building North Intakes	3,167
	Auxiliary Building South Intakes	3,167
North Main Steam Valve Room	~~MCR~~ North Intakes	880
South Main Steam Valve Room	~~MCR~~ South Intakes	406
North Main Steam Valve Room	~~MCR~~ South Intakes	3,167
South Main Steam Valve Room	~~MCR~~ North Intakes	3,167
North Main Steam Valve Room	Auxiliary Building North Intakes	1,878
South Main Steam Valve Room	Auxiliary Building South Intakes	1,241
North Atmospheric Dump Valves	~~MCR~~ North Intakes	880
South Atmospheric Dump Valves	~~MCR~~ South Intakes	406
North Main Steam Valves	~~MCR~~ North Intakes	880
South Main Steam Valves	~~MCR~~ South Intakes	406
North Auxiliary Building	~~MCR~~ North Intakes	880
North Auxiliary Building	~~MCR~~ South Intakes	3,167
South Auxiliary Building	~~MCR~~ South Intakes	3,167
South Auxiliary Building	~~MCR~~ North Intakes	406
South Auxiliary Building	Auxiliary Building North Intakes	3,167
South Auxiliary Building	Auxiliary Building South Intakes	406
Fuel Handling Area	~~MCR~~ North Intakes	3,167
Fuel Handling Area	~~MCR~~ South Intakes	406

"~~MCR~~" in Table 2.3-13 should be replaced with "MCR and TSC"

Table 2.3-13 (5 of 6)

Parameter		Value
Release Height		
< From >	< To >	< Height (m) >
Reactor Containment Building	~~MCR~~ North Intakes ~~MCR~~ South Intakes MCR Roof Centerline Auxiliary Building North Intakes Auxiliary Building South Intakes	54.0 54.0 54.0 54.0 54.0
North Main Steam Valve Room South Main Steam Valve Room North Main Steam Valve Room South Main Steam Valve Room North Main Steam Valve Room South Main Steam Valve Room	~~MCR~~ North Intakes ~~MCR~~ South Intakes ~~MCR~~ South Intakes ~~MCR~~ North Intakes Auxiliary Building North Intakes Auxiliary Building South Intakes	25.3 25.3 25.3 25.3 25.3 25.3
North Atmospheric Dump Valves South Atmospheric Dump Valves	~~MCR~~ North Intakes ~~MCR~~ South Intakes	24.0 24.0
North Main Steam Valves South Main Steam Valves	~~MCR~~ North Intakes ~~MCR~~ South Intakes	24.0 24.0
North Auxiliary Building North Auxiliary Building South Auxiliary Building South Auxiliary Building South Auxiliary Building South Auxiliary Building	~~MCR~~ North Intakes ~~MCR~~ South Intakes ~~MCR~~ South Intakes ~~MCR~~ North Intakes Auxiliary Building North Intakes Auxiliary Building South Intakes	34.8 34.8 24.4 24.4 24.4 24.4
Fuel Handling Area Fuel Handling Area	~~MCR~~ North Intakes ~~MCR~~ South Intakes	17.0 17.0

"~~MCR~~" in Table 2.3-13 should be replaced with "MCR and TSC"

Table 2.3-13 (6 of 6)

Parameter	Value
Intake Height from Ground Level	
~~MCR~~ intakes	25.8 m
MCR roof centerline	24.4 m
Auxiliary building intakes (infiltration path way)	32.0 m
Surface Roughness Length	0.2 m
Minimum Wind Speed	0.5 m/s
Average Sector Width Constant	4.3
Lower Measurement Height for Meteorological Data	10.0 m
Intermediate Measurement Height for Meteorological Data	60.0 m
Wind Speed Units for Meteorological Data	Miles per hour (mph)
Vertical Diffusion Area Coefficient (σ_{Z0})	
Reactor containment building – ~~MCR~~ intakes	0.0 m
Reactor containment building – MCR roof centerline	0.0 m
Reactor containment building – auxiliary building intakes	0.0 m
Horizontal Diffusion Area Coefficient(1) (σ_{Y0})	
Reactor containment building – ~~MCR~~ intakes	8.0 m
Reactor containment building – MCR roof centerline	8.0 m
Reactor containment building – auxiliary building intakes	8.0 m

(1) Width of Diffuse Area $\times \frac{1}{6}$: Horizontal diffusion area coefficients are calculated by this equation described in Reference 6.

"~~MCR~~" in Table 2.3-13 should be replaced with "MCR and TSC"

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.:	**174-8211**
SRP Section:	**02.03.04 - Short Term Atmospheric Dispersion Estimates for Accident Releases**
Application Section:	**02.03.04**
Date of RAI Issue:	**08/26/2015**

Question No. 02.03.04-5

The Staff considered the Applicant's responses to RAI Question Nos. 02.03.04-2 and 02.03.04-3 (see ML15132A599 and ML15132A600, dated May 12, 2015). These questions pertained to the accident-related atmospheric dispersion modeling analyses in the Revision 0 submittal of Section 2.3.4 of the Korea Hydro and Nuclear Power Co., Ltd. (KHNP) application for Design Certification (DC) of the APR1400 Standard Design (ML15006A059).

In particular, the items under RAI Question No. 02.03.04-2 sought clarification, through revision of Tier 2, DCD Figure 2.3-1, of several air intake and potential radiological release locations to be considered in the atmospheric dispersion modeling analyses in Section 2.3.4 using the ARCON96 dispersion model. Those results provide direct input to onsite Control Room (CR) and Technical Support Center (TSC) dose calculations for design-basis accidents in Chapter 15. RAI Question 02.03.04-3 requested verification and clarification of the relationship between the Applicant's dispersion analyses to develop CR and TSC site parameter values and the use of meteorological data from the existing Prairie Island nuclear generating plant.

SRP Acceptance Criterion (6) under Subsection II (Acceptance Criteria) of NUREG-0800 for Section 2.3.4 calls for "a site plan drawn to scale….showing True North and potential atmospheric release pathways, control room intake, and unfiltered inleakage pathways" to be provided. The Applicant's responses to the items under RAI Question No. 02.03.04-2 provided the requested clarifications including revisions to Tier 2, DCD Figure 2.3-1.

Tier 2, DCD Table 2.3-13 (Pages 1 to 6 of 6), as revised, list design input parameters to the ARCON96 dispersion modeling and include various source-receptor pairs. The resulting site parameter relative concentration (X/Q) values are listed in Tier 2, DCD Tables 2.3-2 through 2.3-12. However, it does not appear that all possible source-receptor combinations shown in Tier 2, DCD Figure 2.3-1 have been considered.

Further, Tier 2, DCD Figure 2.3-1 is referenced to Plant North. The Staff understands this to be appropriate at the DC stage and that a site-specific orientation of the layout will be determined

by the Combined License (COL) (under 10 CFR Part 52) or Operating License (OL) (under 10 CFR Part 50) applicant. Nevertheless, source receptor combinations not modeled in the DCD may apply to some COL or OL applicants and could represent the controlling conditions for a given accident scenario (e.g., based on worse dispersion conditions for a given source-receptor combination and orientation that is farther apart). Therefore, the Applicant should address the following technical issues:

(1) Identify the source-receptor pairs that have not been evaluated and, given the above, provide technical justification for not having done so for each. If additional modeling is necessary, revise the affected site parameter values, text, and associated current or new tables.

(2) The Applicant's response to RAI Question 02.03.04-3 indicates that the decision to use the Prairie Island meteorological data from among the six site locations considered (i.e., San Onofre, Hope Creek, Prairie Island, Quad Cities, Limerick, and J.A. Fitzpatrick) was based on using these data and the APR1400 design-specific source-receptor design parameters to perform a sensitivity analysis to identify the most conservative data for the Control Room habitability analysis.

Explain in more detail the scope and limitations of the sensitivity analysis and whether it simply evaluated variations in X/Qs for the various source-receptor pairs considered based on presumably different meteorological conditions from among the six sites, or because wind direction measurements are referenced to True North whether different plant layout orientations were also accounted for using each meteorological data set.

Response

(1) In order to identify any missing source-receptor pairs that are not provided in DCD Tables 2.3-2 through 2.3-12, all possible forty one (41) source-receptor combinations are listed and described in Table 1. As indicated in Table 1, among these possible combinations, the pairs for cross release-intake cases, e.g. south vent to north intake or north vent to south intake, are always bounded by the cases for parallel release-intake cases, e.g. north vent to north intake or south vent to south intake, as presented in DCD Tables 2.3-4 and Table 2.3-5.

The onsite X/Q value for the Pair No. 33 (MSV South Vent to AB South Intake) is bounding Pairs No. 22 through 27, 32, and 34 through 37. The X/Q value for Pair No. 39 (AB South Vent to AB South Intake) bounds Pairs No. 28, 29 and 38.

As a result of review, it was found that the following two pairs were not included in DCD; Pair No. 28 (AB north vent to the AB north intake) and Pair No. 40 (Fuel handling area vent to the AB south intake). As described above, Pair No. 28 is bounded by Pair No. 39. The onsite X/Q value for Pair No. 40 was used for fuel handling accident, although it was not provided in the DCD. For the clarity, Pairs No. 28 and 40 will be added in DCD Tables as indicated in Attachment.

Table 1. Combinations of Source-Receptor Pairs for Onsite χ/Q

Pair No.	Source Point	Receptor Point	Remarks
1	Containment Building Surface	MCR Roof Centerline	Table 2.3-2
2	Main Steam Valve Room North Vent	MCR North Intake	Table 2.3-4
3	Main Steam Valve Room South Vent		Table 2.3-5
4	Atmospheric Dump Valve North Vent		Table 2.3-7
5	Atmospheric Dump Valve South Vent		Bounded by Pair No. 15
6	Main Steam Safety Valve North Vent		Table 2.3-8
7	Main Steam Safety Valve South Vent		Bounded by Pair No. 17
8	Auxiliary Building North Vent		Table 2.3-9
9	Auxiliary Building South Vent		Table 2.3-10
10	Fuel Handling Area Vent		Table 2.3-12
11	Containment Building Surface		Table 2.3-2
12	Main Steam Valve Room North Vent	MCR South Intake	Table 2.3-5
13	Main Steam Valve Room South Vent		Table 2.3-4
14	Atmospheric Dump Valve North Vent		Bounded by Pair No. 4
15	Atmospheric Dump Valve South Vent		Table 2.3-7
16	Main Steam Safety Valve North Vent		Bounded by Pair No. 8
17	Main Steam Safety Valve South Vent		Table 2.3-8
18	Auxiliary Building North Vent		Table 2.3-10
19	Auxiliary Building South Vent		Table 2.3-9
20	Fuel Handling Area Vent		Table 2.3-12
21	Containment Building Surface		Table 2.3-2
22	Main Steam Valve Room North Vent	Auxiliary Building North Intake	Bounded by Pair No. 33
23	Main Steam Valve Room South Vent		Bounded by Pair No. 33
24	Atmospheric Dump Valve North Vent		Bounded by Pair No. 35
25	Atmospheric Dump Valve South Vent		Bounded by Pair No. 35
26	Main Steam Safety Valve North Vent		Bounded by Pair No. 37
27	Main Steam Safety Valve South Vent		Bounded by Pair No. 37
28	Auxiliary Building North Vent		Bounded by Pair No. 39. But, this pair will be added in Table 2.3-11
29	Auxiliary Building South Vent		Bounded by Pair No. 39
30	Fuel Handling Area Vent		Bounded by Pair No. 40
31	Containment Building Surface		Table 2.3-3
32	Main Steam Valve Room North Vent	Auxiliary Building South Intake	Bounded by Pair No. 22
33	Main Steam Valve Room South Vent		Table 2.3-6
34	Atmospheric Dump Valve North Vent		Bounded by Pair No. 24
35	Atmospheric Dump Valve South Vent		Bounded by Pair No. 33
36	Main Steam Safety Valve North Vent		Bounded by Pair No. 26
37	Main Steam Safety Valve South Vent		Bounded by Pair No. 33
38	Auxiliary Building North Vent		Bounded by Pair No. 28
39	Auxiliary Building South Vent		Table 2.3-11
40	Fuel Handling Area Vent		This pair will be added in Table 2.3-12
41	Containment Building Surface		Bounded by Pair No. 31

(2) The Onsite X/Qs listed in DCD Section 2.3 are determined based on the assumption that the True north meteorological data is the same as plant north. If all possible plant orientations are to be considered for the six U.S. site meteorological data, a huge amount of evaluations would need to be performed. Therefore, to avoid this complexity while providing conservatism in the analysis, the following approach is applied:

a. Publicly available U.S. site-specific onsite χ/Q values used in the AST license amendment requests (LARs) were investigated from NRC ADAMS database.

b. The U.S. site-specific onsite χ/Qs provided in Table 2 were reviewed to identify the most limiting χ/Q values. It should be noted that some of excessively high onsite χ/Qs in Table 2 (Seabrook and Waterford) are not due to the meteorological conditions of these sites but due to the limiting source-receptor geometries (i.e., short distance between the source and receptor points).

c. The APR1400 design-specific source-receptor geometric models are developed for the control room north intake (NI) and south intake (SI) for the releases from the north and south Main Steam Valve Room. These models potentially cover releases from both the north and south sides of the plant.

d. The ARCON96 code inputs are developed based on the APR1400 plant-specific design.

e. The publicly available meteorological data is selected for six (6) US sites namely San Onofre (Pacific Ocean), Hope Creek (Delaware River), Prairie Island (Mississippi River), Quad Cities (Mississippi River), Limerick (Schuylkill River), J.A FitzPatrick (Lake Ontario) and used in ARCON96 analyses. The meteorological data files for these plants are formatted for the ARCON96 use.

f. The four APR1400 design-specific release models developed in Steps (c) and (d) are calculated using ARCON96 code and the resulting χ/Qs were reviewed as provided in Tables 3 through 8.

g. The review of the χ/Q values in Tables 3 through 8 indicated that:

- The release from the Main Steam Valve Room South side (MSS) of the APR1400 plant results in the most limiting χ/Qs for the south CR intake (SI) with the Hope Creek meteorological data during the first 2 hours of an event (Table 4) and with the Quad Cities meteorological data after 2 hours (Table 6).

- The release from the south side (MSS) of the APR1400 plant results in higher χ/Qs for the north CR intake (NI) with the FitzPatrick meteorological data for all time intervals (Table 8).

- The release from the north side (MSN) of the APR1400 plant results in a higher χ/Qs for the north CR intake (NI) with the Prairie Island meteorological data during the first 2 hours of an event (Table 5), with the Quad Cities meteorological data from 2 to 24 hours (Table 6), and with the Prairie Island meteorological data after 24 hours (Table 5). A review of Tables 5 and 6 shows

that the differences between the Prairie Island and Quad Cities χ/Qs are minimal (< 5%) during the first 24 hours.

- The release from the north side (MSN) of the APR1400 plant results in a higher χ/Qs for the south CR intake (SI) with the Hope Creek meteorological data for all time intervals (Table 4).

As a result, it was found that no single site-specific meteorological condition provided the limiting χ/Qs for all four source-receptor geometries. To address the absence of a single site providing limiting χ/Q values for APR1400 source-receptor geometries, the onsite χ/Q values were analyzed using the 5-year Prairie Island meteorological hourly data, and the resulting χ/Q values are increased by 50% such that the modeled onsite χ/Q values become bounding for the US site meteorological conditions as indicated in Table 9.

Table 2. Onsite Control Room χ/Qs - Various US Sites

Release To Control Room	Control Room χ/Q Values 0 to 2 hrs	2 to 8 hrs	8 to 24 hrs	1 to 4 days	4 to 30 days	Reference AST License Amendment
Containment Surface Leakage						
Point Beach 1 & 2	1.39E-03	9.80E+04	3.84E-04	3.46E-04	3.02E-04	Table 3.1-1, 4/14/2011, ML110240054
San Onofre 2 & 3	1.01E-03	6.41E-04	1.77E-04	2.36E-04	2.20E-04	Table 2, 12/29/2006, ML063400359
Surry 1 & 2	6.74E-04	5.18E-04	2.22E-04	1.66E-04	1.20E-04	Table 2, 3/8/2002, ML020710159
HB Robinson 2	4.15E-03	2.74E-03	1.17E-03	8.18E-04	6.74E-04	Table 3.5-1, 9/24/2004, ML042680089
Seabrook 1	3.08E-03	2.17E-03	8.48E-04	6.31E-04	4.64E-04	Table 2, 2/24/2005, ML050320373
North Anna 1 & 2	1.23E-03	9.02E-04	3.57E-04	2.55E-04	1.91E-04	Table 1, 6/15/2005, ML051590510
Byron/Braidwood 1 & 2	1.01E-03	7.25E-04	3.07E-04	2.07E-04	1.46E-04	Table 1, 9/8/2006, ML062340420
Millstone 3	5.34E-04	3.23E-04	1.38E-04	8.78E-05	7.42E-05	Table 2, 9/15/2006, ML061990135
South Texas Project 1 & 2	2.17E-04	1.37E-04	6.15E-05	4.14E-05	2.30E-05	Table 2, 3/6/2008, ML080160013
Refueling Water Storage Tank (RWST) Release						
San Onofre 2 & 3	5.67E-04	2.25E-04	8.84E-05	8.97E-05	7.37E-05	Table 2, 12/29/2006, ML063400359
Oconee 1, 2 & 3	2.13E-04	1.61E-04	6.66E-05	5.19E-05	4.06E-04	Table 4, 6/1/2004, ML041540097
Seabrook 1	7.52E-03	3.85E-03	1.26E-03	9.29E-04	7.23E-04	Table 2, 2/24/2005 ML050320373
North Anna 1 & 2	2.18E-03	1.42E-03	4.89E-04	3.84E-04	2.72E-04	Table 1, 6/15/2005, ML051590510
Millstone 3	2.61E-04	1.59E-04	6.45E-05	4.83E-05	3.63E-05	Table 2, 9/15/2006, ML061990135
Point Beach 1 & 2	9.89E-03	7.98E-03	2.88E-03	2.75E-03	2.35E-03	Table 3.1-1, 4/14/2011, ML110240054
Atmospheric Dump Valve (ADV) Release						
Salem 1 & 2	1.57E-02	1.13E-02	4.24E-03	3.08E-03	2.26E-03	Table 2, 2/17/2006, ML060040322
San Onofre 2 & 3	3.70E-03	1.99E-03	6.95E-04	7.04E-04	6.34E-04	Table 2, 12/29/2006, ML063400359
Waterford 3	1.06E-01	7.45E-02	3.30E-02	2.31E-02	1.62E-02	Table 15, 3/29/2005, ML050890248
Seabrook 1	6.98E-04	2.79E-03	1.02E-03	7.54E-04	5.45E-04	Table 2, 2/24/2005, ML050320373
North Anna 1 & 2	1.04E-02	8.20E-03	3.23E-03	2.25E-03	1.68E-03	Table 1, 6/15/2005, ML051590510
Byron/Braidwood 1 & 2	8.14E-04	6.98E-04	3.12E-04	1.95E-04	1.67E-04	Table 1, 9/8/2006, ML062340420
South Texas Project 1 & 2	6.13E-04	3.27E-04	1.55E-04	1.01E-04	7.18E-05	Table 2, 3/6/2008, ML080160013
Main Steam Safety Valve (MSSV) Release						
Point Beach 1 & 2	4.66E-03	3.40E-03	1.17E-03	1.07E-03	9.05E-04	Table 3.1-1, 4/14/2011, ML110240054
Salem 1 & 2	1.57E-02	1.13E-02	4.24E-03	3.08E-03	2.26E-03	Table 2, 2/17/2006, ML060040322
San Onofre 2 & 3	1.22E-03	7.52E-04	2.48E-04	2.86E-04	2.60E-04	Table 2, 12/29/2006, ML063400359
Waterford 3	4.36E-02	3.08E-02	1.33E-02	9.01E-03	6.57E-03	Table 15, 3/29/2005, ML050890248
HB Robinson 2	2.60E-03	1.65E-03	7.22E-04	4.97E-04	4.01E-04	Table 3.5-1, 9/24/2004, ML042680089
Seabrook 1	8.22E-04	3.31E-03	1.24E-03	8.72E-04	5.86E-04	Table 2, 2/24/2005, ML050320373
Byron/Braidwood 1 & 2	8.14E-04	6.98E-04	3.12E-04	1.95E-04	1.67E-04	Table 1, 9/8/2006, ML062340420
Millstone 3	1.46E-03	8.76E-04	3.42E-04	2.71E-04	1.96E-04	Table 2, 9/15/2006, ML061990135

Table 2 (Cont'd) Onsite Control Room χ/Qs - Various US Sites

Release To Control Room	Control Room χ/Q Values					Reference AST License Amendment
	0 to 2 hrs	2 to 8 hrs	8 to 24 hrs	1 to 4 days	4 to 30 days	
Fuel Handling Building (FHA) Release						
San Onofre 2 & 3	9.48E-04	7.61E-04	1.92E-04	2.65E-04	2.43E-04	Table 2, 12/29/2006, ML063400359
Waterford 3	9.75E-04	7.74E-04	3.33E-04	2.22E-04	1.55E-04	Table 15, 3/29/2005, ML050890248
Surry 1 & 2	1.07E-03					Table 2, 3/8/2002, ML020710159
Oconee 1, 2 & 3	5.38E-04	3.74E-04	1.57E-04	1.24E-04	1.01E-04	Table 4, 6/1/2004, ML041540097
HB Robinson 2	1.34E-03	1.02E-03	4.31E-04	3.21E-04	2.56E-04	Table 3.5-1, 9/24/2004, ML042680089
McGuire 1 & 2	1.68E-03					Table 4, 12/22/2006, ML063100406
Containment Building Equipment or Personnel Hatch (FHA)						
San Onofre 2 & 3	8.01E-04	6.35E-04	1.78E-04	2.23E-04	2.03E-04	Table 2, 12/29/2006, ML063400359
Waterford 3	1.93E-03	1.60E-03	7.42E-04	5.61E-04	4.24E-04	Table 15, 3/29/2005, ML050890248
Seabrook 1	2.84E-03	2.30E-03	8.67E-04	5.87E-04	3.70E-04	Table 2, 2/24/2005, ML050320373
North Anna 1 & 2	3.75E-03	2.60E-03	1.03E-03	7.03E-04	5.52E-04	Table 1, 6/15/2005, ML051590510
McGuire 1 & 2	4.06E-03					Table 4, 12/22/2006, ML063100406
Plant Vent Stack						
Point Beach 1 & 2	1.80E-03	1.31E-03	5.15E-04	4.03E-04	3.03E-04	Table 3.1-1, 4/14/2011, ML110240054
Salem 1 & 2	1.78E-05	1.31E-05	5.22E-04	3.77E-04	3.17E-04	Table 2, 2/17/2006, ML060040322
San Onofre 2 & 3	1.15E-03	6.23E-04	2.14E-04	2.22E-04	2.02E-04	Table 2, 12/29/2006, ML063400359
Waterford 3	2.77E-03	1.78E-03	7.22E-04	5.49E-03	4.32E-04	Table 15, 3/29/2005, ML050890248
Surry 1 & 2	6.95E-04	5.40E-04	2.30E-04	1.71E-04	1.22E-04	Table 2, 3/8/2002, ML020710159
Oconee 1, 2 & 3	4.79E-04	3.40E-04	1.40E-04	1.09E-04	8.86E-05	Table 4, 6/1/2004, ML041540097
HB Robinson 2	1.24E-03	8.97E-04	3.62E-04	2.58E-04	2.14E-04	Table 3.5-1, 9/24/2004, ML042680089
Seabrook 1	7.54E-04	5.03E-04	2.00E-04	1.45E-04	9.89E-05	Table 2, 2/24/2005, ML050320373
North Anna 1 & 2	3.75E-03	2.65E-03	1.03E-03	7.77E-04	5.70E-04	Table 1, 6/15/2005, ML051590510
Byron & Braidwood 1 & 2	2.46E-04	1.92E-03	8.14E-04	5.52E-04	4.40E-04	Table 1, 9/8/2006, ML062340420
Millstone 3	3.18E-04	2.26E-04	9.06E-05	6.42E-05	4.59E-05	Table 2, 9/15/2006, ML061990135
South Texas Project 1 & 2	7.12E-04	5.28E-04	2.04E-04	1.61E-04	9.76E-05	Table 2, 3/6/2008, ML080160013
MSLB Accident Release						
Salem 1 & 2	6.17E-03	4.19E-03	1.57E-03	1.04E-03	8.13E-04	Table 2, 2/17/2006, ML060040322
San Onofre 2 & 3	7.78E-03	4.81E-03	1.62E-03	1.83E-03	1.68E-03	Table 2, 12/29/2006, ML063400359
Waterford 3	5.09E-02	3.26E-02	1.39E-02	8.81E-03	6.87E-03	Table 15, 3/29/2005, ML050890248
HB Robinson 2	2.48E-03	1.57E-03	7.05E-04	4.74E-04	3.93E-04	Table 3.5-1, 9/24/2004, ML042680089
Seabrook 1	4.55E-03	3.72E-03	1.38E-03	9.67E-04	6.35E-04	Table 2, 2/24/2005, ML050320373
Byron & Braidwood 1 & 2	1.70E-02	1.46E-02	6.68E-03	4.48E-03	3.31E-03	Table 1, 9/8/2006, ML062340420

Table 3

χ/Qs Values for North & South Main Steam Valve Room Releases to
North & South Control Room Intakes
using San Onofre Met Data Files

Time Interval (hr)	Atmospheric Dispersion Factors (χ/Qs) (s/m^3)			
	North MSN To CR(NI)	South MSS To CR(SI)	North MSN To CR(SI)	South MSS To CR(NI)
0-2	8.16E-03	1.47E-02	8.94E-04	9.77E-04
2-8	4.47E-03	8.00E-03	5.91E-04	7.35E-04
8-24	1.67E-03	3.20E-03	2.09E-04	3.37E-04
24-96	1.50E-03	3.49E-03	2.37E-04	2.47E-04
96-720	1.33E-03	3.11E-03	2.18E-04	1.93E-04

Table 4

χ/Qs Values for North & South Main Steam Valve Room Releases to
North & South Control Room Intakes
using Hope Creek Met Data Files

Time Interval (hr)	Atmospheric Dispersion Factors (χ/Qs) (s/m^3)			
	North MSN To CR(NI)	South MSS To CR(SI)	North MSN To CR(SI)	South MSS To CR(NI)
0-2	1.37E-02	3.29E-02	1.53E-03	1.43E-03
2-8	8.83E-03	2.42E-02	1.24E-03	1.07E-03
8-24	3.42E-03	9.51E-03	5.35E-04	4.36E-04
24-96	2.28E-03	5.96E-03	3.92E-04	3.03E-04
96-720	1.69E-03	3.72E-03	2.78E-04	2.46E-04

Table 5

χ/Qs Values for North & South Main Steam Valve Room Releases to
North & South Control Room Intakes
using Prairie Island Met Data Files

Time Interval (hr)	Atmospheric Dispersion Factors (χ/Qs) (s/m^3)			
	North MSN To CR(NI)	South MSS To CR(SI)	North MSN To CR(SI)	South MSS To CR(NI)
0-2	1.43E-02	3.00E-02	1.24E-03	1.37E-03
2-8	1.12E-02	2.36E-02	7.03E-04	1.12E-03
8-24	4.89E-03	1.03E-02	2.92E-04	4.91E-04
24-96	3.40E-03	6.89E-03	1.91E-04	3.09E-04
96-720	2.70E-03	5.36E-03	1.45E-04	2.42E-04

Table 6

χ/Qs Values for North & South Main Steam Valve Room Releases to
North & South Control Room Intakes
using Quad Cities Met Data Files

Time Interval (hr)	Atmospheric Dispersion Factors (χ/Qs) (s/m^3)			
	North MSN To CR(NI)	South MSS To CR(SI)	North MSN To CR(SI)	South MSS To CR(NI)
0-2	1.38E-02	3.21E-02	1.32E-03	1.33E-03
2-8	1.17E-02	2.73E-02	9.75E-04	1.02E-03
8-24	4.90E-03	1.19E-02	3.99E-04	3.97E-04
24-96	3.09E-03	8.03E-03	2.63E-04	2.60E-04
96-720	2.21E-03	5.60E-03	1.63E-04	1.93E-04

Table 7

χ/Qs Values for North & South Main Steam Valve Room Releases to
North & South Control Room Intakes
using Limerick Met Data Files

Time Interval (hr)	Atmospheric Dispersion Factors (χ/Qs) (s/m^3)			
	North MSN To CR(NI)	South MSS To CR(SI)	North MSN To CR(SI)	South MSS To CR(NI)
0-2	1.25E-02	2.93E-02	1.30E-03	1.27E-03
2-8	8.85E-03	2.40E-02	8.50E-04	8.29E-04
8-24	3.35E-03	9.69E-03	3.49E-04	3.05E-04
24-96	2.30E-03	6.21E-03	2.28E-04	1.90E-04
96-720	1.55E-03	4.30E-03	1.81E-04	1.42E-04

Table 8

χ/Qs Values for North & South Main Steam Valve Room Releases to
North & South Control Room Intakes
using FitzPatrick Met Data Files

Time Interval (hr)	Atmospheric Dispersion Factors (χ/Qs) (s/m^3)			
	North MSN To CR(NI)	South MSS To CR(SI)	North MSN To CR(SI)	South MSS To CR(NI)
0-2	1.30E-02	2.69E-02	1.33E-03	1.50E-03
2-8	1.04E-02	1.63E-02	1.09E-03	1.38E-03
8-24	3.57E-03	6.49E-03	3.81E-04	6.59E-04
24-96	2.15E-03	4.40E-03	2.56E-04	3.79E-04
96-720	1.55E-03	2.51E-03	1.76E-04	3.20E-04

Table 9

Bounding χ/Qs Values for North & South Main Steam Valve Room
Releases to North & South Control Room Intakes
using Prairie Island Met Data Files

Time Interval (hr)	Atmospheric Dispersion Factors (χ/Qs)* (s/m^3)			
	North MSN To CR(NI)	South MSS To CR(SI)	North MSN To CR(SI)	South MSS To CR(NI)
0-2	2.15E-02	4.50E-02	1.86E-03	2.06E-03
2-8	1.68E-02	3.54E-02	1.05E-03	1.68E-03
8-24	7.34E-03	1.55E-02	4.38E-04	7.37E-04
24-96	5.10E-03	1.03E-02	2.87E-04	4.64E-04
96-720	4.05E-03	8.04E-03	2.18E-04	3.63E-04

* χ /Q Values in Table 5 are multiplied by 1.5

Impact on DCD

DCD Table 2.3-11 and 2.3-12 will be revised as indicated in Attachment.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Reports.

APR1400 DCD TIER 2

North and South

Table 2.3-11

Onsite χ/Q for Auxiliary Building ~~South~~ Exhaust Release to Auxiliary Building ~~South~~ Intake

Time Interval (hr)	Onsite χ/Q (s/m^3)
0–2	6.78E-04
2–8	5.54E-04
8–24	2.40E-04
24–96	1.70E-04
96–720	1.32E-04

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A

Time Interval (hr)	Onsite χ/Q (s/m^3)	
	Auxiliary Building North Exhaust to Auxiliary Building North Intake	Auxiliary Building South Exhaust to Auxiliary Building South Intake
0-2	4.98E-04	6.78E-04
2-8	4.06E-04	5.54E-04
8-24	1.76E-04	2.40E-04
24-96	1.14E-04	1.70E-04
96-720	9.00E-05	1.32E-04

Table 2.3-12

and Auxiliary Building South Intake

Onsite χ/Q for Fuel Handling Area Exhaust Release to MCR North and South Intakes

Time Interval (hr)	Onsite χ/Q (s/m^3)	
	Fuel Handling Area To	
	MCR North Intake	MCR South Intake
0–2	1.52E-04	2.59E-04
2–8	1.31E-04	2.04E-04
8–24	6.02E-05	8.98E-05
24–96	4.01E-05	5.93E-05
96–720	3.19E-05	4.58E-05

AB South Intake
1.04E-03
8.18E-04
3.59E-04
2.37E-04
1.83E-04