PMNorthAnna3COLPEmails Resource

From: Brad Harvey
Sent: Tuesday, October 21, 2008 3:13 PM
To: carl.berkowitz@pnl.gov
Cc: Alicia Williamson; NorthAnna3COL Resource; Ramsdell, James V Jr (Van)
Subject: FW: Response to RAI Ltrs Nos. 017, 019, 025 FSAR Chapters 1, 2, 12, 15 ER Chapters 2, 3, 5 COLA Part 7
Attachments: 101708 D. ltr. Response to Request for Additional Information Letters Nos. 017, 019, and 025 (FSAR Chapts. 1, 2, 12, and 15; ER Chapters 2, 3, and 5; COLA Part 7).pdf; image002.png

Importance: High

Carl:

Here are several North Anna COL FSAR RAI responses that also impact the routine release X/Q and dose calculations presented in the ER.

I haven't digested the impact of these RAI responses yet, but thought you should see them sooner than later.

Brad
301-415-4118

From: Thomas Kevern
Sent: Tuesday, October 21, 2008 8:22 AM
To: Jay Lee; Jean-Claude Dehmel; Brad Harvey
Cc: Timothy Frye; Charles Cox; Andrea Johnson
Subject: FW: Response to Request for Additional Information Letters Nos. 017, 019, 025 (FSAR Chapters 1, 2, 12, and 15; ER Chapters 2, 3, and 5; COLA Part 7)
Importance: High

Brad & Jay & Jean-Claude:

Forwarded for your evaluation - overdue Dominion responses to the following RAIs:

- RAI Question 02.03.05-1 χ/Q and D/Q Values
- RAI Question 02.03.05-2 Clarification of χ/Q and D/Q Values
- RAI Question 02.03.05-3 χ/Q and D/Q Values Out to 50 Miles
- RAI Question 12.02-10 Clarification of FSAR Tables in Chapter 12
- RAI Question 15.06.05-1 Dose Evaluation Factors

Please contact me if questions - or review schedule issues.

Thanks.
Tom

From: Wanda.K.Marshall@dom.com [mailto:Wanda.K.Marshall@dom.com]
Sent: Monday, October 20, 2008 5:39 PM
Cc: Thomas Kevern; NRC.North.Anna@dom.com; JDebiec@odec.com; gzinke@entergy.com; twilli2@entergy.com; rick.kingston@ge.com; kenneth.ainger@exeloncorp.com; smithpw@dteenergy.com; Andrea Johnson; Chandu Patel; Bruce Bavol; Tom Tai; Dennis Galvin; Michael Eudy; Rocky Foster; Leslie Perkins; Mark Tonacci; Jerry Hale; david.distel@exeloncorp.com; joseph.bauer@exeloncorp.com; fburfor@entergy.com
Subject: Response to Request for Additional Information Letters Nos. 017, 019, 025 (FSAR Chapters 1, 2, 12, and 15; ER Chapters 2, 3, and 5; COLA Part 7)
Importance: High

cc list:

Please see attached.

Wanda K. Marshall
Administrative Assistant III
Dominion Resources Services
COL Project Team
wanda.k.marshall@dom.com

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Hearing Identifier: NorthAnna3_Public_EX
Email Number: 535

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Sent Date: 10/21/2008 3:13:05 PM
Received Date: 10/21/2008 3:13:11 PM
From: Brad Harvey

Created By: Brad.Harvey@nrc.gov

Recipients:
"Alicia Williamson" <Alicia.Williamson@nrc.gov>
Tracking Status: None
"NorthAnna3COL Resource" <NorthAnna3COL.Resource@nrc.gov>
Tracking Status: None
"Ramsdell, James V Jr (Van)" <van.ramsdell@pnl.gov>
Tracking Status: None
"carl.berkowitz@pnl.gov" <carl.berkowitz@pnl.gov>
Tracking Status: None

Post Office: HQCLSTR01.nrc.gov

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October 17, 2008

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Serial No. NA3-08-116
Docket No. 52-017
COL/BCB

DOMINION VIRGINIA POWER
NORTH ANNA UNIT 3 COMBINED LICENSE APPLICATION
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION LETTERS NOS. 017, 019, AND 025
(FSAR CHAPTERS 1, 2, 12, AND 15; ER CHAPTERS 2, 3, AND 5; COLA PART 7)

On July 15, July 21, and August 12, 2008, the NRC requested additional information to support the review of certain portions of the North Anna Unit 3 Combined License Application (Reference RAI Letters Nos. 017, 019, and 025). Dominion responded to these requests by letters dated August 28, 2008 (Serial No. NA3-08-086R), September 3, 2008 (Serial No. NA3-08-88R), and September 26, 2008 (Serial No. NA3-08-102R), respectively. Dominion's response to the following RAIs are provided in this letter:

- RAI Question 02.03.05-1 χ/Q and D/Q Values
- RAI Question 02.03.05-2 Clarification of χ/Q and D/Q Values
- RAI Question 02.03.05-3 χ/Q and D/Q Values Out to 50 Miles
- RAI Question 12.02-10 Clarification of FSAR Tables in Chapter 12
- RAI Question 15.06.05-1 Dose Evaluation Factors

The response to NRC RAI Letter No. 017 indicated that a response to RAI 02.03.05-1, χ/Q and D/Q Values, would be provided separately. The response to this RAI is provided in Enclosure 1 of this letter.

The response to NRC RAI Letter No. 019 indicated that responses to RAIs 02.03.05-2, Clarification of χ/Q and D/Q Values, and 02.03.05-3, χ/Q and D/Q Values Out to 50 Miles, would be provided separately. The responses to these RAIs are provided in Enclosures 2 and 3 of this letter.

The response to NRC RAI Letter No. 025 indicated that responses to RAIs 12.02-10, Clarification of FSAR Tables in Chapter 12, and 15.06.05-1, Dose Evaluation Factors, would be included with the responses to RAIs 02.03.05-1, 02.03.05-2, and 02.03.05-3. The responses to these RAIs are provided in Enclosures 4 and 5 of this letter.

This information will be incorporated into a future submission of the North Anna Unit 3 COLA, as described in the Enclosures.

Please contact Regina Borsh at (804) 273-2247 (regina.borsh@dom.com) if you have questions.

Very truly yours,

Marvin L. Smith

Marvin L. Smith

COMMONWEALTH OF VIRGINIA

COUNTY OF HENRICO

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Marvin L. Smith, who is Project Director–COL Project of Virginia Electric and Power Company (Dominion Virginia Power). He has affirmed before me that he is duly authorized to execute and file the foregoing document on behalf of the Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 17th day of October, 2008
My registration number is 7173057 and my
Commission expires: August 31, 2012

Wanda K. Marshall
Notary Public

WANDA K. MARSHALL
Notary Public
Commonwealth of Virginia
7173057
My Commission Expires Aug 31, 2012

Enclosures:

1. Response to NRC RAI Letter No. 017, RAI Question No. 02.03.05-1
2. Response to NRC RAI Letter No. 019, RAI Question No. 02.03.05-2
3. Response to NRC RAI Letter No. 019, RAI Question No. 02.03.05-3
4. Response to NRC RAI Letter No. 025, RAI Question No. 12.02-10
5. Response to NRC RAI Letter No. 025, RAI Question No. 15.06.05-1

Commitments made by this letter:

1. The information provided in the RAI responses will be incorporated into a future submission of the North Anna Unit 3 COLA, as described in the Enclosures.

cc: U. S. Nuclear Regulatory Commission, Region II
T. A. Kevern, NRC
J. T. Reece, NRC
J. J. Debiec, ODEC
G. A. Zinke, NuStart/Entergy
T. L. Williamson, Entergy
R. Kingston, GEH
K. Ainger, Exelon
P. Smith, DTE

ENCLOSURE 1

Response to NRC RAI Letter No. 017

RAI Question No. 02.03.05-1

NRC RAI 02.03.05-1

FSAR Table 2.3-17R presents maximum predicted annual average X/Q and D/Q values for the ESE sector for various distances out to 50 miles. Please revise the FSAR to explain why the X/Q and D/Q values presented in FSAR Table 2.3-17R differ from the X/Q and D/Q values presented in SSAR Table 2.3-17. Please also consider adding this qualifier to other FSAR and ER tables presenting X/Q and D/Q values used in routine release dose calculations.

Dominion Response

Vent building height and cross-sectional area are required inputs to the XOQDOQ atmospheric dispersion model. At the time of the ESPA, the reactor technology had not been selected and representative reactor building dimensions were used for the height and cross-sectional area. The ESPA evaluation assumed that the building height would be approximately 32 m and the smallest probable building cross-sectional area would be about 2250 m^2. Those values were used for determining the χ/Q and D/Q estimates presented in SSAR Table 2.3-17.

For the COLA, the ESBWR technology had been selected and the exterior dimensions were available for the ESBWR reactor, turbine, and radwaste buildings, which have vent stacks. Of these buildings, the reactor and turbine building were considered for normal releases. A building height of 49 m above grade and a minimum cross-sectional area of 2400 m^2 were used for the χ/Q and D/Q estimates presented in FSAR Table 2.3-17R.

The χ/Q and D/Q values were found to be dependent on building height, but not the cross-sectional area at the Unit 3 site. Therefore, the change in height from 32 m (for the ESPA) to 49 m (for the COLA) accounts for the differences between the χ/Q and D/Q values presented in SSAR Table 2.3-17 and FSAR Table 2.3-17R.

The FSAR and COLA ER will be revised to include the input data and assumptions used in the XOQDOQ modeling.

Proposed COLA Revision

FSAR Section 2.3.5.1 and ER Section 2.7.6 will be revised to provide the inputs and assumptions for the routine release χ/Q and D/Q values presented in the tables in these sections. These changes are shown on the attached FSAR and ER markups.

Markup of North Anna COLA

The attached markup represents Dominion's good faith effort to show how the COLA will be revised in a future COLA submittal in response to the subject RAI. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be somewhat different than as presented herein.

heights away from the Unit 3 power block buildings which could have postulated fission product releases. As a result, the entire EAB is located beyond the wake influence zone that can be induced by tall structures, e.g., the Unit 3 Turbine Building or Reactor Building.

NAPS ESP COL 2.3-2

2.3.4.3 Atmospheric Dispersion Factors for On-Site Doses

Onsite χ/Q values for use in evaluating potential doses from Unit 3 postulated release locations (sources) to on-site receptor locations are based on the Unit 3 plant layout shown in Figure 2.3-201. The meteorological data used in evaluating on-site doses is the same data used for the accident condition dose calculations in SSAR Section 2.3.4. The χ/Q values for the control room were calculated using the ARCON96 computer code in accordance with guidance as documented in RG 1.194. The source and receptor combinations are shown in Table 2.3-201 through Table 2.3-205. Figure 2.3-201 shows the locations of postulated accidental releases from Unit 3 and the Unit 3 receptor locations.

NAPS COL 2.0-11-A

2.3.5 Long-Term (Routine) Diffusion Estimates

The information needed to address DCD COL Item 2.0-11-A is included in SSAR Section 2.3.5, which is incorporated by reference with the following supplements and variances.

2.3.5.1 Basis

The ~~fifth paragraph~~ third through sixth paragraphs of this SSAR section ~~is~~ are supplemented as follows with information to address the receptors near the Unit 3 site.

NAPS ESP COL 2.3-3

The following input data and assumptions were used in the XOQDOQ modeling:

- Meteorological Data: Three-year combined (1996–1998) onsite joint frequency distribution of wind speed, wind direction, and atmospheric stability.
- Type of Release: Ground level.
- Wind Sensor Height: 10 m (33 ft).
- Vertical Temperature Difference: 10 m (33 ft) – 48.4 m (158.9 ft).
- Number of Wind Speed Categories: 7.

- Release Height: 10 m (33 ft) (default height).
- Reactor Building Height: 49 m (161 ft).
- Minimum Reactor Building Cross-Sectional Area: 2400 m^2 (25,800 ft^2).
- Distances from the release point to the nearest residence, nearest site boundary, milk cow, vegetable garden, milk goat, meat animal: See Table 2.3-15R.

For the dispersion analysis, the ESBWR Reactor Building is used to determine the minimum building cross-sectional area for evaluating building downwash effects. The height of this building is approximately 49 m (161 ft) including parapets. Based on this height and a nominal width of 49 m (161 ft) on the rectangular face of the building, a minimum building cross-sectional area of 2400 m^2 (25,800 ft^2) was used to determine χ/Q and D/Q estimates. The perpendicular face of the building is narrower at the top, but the total area, including stairwells and the elevator shaft, is greater than 2400 m^2 (25,800 ft^2) in that perpendicular direction. For the NAPS site, the χ/Q and D/Q values were found to depend on building height but not cross-sectional area.

The annual Radiological Environmental Monitoring Program (Reference 2.3-201) was reviewed to determine if the distances of any of the nearest receptors modeled for the SSAR have changed. The results of that review, as documented in Table 2.3-15R, show the closest receptor to be the residence. The evaluation assumed conservatively, that each receptor (meat animal, vegetable garden, residence) is at the location of the closest receptor. The results, as documented in Table 2.3-15R, show the closest receptor to be the residence ~~at~~ in the NW direction at a distance of 1.20 km (3930 ft). Therefore, for the purposes of the atmospheric dispersion analysis and the subsequent dose evaluations, one of each type of receptor was assumed to be at 1.20 km (3930 ft) in each compass direction. ~~For the purposes of the atmospheric dispersion analysis and the subsequent dose evaluations, it was conservatively assumed that each receptor (meat animal, vegetable garden, residence) is at the location of the closest receptor. Therefore, one of each type of receptor was assumed to be at 1.20 km (3930 ft) in each compass direction.~~ The maximum annual average χ/Q value calculated for the nearest residence, vegetable garden, and meat animal, all assumed at 1.20 km (3930 ft), ~~to the ESE of the plant envelope~~ is 4.20 E-6 sec/m^3 in the ESE direction. The maximum D/Q for these

2.5 Socioeconomics

The information for this section is provided in ESP-ER Section 2.5 and in FEIS Sections 2.8 and 2.9.

No new and significant information has been identified for socioeconomics.

2.6 Geology

The information for this section is provided in ESP-ER Section 2.6 and in FEIS Section 2.4.

No new and significant information has been identified for this section.

2.7 Meteorology and Air Quality

The information for this section is provided in ESP-ER Section 2.7 and in FEIS Section 2.3. Supplemental information concerning atmospheric dispersion coefficients ~~as~~ is provided in Sections 2.7.5 and 2.7.6.

2.7.1 General Climate

No new and significant information has been identified for this section.

2.7.2 Regional Air Quality

No new and significant information has been identified for this section.

2.7.3 Severe Weather

No new and significant information has been identified for this section.

2.7.4 Local Meteorology

No new and significant information has been identified for this section.

2.7.5 Short-Term Diffusion Estimates

For the short-term atmospheric dispersion coefficients (used in the evaluation of doses due to design basis accidents, in Section 7.1), the ESP values listed in FEIS Table 5-14 are used for this ER.

2.7.6 Long-Term (Routine) Diffusion Estimates

As a part of the preparation of this ER, the annual Radiological Environmental Monitoring Program was reviewed to determine if the distances to any of the nearest sensitive receptors, modeled for the ESP-ER have changed. The results of that review, as documented in Table 2.7-1, show the closest receptor to be the residence at the NW direction at a distance of 1.20 km (3930 feet). For the purposes of the atmospheric dispersion analysis and the subsequent dose evaluations, it was conservatively assumed that each sensitive receptor (meat animal, vegetable garden, residence) is

at the location of the closest receptor. Therefore, one of each type of receptor was assumed to be at 1.20 km (3930 feet) in each compass direction. The maximum annual average χ/Q value calculated for the nearest residence, vegetable garden, and meat animal, all assumed at 0.74 miles ~~to the ESE of the facility boundary shown in FSAR Figure 2.0-205~~, is 4.20 E-6 sec/m^3 in the ESE direction. The maximum D/Q for those receptors is 1.10E-8 m^{-2} in the NNE direction. In the evaluation performed for this ER, the distance to the site boundary (EAB) was found to be 1.0 mile in the direction where the maximum χ/Q is calculated. However, for conservatism, the greater χ/Q value from the ESP-ER, which is based on a distance of 0.88 miles, is retained for use in this ER. The maximum annual χ/Q (no decay, undepleted) at the EAB is 3.70 E-6 sec/m^3, at a distance of 1.42 km (0.88 mile) to the ESE of the facility boundary. The results are summarized in Table 2.7-2 and Table 2.7-3. These tables present the maximum calculated χ/Qs and D/Qs at sensitive receptors and at various distances from the site.

Long-term (~~Annual~~ annual average) χ/Q and D/Q estimates generated by the XOQDOQ model for the sensitive receptors and at distances between 0.25 mile to 50 miles, as well as for various segment boundaries, are also presented. Table 2.7-4 presents χ/Q and D/Q estimates at the specific points of interest. ~~Table 2.7-5 lists χ/Q estimates at downwind distances between 0.25 and 50 miles and along various segments. Table 2.7-7 contains χ/Q estimates that include radioactive decay with a half life of 2.26 days for short-lived noble gases. Table 2.7-9 contains χ/Q estimates that include radioactive decay with a half life of 8 days for all iodines released to the atmosphere. Finally, Table 2.7-11 contains estimates of long-term average D/Q at downwind distances between 0.25 and 50 miles.~~

Table 2.7-5 presents the no decay and undepleted χ/Q estimates at various downwind distances between 0.4 km (0.25 mi) and 80.5 km (50 mi). Table 2.7-6 presents the no decay and undepleted χ/Q estimates for various distance segments out to 80.5 km (50 mi).

Table 2.7-7 presents the 2.26 day decay (for short-lived noble gases) and undepleted χ/Q estimates at the same downwind distances. Table 2.7-8 presents the 2.26 day decay and undepleted χ/Q estimates for the same distance segments.

Table 2.7-9 presents the 8 day decay (for all iodines released to the atmosphere) and depleted χ/Q estimates at the same downwind distances. Table 2.7-10 presents the 8 day decay and depleted χ/Q estimates for the same distance segments.

Table 2.7-11 presents the D/Q estimates for the same downwind distances. Table 2.7-12 presents the D/Q estimates for the same distance segments.

The methodology used to determine the long-term dispersion and deposition coefficients (used in the evaluation of doses due to normal operating releases) remains the same as that described in ESP-ER Section 2.7.6.

The following input data and assumptions were used in the XOQDOQ modeling:

- Meteorological Data: Three-year combined (1996–1998) onsite joint frequency distribution of wind speed, wind direction, and atmospheric stability.
- Type of Release: Ground level.
- Wind Sensor Height: 10 m (33 ft).
- Vertical Temperature Difference: 10 m (33 ft) – 48.4 m (158.9 ft).
- Number of Wind Speed Categories: 7.
- Release Height: 10 m (33 ft) (default height).
- Reactor Building Height: 49 m (161 ft).
- Minimum Reactor Building Cross-Sectional Area: 2400 m^2 (25,800 ft^2).
- Distances from the release point to the nearest residence, nearest site boundary, milk cow, vegetable garden, milk goat, meat animal: See Table 2.7-1.

For the dispersion analysis, the ESBWR Reactor Building is used to determine the minimum building cross-sectional area for evaluating building downwash effects. The height of this building is approximately 49 m (161 ft) including parapets. Based on this height and a nominal width of 49 m (161 ft) on the rectangular face of the building, a minimum building cross-sectional area of 2400 m^2 (25,800 ft^2) was used to determine χ/Q and D/Q estimates. The perpendicular face of the building is narrower at the top, but the total area, including stairwells and the elevator shaft, is greater than 2400 m^2 (25,800 ft^2) in that perpendicular direction. For the NAPS site, the χ/Q and D/Q values were found to depend on building height but not cross-sectional area.

ESP-ER Tables 2.7-13 through 2.7-20 have been replaced in this ER by Tables 2.7-1 through ~~2.7-8~~ 2.7-12.

No other new and significant information has been identified for this section.

ENCLOSURE 2

Response to NRC RAI Letter No. 019

RAI Question No. 02.03.05-2

NRC RAI 02.03.05-2

FSAR Table 2.3-16R presents revised χ/Q and D/Q values for the residence, meat animal, and vegetable garden. Please clarify the following inconsistencies with corresponding information in the Environmental Report and revise the FSAR as appropriate.

a. *FSAR Table 2.3-16R shows that the maximum D/Q value for the residence, meat animal, and vegetable garden receptors is 9.00E-09 1/m^2 in the ESE sector at 0.74 miles. This conflicts with the information shown in ER Table 2.7-4 which shows a higher D/Q for these receptors, 1.1E-08 1/m^2 in the NNE sector at 0.74 miles.*

b. *Please verify that the no-decay and 2.26-day decay χ/Q values presented in FSAR Table 2.3-16R are undepleted values and the 8-day decay χ/Q values are depleted values.*

c. *ER Table 2.7-4 includes a list of revised distances in each sector to the EAB. Please revise FSAR Table 2.3-15R to include this list of distances to the EAB.*

d. *Should the distances and directions to the highest EAB χ/Q and D/Q values as listed in FSAR Table 2.3-16R be consistent with the distances shown in ER Table 2.7-4?*

Dominion Response

Clarifications and corrections in response to the subject RAI are as follows:

a. The maximum D/Q (ground deposition coefficient) values for the residence, meat animal, and vegetable garden receptors shown as 1.1E-08 1/m^2 in the NNE sector in ER Table 2.7-4 are correct. The values shown as 9.00E-09 1/m^2 in the ESE sector in FSAR Table 2.3-16R are the correct D/Q values for the ESE sector (which has the maximum χ/Q value), but are not the maximum D/Q values. The maximum D/Q values are in the NNE sector and should have been shown on FSAR Table 2.3-16R and used to calculate the doses to the maximally exposed individual (MEI) on FSAR Tables 12.2-18bR, 12.2-201, and 12.2-203. Instead, the slightly lower D/Q values for the ESE sector are shown on FSAR Table 2.3-16R and were used to calculate the doses to the MEI. This error similarly affected ER Tables 2.7-2, 5.4-4, 5.4-5, and 5.4-6.

   FSAR Section 2.3.5.1 and Tables 2.0-201 and 2.3-16R will be revised to identify the maximum D/Q values as 1.1E-08 1/m^2 in the NNE sector. ER Section 2.7.6 and Table 2.7-2 will be similarly revised.

In addition, FSAR Section 12.2.2.4.4 and Tables 12.2-18bR, 12.2-201, and 12.2-203; and ER Section 5.4.2.2 and Tables 5.4-4, 5.4-5, and 5.4-6 will be revised to reflect the calculated doses to the MEI based on a maximum D/Q value of 1.1E-08 $1/m^2$ in the NNE sector. Related editorial changes will also be made to ER Table 5.4-6 to be consistent with FSAR Table 12.2-203.

b. The no-decay and 2.26-day decay χ/Q values presented in FSAR Table 2.3-16R are undepleted values and the 8-day decay χ/Q values are depleted values. FSAR Table 2.3-16R and ER Table 2.7-2 will be revised to include this information.

c. FSAR Table 2.3-15R and ER Table 2.7-1 will be revised to add the shortest distance from any point of the plant facility boundary (see FSAR Figure 2.0-205) to the exclusion area boundary (EAB) for each directional sector.

d. The distances and directions to the EAB maximum χ/Q and D/Q values in FSAR Table 2.3-16R are not, and should not be, consistent with the distances and directions to the highest predicted χ/Q and D/Q values in ER Table 2.7-4. The ER table presents the actual expected values while the FSAR table presents conservatively higher values using the maximum χ/Q and D/Q values for the site boundary from the Early Site Permit Application (ESPA) Site Safety Analysis Report (SSAR). These values are shown on FSAR Table 2.3-16R for the EAB, which is the same as the site boundary for the NAPS site.

   FSAR Section 2.3.5.1 will be revised to more clearly explain that in preparing the FSAR, the shortest distance from any point on the plant facility boundary (See FSAR Figure 2.0-205) to the site boundary (i.e., EAB) in the direction where the maximum χ/Q is calculated was found to be 1.6 km (1.0 mile). While this actual distance is more accurate than the earlier estimate of 1.42 km (0.88 miles) used in the ESPA SSAR, the shorter distance and resulting higher χ/Q values from the ESPA SSAR were retained for use in the FSAR.

   While FSAR Table 2.3-16R presents the maximum χ/Q values for the EAB at a distance of 0.88 mi in the ESE direction, the maximum D/Q values are at a distance of 0.62 mi in the S direction, as shown on ESP ER Table 2.7-16. To clarify this difference with respect to maximum χ/Q and D/Q values, FSAR Table 2.3-16R, Note "a" will be revised as follows: "a: direction South and distance of 0.62 mi for maximum D/Q for EAB." FSAR Table 2.0-201 and ER Table 2.7-2 will be similarly revised. Note "c" will also be added to FSAR Table 2.3-16R and ER Table 2.7-2 to identify the

SSAR and ESP ER, respectively, as the sources of the EAB location information.

Proposed COLA Revision

The FSAR and ER will be revised as stated in the above response. These changes are shown on the attached FSAR and ER markups.

Markup of North Anna COLA

The attached markup represents Dominion's good faith effort to show how the COLA will be revised in a future COLA submittal in response to the subject RAI. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be somewhat different than as presented herein.

NAPS COL 2.0-1-A

Table 2.0-201 Evaluation of Site/Design Parameters and Characteristics

Subject[16]	DCD Site Parameter Value[1][16]	Site Characteristic	Evaluation
Long Term Dispersion Estimates (continued)			
D/Q	4.0E-09 m^{-2}	**ESP and Unit 3** 1.2×10^{-8} $1/m^2$, annual average, D/Q value, EAB, east-southeast*, 1.4 km (0.88 mi)	The ESP site characteristic value for this long term dispersion estimate is defined as the maximum annual average EAB D/Q value for use in determining gaseous pathway doses to the maximally exposed individual. The ESP site characteristic value does not fall within (is greater than) the DCD site parameter value. See Section 12.2 for the site-specific concentration and dose analysis inputs and results. The Unit 3 site characteristic value is provided in Table 2.3-16R and falls within (is the same as) the ESP site characteristic value. * The direction is south and the distance is 1 km (0.62 mi) as shown in ~~Note a of ESP ER Table 2.7-14~~ ESP-ER Table 2.7-16 and in Table 2.3-16R.
χ/Q	2.0E-06 s/m^3	**ESP** 2.4×10^{-6} s/m^3, annual average, undepleted/no decay, nearest resident, north-northeast, 1.5 km (0.96 mi)	The ESP site characteristic value for this long term dispersion estimate is defined as the maximum annual average resident undepleted/no decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual. The ESP site characteristic value does not fall within (is greater than) the DCD site parameter value.
		Unit 3 4.2×10^{-6} s/m^3 east-southeast, 1.2 km (0.74 mi)	The Unit 3 site characteristic value for this long term dispersion estimate is provided in Table 2.3-16R. The Unit 3 site characteristic value does not fall within (is greater than) the DCD site parameter value. See Section 12.2 for the site-specific concentration and dose analysis inputs and results. The Unit 3 site characteristic value does not fall within (is greater than) the ESP site characteristic value.

NAPS ESP VAR 2.0-1a

NAPS COL 2.0-1-A

Table 2.0-201 Evaluation of Site/Design Parameters and Characteristics

Subject (16)	DCD Site Parameter Value (1)(16)	Site Characteristic	Evaluation
Long Term Dispersion Estimates (continued)			
χ/Q	2.0E-06 s/m^3	**ESP** 2.1×10^{-6} s/m^3, annual average, ~~un~~depleted/8.00-day decay, nearest resident, north-northeast, 1.5 km (0.96 mi)	The ESP site characteristic value for this long term dispersion estimate is defined as the maximum annual average resident ~~un~~depleted/8.00-day decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual. The ESP site characteristic value does not fall within (is greater than) the DCD site parameter value.
		Unit 3 3.7×10^{-6} s/m^3 east-southeast, 1.2 km (0.74 mi)	The Unit 3 site characteristic value for this long term dispersion estimate is provided in Table 2.3-16R. The Unit 3 site characteristic value does not fall within (is greater than) the DCD site parameter value. See Section 12.2 for the site-specific concentration and dose analysis inputs and results. The Unit 3 site characteristic value does not fall within (is greater than) the ESP site characteristic value.
D/Q	4.0E-09 m^{-2}	**ESP** 7.2×10^{-9} 1/m^2, annual average, nearest resident, north-northeast, 1.5 km (0.96 mi)	The ESP site characteristic value for this long term dispersion estimate is defined as the maximum annual average resident D/Q value for use in determining gaseous pathway doses to the maximally exposed individual. The ESP site characteristic value does not fall within (is greater than) the DCD site parameter value.
		Unit 3 ~~9.0×10^{-9}~~ 1.1×10^{-8} 1/m^2 ~~east southeast~~ north-northeast, 1.2 km (0.74 mi)	The Unit 3 site characteristic value for this long term dispersion estimate is provided in Table 2.3-16R. The Unit 3 site characteristic value does not fall within (is greater than) the DCD site parameter value. See Section 12.2 for the site-specific concentration and dose analysis inputs and results. The Unit 3 site characteristic value does not fall within (is greater than) the ESP site characteristic value.

NAPS ESP VAR 2.0-1c

NAPS ESP VAR 2.0-1d

NAPS COL 2.0-1-A

Table 2.0-201 Evaluation of Site/Design Parameters and Characteristics

Subject[16]	DCD Site Parameter Value[1][16]	Site Characteristic	Evaluation
Long Term Dispersion Estimates (continued)			
χ/Q	2.0E-06 s/m^3	**ESP** 1.4×10^{-6} s/m^3, annual average, undepleted/2.26-day decay, nearest meat animal, southeast, 2.2 km (1.37 mi)	The ESP site characteristic value for this long term dispersion estimate is defined as the maximum annual average meat animal undepleted/2.26-day decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual. This ESP site characteristic value is 1.4×10^{-6} s/m^3 and falls within (is smaller than) the DCD site parameter value. See Section 12.2 for the site-specific concentration and dose analysis inputs and results.
NAPS ESP VAR 2.0-1f		**Unit 3** 4.1×10^{-6} s/m^3 east-southeast, 1.2 km (0.74 mi)	The Unit 3 site characteristic value for this long term dispersion estimate is provided in Table 2.3-16R. The Unit 3 site characteristic value does not fall within (is greater than) the DCD site parameter value. See Section 12.2 for the site-specific concentration and dose analysis inputs and results. The Unit 3 site characteristic value does not fall within (is greater than) the ESP site characteristic value.
χ/Q	2.0E-06 s/m^3	**ESP** 1.2×10^{-6} s/m^3, annual average, ~~un~~depleted/8.00-day decay, nearest meat animal, southeast, 2.2 km (1.37 mi)	The ESP site characteristic value for this long term dispersion estimate is defined as the maximum annual average meat animal ~~un~~depleted/8.00-day decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual. The ESP site characteristic value falls within (is smaller than) the DCD site parameter value.
NAPS ESP VAR 2.0-1g		**Unit 3** 3.7×10^{-6} s/m^3 east-southeast, 1.2 km (0.74 mi)	The Unit 3 site characteristic value for this long term dispersion estimate is provided in Table 2.3-16R. The Unit 3 site characteristic value does not fall within (is greater than) the DCD site parameter value. See Section 12.2 for the site-specific concentration and dose analysis inputs and results. The Unit 3 site characteristic value does not fall within (is greater than) the ESP site characteristic value.

NAPS COL 2.0-1-A

Table 2.0-201 Evaluation of Site/Design Parameters and Characteristics

Subject[16]	DCD Site Parameter Value[1][16]	Site Characteristic	Evaluation
Long Term Dispersion Estimates (continued)			
D/Q	4.0E-09 m^{-2}	**ESP** 3.1×10^{-9} $1/m^2$, annual average, nearest meat animal, southeast, 2.2 km (1.37 mi)	The ESP site characteristic value for this long term dispersion estimate is defined as the maximum annual average meat animal D/Q value for use in determining gaseous pathway doses to the maximally exposed individual. The ESP site characteristic value falls within (is smaller than) the DCD site parameter value.
NAPS ESP VAR 2.0-1h		**Unit 3** ~~9.0×10^{-9}~~ 1.1×10^{-8} $1/m^2$ ~~east-southeast~~ north-northeast, 1.2 km (0.74 mi)	The Unit 3 site characteristic value for this long term dispersion estimate is provided in Table 2.3-16R. The Unit 3 site characteristic value does not fall within (is greater than) the DCD site parameter value. See Section 12.2 for the site-specific concentration and dose analysis inputs and results. The Unit 3 site characteristic value does not fall within (is greater than) the ESP site characteristic value.
χ/Q	2.0E-06 s/m^3	**ESP** 2.0×10^{-6} s/m^3, annual average, undepleted/no decay, nearest vegetable garden, northeast, 1.5 km (0.94 mi)	The ESP site characteristic value for this long term dispersion estimate is defined as the maximum annual average vegetable garden undepleted/no decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual. The ESP site characteristic value falls within (is the same as) the DCD site parameter value.
NAPS ESP VAR 2.0-1i		**Unit 3** 4.2×10^{-6} s/m^3 east-southeast, 1.2 km (0.74 mi)	The Unit 3 site characteristic value for this long term dispersion estimate is provided in Table 2.3-16R. The Unit 3 site characteristic value does not fall within (is greater than) the DCD site parameter value. See Section 12.2 for the site-specific concentration and dose analysis inputs and results. The Unit 3 site characteristic value does not fall within (is greater than) the ESP site characteristic value.

NAPS COL 2.0-1-A

Table 2.0-201 Evaluation of Site/Design Parameters and Characteristics

Subject[16]	DCD Site Parameter Value[1][16]	Site Characteristic	Evaluation
Long Term Dispersion Estimates (continued)			
χ/Q	2.0E-06 s/m^3	**ESP** 1.8×10^{-6} s/m^3, annual average, ~~un~~depleted/8.00-day decay, nearest vegetable garden, northeast, 1.5 km (0.94 mi)	The ESP site characteristic value for this long term dispersion estimate is defined as the maximum annual average vegetable garden ~~un~~depleted/8.00-day decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual. The ESP site characteristic value falls within (is less than) the DCD site parameter value.
		Unit 3 3.7×10^{-6} s/m^3 east-southeast, 1.2 km (0.74 mi)	The Unit 3 site characteristic value for this long term dispersion estimate is provided in Table 2.3-16R. The Unit 3 site characteristic value does not fall within (is greater than) the DCD site parameter value. See Section 12.2 for the site-specific concentration and dose analysis inputs and results. The Unit 3 site characteristic value does not fall within (is greater than) the ESP site characteristic value.
D/Q	4.0E-09 m^{-2}	**ESP** 6.0×10^{-9} 1/m^2, annual average, nearest vegetable garden, northeast, 1.5 km (0.94 mi)	The ESP site characteristic value for this long term dispersion estimate is defined as the maximum annual average vegetable garden D/Q value for use in determining gaseous pathway doses to the maximally exposed individual. The ESP site characteristic value does not fall within (is greater than) the DCD site parameter value.
		Unit 3 ~~9.0×10^{-9}~~ 1.1×10^{-8} 1/m^2 ~~east-southeast~~ north-northeast, 1.2 km (0.74 mi)	The Unit 3 site characteristic value for this long term dispersion estimate is provided in Table 2.3-16R. The Unit 3 site characteristic value does not fall within (is greater than) the DCD site parameter value. See Section 12.2 for the site-specific concentration and dose analysis inputs and results. The Unit 3 site characteristic value does not fall within (is greater than) the ESP site characteristic value.

NAPS ESP VAR 2.0-1k

NAPS ESP VAR 2.0-1l

heights away from the Unit 3 power block buildings which could have postulated fission product releases. As a result, the entire EAB is located beyond the wake influence zone that can be induced by tall structures, e.g., the Unit 3 Turbine Building or Reactor Building.

NAPS ESP COL 2.3-2

2.3.4.3 Atmospheric Dispersion Factors for On-Site Doses

Onsite χ/Q values for use in evaluating potential doses from Unit 3 postulated release locations (sources) to on-site receptor locations are based on the Unit 3 plant layout shown in Figure 2.3-201. The meteorological data used in evaluating on-site doses is the same data used for the accident condition dose calculations in SSAR Section 2.3.4. The χ/Q values for the control room were calculated using the ARCON96 computer code in accordance with guidance as documented in RG 1.194. The source and receptor combinations are shown in Table 2.3-201 through Table 2.3-205. Figure 2.3-201 shows the locations of postulated accidental releases from Unit 3 and the Unit 3 receptor locations.

NAPS COL 2.0-11-A

2.3.5 Long-Term (Routine) Diffusion Estimates

The information needed to address DCD COL Item 2.0-11-A is included in SSAR Section 2.3.5, which is incorporated by reference with the following supplements and variances.

2.3.5.1 Basis

The ~~fifth paragraph~~ third through sixth paragraphs of this SSAR section ~~is~~ are supplemented as follows with information to address the receptors near the Unit 3 site.

NAPS ESP COL 2.3-3

The following input data and assumptions were used in the XOQDOQ modeling:

- Meteorological Data: Three-year combined (1996–1998) onsite joint frequency distribution of wind speed, wind direction, and atmospheric stability.
- Type of Release: Ground level.
- Wind Sensor Height: 10 m (33 ft).
- Vertical Temperature Difference: 10 m (33 ft) – 48.4 m (158.9 ft).
- Number of Wind Speed Categories: 7.

- Release Height: 10 m (33 ft) (default height).
- Reactor Building Height: 49 m (161 ft).
- Minimum Reactor Building Cross-Sectional Area: 2400 m^2 (25,800 ft^2).
- Distances from the release point to the nearest residence, nearest site boundary, milk cow, vegetable garden, milk goat, meat animal: See Table 2.3-15R.

For the dispersion analysis, the ESBWR Reactor Building is used to determine the minimum building cross-sectional area for evaluating building downwash effects. The height of this building is approximately 49 m (161 ft) including parapets. Based on this height and a nominal width of 49 m (161 ft) on the rectangular face of the building, a minimum building cross-sectional area of 2400 m^2 (25,800 ft^2) was used to determine χ/Q and D/Q estimates. The perpendicular face of the building is narrower at the top, but the total area, including stairwells and the elevator shaft, is greater than 2400 m^2 (25,800 ft^2) in that perpendicular direction. For the NAPS site, the χ/Q and D/Q values were found to depend on building height but not cross-sectional area.

The annual Radiological Environmental Monitoring Program (Reference 2.3-201) was reviewed to determine if the distances of any of the nearest receptors modeled for the SSAR have changed. The results of that review, as documented in Table 2.3-15R, show the closest receptor to be the residence. The evaluation assumed conservatively, that each receptor (meat animal, vegetable garden, residence) is at the location of the closest receptor. The results, as documented in Table 2.3-15R, show the closest receptor to be the residence ~~at~~ in the NW direction at a distance of 1.20 km (3930 ft). Therefore, for the purposes of the atmospheric dispersion analysis and the subsequent dose evaluations, one of each type of receptor was assumed to be at 1.20 km (3930 ft) in each compass direction. ~~For the purposes of the atmospheric dispersion analysis and the subsequent dose evaluations, it was conservatively assumed that each receptor (meat animal, vegetable garden, residence) is at the location of the closest receptor. Therefore, one of each type of receptor was assumed to be at 1.20 km (3930 ft) in each compass direction.~~ The maximum annual average χ/Q value calculated for the nearest residence, vegetable garden, and meat animal, all assumed at 1.20 km (3930 ft), ~~to the ESE of the plant envelope~~ is 4.20 E-6 sec/m^3 in the ESE direction. The maximum D/Q for these

receptors is 1.10E-8 m^{-2} in the NNE direction. In the evaluation performed for this FSAR, the shortest distance from any point on the plant facility boundary to the site boundary (EAB) was found to be 1.6 km (1.0 mile) in the direction where the maximum χ/Q is calculated. However, for conservatism, the greater χ/Q from SSAR Section 2.3.5, which is based on a distance of 1.42 km (0.88 miles), is retained for use in this section. The maximum annual χ/Q (no decay, undepleted) at the EAB is 3.70×10^{-6} sec/m^3; at a distance of 1.42 km (0.88 mile) to the ESE of the plant facility boundary (Figure 2.0-205).

NAPS ESP VAR 2.0-1a to 2.0-1l

The results are summarized in Table 2.3-16R and Table 2.3-17R. These tables present the maximum calculated χ/Qs and D/Qs at receptors and at various distances from the site.

Add the following at the end of this SSAR section to address annual average χ/Q and D/Q estimates.

NAPS COL 2.0-11-A

Long-term (annual average) χ/Q and D/Q estimates generated by the XOQDOQ model are also presented for each directional sector at twenty-two specific distances, as well as for ten distance segments. Table 2.3-206 presents the no decay and undepleted χ/Q estimates at various downwind distances between 0.4 km (0.25 mi) and 80.5 km (50 mi). Table 2.3-207 presents the no decay and undepleted χ/Q estimates for various distance segments out to 80.5 km (50 mi).

Table 2.3-208 presents the 2.26 day decay (for short-lived noble gases) and undepleted χ/Q estimates at the same downwind distances. Table 2.3-209 presents the 2.26 day decay and undepleted χ/Q estimates for the same distance segments.

Table 2.3-210 presents the 8 day decay (for all iodines released to the atmosphere) and depleted χ/Q estimates at the same downwind distances. Table 2.3-211 presents the 8 day decay and depleted χ/Q estimates for the same distance segments.

Table 2.3-212 presents the D/Q estimates for the same downwind distances. Table 2.3-213 presents the D/Q estimates for the same distance segments.

NAPS ESP COL 2.3-3

Table 2.3-15R Source to Receptor Distances

Type	Direction	Distance from Unit 1 (ft)	Distance from Unit 1 (miles/km)	Distance from Plant Facility Boundary (ft)[1]	Distance from Plant Facility Boundary (miles/km)[1]
Site Boundary (Exclusion Area Boundary)					
EAB	S	5199	0.98/1.58	3719	0.70/1.13
EAB	SSW	5394	1.01/1.64	3238	0.61/0.99
EAB	SW	5527	1.05/1.68	2877	0.54/0.88
EAB	WSW	5571	1.06/1.70	2891	0.55/0.88
EAB	W	5519	1.05/1.68	2914	0.55/0.89
EAB	WNW	5380	1.02/1.64	3393	0.64/1.03
EAB	NW	5181	0.98/1.58	3919	0.74/1.19
EAB	NNW	4957	0.94/1.51	4417	0.84/1.35
EAB	N	4744	0.90/1.45	4847	0.92/1.48
EAB	NNE	4572	0.87/1.39	5110	0.97/1.56
EAB	NE	4463	0.85/1.36	4858	0.92/1.48
EAB	ENE	4427	0.84/1.35	4967	0.94/1.51
EAB	E	4470	0.85/1.36	5604	1.06/1.71
EAB	ESE	4585	0.97/1.40	5304	1.00/1.62
EAB	SE	4761	0.90/1.45	4603	0.87/1.40
EAB	SSE	4976	0.94/1.52	4180	0.79/1.27

Note 1: distances are from the plant facility boundary. See Figure 2.0-205.

NAPS ESP COL 2.3-3
NAPS ESP VAR 2.0-1a to 2.0-1l

Table 2.3-16R XOQDOQ Predicted Maximum χ/Q and D/Q Values at Specific Points of Interest

Type of Location	Direction from Site	Distance (miles)	χ/Q (No Decay, Undepleted)	χ/Q (2.26 Day Decay, Undepleted)	χ/Q (8 Day Decay, Depleted)	D/Q
Residence	ESE	0.74	4.20E-06	4.10E-06	3.70E-06	~~9.00E-09~~ 1.1E-08[b]
EAB[c]	ESE	0.88	3.7E-06	3.7E-06	3.3E-06	1.2E-08[a]
Meat Animal	ESE	0.74	4.20E-06	4.10E-06	3.70E-06	~~9.00E-09~~ 1.1E-08[b]
Veg. Garden	ESE	0.74	4.20E-06	4.10E-06	3.70E-06	~~9.00E-09~~ 1.1E-08[b]

Notes:
χ/Q – sec/m^3
D/Q – 1/m^2
a: direction South and distance of 0.62 mi for maximum D/Q for EAB
b: direction North-Northeast for maximum D/Q for residence, meat animal, and vegetable garden
c: from SSAR Table 2.3-16

12.2.2.4.1 Compliance with 10 CFR 50, Appendix I, Section II.A

Table 12.2-202 demonstrates that offsite doses due to Unit 3 radioactive liquid effluents comply with the regulatory dose limits in 10 CFR 50, Appendix I, Section II.A.

NAPS
ESP COL 11.1-1

12.2.2.4.2 Compliance with 10 CFR 50, Appendix I, Section II.D

Population dose is determined for the liquid effluent releases from Unit 3 for both total body dose and thyroid dose. The total body dose is 1.0 person-rem/yr as shown in Table 12.2-204. The thyroid dose is 0.69 person-rem/yr. The cost-benefit analysis performed to consider liquid radwaste augments to reduce doses due to liquid effluents is presented in the reference described in Section 11.2. Based on the above liquid effluent dose estimate values and the threshold value from the cost-benefit analysis, no augments are cost-beneficial. Therefore, Unit 3 complies with 10 CFR 50, Appendix I, Section II.D.

12.2.2.4.3 Compliance with 10 CFR 20, Appendix B, Table 2, Column 2

Compliance with 10 CFR 20, Appendix B, Table 2, Column 2 is demonstrated in Table 12.2-19bR.

12.2.2.4.4 Compliance with 10 CFR 20.1301 and 20.1302

This section demonstrates that offsite doses due to Unit 3, combined with offsite doses due to Units 1 and 2 and the NAPS independent spent fuel storage installation (ISFSI), comply with the regulatory limits in 10 CFR 20.1301 for doses to members of the public.

Using the Unit 3-specific gaseous effluent release activities identified in Table 12.2-17R, and the Unit 3-specific liquid effluent release activities identified in Table 12.2-19bR, the total annual doses to the MEI and the population resulting from Unit 3 liquid and gaseous effluents are calculated and presented in Tables 12.2-203 and 12.2-204, respectively.

The direct radiation contribution from operation of Unit 3 is negligible. The direct dose contribution from Unit 3 at two distances is provided in DCD Table 12.2-21. That table shows the annual dose at 1000 m (0.62 mi) to be 1.66E-06 mSv/yr (1.66E-04 mrem/yr). Section 9.3.9 shows that Unit 3 uses hydrogen water chemistry, and DCD Section 12.2.1.3 explains that the direct dose contribution takes into account hydrogen water chemistry. The distance from Unit 3 to the

Table 2.3-15R. The distance from Unit 3 to the location on the site boundary with the highest gaseous effluent annual dose is 1416 m (0.88 mile) in the ESE direction. This is the distance from Unit 3 to the site boundary, that is, the exclusion area boundary (EAB) in the direction of maximum annual χ/Q, as shown in Table 2.3-16R. These distances from Unit 3 to each type of receptor location are greater than those presented in the DCD, so the Unit 3 direct radiation dose rate at each location us even lower than the very low rate cited above for 1000 m (0.62 mi).

The total annual doses to the MEI resulting from North Anna Units 1 and 2 liquid and gaseous effluents are provided in Table 12.2-203. The values shown are representative based on review of Units 1 and 2 annual radiological environmental operating reports (e.g., Reference 12.2-203).

The direct radiation contribution from operation of Units 1 and 2 is negligible. An evaluation of operating plants by the NRC states that:

> "...because the primary coolant of an LWR is contained in a heavily shielded area, dose rates in the vicinity of light water reactors are generally undetectable and are less than 1 mrem/year at the site boundary."

The NRC concludes that the direct radiation from normal operation results in "small contributions at site boundaries" (Reference 12.2-204, Section 4.6.1.2). For the NAPS site, the nearest residence is at a distance typical of a site boundary evaluated by NRC. An assumed value of 1 mrem/yr is included in Table 12.2-203 to account for the dose to the MEI at the nearest residence from operation of Units 1 and 2.

The direct radiation contribution from operation of the NAPS ISFSI is small, both at the residence nearest to the ISFSI, which is south and slightly east of the ISFSI at about 1030 m (0.64 mi), and at the closest point to the site boundary, which is south and slightly west of the ISFSI at approximately 760 m (0.47 m). The annual contribution at the site boundary from the ISFSI is no more than 3.6E-02 mSv/yr (3.6 mrem/yr). This value is based on a conservatively estimated peak dose rate from 84 fully-loaded casks/modules in the ISFSI and the distance from the ISFSI to the site boundary, which is shorter than that to the residence nearest the ISFSI. This ISFSI dose contribution is then conservatively applied to the MEI for the nearest residence from Unit 3, which is 1191 m (0.74 mi) in the NW direction and even further from the ISFSI.

Table 12.2-203 shows that the total NAPS site doses resulting from the normal operation of Units 1, 2, and 3 and applied at the nearest residence are well within the regulatory limits of 40 CFR 190. These doses are applied at the distance to the nearest residence from Unit 3, that is, 1191 m (0.74 mi), but in the direction of the maximum annual χ/Q, that is, in the ESE direction, and using the maximum D/Q, which is from the NNE direction. These doses bound those at the site boundary.

Table 12.2-204 shows the total body doses from liquid and gaseous effluents doses attributable to Unit 3 for the population within 50 miles of the NAPS site.

12.2.2.4.5 Compliance with 10 CFR 20.1302

Surveys of radiation levels in unrestricted and controlled areas and radioactive materials in effluents released to unrestricted and controlled areas are conducted to demonstrate compliance with the dose limits given in 10 CFR 20.1302 for individual members of the public.

Compliance with the annual dose limit in 10 CFR 20.1302 is demonstrated by showing that the calculated total effective dose equivalent to the individual likely to receive the highest dose does not exceed the annual dose limit.

NAPS
ESP COL 11.1-1

12.2.2.4.6 Comparison of ESPA to NAPS Site with Unit 3 Liquid Effluent Concentrations

As described in Section 12.2.2.4, the radioactive liquid effluent concentrations for Unit 3 are provided in Table 12.2-19bR. This table also shows the maximum activity concentration for each nuclide at the end of the discharge canal from the combined operation of Units 1, 2, and 3, and the corresponding concentration limit for the NAPS site.

The radioactive liquid effluent concentrations for the NAPS site from the combined operation of the two new units and the existing units as presented in the ESPA are included in ESP-ER Table 5.4-6. That table presents the composite annual release activities of liquid effluents for a single new unit, but based on a composite of possible radionuclide releases from many reactor designs. For all isotopes except tritium, the maximum annual activity for each radionuclide is the maximum from the many different types of reactor designs considered. ESP-ER Table 5.4-6 contains more radionuclides than Table 12.2-19bR due to the use of the composite set of nuclides in the ESP-ER.

NAPS COL 12.2-2-A
NAPS ESP COL 11.1-1
NAPS ESP VAR 12.2-1

Table 12.2-18bR Gaseous Pathway Doses to the MEI (mrem/yr)

		ESP			Unit 3		
Location	**Pathway**	**Total Body**	**Thyroid**	**Skin**	**Total Body**	**Thyroid**	**Skin**
~~Nearest~~ Site Boundary (1416 m (0.88 mi) ESE for ESP-ER and FSAR)	Plume	2.1E+00	NA	6.2E+00	1.6E+00	**1.6E+00**	4.0E+00
	Inhalation						
	Adult	3.0E-01	1.6E+00	NA	9.1E-03	6.8E-01	NA
	Teen	3.1E-01	2.0E+00	NA	9.7E-03	8.9E-01	NA
	Child	2.7E-01	2.3E+00	NA	9.1E-03	1.1E+00	NA
	Infant	1.6E-01	2.0E+00	NA	5.5E-03	9.8E-01	NA
Nearest Garden (1513 m (0.94 mi) NE for ESP-ER; 1191 m (0.74 mi) ESE for FSAR)	Vegetable						
	Adult	4.4E-01	4.9E+00	NA	~~3.6E-01~~ 3.7E-01	~~3.3E+00~~ 4.0E+00	NA
	Teen	5.7E-01	6.6E+00	NA	~~5.7E-01~~ **5.8E-01**	~~4.6E+00~~ 5.5E+00	NA
	Child	1.1E+00	1.3E+01	NA	**1.3E+00**	~~9.1E+00~~ 1.1E+01	NA
Nearest Residence (1545 m (0.96 mi) NNE for ESP-ER; 1191 m (0.74 mi) ESE for FSAR)	Plume	1.4E+00	NA	4.0E+00	~~3.0E-01~~ 3.2E-01	~~**3.0E-01**~~ **3.2E-01**	~~6.2E-01~~ 6.5E-01
	Inhalation						
	Adult	2.0E-01	1.0E+00	NA	9.9E-03	7.2E-01	NA
	Teen	2.0E-01	1.3E+00	NA	1.0E-02	9.3E-01	NA
	Child	1.8E-01	1.5E+00	NA	9.6E-03	1.1E+00	NA
	Infant	1.0E-01	1.3E+00	NA	5.8E-03	1.0E+00	NA
Nearest Meat Cow (2205 m (1.37 mi) SE for ESP-ER; 1191 m (0.74 mi) ESE for FSAR)	Meat						
	Adult	6.7E-02	1.5E-01	NA	**1.3E-01**	~~**2.4E-01**~~ **2.6E-01**	NA
	Teen	4.9E-02	1.1E-01	NA	**1.1E-01**	~~**1.9E-01**~~ **2.0E-01**	NA
	Child	7.9E-02	1.7E-01	NA	**2.0E-01**	~~**3.2E-01**~~ **3.4E-01**	NA

NAPS COL 12.2-2-A
NAPS ESP COL 11.1-1
NAPS ESP VAR 12.2-1

Table 12.2-18bR Gaseous Pathway Doses to the MEI (mrem/yr)

		ESP			Unit 3		
Location	**Pathway**	**Total Body**	**Thyroid**	**Skin**	**Total Body**	**Thyroid**	**Skin**
Nearest Garden/ Residence/ Meat Cow (Varies for ESP-ER; 1191 m (0.74 mi) ESE for FSAR)	All						
	Adult	1.6E+00	4.9E+00	4.0E+00	~~8.0E-01~~ 8.3E-01	~~4.6E+00~~ **5.3E+00**	~~6.2E-01~~ 6.5E-01
	Teen	1.6E+00	6.6E+00	4.0E+00	~~9.9E-01~~ 1.0E+00	~~6.0E+00~~ **7.0E+00**	~~6.2E-01~~ 6.5E-01
	Child	1.6E+00	1.3E+01	4.0E+00	**1.9E+00**	~~1.1E+01~~ 1.3E+01	~~6.2E-01~~ 6.5E-01
	Infant	1.5E+00	1.3E+00	4.0E+00	~~3.1E-01~~ 3.3E-01	~~1.3E+00~~ **1.4E+00**	~~6.2E-01~~ 6.5E-01

Notes: 1. There are no infant doses for the vegetable and meat pathways because infants do not consume these foods.
2. "NA" denotes "not applicable."
3. 1 mrem = 0.01 msv
4. For Unit 3, the doses shown for "nearest garden/residence/meat cow" location are the sum of garden, residence, and meat cow doses at 1191m. For ESP, these doses are the maximum of garden/residence, and meat cow doses at 1513m NE, 1545m NNE, and 2205m SE, respectively. The site boundary and residence plume doses include ground shine contribution.

NAPS COL 12.2-2-A
NAPS
ESP COL 11.1-1

Table 12.2-201 Comparison of Annual Doses to the MEI from Gaseous Effluents Per Unit

Type of Dose	Location	ESP (Single Unit)	Unit 3	10 CFR 50 Limit
Gamma Air (mrad/yr)	Site Boundary	3.2	2.2	10
Beta Air (mrad/yr)	Site Boundary	4.8	2.5	20
Total Body (mrem/yr)	Site Boundary	2.4	1.6	5
Skin (mrem/yr)	Site Boundary	6.2	4.0	15
Iodines and Particulates - Thyroid (mrem/yr)	Garden/ Residence/ Meat Cow	12	~~9.1~~ 11	15

1 mrad = 0.01 mGy
1 mrem = 0.01 mSv

NAPS COL 12.2-2-A
NAPS COL 12.2-3-A
NAPS ESP COL 11.1-1
NAPS ESP VAR 12.2-4

Table 12.2-203 Comparison of Site Doses to the MEI

Type of Dose	ESP Site Total(1)	Unit 3 (ESBWR) Liquid	Gaseous	Total	Existing Units(2)	Site Total(3)	40 CFR 190 Limit
Total Body (mrem/yr)	6.8	0.094	1.9	~~1.9~~ 2.0	**5.0**	**6.9**	25
Thyroid (mrem/yr)	27	0.18	~~11~~ 13	~~11~~ 13	**5.1**	18	75
Bone (mrem/yr)	12	1.3	~~7.9~~ 8.0	9.2	**5.1**	**14**	25

Notes:

(1) The ESP site total doses are for two new units and two existing units, and do not include a dose contribution from the ISFSI.

(2) The doses from existing units include ISFSI contribution and an assumed dose of 1 mrem/yr due to direct radiation from the existing units.

(3) This site total dose includes the Unit 3 total dose and the dose from the existing units.

(4) 1 mrem = 0.01 msv

2.5 Socioeconomics

The information for this section is provided in ESP-ER Section 2.5 and in FEIS Sections 2.8 and 2.9.

No new and significant information has been identified for socioeconomics.

2.6 Geology

The information for this section is provided in ESP-ER Section 2.6 and in FEIS Section 2.4.

No new and significant information has been identified for this section.

2.7 Meteorology and Air Quality

The information for this section is provided in ESP-ER Section 2.7 and in FEIS Section 2.3. Supplemental information concerning atmospheric dispersion coefficients ~~as~~ is provided in Sections 2.7.5 and 2.7.6.

2.7.1 General Climate

No new and significant information has been identified for this section.

2.7.2 Regional Air Quality

No new and significant information has been identified for this section.

2.7.3 Severe Weather

No new and significant information has been identified for this section.

2.7.4 Local Meteorology

No new and significant information has been identified for this section.

2.7.5 Short-Term Diffusion Estimates

For the short-term atmospheric dispersion coefficients (used in the evaluation of doses due to design basis accidents, in Section 7.1), the ESP values listed in FEIS Table 5-14 are used for this ER.

2.7.6 Long-Term (Routine) Diffusion Estimates

As a part of the preparation of this ER, the annual Radiological Environmental Monitoring Program was reviewed to determine if the distances to any of the nearest sensitive receptors, modeled for the ESP-ER have changed. The results of that review, as documented in Table 2.7-1, show the closest receptor to be the residence at the NW direction at a distance of 1.20 km (3930 feet). For the purposes of the atmospheric dispersion analysis and the subsequent dose evaluations, it was conservatively assumed that each sensitive receptor (meat animal, vegetable garden, residence) is

at the location of the closest receptor. Therefore, one of each type of receptor was assumed to be at 1.20 km (3930 feet) in each compass direction. The maximum annual average χ/Q value calculated for the nearest residence, vegetable garden, and meat animal, all assumed at 0.74 miles ~~to the ESE of the facility boundary shown in FSAR Figure 2.0-205~~, is 4.20 E-6 sec/m^3 in the ESE direction. The maximum D/Q for those receptors is 1.10E-8 m^{-2} in the NNE direction. In the evaluation performed for this ER, the distance to the site boundary (EAB) was found to be 1.0 mile in the direction where the maximum χ/Q is calculated. However, for conservatism, the greater χ/Q value from the ESP-ER, which is based on a distance of 0.88 miles, is retained for use in this ER. The maximum annual χ/Q (no decay, undepleted) at the EAB is 3.70 E-6 sec/m^3, at a distance of 1.42 km (0.88 mile) to the ESE of the facility boundary. The results are summarized in Table 2.7-2 and Table 2.7-3. These tables present the maximum calculated χ/Qs and D/Qs at sensitive receptors and at various distances from the site.

Long-term (~~Annual~~ annual average) χ/Q and D/Q estimates generated by the XOQDOQ model for the sensitive receptors and at distances between 0.25 mile to 50 miles, as well as for various segment boundaries, are also presented. Table 2.7-4 presents χ/Q and D/Q estimates at the specific points of interest. ~~Table 2.7-5 lists χ/Q estimates at downwind distances between 0.25 and 50 miles and along various segments. Table 2.7-7 contains χ/Q estimates that include radioactive decay with a half life of 2.26 days for short lived noble gases. Table 2.7-9 contains χ/Q estimates that include radioactive decay with a half life of 8 days for all iodines released to the atmosphere. Finally, Table 2.7-11 contains estimates of long-term average D/Q at downwind distances between 0.25 and 50 miles.~~

Table 2.7-5 presents the no decay and undepleted χ/Q estimates at various downwind distances between 0.4 km (0.25 mi) and 80.5 km (50 mi). Table 2.7-6 presents the no decay and undepleted χ/Q estimates for various distance segments out to 80.5 km (50 mi).

Table 2.7-7 presents the 2.26 day decay (for short-lived noble gases) and undepleted χ/Q estimates at the same downwind distances. Table 2.7-8 presents the 2.26 day decay and undepleted χ/Q estimates for the same distance segments.

Table 2.7-9 presents the 8 day decay (for all iodines released to the atmosphere) and depleted χ/Q estimates at the same downwind distances. Table 2.7-10 presents the 8 day decay and depleted χ/Q estimates for the same distance segments.

Table 2.7-11 presents the D/Q estimates for the same downwind distances. Table 2.7-12 presents the D/Q estimates for the same distance segments.

The methodology used to determine the long-term dispersion and deposition coefficients (used in the evaluation of doses due to normal operating releases) remains the same as that described in ESP-ER Section 2.7.6.

The following input data and assumptions were used in the XOQDOQ modeling:

Table 2.7-1 Source to Sensitive Receptor Distances

Type	Direction	Distance from Unit 1 (Feet)	Distance from Unit 1 (Miles/km)	Distance From Facility Boundary (Feet)[1]	Distance from Facility Boundary (Miles/km)[1]
Site Boundary (Exclusion Area Boundary)					
EAB	S	5199	0.98/1.58	3719	0.70/1.13
EAB	SSW	5394	1.01/1.64	3238	0.61/0.99
EAB	SW	5527	1.05/1.68	2877	0.54/0.88
EAB	WSW	5571	1.06/1.70	2891	0.55/0.88
EAB	W	5519	1.05/1.68	2914	0.55/0.89
EAB	WNW	5380	1.02/1.64	3393	0.64/1.03
EAB	NW	5181	0.98/1.58	3919	0.74/1.19
EAB	NNW	4957	0.94/1.51	4417	0.84/1.35
EAB	N	4744	0.90/1.45	4847	0.92/1.48
EAB	NNE	4572	0.87/1.39	5110	0.97/1.56
EAB	NE	4463	0.85/1.36	4858	0.92/1.48
EAB	ENE	4427	0.84/1.35	4967	0.94/1.51
EAB	E	4470	0.85/1.36	5604	1.06/1.71
EAB	ESE	4585	0.97/1.40	5304	1.00/1.62
EAB	SE	4761	0.90/1.45	4603	0.87/1.40
EAB	SSE	4976	0.94/1.52	4180	0.79/1.27

Note 1: Distances are from the plant facility boundary. See FSAR Figure 2.0-205.

Note 2: No milk cows or goats within a 5-mile radius of NAPS.

Table 2.7-2 XOQDOQ Predicted Maximum χ/Q and D/Q Values at Specific Points of Interest

Type of Location	Direction from Site	Distance (miles)	χ/Q (No Decay, Undepleted)	χ/Q (2.260 Day Decay, Undepleted)	χ/Q (8.000 Day Decay, Depleted)	D/Q
Residence	ESE	0.74	4.20E-06	4.10E-06	3.70E-06	~~9.00E-09~~ 1.1E-08[b]
EAB[c]	ESE	0.88	3.7E-06	3.7E-06	3.3E-06	1.2E-08[a]
Meat Animal	ESE	0.74	4.20E-06	4.10E-06	3.70E-06	~~9.00E-09~~ 1.1E-08[b]
Veg. Garden	ESE	0.74	4.20E-06	4.10E-06	3.70E-06	~~9.00E-09~~ 1.1E-08[b]

Notes:
χ/Q – sec/m^3
D/Q – 1/m^2

a: direction South and distance of 0.62 mi for maximum D/Q for EAB
b: direction North-Northeast for maximum D/Q for residence, meat animal, and vegetable garden
c: from ESP-ER Table 2.7-2

indicate isotopes for which the estimated ESBWR release activity is greater than the corresponding ESP-ER composite release activity. "NP" denotes isotopes which are not present in ESBWR liquid effluents.

There are small increases in liquid effluent release activities for twelve radioisotopes associated with normal operation of Unit 3 as compared to the composite release activities presented in the ESP-ER. However, the total liquid effluent release activity of Unit 3 is at least an order of magnitude lower than the total ESP-ER composite release activity.

ESP-ER Table 5.4-10 provided the total body and organ doses to the maximally exposed individual (MEI) resulting from liquid and gaseous effluent releases of a single new unit. These calculated doses were determined to be within the design objectives of 10 CFR 50, Appendix I. Using design-specific release activities of liquid effluents from Unit 3, the total annual doses to the MEI from liquid effluents are calculated and presented in Table 5.4-2. The total annual doses from liquid effluents were calculated using the same methodologies and parameters (with the exception of release activity) as those used in ESP-ER annual MEI dose calculations.

As shown in Table 5.4-2, the annual doses to the MEI from different liquid effluent pathways are consistently lower than those calculated and presented in the ESP-ER. Therefore, the dose impacts to the MEI remain SMALL, and no new mitigation measures or controls are warranted.

5.4.2.2 Gaseous Pathway Doses

ESP-ER Table 5.4-7 presented the composite release activities of gaseous effluents for a single new unit. These composite activities were obtained by taking the maximum activity for each isotope from multiple reactor designs. ESBWR-specific gaseous effluent release activities are presented in Table 5.4-3 and are compared to ESP-ER composite release activities. All Unit 3 ESBWR-specific release activities are lower than the corresponding ESP-ER composite release activities. "NP" denotes isotopes which are not present in ESBWR gaseous effluents.

The total annual doses to the MEI from gaseous effluents have been re-calculated using the ESBWR-specific gaseous release activities and the same methodologies and parameters as those used in ESP-ER calculations, with the exception of MEI locations. As discussed in Section 2.7, the MEI locations for the vegetable garden, residential, and meat cow receptors have changed. A single, bounding location ~~(0.74 mile ESE from the facility boundary)~~, has been selected for these receptors and the doses from the garden, residential, and meat cow pathways are summed to arrive at the total dose at this location. The χ/Q values are at 0.74 mile ESE from the facility boundary and the D/Q values are at the same distance in the NNE direction. The ~~nearest~~ maximum χ/Q site boundary MEI location (0.88 mile ESE of the ~~site~~ plant boundary) ~~is~~ and maximum D/Q site boundary location (0.62 mile in the south direction) are the same as ~~was~~ were used in the ESP-ER. The results of the total annual dose calculations are provided in Table 5.4-4. The values in bold print indicate the Unit 3 gaseous pathway doses to the MEI that are larger than the corresponding ESP-ER doses.

Table 5.4-4 Gaseous Pathway Doses (mrem/yr) to the MEI

		ESP-ER			Unit 3		
Location	**Pathway**	**Total Body**	**Thyroid**	**Skin**	**Total Body**	**Thyroid**	**Skin**
~~Nearest~~ Site Boundary (0.88 mi ESE for ESP-ER; same location for this ER)	Plume	2.1E+00	N/A	6.2E+00	1.6E+00	**1.6E+00**	4.0E+00
	Inhalation						
	Adult	3.0E-01	1.6E+00	N/A	9.1E-03	6.8E-01	N/A
	Teen	3.1E-01	2.0E+00	N/A	9.7E-03	8.9E-01	N/A
	Child	2.7E-01	2.3E+00	N/A	9.1E-03	1.1E+00	N/A
	Infant	1.6E-01	2.0E+00	N/A	5.5E-03	9.8E-01	N/A
Nearest Garden (0.94 mi NE for ESP-ER; 0.74 mi ESE for this ER)	Vegetable						
	Adult	4.4E-01	4.9E+00	N/A	~~3.6E-01~~ 3.7E-01	~~3.3E+00~~ 4.0E+00	N/A
	Teen	5.7E-01	6.6E+00	N/A	~~5.7E-01~~ **5.8E-01**	~~4.6E+00~~ 5.5E+00	N/A
	Child	1.1E-00	1.3E+01	N/A	**1.3E+00**	~~9.1E+00~~ 1.1E+01	N/A
Nearest Residence (0.96 mi NNE for ESP-ER; 0.74 mi ESE for this ER)	Plume	1.4E+00	N/A	4.0E+00	~~3.0E-01~~ 3.2E-01	~~**3.0E-01**~~ **3.2E-01**	~~6.2E-01~~ 6.5E-01
	Inhalation						
	Adult	2.0E-01	1.0E+00	N/A	9.9E-03	7.2E-01	N/A
	Teen	2.0E-01	1.3E+00	N/A	1.0E-02	9.3E-01	N/A
	Child	1.8E-01	1.5E+00	N/A	9.6E-03	1.1E+00	N/A
	Infant	1.0E-01	1.3E+00	N/A	5.8E-03	1.0E+00	N/A
Nearest Meat Cow (1.37 mi SE for ESP-ER; 0.74 mi ESE for this ER)	Meat						
	Adult	6.7E-02	1.5E-01	N/A	**1.3E-01**	~~**2.4E-01**~~ **2.6E-01**	N/A
	Teen	4.9E-02	1.1E-01	N/A	**1.1E-01**	~~**1.9E-01**~~ **2.0E-01**	N/A
	Child	7.9E-02	1.7E-01	N/A	**2.0E-01**	~~**3.2E-01**~~ **3.4E-01**	N/A

Table 5.4-4 Gaseous Pathway Doses (mrem/yr) to the MEI

		ESP-ER			Unit 3		
Location	**Pathway**	**Total Body**	**Thyroid**	**Skin**	**Total Body**	**Thyroid**	**Skin**
Nearest Garden/ Residence/ Meat Cow (Varies for ESP-ER; 0.74 mi ESE for this ER)	All						
	Adult	1.6E+00	4.9E+00	4.0E+00	~~8.0E-01~~ 8.3E-01	~~4.6E+00~~ **5.3E+00**	~~6.2E-01~~ 6.5E-01
	Teen	1.6E+00	6.6E+00	4.0E+00	~~9.9E-01~~ 1.0E+00	~~6.0E+00~~ **7.0E+00**	~~6.2E-01~~ 6.5E-01
	Child	1.6E+00	1.3E+01	4.0E+00	**1.9E+00**	~~1.1E+01~~ 1.3E+01	~~6.2E-01~~ 6.5E-01
	Infant	1.5E+00	1.3E+00	4.0E+00	~~3.1E-01~~ 3.3E-01	~~1.3E+00~~ **1.4E+00**	~~6.2E-01~~ 6.5E-01

Notes:

1. There are no infant doses for the vegetable and meat pathways because infants do not consume these foods.
2. "N/A" denotes "not applicable."
3. For Unit 3, the doses shown for "nearest garden/residence/meat cow" location are the sum of garden, residence, and meat cow doses at 0.74 mi. For ESP-ER, these doses are the maximum of garden, residence, and meat cow doses at 0.94 mi NNE, and 1.37 mi SE, respectively.

Table 5.4-5 Comparison of Annual Doses to the MEI from Gaseous Effluents

Type of Dose	ESP-ER 1 New Unit (MEI Location)	Unit 3 (MEI Location)	10 CFR 50 Appendix I Limit
Gamma Air (mrad/yr)	3.2 (Site Boundary)	2.2 (Site Boundary)	10
Beta Air (mrad/yr)	4.8 (Site Boundary)	2.5 (Site Boundary)	20
Total Body (mrem/yr)	2.4 (Site Boundary)	1.6 (Site Boundary)	5
Skin (mrem/yr)	6.2 (Site Boundary)	4.0 (Site Boundary)	15
Iodine and Particulates – Thyroid (mrem/yr)	12 (Garden)	~~9.1~~ 11 (Garden/ Residence/ Meat Cow)	15

Table 5.4-6 Comparison of Site Doses (mrem/yr) to the MEI

	ESP	North Anna Unit 3 (ESBWR)					
Type of Dose	**Site Total (1)**	**Liquid**	**Gaseous**	**Total**	**Existing Units (2)**	**Site Total (3)**	**40 CFR 190 Limit**
Total Body (mrem/yr)	6.8	0.094	1.9	2.0	5.0	6.9	25
Thyroid (mrem/yr)	27	0.18	13	13	5.1	18	75
Bone (mrem/yr)	12	1.3	8.0	9.2	5.1	14	25

Notes:

1. The ESP site total doses are for two new units and the two existing units, and do not include a dose contribution from the ISFSI.

2. The doses from existing units include ISFSI contribution and an assumed dose of 1 mrem/yr due to direct radiation from the existing units.

3. This site total dose includes the Unit 3 total dose and the dose from the existing units.

ENCLOSURE 3

Response to NRC RAI Letter No. 019

RAI Question No. 02.03.05-3

NRC RAI 02.03.05-3

FSAR Section 2.3.5, Long-Term (Routine) Diffusion Estimates, addresses X/Q and D/Q values. Please revise Section 2.3.5 to include X/Q and D/Q values out to 50 miles which are used to perform the population dose calculation for the radwaste system cost-benefit analysis required by Section II.D of Appendix I to Part 50.

Dominion Response

FSAR Section 2.3.5 will be revised to provide the χ/Q (atmospheric dispersion coefficient) and D/Q (ground deposition coefficient) values out to 50 miles.

Proposed COLA Revision

FSAR Section 2.3.5.1 will be revised and Tables 2.3-206, 2.3-207, 2.3-208, 2.3-209, 2.3-210, 2.3-211, 2.3-212, and 2.3-213 will be added to provide χ/Q and D/Q values out to 50 miles.

To clarify titles with respect to content and to be consistent with the new FSAR tables, ER Section 2.7.6 will be revised and Tables 2.7-5, 2.7-6, 2.7-7, and 2.7-8 will be divided, creating additional Tables 2.7-9, 2.7-10, 2.7-11, and 2.7-12.

These changes are shown on the attached FSAR and ER markups.

Markup of North Anna COLA

The attached markup represents Dominion's good faith effort to show how the COLA will be revised in a future COLA submittal in response to the subject RAI. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be somewhat different than as presented herein.

heights away from the Unit 3 power block buildings which could have postulated fission product releases. As a result, the entire EAB is located beyond the wake influence zone that can be induced by tall structures, e.g., the Unit 3 Turbine Building or Reactor Building.

NAPS ESP COL 2.3-2

2.3.4.3 Atmospheric Dispersion Factors for On-Site Doses

Onsite χ/Q values for use in evaluating potential doses from Unit 3 postulated release locations (sources) to on-site receptor locations are based on the Unit 3 plant layout shown in Figure 2.3-201. The meteorological data used in evaluating on-site doses is the same data used for the accident condition dose calculations in SSAR Section 2.3.4. The χ/Q values for the control room were calculated using the ARCON96 computer code in accordance with guidance as documented in RG 1.194. The source and receptor combinations are shown in Table 2.3-201 through Table 2.3-205. Figure 2.3-201 shows the locations of postulated accidental releases from Unit 3 and the Unit 3 receptor locations.

NAPS COL 2.0-11-A

2.3.5 Long-Term (Routine) Diffusion Estimates

The information needed to address DCD COL Item 2.0-11-A is included in SSAR Section 2.3.5, which is incorporated by reference with the following supplements and variances.

2.3.5.1 Basis

The ~~fifth paragraph~~ third through sixth paragraphs of this SSAR section ~~is~~ are supplemented as follows with information to address the receptors near the Unit 3 site.

NAPS ESP COL 2.3-3

The following input data and assumptions were used in the XOQDOQ modeling:

- Meteorological Data: Three-year combined (1996–1998) onsite joint frequency distribution of wind speed, wind direction, and atmospheric stability.
- Type of Release: Ground level.
- Wind Sensor Height: 10 m (33 ft).
- Vertical Temperature Difference: 10 m (33 ft) – 48.4 m (158.9 ft).
- Number of Wind Speed Categories: 7.

- Release Height: 10 m (33 ft) (default height).
- Reactor Building Height: 49 m (161 ft).
- Minimum Reactor Building Cross-Sectional Area: 2400 m^2 (25,800 ft^2).
- Distances from the release point to the nearest residence, nearest site boundary, milk cow, vegetable garden, milk goat, meat animal: See Table 2.3-15R.

For the dispersion analysis, the ESBWR Reactor Building is used to determine the minimum building cross-sectional area for evaluating building downwash effects. The height of this building is approximately 49 m (161 ft) including parapets. Based on this height and a nominal width of 49 m (161 ft) on the rectangular face of the building, a minimum building cross-sectional area of 2400 m^2 (25,800 ft^2) was used to determine χ/Q and D/Q estimates. The perpendicular face of the building is narrower at the top, but the total area, including stairwells and the elevator shaft, is greater than 2400 m^2 (25,800 ft^2) in that perpendicular direction. For the NAPS site, the χ/Q and D/Q values were found to depend on building height but not cross-sectional area.

The annual Radiological Environmental Monitoring Program (Reference 2.3-201) was reviewed to determine if the distances of any of the nearest receptors modeled for the SSAR have changed. The results of that review, as documented in Table 2.3-15R, show the closest receptor to be the residence. The evaluation assumed conservatively, that each receptor (meat animal, vegetable garden, residence) is at the location of the closest receptor. The results, as documented in Table 2.3-15R, show the closest receptor to be the residence ~~at~~ in the NW direction at a distance of 1.20 km (3930 ft). Therefore, for the purposes of the atmospheric dispersion analysis and the subsequent dose evaluations, one of each type of receptor was assumed to be at 1.20 km (3930 ft) in each compass direction. ~~For the purposes of the atmospheric dispersion analysis and the subsequent dose evaluations, it was conservatively assumed that each receptor (meat animal, vegetable garden, residence) is at the location of the closest receptor. Therefore, one of each type of receptor was assumed to be at 1.20 km (3930 ft) in each compass direction.~~ The maximum annual average χ/Q value calculated for the nearest residence, vegetable garden, and meat animal, all assumed at 1.20 km (3930 ft), ~~to the ESE of the plant envelope~~ is 4.20 E-6 sec/m^3 in the ESE direction. The maximum D/Q for these

receptors is 1.10E-8 m^{-2} in the NNE direction. In the evaluation performed for this FSAR, the shortest distance from any point on the plant facility boundary to the site boundary (EAB) was found to be 1.6 km (1.0 mile) in the direction where the maximum χ/Q is calculated. However, for conservatism, the greater χ/Q from SSAR Section 2.3.5, which is based on a distance of 1.42 km (0.88 miles), is retained for use in this section. The maximum annual χ/Q (no decay, undepleted) at the EAB is 3.70×10^{-6} sec/m^3; at a distance of 1.42 km (0.88 mile) to the ESE of the plant facility boundary (Figure 2.0-205).

NAPS ESP VAR 2.0-1a to 2.0-1l

The results are summarized in Table 2.3-16R and Table 2.3-17R. These tables present the maximum calculated χ/Qs and D/Qs at receptors and at various distances from the site.

Add the following at the end of this SSAR section to address annual average χ/Q and D/Q estimates.

NAPS COL 2.0-11-A

Long-term (annual average) χ/Q and D/Q estimates generated by the XOQDOQ model are also presented for each directional sector at twenty-two specific distances, as well as for ten distance segments. Table 2.3-206 presents the no decay and undepleted χ/Q estimates at various downwind distances between 0.4 km (0.25 mi) and 80.5 km (50 mi). Table 2.3-207 presents the no decay and undepleted χ/Q estimates for various distance segments out to 80.5 km (50 mi).

Table 2.3-208 presents the 2.26 day decay (for short-lived noble gases) and undepleted χ/Q estimates at the same downwind distances. Table 2.3-209 presents the 2.26 day decay and undepleted χ/Q estimates for the same distance segments.

Table 2.3-210 presents the 8 day decay (for all iodines released to the atmosphere) and depleted χ/Q estimates at the same downwind distances. Table 2.3-211 presents the 8 day decay and depleted χ/Q estimates for the same distance segments.

Table 2.3-212 presents the D/Q estimates for the same downwind distances. Table 2.3-213 presents the D/Q estimates for the same distance segments.

NAPS ESP COL 2.3-2

Table 2.3-204 Unit 3 Fuel Building and Radwaste Building χ/Q Results (sec/m^3)

Source/Receptor	0–2 hr	2–8 hr	8–24 hr	1–4 d	4–30 d
FB Cask Doors to N	1.21E-03	7.96E-04	3.54E-04	2.44E-04	2.08E-04
FB Source to N	2.65E-03	2.01E-03	8.08E-04	6.28E-04	5.18E-04
RW to N	1.27E-03	1.02E-03	4.30E-04	3.02E-04	2.55E-04

NAPS ESP COL 2.3-2

Table 2.3-205 Unit 3 Cross Unit Results

Source/Receptor	0–2 hr	2–8 hr	8–24 hr	1–4 d	4–30 d
Unit 1/2 Release to Unit 3	9.83E-05	7.04E-05	2.64E-05	1.89E-05	1.55E-05

NAPS COL 2.0-11-A

Table 2.3-206 Long-Term χ/Q (sec/m³) for Routine Releases at Distances Between 0.25 to 50 Miles, No Decay, Undepleted

	Ground Level Release - No Purge Releases										
	Distance in Miles from the Site										
Sector	**0.250**	**0.500**	**0.750**	**1.000**	**1.500**	**2.000**	**2.500**	**3.000**	**3.500**	**4.000**	**4.500**
S	8.349E-06	2.976E-06	1.595E-06	1.023E-06	5.508E-07	3.558E-07	2.538E-07	1.928E-07	1.529E-07	1.252E-07	1.050E-07
SSW	6.537E-06	2.338E-06	1.261E-06	8.122E-07	4.388E-07	2.841E-07	2.030E-07	1.544E-07	1.226E-07	1.005E-07	8.434E-08
SW	5.863E-06	2.085E-06	1.125E-06	7.259E-07	3.931E-07	2.550E-07	1.825E-07	1.390E-07	1.105E-07	9.067E-08	7.617E-08
WSW	5.511E-06	1.940E-06	1.044E-06	6.739E-07	3.656E-07	2.375E-07	1.702E-07	1.298E-07	1.033E-07	8.482E-08	7.132E-08
W	6.877E-06	2.365E-06	1.265E-06	8.167E-07	4.457E-07	2.913E-07	2.098E-07	1.606E-07	1.282E-07	1.056E-07	8.904E-08
WNW	6.006E-06	2.046E-06	1.097E-06	7.084E-07	3.860E-07	2.519E-07	1.812E-07	1.387E-07	1.107E-07	9.113E-08	7.682E-08
NW	6.009E-06	2.064E-06	1.122E-06	7.288E-07	4.001E-07	2.624E-07	1.895E-07	1.454E-07	1.163E-07	9.597E-08	8.104E-08
NNW	5.110E-06	1.747E-06	9.583E-07	6.266E-07	3.458E-07	2.274E-07	1.645E-07	1.264E-07	1.013E-07	8.362E-08	7.067E-08
N	1.299E-05	4.468E-06	2.462E-06	1.613E-06	8.890E-07	5.834E-07	4.214E-07	3.234E-07	2.588E-07	2.136E-07	1.803E-07
NNE	1.657E-05	5.654E-06	3.098E-06	2.029E-06	1.119E-06	7.350E-07	5.312E-07	4.079E-07	3.265E-07	2.695E-07	2.276E-07
NE	1.352E-05	4.622E-06	2.530E-06	1.656E-06	9.142E-07	6.013E-07	4.350E-07	3.343E-07	2.679E-07	2.212E-07	1.870E-07
ENE	8.502E-06	2.817E-06	1.532E-06	1.007E-06	5.622E-07	3.730E-07	2.717E-07	2.100E-07	1.690E-07	1.401E-07	1.188E-07
E	1.668E-05	5.305E-06	2.852E-06	1.885E-06	1.069E-06	7.183E-07	5.283E-07	4.114E-07	3.333E-07	2.779E-07	2.368E-07
ESE	2.566E-05	7.927E-06	4.114E-06	2.670E-06	1.524E-06	1.038E-06	7.709E-07	6.052E-07	4.936E-07	4.140E-07	3.546E-07
SE	1.818E-05	5.672E-06	2.914E-06	1.868E-06	1.056E-06	7.154E-07	5.298E-07	4.149E-07	3.378E-07	2.828E-07	2.420E-07
SSE	9.287E-06	3.113E-06	1.640E-06	1.051E-06	5.752E-07	3.782E-07	2.737E-07	2.104E-07	1.687E-07	1.394E-07	1.179E-07

NAPS COL 2.0-11-A

Table 2.3-206 Long-Term χ/Q (sec/m^3) for Routine Releases at Distances Between 0.25 to 50 Miles, No Decay, Undepleted

	Ground Level Release - No Purge Releases										
	Distance in Miles from the Site										
Sector	**5.000**	**7.500**	**10.000**	**15.000**	**20.000**	**25.000**	**30.000**	**35.000**	**40.000**	**45.000**	**50.000**
S	8.977E-08	4.929E-08	3.232E-08	1.794E-08	1.188E-08	8.646E-09	6.678E-09	5.373E-09	4.453E-09	3.776E-09	3.259E-09
SSW	7.215E-08	3.970E-08	2.608E-08	1.450E-08	9.599E-09	6.984E-09	5.393E-09	4.338E-09	3.595E-09	3.047E-09	2.629E-09
SW	6.521E-08	3.601E-08	2.372E-08	1.324E-08	8.788E-09	6.409E-09	4.959E-09	3.995E-09	3.315E-09	2.813E-09	2.430E-09
WSW	6.111E-08	3.386E-08	2.236E-08	1.253E-08	8.344E-09	6.101E-09	4.730E-09	3.818E-09	3.174E-09	2.697E-09	2.333E-09
W	7.648E-08	4.280E-08	2.847E-08	1.613E-08	1.083E-08	7.971E-09	6.213E-09	5.038E-09	4.205E-09	3.587E-09	3.113E-09
WNW	6.599E-08	3.696E-08	2.460E-08	1.396E-08	9.406E-09	6.937E-09	5.417E-09	4.399E-09	3.676E-09	3.139E-09	2.727E-09
NW	6.970E-08	3.920E-08	2.616E-08	1.488E-08	1.002E-08	7.391E-09	5.770E-09	4.684E-09	3.913E-09	3.340E-09	2.900E-09
NNW	6.083E-08	3.431E-08	2.294E-08	1.307E-08	8.809E-09	6.497E-09	5.072E-09	4.118E-09	3.439E-09	2.935E-09	2.548E-09
N	1.551E-07	8.723E-08	5.819E-08	3.307E-08	2.223E-08	1.637E-08	1.276E-08	1.034E-08	8.630E-09	7.358E-09	6.382E-09
NNE	1.958E-07	1.103E-07	7.363E-08	4.190E-08	2.821E-08	2.079E-08	1.622E-08	1.316E-08	1.099E-08	9.374E-09	8.135E-09
NE	1.609E-07	9.075E-08	6.066E-08	3.457E-08	2.329E-08	1.718E-08	1.341E-08	1.089E-08	9.095E-09	7.763E-09	6.739E-09
ENE	1.026E-07	5.856E-08	3.948E-08	2.277E-08	1.547E-08	1.148E-08	9.008E-09	7.345E-09	6.158E-09	5.273E-09	4.592E-09
E	2.053E-07	1.190E-07	8.114E-08	4.750E-08	3.260E-08	2.439E-08	1.926E-08	1.579E-08	1.330E-08	1.144E-08	9.993E-09
ESE	3.089E-07	1.823E-07	1.258E-07	7.493E-08	5.206E-08	3.932E-08	3.130E-08	2.583E-08	2.188E-08	1.891E-08	1.660E-08
SE	2.106E-07	1.239E-07	8.534E-08	5.075E-08	3.524E-08	2.661E-08	2.118E-08	1.748E-08	1.481E-08	1.280E-08	1.124E-08
SSE	1.016E-07	5.751E-08	3.860E-08	2.216E-08	1.504E-08	1.116E-08	8.765E-09	7.150E-09	5.999E-09	5.141E-09	4.480E-09

NAPS COL 2.0-11-A

Table 2.3-207 Long-Term χ/Q (sec/m³) for Routine Releases Along Various Distance Segments, No Decay, Undepleted

	Ground Level Release - No Purge Releases									
	Segment Boundaries in Miles from the Site									
Direction From Site	0.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	1.648E-06	5.691E-07	2.566E-07	1.538E-07	1.054E-07	5.074E-08	1.844E-08	8.721E-09	5.395E-09	3.785E-09
SSW	1.301E-06	4.530E-07	2.052E-07	1.233E-07	8.461E-08	4.086E-08	1.489E-08	7.045E-09	4.357E-09	3.055E-09
SW	1.161E-06	4.057E-07	1.845E-07	1.111E-07	7.641E-08	3.704E-08	1.359E-08	6.463E-09	4.011E-09	2.820E-09
WSW	1.079E-06	3.772E-07	1.720E-07	1.038E-07	7.154E-08	3.480E-08	1.285E-08	6.151E-09	3.833E-09	2.704E-09
W	1.310E-06	4.595E-07	2.118E-07	1.289E-07	8.930E-08	4.392E-08	1.652E-08	8.030E-09	5.056E-09	3.594E-09
WNW	1.135E-06	3.980E-07	1.830E-07	1.112E-07	7.705E-08	3.792E-08	1.430E-08	6.988E-09	4.415E-09	3.146E-09
NW	1.157E-06	4.120E-07	1.913E-07	1.169E-07	8.126E-08	4.018E-08	1.523E-08	7.444E-09	4.700E-09	3.347E-09
NNW	9.862E-07	3.556E-07	1.660E-07	1.017E-07	7.086E-08	3.515E-08	1.337E-08	6.544E-09	4.132E-09	2.941E-09
N	2.530E-06	9.140E-07	4.254E-07	2.601E-07	1.808E-07	8.941E-08	3.383E-08	1.649E-08	1.038E-08	7.373E-09
NNE	3.191E-06	1.151E-06	5.362E-07	3.280E-07	2.283E-07	1.130E-07	4.287E-08	2.094E-08	1.321E-08	9.393E-09
NE	2.606E-06	9.399E-07	4.391E-07	2.691E-07	1.875E-07	9.297E-08	3.536E-08	1.730E-08	1.093E-08	7.778E-09
ENE	1.584E-06	5.770E-07	2.740E-07	1.697E-07	1.191E-07	5.987E-08	2.324E-08	1.155E-08	7.368E-09	5.283E-09
E	2.967E-06	1.094E-06	5.322E-07	3.345E-07	2.373E-07	1.214E-07	4.835E-08	2.453E-08	1.583E-08	1.145E-08
ESE	4.319E-06	1.563E-06	7.757E-07	4.952E-07	3.553E-07	1.853E-07	7.606E-08	3.951E-08	2.588E-08	1.893E-08
SE	3.062E-06	1.085E-06	5.334E-07	3.389E-07	2.425E-07	1.260E-07	5.154E-08	2.674E-08	1.752E-08	1.282E-08
SSE	1.705E-06	5.933E-07	2.763E-07	1.695E-07	1.182E-07	5.889E-08	2.265E-08	1.124E-08	7.173E-09	5.150E-09

NAPS COL 2.0-11-A

Table 2.3-208 Long-Term χ/Q (sec/m^3) for Routine Releases at Distances Between 0.25 to 50 Miles, 2.260 Day Decay, Undepleted

	Ground Level Release - No Purge Releases										
	Distance in Miles from the Site										
Sector	**0.250**	**0.500**	**0.750**	**1.000**	**1.500**	**2.000**	**2.500**	**3.000**	**3.500**	**4.000**	**4.500**
S	8.340E-06	2.969E-06	1.590E-06	1.019E-06	5.474E-07	3.529E-07	2.512E-07	1.904E-07	1.507E-07	1.231E-07	1.030E-07
SSW	6.530E-06	2.333E-06	1.257E-06	8.086E-07	4.359E-07	2.816E-07	2.007E-07	1.523E-07	1.207E-07	9.866E-08	8.262E-08
SW	5.856E-06	2.080E-06	1.121E-06	7.224E-07	3.903E-07	2.526E-07	1.804E-07	1.370E-07	1.087E-07	8.892E-08	7.452E-08
WSW	5.504E-06	1.936E-06	1.041E-06	6.705E-07	3.628E-07	2.351E-07	1.681E-07	1.278E-07	1.015E-07	8.308E-08	6.967E-08
W	6.868E-06	2.359E-06	1.260E-06	8.125E-07	4.423E-07	2.883E-07	2.070E-07	1.581E-07	1.259E-07	1.034E-07	8.693E-08
WNW	5.998E-06	2.041E-06	1.093E-06	7.049E-07	3.831E-07	2.494E-07	1.789E-07	1.366E-07	1.087E-07	8.928E-08	7.507E-08
NW	6.001E-06	2.059E-06	1.117E-06	7.252E-07	3.971E-07	2.598E-07	1.871E-07	1.432E-07	1.143E-07	9.404E-08	7.920E-08
NNW	5.103E-06	1.742E-06	9.543E-07	6.231E-07	3.429E-07	2.248E-07	1.622E-07	1.243E-07	9.926E-08	8.173E-08	6.888E-08
N	1.297E-05	4.455E-06	2.452E-06	1.604E-06	8.816E-07	5.770E-07	4.156E-07	3.181E-07	2.538E-07	2.088E-07	1.759E-07
NNE	1.655E-05	5.639E-06	3.086E-06	2.019E-06	1.110E-06	7.273E-07	5.242E-07	4.014E-07	3.205E-07	2.638E-07	2.222E-07
NE	1.350E-05	4.610E-06	2.520E-06	1.647E-06	9.071E-07	5.950E-07	4.294E-07	3.291E-07	2.630E-07	2.166E-07	1.826E-07
ENE	8.490E-06	2.809E-06	1.525E-06	1.001E-06	5.574E-07	3.687E-07	2.678E-07	2.063E-07	1.656E-07	1.369E-07	1.158E-07
E	1.665E-05	5.288E-06	2.839E-06	1.874E-06	1.059E-06	7.094E-07	5.201E-07	4.038E-07	3.261E-07	2.710E-07	2.302E-07
ESE	2.562E-05	7.901E-06	4.094E-06	2.653E-06	1.509E-06	1.024E-06	7.584E-07	5.935E-07	4.825E-07	4.033E-07	3.443E-07
SE	1.815E-05	5.654E-06	2.900E-06	1.857E-06	1.046E-06	7.064E-07	5.213E-07	4.070E-07	3.302E-07	2.756E-07	2.350E-07
SSE	9.275E-06	3.105E-06	1.634E-06	1.045E-06	5.708E-07	3.743E-07	2.701E-07	2.071E-07	1.656E-07	1.364E-07	1.151E-07

NAPS COL 2.0-11-A

Table 2.3-208 Long-Term χ/Q (sec/m³) for Routine Releases at Distances Between 0.25 to 50 Miles, 2.260 Day Decay, Undepleted

	Ground Level Release - No Purge Releases										
	Distance in Miles from the Site										
Sector	**5.000**	**7.500**	**10.000**	**15.000**	**20.000**	**25.000**	**30.000**	**35.000**	**40.000**	**45.000**	**50.000**
S	8.787E-08	4.771E-08	3.094E-08	1.680E-08	1.087E-08	7.736E-09	5.842E-09	4.596E-09	3.725E-09	3.089E-09	2.607E-09
SSW	7.050E-08	3.834E-08	2.489E-08	1.351E-08	8.731E-09	6.203E-09	4.677E-09	3.673E-09	2.972E-09	2.460E-09	2.074E-09
SW	6.364E-08	3.471E-08	2.257E-08	1.228E-08	7.951E-09	5.654E-09	4.265E-09	3.351E-09	2.712E-09	2.244E-09	1.891E-09
WSW	5.954E-08	3.256E-08	2.121E-08	1.157E-08	7.502E-09	5.340E-09	4.031E-09	3.168E-09	2.564E-09	2.123E-09	1.788E-09
W	7.446E-08	4.111E-08	2.697E-08	1.486E-08	9.706E-09	6.949E-09	5.269E-09	4.157E-09	3.376E-09	2.802E-09	2.367E-09
WNW	6.431E-08	3.555E-08	2.335E-08	1.291E-08	8.466E-09	6.082E-09	4.626E-09	3.660E-09	2.980E-09	2.479E-09	2.099E-09
NW	6.795E-08	3.772E-08	2.484E-08	1.377E-08	9.036E-09	6.493E-09	4.940E-09	3.908E-09	3.182E-09	2.648E-09	2.242E-09
NNW	5.912E-08	3.287E-08	2.166E-08	1.200E-08	7.858E-09	5.634E-09	4.276E-09	3.375E-09	2.741E-09	2.276E-09	1.922E-09
N	1.508E-07	8.364E-08	5.502E-08	3.040E-08	1.988E-08	1.424E-08	1.080E-08	8.516E-09	6.914E-09	5.737E-09	4.844E-09
NNE	1.907E-07	1.059E-07	6.976E-08	3.863E-08	2.532E-08	1.816E-08	1.380E-08	1.090E-08	8.864E-09	7.367E-09	6.228E-09
NE	1.567E-07	8.721E-08	5.752E-08	3.192E-08	2.094E-08	1.504E-08	1.144E-08	9.046E-09	7.361E-09	6.123E-09	5.181E-09
ENE	9.965E-08	5.604E-08	3.722E-08	2.084E-08	1.375E-08	9.910E-09	7.553E-09	5.983E-09	4.873E-09	4.055E-09	3.432E-09
E	1.990E-07	1.136E-07	7.620E-08	4.324E-08	2.877E-08	2.087E-08	1.598E-08	1.271E-08	1.038E-08	8.662E-09	7.346E-09
ESE	2.989E-07	1.735E-07	1.178E-07	6.789E-08	4.566E-08	3.339E-08	2.573E-08	2.057E-08	1.688E-08	1.413E-08	1.202E-08
SE	2.038E-07	1.179E-07	7.991E-08	4.598E-08	3.091E-08	2.259E-08	1.741E-08	1.391E-08	1.142E-08	9.560E-09	8.134E-09
SSE	9.884E-08	5.519E-08	3.652E-08	2.038E-08	1.344E-08	9.697E-09	7.400E-09	5.869E-09	4.787E-09	3.989E-09	3.381E-09

NAPS COL 2.0-11-A

Table 2.3-209 Long-Term χ/Q (sec/m^3) for Routine Releases Along Various Distance Segments, 2.260 Day Decay, Undepleted

	Ground Level Release - No Purge Releases									
	Segment Boundaries in Miles from the Site									
Direction From Site	0.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	1.643E-06	5.658E-07	2.540E-07	1.515E-07	1.034E-07	4.918E-08	1.731E-08	7.815E-09	4.620E-09	3.099E-09
SSW	1.297E-06	4.501E-07	2.029E-07	1.213E-07	8.288E-08	3.951E-08	1.391E-08	6.267E-09	3.693E-09	2.469E-09
SW	1.157E-06	4.029E-07	1.823E-07	1.092E-07	7.476E-08	3.574E-08	1.264E-08	5.711E-09	3.368E-09	2.252E-09
WSW	1.075E-06	3.744E-07	1.699E-07	1.020E-07	6.989E-08	3.351E-08	1.190E-08	5.393E-09	3.185E-09	2.130E-09
W	1.305E-06	4.561E-07	2.091E-07	1.265E-07	8.719E-08	4.224E-08	1.526E-08	7.012E-09	4.177E-09	2.811E-09
WNW	1.131E-06	3.952E-07	1.808E-07	1.093E-07	7.530E-08	3.652E-08	1.325E-08	6.135E-09	3.677E-09	2.487E-09
NW	1.152E-06	4.090E-07	1.889E-07	1.148E-07	7.943E-08	3.871E-08	1.413E-08	6.550E-09	3.926E-09	2.656E-09
NNW	9.822E-07	3.527E-07	1.637E-07	9.973E-08	6.907E-08	3.372E-08	1.231E-08	5.684E-09	3.391E-09	2.283E-09
N	2.520E-06	9.067E-07	4.196E-07	2.551E-07	1.764E-07	8.585E-08	3.120E-08	1.437E-08	8.557E-09	5.755E-09
NNE	3.179E-06	1.142E-06	5.292E-07	3.220E-07	2.228E-07	1.087E-07	3.963E-08	1.832E-08	1.095E-08	7.389E-09
NE	2.597E-06	9.328E-07	4.335E-07	2.642E-07	1.831E-07	8.946E-08	3.273E-08	1.517E-08	9.088E-09	6.141E-09
ENE	1.578E-06	5.722E-07	2.701E-07	1.663E-07	1.160E-07	5.737E-08	2.133E-08	9.991E-09	6.009E-09	4.067E-09
E	2.954E-06	1.085E-06	5.241E-07	3.273E-07	2.307E-07	1.159E-07	4.413E-08	2.102E-08	1.276E-08	8.685E-09
ESE	4.300E-06	1.548E-06	7.634E-07	4.840E-07	3.450E-07	1.766E-07	6.909E-08	3.360E-08	2.064E-08	1.416E-08
SE	3.048E-06	1.075E-06	5.249E-07	3.313E-07	2.355E-07	1.201E-07	4.682E-08	2.274E-08	1.396E-08	9.582E-09
SSE	1.699E-06	5.889E-07	2.727E-07	1.663E-07	1.154E-07	5.659E-08	2.088E-08	9.777E-09	5.894E-09	4.001E-09

NAPS COL 2.0-11-A

Table 2.3-210 Long-Term χ/Q (sec/m³) for Routine Releases at Distances Between 0.25 to 50 Miles, 8.000 Day Decay, Depleted

	Ground Level Release - No Purge Releases										
	Distance in Miles from the Site										
Sector	**0.250**	**0.500**	**0.750**	**1.000**	**1.500**	**2.000**	**2.500**	**3.000**	**3.500**	**4.000**	**4.500**
S	7.899E-06	2.716E-06	1.420E-06	8.947E-07	4.669E-07	2.939E-07	2.050E-07	1.526E-07	1.188E-07	9.566E-08	7.897E-08
SSW	6.185E-06	2.134E-06	1.122E-06	7.101E-07	3.720E-07	2.347E-07	1.639E-07	1.222E-07	9.526E-08	7.674E-08	6.340E-08
SW	5.547E-06	1.902E-06	1.002E-06	6.345E-07	3.332E-07	2.106E-07	1.474E-07	1.100E-07	8.583E-08	6.922E-08	5.723E-08
WSW	5.214E-06	1.771E-06	9.297E-07	5.891E-07	3.098E-07	1.961E-07	1.374E-07	1.027E-07	8.020E-08	6.473E-08	5.357E-08
W	6.506E-06	2.158E-06	1.126E-06	7.138E-07	3.777E-07	2.405E-07	1.693E-07	1.270E-07	9.954E-08	8.058E-08	6.686E-08
WNW	5.682E-06	1.867E-06	9.770E-07	6.193E-07	3.271E-07	2.080E-07	1.463E-07	1.097E-07	8.593E-08	6.955E-08	5.770E-08
NW	5.685E-06	1.884E-06	9.984E-07	6.371E-07	3.391E-07	2.167E-07	1.529E-07	1.150E-07	9.032E-08	7.325E-08	6.088E-08
NNW	4.835E-06	1.594E-06	8.530E-07	5.476E-07	2.930E-07	1.877E-07	1.327E-07	9.991E-08	7.856E-08	6.378E-08	5.304E-08
N	1.229E-05	4.077E-06	2.192E-06	1.410E-06	7.532E-07	4.816E-07	3.400E-07	2.557E-07	2.009E-07	1.629E-07	1.354E-07
NNE	1.568E-05	5.159E-06	2.758E-06	1.774E-06	9.485E-07	6.068E-07	4.287E-07	3.225E-07	2.534E-07	2.056E-07	1.709E-07
NE	1.279E-05	4.218E-06	2.252E-06	1.447E-06	7.747E-07	4.964E-07	3.511E-07	2.644E-07	2.079E-07	1.688E-07	1.404E-07
ENE	8.043E-06	2.570E-06	1.363E-06	8.802E-07	4.763E-07	3.079E-07	2.192E-07	1.660E-07	1.311E-07	1.068E-07	8.918E-08
E	1.578E-05	4.840E-06	2.539E-06	1.647E-06	9.054E-07	5.927E-07	4.260E-07	3.251E-07	2.584E-07	2.118E-07	1.776E-07
ESE	2.428E-05	7.232E-06	3.661E-06	2.333E-06	1.291E-06	8.561E-07	6.216E-07	4.781E-07	3.827E-07	3.154E-07	2.659E-07
SE	1.720E-05	5.175E-06	2.593E-06	1.633E-06	8.942E-07	5.903E-07	4.272E-07	3.278E-07	2.619E-07	2.155E-07	1.814E-07
SSE	8.786E-06	2.841E-06	1.460E-06	9.185E-07	4.874E-07	3.122E-07	2.209E-07	1.664E-07	1.309E-07	1.064E-07	8.852E-08

NAPS COL 2.0-11-A

Table 2.3-210 Long-Term χ/Q (sec/m³) for Routine Releases at Distances Between 0.25 to 50 Miles, 8.000 Day Decay, Depleted

	Ground Level Release - No Purge Releases										
	Distance in Miles from the Site										
Sector	**5.000**	**7.500**	**10.000**	**15.000**	**20.000**	**25.000**	**30.000**	**35.000**	**40.000**	**45.000**	**50.000**
S	6.651E-08	3.443E-08	2.145E-08	1.095E-08	6.764E-09	4.634E-09	3.389E-09	2.593E-09	2.050E-09	1.663E-09	1.376E-09
SSW	5.343E-08	2.771E-08	1.729E-08	8.835E-09	5.456E-09	3.735E-09	2.730E-09	2.087E-09	1.650E-09	1.337E-09	1.106E-09
SW	4.828E-08	2.512E-08	1.571E-08	8.057E-09	4.988E-09	3.421E-09	2.504E-09	1.917E-09	1.517E-09	1.230E-09	1.018E-09
WSW	4.522E-08	2.361E-08	1.480E-08	7.614E-09	4.727E-09	3.249E-09	2.383E-09	1.827E-09	1.447E-09	1.175E-09	9.732E-10
W	5.658E-08	2.983E-08	1.883E-08	9.796E-09	6.130E-09	4.240E-09	3.125E-09	2.406E-09	1.913E-09	1.559E-09	1.295E-09
WNW	4.883E-08	2.577E-08	1.629E-08	8.491E-09	5.330E-09	3.696E-09	2.730E-09	2.106E-09	1.677E-09	1.369E-09	1.139E-09
NW	5.158E-08	2.733E-08	1.732E-08	9.051E-09	5.682E-09	3.940E-09	2.910E-09	2.244E-09	1.787E-09	1.458E-09	1.212E-09
NNW	4.498E-08	2.389E-08	1.516E-08	7.933E-09	4.979E-09	3.451E-09	2.547E-09	1.963E-09	1.562E-09	1.274E-09	1.058E-09
N	1.147E-07	6.077E-08	3.848E-08	2.008E-08	1.258E-08	8.703E-09	6.415E-09	4.939E-09	3.926E-09	3.198E-09	2.655E-09
NNE	1.449E-07	7.685E-08	4.871E-08	2.546E-08	1.597E-08	1.107E-08	8.167E-09	6.294E-09	5.008E-09	4.082E-09	3.393E-09
NE	1.191E-07	6.325E-08	4.014E-08	2.101E-08	1.320E-08	9.151E-09	6.758E-09	5.211E-09	4.149E-09	3.384E-09	2.813E-09
ENE	7.585E-08	4.077E-08	2.608E-08	1.381E-08	8.733E-09	6.090E-09	4.516E-09	3.495E-09	2.791E-09	2.282E-09	1.901E-09
E	1.517E-07	8.281E-08	5.355E-08	2.876E-08	1.837E-08	1.291E-08	9.628E-09	7.488E-09	6.004E-09	4.927E-09	4.118E-09
ESE	2.281E-07	1.267E-07	8.293E-08	4.530E-08	2.928E-08	2.076E-08	1.560E-08	1.221E-08	9.839E-09	8.111E-09	6.808E-09
SE	1.555E-07	8.612E-08	5.627E-08	3.068E-08	1.982E-08	1.405E-08	1.056E-08	8.261E-09	6.659E-09	5.490E-09	4.608E-09
SSE	7.512E-08	4.007E-08	2.552E-08	1.345E-08	8.506E-09	5.932E-09	4.402E-09	3.409E-09	2.724E-09	2.229E-09	1.859E-09

NAPS COL 2.0-11-A

Table 2.3-211 Long-Term χ/Q (sec/m^3) for Routine Releases Along Various Distance Segments, 8.000 Day Decay, Depleted

	Ground Level Release - No Purge Releases									
	Segment Boundaries in Miles from the Site									
Direction From Site	0.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	1.474E-06	4.851E-07	2.078E-07	1.197E-07	7.930E-08	3.579E-08	1.142E-08	4.704E-09	2.613E-09	1.671E-09
SSW	1.164E-06	3.861E-07	1.661E-07	9.590E-08	6.366E-08	2.879E-08	9.212E-09	3.792E-09	2.104E-09	1.344E-09
SW	1.039E-06	3.457E-07	1.493E-07	8.640E-08	5.747E-08	2.608E-08	8.394E-09	3.472E-09	1.932E-09	1.237E-09
WSW	9.652E-07	3.213E-07	1.392E-07	8.073E-08	5.378E-08	2.449E-08	7.927E-09	3.297E-09	1.841E-09	1.181E-09
W	1.172E-06	3.914E-07	1.714E-07	1.002E-07	6.712E-08	3.089E-08	1.018E-08	4.298E-09	2.424E-09	1.566E-09
WNW	1.016E-06	3.391E-07	1.481E-07	8.647E-08	5.793E-08	2.668E-08	8.818E-09	3.746E-09	2.121E-09	1.375E-09
NW	1.035E-06	3.509E-07	1.548E-07	9.087E-08	6.110E-08	2.827E-08	9.391E-09	3.993E-09	2.260E-09	1.465E-09
NNW	8.820E-07	3.028E-07	1.342E-07	7.903E-08	5.324E-08	2.470E-08	8.226E-09	3.497E-09	1.977E-09	1.279E-09
N	2.263E-06	7.783E-07	3.440E-07	2.021E-07	1.359E-07	6.285E-08	2.083E-08	8.820E-09	4.975E-09	3.213E-09
NNE	2.854E-06	9.800E-07	4.337E-07	2.550E-07	1.716E-07	7.946E-08	2.641E-08	1.122E-08	6.339E-09	4.101E-09
NE	2.331E-06	8.004E-07	3.552E-07	2.092E-07	1.409E-07	6.538E-08	2.179E-08	9.272E-09	5.248E-09	3.399E-09
ENE	1.417E-06	4.912E-07	2.215E-07	1.318E-07	8.948E-08	4.204E-08	1.428E-08	6.165E-09	3.519E-09	2.292E-09
E	2.654E-06	9.313E-07	4.301E-07	2.597E-07	1.781E-07	8.511E-08	2.965E-08	1.305E-08	7.534E-09	4.946E-09
ESE	3.864E-06	1.329E-06	6.267E-07	3.843E-07	2.666E-07	1.298E-07	4.654E-08	2.097E-08	1.227E-08	8.140E-09
SE	2.740E-06	9.232E-07	4.309E-07	2.631E-07	1.819E-07	8.828E-08	3.154E-08	1.419E-08	8.307E-09	5.510E-09
SSE	1.526E-06	5.054E-07	2.235E-07	1.317E-07	8.884E-08	4.140E-08	1.394E-08	6.007E-09	3.432E-09	2.239E-09

NAPS COL 2.0-11-A

Table 2.3-212 Long-Term D/Q ($1/m^2$) for Routine Releases at Distances Between 0.25 to 50 Miles

Ground Level Release - No Purge Releases
Relative Deposition Per Unit Area ($1/m^2$) At Fixed Points By Downwind Sectors
Distances In Miles

Direction From Site	0.25	0.50	0.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
S	4.819E-08	1.630E-08	8.367E-09	5.138E-09	2.561E-09	1.553E-09	1.050E-09	7.611E-10	5.787E-10	4.559E-10	3.691E-10
SSW	3.194E-08	1.080E-08	5.546E-09	3.405E-09	1.698E-09	1.030E-09	6.961E-10	5.045E-10	3.836E-10	3.022E-10	2.446E-10
SW	2.633E-08	8.902E-09	4.571E-09	2.807E-09	1.399E-09	8.486E-10	5.738E-10	4.158E-10	3.161E-10	2.491E-10	2.016E-10
WSW	2.286E-08	7.732E-09	3.970E-09	2.438E-09	1.215E-09	7.371E-10	4.983E-10	3.611E-10	2.746E-10	2.163E-10	1.751E-10
W	2.691E-08	9.101E-09	4.673E-09	2.869E-09	1.430E-09	8.676E-10	5.866E-10	4.251E-10	3.232E-10	2.546E-10	2.061E-10
WNW	2.495E-08	8.438E-09	4.333E-09	2.660E-09	1.326E-09	8.044E-10	5.439E-10	3.941E-10	2.997E-10	2.361E-10	1.911E-10
NW	2.242E-08	7.583E-09	3.893E-09	2.391E-09	1.192E-09	7.229E-10	4.887E-10	3.542E-10	2.693E-10	2.122E-10	1.718E-10
NNW	1.628E-08	5.504E-09	2.826E-09	1.735E-09	8.652E-10	5.247E-10	3.548E-10	2.571E-10	1.955E-10	1.540E-10	1.247E-10
N	4.309E-08	1.457E-08	7.481E-09	4.594E-09	2.290E-09	1.389E-09	9.391E-10	6.805E-10	5.175E-10	4.077E-10	3.300E-10
NNE	6.257E-08	2.116E-08	1.086E-08	6.671E-09	3.326E-09	2.017E-09	1.364E-09	9.882E-10	7.514E-10	5.920E-10	4.793E-10
NE	5.046E-08	1.706E-08	8.761E-09	5.379E-09	2.682E-09	1.627E-09	1.100E-09	7.969E-10	6.059E-10	4.774E-10	3.865E-10
ENE	2.720E-08	9.199E-09	4.723E-09	2.900E-09	1.446E-09	8.769E-10	5.929E-10	4.296E-10	3.267E-10	2.574E-10	2.084E-10
E	3.824E-08	1.293E-08	6.640E-09	4.077E-09	2.033E-09	1.233E-09	8.335E-10	6.040E-10	4.593E-10	3.618E-10	2.929E-10
ESE	5.097E-08	1.724E-08	8.849E-09	5.434E-09	2.709E-09	1.643E-09	1.111E-09	8.050E-10	6.121E-10	4.822E-10	3.904E-10
SE	4.574E-08	1.547E-08	7.942E-09	4.877E-09	2.431E-09	1.475E-09	9.970E-10	7.225E-10	5.493E-10	4.328E-10	3.504E-10
SSE	4.085E-08	1.381E-08	7.092E-09	4.355E-09	2.171E-09	1.317E-09	8.902E-10	6.451E-10	4.905E-10	3.865E-10	3.129E-10

NAPS COL 2.0-11-A

Table 2.3-212 Long-Term D/Q (1/m^2) for Routine Releases at Distances Between 0.25 to 50 Miles

Ground Level Release - No Purge Releases
Relative Deposition Per Unit Area (1/m^2) At Fixed Points By Downwind Sectors
Distances In Miles

Direction From Site	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
S	3.053E-10	1.496E-10	9.388E-11	4.745E-11	2.872E-11	1.926E-11	1.380E-11	1.036E-11	8.056E-12	6.435E-12	5.252E-12
SSW	2.024E-10	9.917E-11	6.222E-11	3.145E-11	1.904E-11	1.276E-11	9.145E-12	6.867E-12	5.339E-12	4.265E-12	3.481E-12
SW	1.668E-10	8.174E-11	5.129E-11	2.592E-11	1.569E-11	1.052E-11	7.538E-12	5.660E-12	4.401E-12	3.515E-12	2.869E-12
WSW	1.449E-10	7.099E-11	4.454E-11	2.251E-11	1.363E-11	9.136E-12	6.547E-12	4.916E-12	3.822E-12	3.053E-12	2.492E-12
W	1.705E-10	8.356E-11	5.243E-11	2.650E-11	1.604E-11	1.075E-11	7.706E-12	5.786E-12	4.499E-12	3.594E-12	2.933E-12
WNW	1.581E-10	7.748E-11	4.861E-11	2.457E-11	1.487E-11	9.971E-12	7.145E-12	5.365E-12	4.171E-12	3.332E-12	2.720E-12
NW	1.421E-10	6.962E-11	4.369E-11	2.208E-11	1.336E-11	8.961E-12	6.421E-12	4.821E-12	3.749E-12	2.994E-12	2.444E-12
NNW	1.031E-10	5.054E-11	3.171E-11	1.603E-11	9.701E-12	6.504E-12	4.661E-12	3.500E-12	2.721E-12	2.174E-12	1.774E-12
N	2.730E-10	1.338E-10	8.394E-11	4.243E-11	2.568E-11	1.722E-11	1.234E-11	9.264E-12	7.203E-12	5.754E-12	4.697E-12
NNE	3.964E-10	1.943E-10	1.219E-10	6.161E-11	3.729E-11	2.500E-11	1.792E-11	1.345E-11	1.046E-11	8.355E-12	6.820E-12
NE	3.197E-10	1.567E-10	9.830E-11	4.968E-11	3.007E-11	2.016E-11	1.445E-11	1.085E-11	8.435E-12	6.738E-12	5.500E-12
ENE	1.724E-10	8.446E-11	5.300E-11	2.679E-11	1.621E-11	1.087E-11	7.789E-12	5.849E-12	4.548E-12	3.633E-12	2.965E-12
E	2.423E-10	1.187E-10	7.451E-11	3.766E-11	2.279E-11	1.528E-11	1.095E-11	8.223E-12	6.393E-12	5.107E-12	4.168E-12
ESE	3.229E-10	1.583E-10	9.929E-11	5.019E-11	3.038E-11	2.037E-11	1.459E-11	1.096E-11	8.520E-12	6.806E-12	5.555E-12
SE	2.898E-10	1.420E-10	8.912E-11	4.504E-11	2.726E-11	1.828E-11	1.310E-11	9.835E-12	7.647E-12	6.108E-12	4.986E-12
SSE	2.588E-10	1.268E-10	7.957E-11	4.022E-11	2.434E-11	1.632E-11	1.170E-11	8.782E-12	6.828E-12	5.454E-12	4.452E-12

NAPS COL 2.0-11-A

Table 2.3-213 Long-Term D/Q (1/m^2) for Routine Releases Along Various Distance Segments

Ground Level Release - No Purge Release
Relative Deposition Per Unit Area (1/m^2) By Downwind Sectors
Segment Boundaries In Miles

Direction From Site	0.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	8.694E-09	2.686E-09	1.069E-09	5.841E-10	3.712E-10	1.594E-10	4.944E-11	1.960E-11	1.046E-11	6.477E-12
SSW	5.762E-09	1.780E-09	7.084E-10	3.871E-10	2.460E-10	1.057E-10	3.277E-11	1.299E-11	6.936E-12	4.293E-12
SW	4.749E-09	1.467E-09	5.839E-10	3.191E-10	2.028E-10	8.710E-11	2.701E-11	1.071E-11	5.717E-12	3.538E-12
WSW	4.125E-09	1.274E-09	5.071E-10	2.771E-10	1.761E-10	7.565E-11	2.346E-11	9.298E-12	4.965E-12	3.073E-12
W	4.855E-09	1.500E-09	5.969E-10	3.262E-10	2.073E-10	8.905E-11	2.761E-11	1.094E-11	5.844E-12	3.617E-12
WNW	4.502E-09	1.391E-09	5.534E-10	3.024E-10	1.922E-10	8.256E-11	2.560E-11	1.015E-11	5.419E-12	3.354E-12
NW	4.045E-09	1.250E-09	4.973E-10	2.718E-10	1.727E-10	7.420E-11	2.301E-11	9.119E-12	4.870E-12	3.014E-12
NNW	2.937E-09	9.072E-10	3.610E-10	1.973E-10	1.254E-10	5.386E-11	1.670E-11	6.619E-12	3.535E-12	2.188E-12
N	7.773E-09	2.402E-09	9.557E-10	5.222E-10	3.319E-10	1.426E-10	4.421E-11	1.752E-11	9.357E-12	5.792E-12
NNE	1.129E-08	3.487E-09	1.388E-09	7.583E-10	4.820E-10	2.070E-10	6.420E-11	2.544E-11	1.359E-11	8.410E-12
NE	9.103E-09	2.812E-09	1.119E-09	6.115E-10	3.887E-10	1.669E-10	5.177E-11	2.052E-11	1.096E-11	6.782E-12
ENE	4.908E-09	1.516E-09	6.033E-10	3.297E-10	2.095E-10	9.001E-11	2.791E-11	1.106E-11	5.907E-12	3.656E-12
E	6.899E-09	2.132E-09	8.482E-10	4.635E-10	2.946E-10	1.265E-10	3.924E-11	1.555E-11	8.305E-12	5.140E-12
ESE	9.195E-09	2.841E-09	1.130E-09	6.177E-10	3.926E-10	1.686E-10	5.230E-11	2.073E-11	1.107E-11	6.851E-12
SE	8.252E-09	2.550E-09	1.015E-09	5.544E-10	3.524E-10	1.514E-10	4.693E-11	1.860E-11	9.934E-12	6.149E-12
SSE	7.369E-09	2.277E-09	9.059E-10	4.950E-10	3.146E-10	1.351E-10	4.191E-11	1.661E-11	8.870E-12	5.490E-12

2.5 Socioeconomics

The information for this section is provided in ESP-ER Section 2.5 and in FEIS Sections 2.8 and 2.9.

No new and significant information has been identified for socioeconomics.

2.6 Geology

The information for this section is provided in ESP-ER Section 2.6 and in FEIS Section 2.4.

No new and significant information has been identified for this section.

2.7 Meteorology and Air Quality

The information for this section is provided in ESP-ER Section 2.7 and in FEIS Section 2.3. Supplemental information concerning atmospheric dispersion coefficients ~~as~~ is provided in Sections 2.7.5 and 2.7.6.

2.7.1 General Climate

No new and significant information has been identified for this section.

2.7.2 Regional Air Quality

No new and significant information has been identified for this section.

2.7.3 Severe Weather

No new and significant information has been identified for this section.

2.7.4 Local Meteorology

No new and significant information has been identified for this section.

2.7.5 Short-Term Diffusion Estimates

For the short-term atmospheric dispersion coefficients (used in the evaluation of doses due to design basis accidents, in Section 7.1), the ESP values listed in FEIS Table 5-14 are used for this ER.

2.7.6 Long-Term (Routine) Diffusion Estimates

As a part of the preparation of this ER, the annual Radiological Environmental Monitoring Program was reviewed to determine if the distances to any of the nearest sensitive receptors, modeled for the ESP-ER have changed. The results of that review, as documented in Table 2.7-1, show the closest receptor to be the residence at the NW direction at a distance of 1.20 km (3930 feet). For the purposes of the atmospheric dispersion analysis and the subsequent dose evaluations, it was conservatively assumed that each sensitive receptor (meat animal, vegetable garden, residence) is

at the location of the closest receptor. Therefore, one of each type of receptor was assumed to be at 1.20 km (3930 feet) in each compass direction. The maximum annual average χ/Q value calculated for the nearest residence, vegetable garden, and meat animal, all assumed at 0.74 miles ~~to the ESE of the facility boundary shown in FSAR Figure 2.0-205~~, is 4.20 E-6 sec/m^3 in the ESE direction. The maximum D/Q for those receptors is 1.10E-8 m^{-2} in the NNE direction. In the evaluation performed for this ER, the distance to the site boundary (EAB) was found to be 1.0 mile in the direction where the maximum χ/Q is calculated. However, for conservatism, the greater χ/Q value from the ESP-ER, which is based on a distance of 0.88 miles, is retained for use in this ER. The maximum annual χ/Q (no decay, undepleted) at the EAB is 3.70 E-6 sec/m^3, at a distance of 1.42 km (0.88 mile) to the ESE of the facility boundary. The results are summarized in Table 2.7-2 and Table 2.7-3. These tables present the maximum calculated χ/Qs and D/Qs at sensitive receptors and at various distances from the site.

Long-term (~~Annual~~ annual average) χ/Q and D/Q estimates generated by the XOQDOQ model for the sensitive receptors and at distances between 0.25 mile to 50 miles, as well as for various segment boundaries, are also presented. Table 2.7-4 presents χ/Q and D/Q estimates at the specific points of interest. ~~Table 2.7-5 lists χ/Q estimates at downwind distances between 0.25 and 50 miles and along various segments. Table 2.7-7 contains χ/Q estimates that include radioactive decay with a half-life of 2.26 days for short-lived noble gases. Table 2.7-9 contains χ/Q estimates that include radioactive decay with a half-life of 8 days for all iodines released to the atmosphere. Finally, Table 2.7-11 contains estimates of long-term average D/Q at downwind distances between 0.25 and 50 miles.~~

Table 2.7-5 presents the no decay and undepleted χ/Q estimates at various downwind distances between 0.4 km (0.25 mi) and 80.5 km (50 mi). Table 2.7-6 presents the no decay and undepleted χ/Q estimates for various distance segments out to 80.5 km (50 mi).

Table 2.7-7 presents the 2.26 day decay (for short-lived noble gases) and undepleted χ/Q estimates at the same downwind distances. Table 2.7-8 presents the 2.26 day decay and undepleted χ/Q estimates for the same distance segments.

Table 2.7-9 presents the 8 day decay (for all iodines released to the atmosphere) and depleted χ/Q estimates at the same downwind distances. Table 2.7-10 presents the 8 day decay and depleted χ/Q estimates for the same distance segments.

Table 2.7-11 presents the D/Q estimates for the same downwind distances. Table 2.7-12 presents the D/Q estimates for the same distance segments.

The methodology used to determine the long-term dispersion and deposition coefficients (used in the evaluation of doses due to normal operating releases) remains the same as that described in ESP-ER Section 2.7.6.

The following input data and assumptions were used in the XOQDOQ modeling:

- Meteorological Data: Three-year combined (1996–1998) onsite joint frequency distribution of wind speed, wind direction, and atmospheric stability.
- Type of Release: Ground level.
- Wind Sensor Height: 10 m (33 ft).
- Vertical Temperature Difference: 10 m (33 ft) – 48.4 m (158.9 ft).
- Number of Wind Speed Categories: 7.
- Release Height: 10 m (33 ft) (default height).
- Reactor Building Height: 49 m (161 ft).
- Minimum Reactor Building Cross-Sectional Area: 2400 m^2 (25,800 ft^2).
- Distances from the release point to the nearest residence, nearest site boundary, milk cow, vegetable garden, milk goat, meat animal: See Table 2.7-1.

For the dispersion analysis, the ESBWR Reactor Building is used to determine the minimum building cross-sectional area for evaluating building downwash effects. The height of this building is approximately 49 m (161 ft) including parapets. Based on this height and a nominal width of 49 m (161 ft) on the rectangular face of the building, a minimum building cross-sectional area of 2400 m^2 (25,800 ft^2) was used to determine χ/Q and D/Q estimates. The perpendicular face of the building is narrower at the top, but the total area, including stairwells and the elevator shaft, is greater than 2400 m^2 (25,800 ft^2) in that perpendicular direction. For the NAPS site, the χ/Q and D/Q values were found to depend on building height but not cross-sectional area.

ESP-ER Tables 2.7-13 through 2.7-20 have been replaced in this ER by Tables 2.7-1 through ~~2.7-8~~ 2.7-12.

No other new and significant information has been identified for this section.

Table 2.7-5 Long-Term ~~Average~~ χ/Q (sec/m³) for Routine Releases at Distances Between 0.25 to 50 Miles, No Decay, Undepleted

Ground Level Release - No Purge Releases

	Distance in Miles from the Site										
Sector	**0.250**	**0.500**	**0.750**	**1.000**	**1.500**	**2.000**	**2.500**	**3.000**	**3.500**	**4.000**	**4.500**
S	8.349E-06	2.976E-06	1.595E-06	1.023E-06	5.508E-07	3.558E-07	2.538E-07	1.928E-07	1.529E-07	1.252E-07	1.050E-07
SSW	6.537E-06	2.338E-06	1.261E-06	8.122E-07	4.388E-07	2.841E-07	2.030E-07	1.544E-07	1.226E-07	1.005E-07	8.434E-08
SW	5.863E-06	2.085E-06	1.125E-06	7.259E-07	3.931E-07	2.550E-07	1.825E-07	1.390E-07	1.105E-07	9.067E-08	7.617E-08
WSW	5.511E-06	1.940E-06	1.044E-06	6.739E-07	3.656E-07	2.375E-07	1.702E-07	1.298E-07	1.033E-07	8.482E-08	7.132E-08
W	6.877E-06	2.365E-06	1.265E-06	8.167E-07	4.457E-07	2.913E-07	2.098E-07	1.606E-07	1.282E-07	1.056E-07	8.904E-08
WNW	6.006E-06	2.046E-06	1.097E-06	7.084E-07	3.860E-07	2.519E-07	1.812E-07	1.387E-07	1.107E-07	9.113E-08	7.682E-08
NW	6.009E-06	2.064E-06	1.122E-06	7.288E-07	4.001E-07	2.624E-07	1.895E-07	1.454E-07	1.163E-07	9.597E-08	8.104E-08
NNW	5.110E-06	1.747E-06	9.583E-07	6.266E-07	3.458E-07	2.274E-07	1.645E-07	1.264E-07	1.013E-07	8.362E-08	7.067E-08
N	1.299E-05	4.468E-06	2.462E-06	1.613E-06	8.890E-07	5.834E-07	4.214E-07	3.234E-07	2.588E-07	2.136E-07	1.803E-07
NNE	1.657E-05	5.654E-06	3.098E-06	2.029E-06	1.119E-06	7.350E-07	5.312E-07	4.079E-07	3.265E-07	2.695E-07	2.276E-07
NE	1.352E-05	4.622E-06	2.530E-06	1.656E-06	9.142E-07	6.013E-07	4.350E-07	3.343E-07	2.679E-07	2.212E-07	1.870E-07
ENE	8.502E-06	2.817E-06	1.532E-06	1.007E-06	5.622E-07	3.730E-07	2.717E-07	2.100E-07	1.690E-07	1.401E-07	1.188E-07
E	1.668E-05	5.305E-06	2.852E-06	1.885E-06	1.069E-06	7.183E-07	5.283E-07	4.114E-07	3.333E-07	2.779E-07	2.368E-07
ESE	2.566E-05	7.927E-06	4.114E-06	2.670E-06	1.524E-06	1.038E-06	7.709E-07	6.052E-07	4.936E-07	4.140E-07	3.546E-07
SE	1.818E-05	5.672E-06	2.914E-06	1.868E-06	1.056E-06	7.154E-07	5.298E-07	4.149E-07	3.378E-07	2.828E-07	2.420E-07
SSE	9.287E-06	3.113E-06	1.640E-06	1.051E-06	5.752E-07	3.782E-07	2.737E-07	2.104E-07	1.687E-07	1.394E-07	1.179E-07

Table 2.7-5 Long-Term ~~Average~~ χ/Q (sec/m³) for Routine Releases at Distances Between 0.25 to 50 Miles, No Decay, Undepleted

	Ground Level Release - No Purge Releases										
	Distance in Miles from the Site										
Sector	**5.000**	**7.500**	**10.000**	**15.000**	**20.000**	**25.000**	**30.000**	**35.000**	**40.000**	**45.000**	**50.000**
S	8.977E-08	4.929E-08	3.232E-08	1.794E-08	1.188E-08	8.646E-09	6.678E-09	5.373E-09	4.453E-09	3.776E-09	3.259E-09
SSW	7.215E-08	3.970E-08	2.608E-08	1.450E-08	9.599E-09	6.984E-09	5.393E-09	4.338E-09	3.595E-09	3.047E-09	2.629E-09
SW	6.521E-08	3.601E-08	2.372E-08	1.324E-08	8.788E-09	6.409E-09	4.959E-09	3.995E-09	3.315E-09	2.813E-09	2.430E-09
WSW	6.111E-08	3.386E-08	2.236E-08	1.253E-08	8.344E-09	6.101E-09	4.730E-09	3.818E-09	3.174E-09	2.697E-09	2.333E-09
W	7.648E-08	4.280E-08	2.847E-08	1.613E-08	1.083E-08	7.971E-09	6.213E-09	5.038E-09	4.205E-09	3.587E-09	3.113E-09
WNW	6.599E-08	3.696E-08	2.460E-08	1.396E-08	9.406E-09	6.937E-09	5.417E-09	4.399E-09	3.676E-09	3.139E-09	2.727E-09
NW	6.970E-08	3.920E-08	2.616E-08	1.488E-08	1.002E-08	7.391E-09	5.770E-09	4.684E-09	3.913E-09	3.340E-09	2.900E-09
NNW	6.083E-08	3.431E-08	2.294E-08	1.307E-08	8.809E-09	6.497E-09	5.072E-09	4.118E-09	3.439E-09	2.935E-09	2.548E-09
N	1.551E-07	8.723E-08	5.819E-08	3.307E-08	2.223E-08	1.637E-08	1.276E-08	1.034E-08	8.630E-09	7.358E-09	6.382E-09
NNE	1.958E-07	1.103E-07	7.363E-08	4.190E-08	2.821E-08	2.079E-08	1.622E-08	1.316E-08	1.099E-08	9.374E-09	8.135E-09
NE	1.609E-07	9.075E-08	6.066E-08	3.457E-08	2.329E-08	1.718E-08	1.341E-08	1.089E-08	9.095E-09	7.763E-09	6.739E-09
ENE	1.026E-07	5.856E-08	3.948E-08	2.277E-08	1.547E-08	1.148E-08	9.008E-09	7.345E-09	6.158E-09	5.273E-09	4.592E-09
E	2.053E-07	1.190E-07	8.114E-08	4.750E-08	3.260E-08	2.439E-08	1.926E-08	1.579E-08	1.330E-08	1.144E-08	9.993E-09
ESE	3.089E-07	1.823E-07	1.258E-07	7.493E-08	5.206E-08	3.932E-08	3.130E-08	2.583E-08	2.188E-08	1.891E-08	1.660E-08
SE	2.106E-07	1.239E-07	8.534E-08	5.075E-08	3.524E-08	2.661E-08	2.118E-08	1.748E-08	1.481E-08	1.280E-08	1.124E-08
SSE	1.016E-07	5.751E-08	3.860E-08	2.216E-08	1.504E-08	1.116E-08	8.765E-09	7.150E-09	5.999E-09	5.141E-09	4.480E-09

Table 2.7-6 ~~Table 2.7-5~~ Long-Term ~~Average~~ χ/Q (sec/m³) for Routine Releases ~~at~~ Along Various Distances ~~Between 0.25 to 50 Miles~~ Segments, No Decay, Undepleted

Ground Level Release - No Purge Releases

	Segment Boundaries in Miles from the Site									
Direction From Site	**0.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
S	1.648E-06	5.691E-07	2.566E-07	1.538E-07	1.054E-07	5.074E-08	1.844E-08	8.721E-09	5.395E-09	3.785E-09
SSW	1.301E-06	4.530E-07	2.052E-07	1.233E-07	8.461E-08	4.086E-08	1.489E-08	7.045E-09	4.357E-09	3.055E-09
SW	1.161E-06	4.057E-07	1.845E-07	1.111E-07	7.641E-08	3.704E-08	1.359E-08	6.463E-09	4.011E-09	2.820E-09
WSW	1.079E-06	3.772E-07	1.720E-07	1.038E-07	7.154E-08	3.480E-08	1.285E-08	6.151E-09	3.833E-09	2.704E-09
W	1.310E-06	4.595E-07	2.118E-07	1.289E-07	8.930E-08	4.392E-08	1.652E-08	8.030E-09	5.056E-09	3.594E-09
WNW	1.135E-06	3.980E-07	1.830E-07	1.112E-07	7.705E-08	3.792E-08	1.430E-08	6.988E-09	4.415E-09	3.146E-09
NW	1.157E-06	4.120E-07	1.913E-07	1.169E-07	8.126E-08	4.018E-08	1.523E-08	7.444E-09	4.700E-09	3.347E-09
NNW	9.862E-07	3.556E-07	1.660E-07	1.017E-07	7.086E-08	3.515E-08	1.337E-08	6.544E-09	4.132E-09	2.941E-09
N	2.530E-06	9.140E-07	4.254E-07	2.601E-07	1.808E-07	8.941E-08	3.383E-08	1.649E-08	1.038E-08	7.373E-09
NNE	3.191E-06	1.151E-06	5.362E-07	3.280E-07	2.283E-07	1.130E-07	4.287E-08	2.094E-08	1.321E-08	9.393E-09
NE	2.606E-06	9.399E-07	4.391E-07	2.691E-07	1.875E-07	9.297E-08	3.536E-08	1.730E-08	1.093E-08	7.778E-09
ENE	1.584E-06	5.770E-07	2.740E-07	1.697E-07	1.191E-07	5.987E-08	2.324E-08	1.155E-08	7.368E-09	5.283E-09
E	2.967E-06	1.094E-06	5.322E-07	3.345E-07	2.373E-07	1.214E-07	4.835E-08	2.453E-08	1.583E-08	1.145E-08
ESE	4.319E-06	1.563E-06	7.757E-07	4.952E-07	3.553E-07	1.853E-07	7.606E-08	3.951E-08	2.588E-08	1.893E-08
SE	3.062E-06	1.085E-06	5.334E-07	3.389E-07	2.425E-07	1.260E-07	5.154E-08	2.674E-08	1.752E-08	1.282E-08
SSE	1.705E-06	5.933E-07	2.763E-07	1.695E-07	1.182E-07	5.889E-08	2.265E-08	1.124E-08	7.173E-09	5.150E-09

Table 2.7-7 ~~Table 2.7-6~~ Long-Term ~~Average~~ χ/Q (sec/m³) for Routine Releases at Distances Between 0.25 to 50 Miles, 2.260 Day Decay, Undepleted

Ground Level Release - No Purge Releases

	Distance in Miles from the Site										
Sector	**0.250**	**0.500**	**0.750**	**1.000**	**1.500**	**2.000**	**2.500**	**3.000**	**3.500**	**4.000**	**4.500**
S	8.340E-06	2.969E-06	1.590E-06	1.019E-06	5.474E-07	3.529E-07	2.512E-07	1.904E-07	1.507E-07	1.231E-07	1.030E-07
SSW	6.530E-06	2.333E-06	1.257E-06	8.086E-07	4.359E-07	2.816E-07	2.007E-07	1.523E-07	1.207E-07	9.866E-08	8.262E-08
SW	5.856E-06	2.080E-06	1.121E-06	7.224E-07	3.903E-07	2.526E-07	1.804E-07	1.370E-07	1.087E-07	8.892E-08	7.452E-08
WSW	5.504E-06	1.936E-06	1.041E-06	6.705E-07	3.628E-07	2.351E-07	1.681E-07	1.278E-07	1.015E-07	8.308E-08	6.967E-08
W	6.868E-06	2.359E-06	1.260E-06	8.125E-07	4.423E-07	2.883E-07	2.070E-07	1.581E-07	1.259E-07	1.034E-07	8.693E-08
WNW	5.998E-06	2.041E-06	1.093E-06	7.049E-07	3.831E-07	2.494E-07	1.789E-07	1.366E-07	1.087E-07	8.928E-08	7.507E-08
NW	6.001E-06	2.059E-06	1.117E-06	7.252E-07	3.971E-07	2.598E-07	1.871E-07	1.432E-07	1.143E-07	9.404E-08	7.920E-08
NNW	5.103E-06	1.742E-06	9.543E-07	6.231E-07	3.429E-07	2.248E-07	1.622E-07	1.243E-07	9.926E-08	8.173E-08	6.888E-08
N	1.297E-05	4.455E-06	2.452E-06	1.604E-06	8.816E-07	5.770E-07	4.156E-07	3.181E-07	2.538E-07	2.088E-07	1.759E-07
NNE	1.655E-05	5.639E-06	3.086E-06	2.019E-06	1.110E-06	7.273E-07	5.242E-07	4.014E-07	3.205E-07	2.638E-07	2.222E-07
NE	1.350E-05	4.610E-06	2.520E-06	1.647E-06	9.071E-07	5.950E-07	4.294E-07	3.291E-07	2.630E-07	2.166E-07	1.826E-07
ENE	8.490E-06	2.809E-06	1.525E-06	1.001E-06	5.574E-07	3.687E-07	2.678E-07	2.063E-07	1.656E-07	1.369E-07	1.158E-07
E	1.665E-05	5.288E-06	2.839E-06	1.874E-06	1.059E-06	7.094E-07	5.201E-07	4.038E-07	3.261E-07	2.710E-07	2.302E-07
ESE	2.562E-05	7.901E-06	4.094E-06	2.653E-06	1.509E-06	1.024E-06	7.584E-07	5.935E-07	4.825E-07	4.033E-07	3.443E-07
SE	1.815E-05	5.654E-06	2.900E-06	1.857E-06	1.046E-06	7.064E-07	5.213E-07	4.070E-07	3.302E-07	2.756E-07	2.350E-07
SSE	9.275E-06	3.105E-06	1.634E-06	1.045E-06	5.708E-07	3.743E-07	2.701E-07	2.071E-07	1.656E-07	1.364E-07	1.151E-07

Table 2.7-7 ~~Table 2.7-6~~ Long-Term ~~Average~~ χ/Q (sec/m³) for Routine Releases at Distances Between 0.25 to 50 Miles, 2.260 Day Decay, Undepleted

Ground Level Release - No Purge Releases

	Distance in Miles from the Site										
Sector	**5.000**	**7.500**	**10.000**	**15.000**	**20.000**	**25.000**	**30.000**	**35.000**	**40.000**	**45.000**	**50.000**
S	8.787E-08	4.771E-08	3.094E-08	1.680E-08	1.087E-08	7.736E-09	5.842E-09	4.596E-09	3.725E-09	3.089E-09	2.607E-09
SSW	7.050E-08	3.834E-08	2.489E-08	1.351E-08	8.731E-09	6.203E-09	4.677E-09	3.673E-09	2.972E-09	2.460E-09	2.074E-09
SW	6.364E-08	3.471E-08	2.257E-08	1.228E-08	7.951E-09	5.654E-09	4.265E-09	3.351E-09	2.712E-09	2.244E-09	1.891E-09
WSW	5.954E-08	3.256E-08	2.121E-08	1.157E-08	7.502E-09	5.340E-09	4.031E-09	3.168E-09	2.564E-09	2.123E-09	1.788E-09
W	7.446E-08	4.111E-08	2.697E-08	1.486E-08	9.706E-09	6.949E-09	5.269E-09	4.157E-09	3.376E-09	2.802E-09	2.367E-09
WNW	6.431E-08	3.555E-08	2.335E-08	1.291E-08	8.466E-09	6.082E-09	4.626E-09	3.660E-09	2.980E-09	2.479E-09	2.099E-09
NW	6.795E-08	3.772E-08	2.484E-08	1.377E-08	9.036E-09	6.493E-09	4.940E-09	3.908E-09	3.182E-09	2.648E-09	2.242E-09
NNW	5.912E-08	3.287E-08	2.166E-08	1.200E-08	7.858E-09	5.634E-09	4.276E-09	3.375E-09	2.741E-09	2.276E-09	1.922E-09
N	1.508E-07	8.364E-08	5.502E-08	3.040E-08	1.988E-08	1.424E-08	1.080E-08	8.516E-09	6.914E-09	5.737E-09	4.844E-09
NNE	1.907E-07	1.059E-07	6.976E-08	3.863E-08	2.532E-08	1.816E-08	1.380E-08	1.090E-08	8.864E-09	7.367E-09	6.228E-09
NE	1.567E-07	8.721E-08	5.752E-08	3.192E-08	2.094E-08	1.504E-08	1.144E-08	9.046E-09	7.361E-09	6.123E-09	5.181E-09
ENE	9.965E-08	5.604E-08	3.722E-08	2.084E-08	1.375E-08	9.910E-09	7.553E-09	5.983E-09	4.873E-09	4.055E-09	3.432E-09
E	1.990E-07	1.136E-07	7.620E-08	4.324E-08	2.877E-08	2.087E-08	1.598E-08	1.271E-08	1.038E-08	8.662E-09	7.346E-09
ESE	2.989E-07	1.735E-07	1.178E-07	6.789E-08	4.566E-08	3.339E-08	2.573E-08	2.057E-08	1.688E-08	1.413E-08	1.202E-08
SE	2.038E-07	1.179E-07	7.991E-08	4.598E-08	3.091E-08	2.259E-08	1.741E-08	1.391E-08	1.142E-08	9.560E-09	8.134E-09
SSE	9.884E-08	5.519E-08	3.652E-08	2.038E-08	1.344E-08	9.697E-09	7.400E-09	5.869E-09	4.787E-09	3.989E-09	3.381E-09

Table 2.7-8 ~~2.7-6~~ Long-Term ~~Average~~ χ/Q (sec/m³) for Routine Releases ~~at~~ Along Various Distances ~~Between 0.25 to 50 Miles~~ Segments, 2.260 Day Decay, Undepleted

Ground Level Release - No Purge Releases										
	Segment Boundaries in Miles from the Site									
Direction From Site	**0.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
S	1.643E-06	5.658E-07	2.540E-07	1.515E-07	1.034E-07	4.918E-08	1.731E-08	7.815E-09	4.620E-09	3.099E-09
SSW	1.297E-06	4.501E-07	2.029E-07	1.213E-07	8.288E-08	3.951E-08	1.391E-08	6.267E-09	3.693E-09	2.469E-09
SW	1.157E-06	4.029E-07	1.823E-07	1.092E-07	7.476E-08	3.574E-08	1.264E-08	5.711E-09	3.368E-09	2.252E-09
WSW	1.075E-06	3.744E-07	1.699E-07	1.020E-07	6.989E-08	3.351E-08	1.190E-08	5.393E-09	3.185E-09	2.130E-09
W	1.305E-06	4.561E-07	2.091E-07	1.265E-07	8.719E-08	4.224E-08	1.526E-08	7.012E-09	4.177E-09	2.811E-09
WNW	1.131E-06	3.952E-07	1.808E-07	1.093E-07	7.530E-08	3.652E-08	1.325E-08	6.135E-09	3.677E-09	2.487E-09
NW	1.152E-06	4.090E-07	1.889E-07	1.148E-07	7.943E-08	3.871E-08	1.413E-08	6.550E-09	3.926E-09	2.656E-09
NNW	9.822E-07	3.527E-07	1.637E-07	9.973E-08	6.907E-08	3.372E-08	1.231E-08	5.684E-09	3.391E-09	2.283E-09
N	2.520E-06	9.067E-07	4.196E-07	2.551E-07	1.764E-07	8.585E-08	3.120E-08	1.437E-08	8.557E-09	5.755E-09
NNE	3.179E-06	1.142E-06	5.292E-07	3.220E-07	2.228E-07	1.087E-07	3.963E-08	1.832E-08	1.095E-08	7.389E-09
NE	2.597E-06	9.328E-07	4.335E-07	2.642E-07	1.831E-07	8.946E-08	3.273E-08	1.517E-08	9.088E-09	6.141E-09
ENE	1.578E-06	5.722E-07	2.701E-07	1.663E-07	1.160E-07	5.737E-08	2.133E-08	9.991E-09	6.009E-09	4.067E-09
E	2.954E-06	1.085E-06	5.241E-07	3.273E-07	2.307E-07	1.159E-07	4.413E-08	2.102E-08	1.276E-08	8.685E-09
ESE	4.300E-06	1.548E-06	7.634E-07	4.840E-07	3.450E-07	1.766E-07	6.909E-08	3.360E-08	2.064E-08	1.416E-08
SE	3.048E-06	1.075E-06	5.249E-07	3.313E-07	2.355E-07	1.201E-07	4.682E-08	2.274E-08	1.396E-08	9.582E-09
SSE	1.699E-06	5.889E-07	2.727E-07	1.663E-07	1.154E-07	5.659E-08	2.088E-08	9.777E-09	5.894E-09	4.001E-09

Table 2.7-9 ~~Table 2.7-7~~ Long-Term ~~Average~~ χ/Q (sec/m^3) for Routine Releases at Distances Between 0.25 to 50 Miles, 8.000 Day Decay, Depleted

Ground Level Release - No Purge Releases

	Distance in Miles from the Site										
Sector	**0.250**	**0.500**	**0.750**	**1.000**	**1.500**	**2.000**	**2.500**	**3.000**	**3.500**	**4.000**	**4.500**
S	7.899E-06	2.716E-06	1.420E-06	8.947E-07	4.669E-07	2.939E-07	2.050E-07	1.526E-07	1.188E-07	9.566E-08	7.897E-08
SSW	6.185E-06	2.134E-06	1.122E-06	7.101E-07	3.720E-07	2.347E-07	1.639E-07	1.222E-07	9.526E-08	7.674E-08	6.340E-08
SW	5.547E-06	1.902E-06	1.002E-06	6.345E-07	3.332E-07	2.106E-07	1.474E-07	1.100E-07	8.583E-08	6.922E-08	5.723E-08
WSW	5.214E-06	1.771E-06	9.297E-07	5.891E-07	3.098E-07	1.961E-07	1.374E-07	1.027E-07	8.020E-08	6.473E-08	5.357E-08
W	6.506E-06	2.158E-06	1.126E-06	7.138E-07	3.777E-07	2.405E-07	1.693E-07	1.270E-07	9.954E-08	8.058E-08	6.686E-08
WNW	5.682E-06	1.867E-06	9.770E-07	6.193E-07	3.271E-07	2.080E-07	1.463E-07	1.097E-07	8.593E-08	6.955E-08	5.770E-08
NW	5.685E-06	1.884E-06	9.984E-07	6.371E-07	3.391E-07	2.167E-07	1.529E-07	1.150E-07	9.032E-08	7.325E-08	6.088E-08
NNW	4.835E-06	1.594E-06	8.530E-07	5.476E-07	2.930E-07	1.877E-07	1.327E-07	9.991E-08	7.856E-08	6.378E-08	5.304E-08
N	1.229E-05	4.077E-06	2.192E-06	1.410E-06	7.532E-07	4.816E-07	3.400E-07	2.557E-07	2.009E-07	1.629E-07	1.354E-07
NNE	1.568E-05	5.159E-06	2.758E-06	1.774E-06	9.485E-07	6.068E-07	4.287E-07	3.225E-07	2.534E-07	2.056E-07	1.709E-07
NE	1.279E-05	4.218E-06	2.252E-06	1.447E-06	7.747E-07	4.964E-07	3.511E-07	2.644E-07	2.079E-07	1.688E-07	1.404E-07
ENE	8.043E-06	2.570E-06	1.363E-06	8.802E-07	4.763E-07	3.079E-07	2.192E-07	1.660E-07	1.311E-07	1.068E-07	8.918E-08
E	1.578E-05	4.840E-06	2.539E-06	1.647E-06	9.054E-07	5.927E-07	4.260E-07	3.251E-07	2.584E-07	2.118E-07	1.776E-07
ESE	2.428E-05	7.232E-06	3.661E-06	2.333E-06	1.291E-06	8.561E-07	6.216E-07	4.781E-07	3.827E-07	3.154E-07	2.659E-07
SE	1.720E-05	5.175E-06	2.593E-06	1.633E-06	8.942E-07	5.903E-07	4.272E-07	3.278E-07	2.619E-07	2.155E-07	1.814E-07
SSE	8.786E-06	2.841E-06	1.460E-06	9.185E-07	4.874E-07	3.122E-07	2.209E-07	1.664E-07	1.309E-07	1.064E-07	8.852E-08

Table 2.7-9 ~~Table 2.7-7~~ Long-Term ~~Average~~ χ/Q (sec/m^3) for Routine Releases at Distances Between 0.25 to 50 Miles, 8.000 Day Decay, Depleted

Ground Level Release - No Purge Releases

	Distance in Miles from the Site										
Sector	**5.000**	**7.500**	**10.000**	**15.000**	**20.000**	**25.000**	**30.000**	**35.000**	**40.000**	**45.000**	**50.000**
S	6.651E-08	3.443E-08	2.145E-08	1.095E-08	6.764E-09	4.634E-09	3.389E-09	2.593E-09	2.050E-09	1.663E-09	1.376E-09
SSW	5.343E-08	2.771E-08	1.729E-08	8.835E-09	5.456E-09	3.735E-09	2.730E-09	2.087E-09	1.650E-09	1.337E-09	1.106E-09
SW	4.828E-08	2.512E-08	1.571E-08	8.057E-09	4.988E-09	3.421E-09	2.504E-09	1.917E-09	1.517E-09	1.230E-09	1.018E-09
WSW	4.522E-08	2.361E-08	1.480E-08	7.614E-09	4.727E-09	3.249E-09	2.383E-09	1.827E-09	1.447E-09	1.175E-09	9.732E-10
W	5.658E-08	2.983E-08	1.883E-08	9.796E-09	6.130E-09	4.240E-09	3.125E-09	2.406E-09	1.913E-09	1.559E-09	1.295E-09
WNW	4.883E-08	2.577E-08	1.629E-08	8.491E-09	5.330E-09	3.696E-09	2.730E-09	2.106E-09	1.677E-09	1.369E-09	1.139E-09
NW	5.158E-08	2.733E-08	1.732E-08	9.051E-09	5.682E-09	3.940E-09	2.910E-09	2.244E-09	1.787E-09	1.458E-09	1.212E-09
NNW	4.498E-08	2.389E-08	1.516E-08	7.933E-09	4.979E-09	3.451E-09	2.547E-09	1.963E-09	1.562E-09	1.274E-09	1.058E-09
N	1.147E-07	6.077E-08	3.848E-08	2.008E-08	1.258E-08	8.703E-09	6.415E-09	4.939E-09	3.926E-09	3.198E-09	2.655E-09
NNE	1.449E-07	7.685E-08	4.871E-08	2.546E-08	1.597E-08	1.107E-08	8.167E-09	6.294E-09	5.008E-09	4.082E-09	3.393E-09
NE	1.191E-07	6.325E-08	4.014E-08	2.101E-08	1.320E-08	9.151E-09	6.758E-09	5.211E-09	4.149E-09	3.384E-09	2.813E-09
ENE	7.585E-08	4.077E-08	2.608E-08	1.381E-08	8.733E-09	6.090E-09	4.516E-09	3.495E-09	2.791E-09	2.282E-09	1.901E-09
E	1.517E-07	8.281E-08	5.355E-08	2.876E-08	1.837E-08	1.291E-08	9.628E-09	7.488E-09	6.004E-09	4.927E-09	4.118E-09
ESE	2.281E-07	1.267E-07	8.293E-08	4.530E-08	2.928E-08	2.076E-08	1.560E-08	1.221E-08	9.839E-09	8.111E-09	6.808E-09
SE	1.555E-07	8.612E-08	5.627E-08	3.068E-08	1.982E-08	1.405E-08	1.056E-08	8.261E-09	6.659E-09	5.490E-09	4.608E-09
SSE	7.512E-08	4.007E-08	2.552E-08	1.345E-08	8.506E-09	5.932E-09	4.402E-09	3.409E-09	2.724E-09	2.229E-09	1.859E-09

Table 2.7-10 ~~Table 2.7-7~~ Long-Term ~~Average~~ χ/Q (sec/m^3) for Routine Releases ~~at~~ Along Various Distances ~~Between 0.25 to 50 Miles~~ Segments, 8.000 Day Decay, Depleted

Ground Level Release - No Purge Releases										
	Segment Boundaries in Miles from the Site									
Direction From Site	**0.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
S	1.474E-06	4.851E-07	2.078E-07	1.197E-07	7.930E-08	3.579E-08	1.142E-08	4.704E-09	2.613E-09	1.671E-09
SSW	1.164E-06	3.861E-07	1.661E-07	9.590E-08	6.366E-08	2.879E-08	9.212E-09	3.792E-09	2.104E-09	1.344E-09
SW	1.039E-06	3.457E-07	1.493E-07	8.640E-08	5.747E-08	2.608E-08	8.394E-09	3.472E-09	1.932E-09	1.237E-09
WSW	9.652E-07	3.213E-07	1.392E-07	8.073E-08	5.378E-08	2.449E-08	7.927E-09	3.297E-09	1.841E-09	1.181E-09
W	1.172E-06	3.914E-07	1.714E-07	1.002E-07	6.712E-08	3.089E-08	1.018E-08	4.298E-09	2.424E-09	1.566E-09
WNW	1.016E-06	3.391E-07	1.481E-07	8.647E-08	5.793E-08	2.668E-08	8.818E-09	3.746E-09	2.121E-09	1.375E-09
NW	1.035E-06	3.509E-07	1.548E-07	9.087E-08	6.110E-08	2.827E-08	9.391E-09	3.993E-09	2.260E-09	1.465E-09
NNW	8.820E-07	3.028E-07	1.342E-07	7.903E-08	5.324E-08	2.470E-08	8.226E-09	3.497E-09	1.977E-09	1.279E-09
N	2.263E-06	7.783E-07	3.440E-07	2.021E-07	1.359E-07	6.285E-08	2.083E-08	8.820E-09	4.975E-09	3.213E-09
NNE	2.854E-06	9.800E-07	4.337E-07	2.550E-07	1.716E-07	7.946E-08	2.641E-08	1.122E-08	6.339E-09	4.101E-09
NE	2.331E-06	8.004E-07	3.552E-07	2.092E-07	1.409E-07	6.538E-08	2.179E-08	9.272E-09	5.248E-09	3.399E-09
ENE	1.417E-06	4.912E-07	2.215E-07	1.318E-07	8.948E-08	4.204E-08	1.428E-08	6.165E-09	3.519E-09	2.292E-09
E	2.654E-06	9.313E-07	4.301E-07	2.597E-07	1.781E-07	8.511E-08	2.965E-08	1.305E-08	7.534E-09	4.946E-09
ESE	3.864E-06	1.329E-06	6.267E-07	3.843E-07	2.666E-07	1.298E-07	4.654E-08	2.097E-08	1.227E-08	8.140E-09
SE	2.740E-06	9.232E-07	4.309E-07	2.631E-07	1.819E-07	8.828E-08	3.154E-08	1.419E-08	8.307E-09	5.510E-09
SSE	1.526E-06	5.054E-07	2.235E-07	1.317E-07	8.884E-08	4.140E-08	1.394E-08	6.007E-09	3.432E-09	2.239E-09

Table 2.7-11 ~~Table 2.7-8~~ Long-Term ~~Average~~ D/Q ($1/m^2$) for Routine Releases at Distances Between 0.25 to 50 Miles

Ground Level Release - No Purge Releases
Relative Deposition Per Unit Area ($1/m^2$) At Fixed Points By Downwind Sectors
Distances In Miles

Direction From Site	0.25	0.50	0.75	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50
S	4.819E-08	1.630E-08	8.367E-09	5.138E-09	2.561E-09	1.553E-09	1.050E-09	7.611E-10	5.787E-10	4.559E-10	3.691E-10
SSW	3.194E-08	1.080E-08	5.546E-09	3.405E-09	1.698E-09	1.030E-09	6.961E-10	5.045E-10	3.836E-10	3.022E-10	2.446E-10
SW	2.633E-08	8.902E-09	4.571E-09	2.807E-09	1.399E-09	8.486E-10	5.738E-10	4.158E-10	3.161E-10	2.491E-10	2.016E-10
WSW	2.286E-08	7.732E-09	3.970E-09	2.438E-09	1.215E-09	7.371E-10	4.983E-10	3.611E-10	2.746E-10	2.163E-10	1.751E-10
W	2.691E-08	9.101E-09	4.673E-09	2.869E-09	1.430E-09	8.676E-10	5.866E-10	4.251E-10	3.232E-10	2.546E-10	2.061E-10
WNW	2.495E-08	8.438E-09	4.333E-09	2.660E-09	1.326E-09	8.044E-10	5.439E-10	3.941E-10	2.997E-10	2.361E-10	1.911E-10
NW	2.242E-08	7.583E-09	3.893E-09	2.391E-09	1.192E-09	7.229E-10	4.887E-10	3.542E-10	2.693E-10	2.122E-10	1.718E-10
NNW	1.628E-08	5.504E-09	2.826E-09	1.735E-09	8.652E-10	5.247E-10	3.548E-10	2.571E-10	1.955E-10	1.540E-10	1.247E-10
N	4.309E-08	1.457E-08	7.481E-09	4.594E-09	2.290E-09	1.389E-09	9.391E-10	6.805E-10	5.175E-10	4.077E-10	3.300E-10
NNE	6.257E-08	2.116E-08	1.086E-08	6.671E-09	3.326E-09	2.017E-09	1.364E-09	9.882E-10	7.514E-10	5.920E-10	4.793E-10
NE	5.046E-08	1.706E-08	8.761E-09	5.379E-09	2.682E-09	1.627E-09	1.100E-09	7.969E-10	6.059E-10	4.774E-10	3.865E-10
ENE	2.720E-08	9.199E-09	4.723E-09	2.900E-09	1.446E-09	8.769E-10	5.929E-10	4.296E-10	3.267E-10	2.574E-10	2.084E-10
E	3.824E-08	1.293E-08	6.640E-09	4.077E-09	2.033E-09	1.233E-09	8.335E-10	6.040E-10	4.593E-10	3.618E-10	2.929E-10
ESE	5.097E-08	1.724E-08	8.849E-09	5.434E-09	2.709E-09	1.643E-09	1.111E-09	8.050E-10	6.121E-10	4.822E-10	3.904E-10
SE	4.574E-08	1.547E-08	7.942E-09	4.877E-09	2.431E-09	1.475E-09	9.970E-10	7.225E-10	5.493E-10	4.328E-10	3.504E-10
SSE	4.085E-08	1.381E-08	7.092E-09	4.355E-09	2.171E-09	1.317E-09	8.902E-10	6.451E-10	4.905E-10	3.865E-10	3.129E-10

Table 2.7-11 ~~Table 2.7-8~~ Long-Term ~~Average~~ D/Q (1/m^2) for Routine Releases at Distances Between 0.25 to 50 Miles

Ground Level Release - No Purge Releases
Relative Deposition Per Unit Area (1/m^2) At Fixed Points By Downwind Sectors
Distances In Miles

Direction From Site	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00
S	3.053E-10	1.496E-10	9.388E-11	4.745E-11	2.872E-11	1.926E-11	1.380E-11	1.036E-11	8.056E-12	6.435E-12	5.252E-12
SSW	2.024E-10	9.917E-11	6.222E-11	3.145E-11	1.904E-11	1.276E-11	9.145E-12	6.867E-12	5.339E-12	4.265E-12	3.481E-12
SW	1.668E-10	8.174E-11	5.129E-11	2.592E-11	1.569E-11	1.052E-11	7.538E-12	5.660E-12	4.401E-12	3.515E-12	2.869E-12
WSW	1.449E-10	7.099E-11	4.454E-11	2.251E-11	1.363E-11	9.136E-12	6.547E-12	4.916E-12	3.822E-12	3.053E-12	2.492E-12
W	1.705E-10	8.356E-11	5.243E-11	2.650E-11	1.604E-11	1.075E-11	7.706E-12	5.786E-12	4.499E-12	3.594E-12	2.933E-12
WNW	1.581E-10	7.748E-11	4.861E-11	2.457E-11	1.487E-11	9.971E-12	7.145E-12	5.365E-12	4.171E-12	3.332E-12	2.720E-12
NW	1.421E-10	6.962E-11	4.369E-11	2.208E-11	1.336E-11	8.961E-12	6.421E-12	4.821E-12	3.749E-12	2.994E-12	2.444E-12
NNW	1.031E-10	5.054E-11	3.171E-11	1.603E-11	9.701E-12	6.504E-12	4.661E-12	3.500E-12	2.721E-12	2.174E-12	1.774E-12
N	2.730E-10	1.338E-10	8.394E-11	4.243E-11	2.568E-11	1.722E-11	1.234E-11	9.264E-12	7.203E-12	5.754E-12	4.697E-12
NNE	3.964E-10	1.943E-10	1.219E-10	6.161E-11	3.729E-11	2.500E-11	1.792E-11	1.345E-11	1.046E-11	8.355E-12	6.820E-12
NE	3.197E-10	1.567E-10	9.830E-11	4.968E-11	3.007E-11	2.016E-11	1.445E-11	1.085E-11	8.435E-12	6.738E-12	5.500E-12
ENE	1.724E-10	8.446E-11	5.300E-11	2.679E-11	1.621E-11	1.087E-11	7.789E-12	5.849E-12	4.548E-12	3.633E-12	2.965E-12
E	2.423E-10	1.187E-10	7.451E-11	3.766E-11	2.279E-11	1.528E-11	1.095E-11	8.223E-12	6.393E-12	5.107E-12	4.168E-12
ESE	3.229E-10	1.583E-10	9.929E-11	5.019E-11	3.038E-11	2.037E-11	1.459E-11	1.096E-11	8.520E-12	6.806E-12	5.555E-12
SE	2.898E-10	1.420E-10	8.912E-11	4.504E-11	2.726E-11	1.828E-11	1.310E-11	9.835E-12	7.647E-12	6.108E-12	4.986E-12
SSE	2.588E-10	1.268E-10	7.957E-11	4.022E-11	2.434E-11	1.632E-11	1.170E-11	8.782E-12	6.828E-12	5.454E-12	4.452E-12

Table 2.7-12 ~~Table 2.7-8~~ Long-Term ~~Average~~ D/Q (1/m^2) for Routine Releases ~~at~~ Along Various Distances ~~Between 0.25 to 50 Miles~~ Segments

Ground Level Release - No Purge Release
Relative Deposition Per Unit Area (1/m^2) By Downwind Sectors
Segment Boundaries In Miles

Direction From Site	0.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
S	8.694E-09	2.686E-09	1.069E-09	5.841E-10	3.712E-10	1.594E-10	4.944E-11	1.960E-11	1.046E-11	6.477E-12
SSW	5.762E-09	1.780E-09	7.084E-10	3.871E-10	2.460E-10	1.057E-10	3.277E-11	1.299E-11	6.936E-12	4.293E-12
SW	4.749E-09	1.467E-09	5.839E-10	3.191E-10	2.028E-10	8.710E-11	2.701E-11	1.071E-11	5.717E-12	3.538E-12
WSW	4.125E-09	1.274E-09	5.071E-10	2.771E-10	1.761E-10	7.565E-11	2.346E-11	9.298E-12	4.965E-12	3.073E-12
W	4.855E-09	1.500E-09	5.969E-10	3.262E-10	2.073E-10	8.905E-11	2.761E-11	1.094E-11	5.844E-12	3.617E-12
WNW	4.502E-09	1.391E-09	5.534E-10	3.024E-10	1.922E-10	8.256E-11	2.560E-11	1.015E-11	5.419E-12	3.354E-12
NW	4.045E-09	1.250E-09	4.973E-10	2.718E-10	1.727E-10	7.420E-11	2.301E-11	9.119E-12	4.870E-12	3.014E-12
NNW	2.937E-09	9.072E-10	3.610E-10	1.973E-10	1.254E-10	5.386E-11	1.670E-11	6.619E-12	3.535E-12	2.188E-12
N	7.773E-09	2.402E-09	9.557E-10	5.222E-10	3.319E-10	1.426E-10	4.421E-11	1.752E-11	9.357E-12	5.792E-12
NNE	1.129E-08	3.487E-09	1.388E-09	7.583E-10	4.820E-10	2.070E-10	6.420E-11	2.544E-11	1.359E-11	8.410E-12
NE	9.103E-09	2.812E-09	1.119E-09	6.115E-10	3.887E-10	1.669E-10	5.177E-11	2.052E-11	1.096E-11	6.782E-12
ENE	4.908E-09	1.516E-09	6.033E-10	3.297E-10	2.095E-10	9.001E-11	2.791E-11	1.106E-11	5.907E-12	3.656E-12
E	6.899E-09	2.132E-09	8.482E-10	4.635E-10	2.946E-10	1.265E-10	3.924E-11	1.555E-11	8.305E-12	5.140E-12
ESE	9.195E-09	2.841E-09	1.130E-09	6.177E-10	3.926E-10	1.686E-10	5.230E-11	2.073E-11	1.107E-11	6.851E-12
SE	8.252E-09	2.550E-09	1.015E-09	5.544E-10	3.524E-10	1.514E-10	4.693E-11	1.860E-11	9.934E-12	6.149E-12
SSE	7.369E-09	2.277E-09	9.059E-10	4.950E-10	3.146E-10	1.351E-10	4.191E-11	1.661E-11	8.870E-12	5.490E-12

ENCLOSURE 4

Response to NRC RAI Letter No. 025

RAI Question No. 12.02-10

NRC RAI 12.02-10

Staff review of the applicant's proposed revision to FSAR Section 12.2.2 (reference Dominion Letter NA3-08-043 (4/28/08) in response to NRC RAI 12.02-1) indicates internal inconsistencies in the presentation of FSAR data and dose results supporting the demonstration of regulatory compliance. Specifically, the applicant is requested to address and resolve the following items:

(a) In demonstrating consistency with the unity rule of Table 2 (Column 1) of Appendix B to Part 20, add a listing to FSAR Table 12.2-17R showing the ratio of each radionuclide and sum-of-the-ratios for all radionuclides. Currently, the tabulation does not present the sum-of-the-ratios.

(b) The staff's evaluation and analyses generally concur with dose results presented in FSAR Table 12.2-18bR. However, the following observations were noted: (i) the applicant's dose associated with plume exposure at the nearest residence is nearly 1.5 times higher than the staff's estimate; and (ii) in confirming consistency with Part 50 Appendix I, Section II design objectives, the applicant is requested to revise footnote 4 to state that the reported dose includes exposures from plume and ground shine contributions.

(c) Address and resolve the following items in FSAR Tables 12.2-203 and 12.2-204: (i) the presentation of dose results for North Anna Unit 3 should note whether the listed dose results include the incremental dose contribution from turbine building skyshine associated with the use of hydrogen water chemistry (as described in FSAR Section 9.3.9) in demonstrating consistency with Part 20.1301(e); (ii) confirm whether the new total body doses reported for the existing units (6th column of table) need to be identified in the Departure Report (Part 7 of the North Anna Unit 3 application) given that they are higher by a factor of about 5 when compared to the corresponding information presented in ER Table 5.4-11 of the North Anna ESP (Rev. 9, Sept. 2006); (iii) the applicant should confirm whether changes in the basis of collective population doses need to be identified in the Departure Report (Part 7 of the North Anna Unit 3 application) when compared to the information and data presented in North Anna ESP (Rev. 9, Sept. 2006); and (iv) the applicant should confirm that the data presented in ER Tables 5.4-1, 5.4-3, and 2.5-8 of the North Anna ESP (Rev. 9, Sept. 2006) are still valid in terms of the applicability of supporting data for the current and forthcoming versions of the FSAR and supplemental ER.

Dominion Response

a. FSAR Table 12.2-17R will be revised to add concentration ratios by isotope, as well as the sum of the ratios. This revision was addressed in Dominion's response to RAI 12.02-3, dated August 21, 2008 (Serial No. NA3-08-85R), which included an FSAR markup depicting the Table 12.2-17R changes.

b.

   i. The doses in FSAR Table 12.2-18bR were calculated in a conservative manner. The bases for these dose calculations are provided in FSAR Table 12.2-18aR.

   ii. Footnote 4 of FSAR Table 12.2-18bR will be revised to clarify that the plume dose includes ground shine contribution

c.

   i. FSAR Section 12.2.2.4.4 will be revised to clarify that skyshine dose is based on hydrogen water chemistry and is negligible compared to effluent doses. This revision was addressed in Dominion's response to RAI 12.02-2, dated August 4, 2008 (Serial No. NA3-08-063R), which included an FSAR markup depicting the Section 12.2.2.4.4 changes. Therefore, no further clarification is necessary in FSAR Table 12.2-203.

   ii. The total body dose for the existing units shown on FSAR Revision 0, Table 12.2-203 (sixth column) is 2.1 mrem/yr, while the corresponding value on ESP ER Table 5.4-11 (fifth column) is 3.2E-01 mrem/yr. The higher FSAR value is attributable to the estimated direct radiation dose contribution from the Independent Spent Fuel Storage Installation (ISFSI), which was not included in ESP ER Table 5.4-11. The inclusion of the ISFSI direct radiation dose likewise increased the thyroid and bone doses shown on FSAR Table 12.2-203.

   The doses for total body, thyroid, and bone for the existing units shown on FSAR Revision 0, Table 12.2-203 were revised to include the estimated direct radiation dose contribution from the existing units. This change was addressed in Dominion's response to RAI 12.02-2, dated August 4, 2008 (Serial No. NA3-08-063R). Subsequent to this change, the values for the existing units were increased to conservatively reflect the dose contribution from fully filled ISFSI pads, instead of partially filled pads assumed in FSAR Revision 0. The cumulative effects of these changes are shown on the attached FSAR Table 12.2-203 markup.

   The changes described above resulted in the FSAR Table 12.2-203 dose values for the existing units (column six) and the site total values for total body and bone (column seven) being higher than the corresponding values shown on ESP ER Table 5.4-11. This variance

will be reflected in a revision to COLA Part 7 and FSAR Tables 1.8-202 and 12.2-203.

iii. The changes in the basis of collective population doses that resulted in doses that were lower in FSAR Table 12.2-204 than in the ESP ER Table 5.4-12 do not need to be identified as a variance because the FSAR population doses are within (i.e., are less than) the ESP ER doses.

Two factors reduced the population doses from the ESP to the COLA:

- The selection of the ESBWR technology resulted in a change in building dimensions and lower χ/Q and D/Q estimates. This change is further explained in the response to RAI 02.03.05-1.
- The gaseous and liquid effluent source terms were, for many of the radionuclides, reduced from the ESP ER to the COLA due to the selection of the ESBWR and its continuing review for design certification.

  The ESP source term was based on composite activities for the AP1000, ACR-700, ABWR, and ESBWR, with adjustments for the ABWR and ESBWR. In ESPA Revision 9, the activities for the ESBWR source terms for liquid and gaseous effluents were increased by a margin of 25 percent above the values in ESBWR DCD Revision 1 to address uncertainty because the design was not certified by the NRC. Based on progress in the design certification review, the 25 percent margin adjustment was removed in COLA Revision 0. Since the submittal of COLA Revision 0, the liquid source terms in subsequent ESBWR DCD revisions have remained the same, while the gaseous source terms were revised in ESBWR DCD Revision 5. FSAR Tables 12.2-17R and 12.2-19bR will be based on the source terms from DCD Revision 5. These source terms are reflected in Dominion's response to RAI 12.02-3, dated August 21, 2008 (Serial No. NA3-08-85R), which included a markup of FSAR Tables 12.2-17R and 12.2-19bR.

  Those nuclides in the liquid source term in the COLA which exceed the corresponding value in the ESPA are identified as Variance NAPS ESP VAR 12.2-3, Annual Liquid Effluent Releases. The values for the nuclides in the COLA that are not within (i.e., are larger than) the corresponding ESPA values are shown in bold font in FSAR Table 12.2-19bR.

iv. The data in ESP ER Tables 2.5-8, 5.4-1, and 5.4-3 remain valid and are applicable to the COLA.

Proposed COLA Revision

The FSAR and Departures Report will be revised as stated in the above response. These changes are shown on the attached FSAR and Departures Report markups.

Markup of North Anna COLA

The attached markup represents Dominion's good faith effort to show how the COLA will be revised in a future COLA submittal in response to the subject RAI. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be somewhat different than as presented herein.

NAPS SUP 1.8-3

Table 1.8-201 Departures from the Referenced Certified Design

Number	Subject	FSAR Section
None		

NAPS SUP 1.8-4

Table 1.8-202 Variances from the SSAR

Number	Subject	FSAR Location
NAPS ESP VAR 2.0-1a-l	Long-Term Dispersion Estimates (χ/Q and D/Q)	Section 2.3.5, Table 2.0-201
NAPS ESP VAR 2.0-2	Hydraulic Conductivity	Section 2.4.12.1.2, Table 2.0-201
NAPS ESP VAR 2.0-3	Hydraulic Gradient	Section 2.4.12.1.2, Table 2.0-201
NAPS ESP VAR 2.0-4	Vibratory Ground Motion	Section 2.5.2.5, Table 2.0-201
NAPS ESP VAR 2.0-5a-h	Distribution Coefficients (K_d)	Table 2.0-201
NAPS ESP VAR 2.0-6	DBA Source Term Parameters	Table 2.0-201
NAPS ESP VAR 2.4-1	Void Ratio, Porosity, and Seepage Velocity	Section 2.4.12.1.2
NAPS ESP VAR 2.4-2	NAPS Water Supply Well Information	Table 2.4-17R
NAPS ESP VAR 2.5-1	Stability of Slopes	Section 2.5.5
NAPS ESP VAR 12.2-1	Gaseous Pathway Doses	Section 12.2.2.2.6, Table 12.2-18bR
NAPS ESP VAR 12.2-2	[Deleted]	
NAPS ESP VAR 12.2-3	Annual Liquid Effluent Releases	Section 12.2.2.4.6, Table 12.2-19bR
NAPS ESP VAR 12.2-4	Existing Units' and Site Total Doses	Table 12.2-203

NAPS COL 12.2-2-A
NAPS ESP COL 11.1-1
NAPS ESP VAR 12.2-1

Table 12.2-18bR Gaseous Pathway Doses to the MEI (mrem/yr)

		ESP			Unit 3		
Location	**Pathway**	**Total Body**	**Thyroid**	**Skin**	**Total Body**	**Thyroid**	**Skin**
Nearest Garden/ Residence/ Meat Cow (Varies for ESP-ER; 1191 m (0.74 mi) ESE for FSAR)	All						
	Adult	1.6E+00	4.9E+00	4.0E+00	~~8.0E-01~~ 8.3E-01	~~4.6E+00~~ **5.3E+00**	~~6.2E-01~~ 6.5E-01
	Teen	1.6E+00	6.6E+00	4.0E+00	~~9.9E-01~~ 1.0E+00	~~6.0E+00~~ **7.0E+00**	~~6.2E-01~~ 6.5E-01
	Child	1.6E+00	1.3E+01	4.0E+00	**1.9E+00**	~~1.1E+01~~ 1.3E+01	~~6.2E-01~~ 6.5E-01
	Infant	1.5E+00	1.3E+00	4.0E+00	~~3.1E-01~~ 3.3E-01	~~1.3E+00~~ **1.4E+00**	~~6.2E-01~~ 6.5E-01

Notes: 1. There are no infant doses for the vegetable and meat pathways because infants do not consume these foods.
2. "NA" denotes "not applicable."
3. 1 mrem = 0.01 msv
4. For Unit 3, the doses shown for "nearest garden/residence/meat cow" location are the sum of garden, residence, and meat cow doses at 1191m. For ESP, these doses are the maximum of garden/residence, and meat cow doses at 1513m NE, 1545m NNE, and 2205m SE, respectively. The site boundary and residence plume doses include ground shine contribution.

NAPS COL 12.2-2-A
NAPS COL 12.2-3-A
NAPS ESP COL 11.1-1
NAPS ESP VAR 12.2-4

Table 12.2-203 Comparison of Site Doses to the MEI

Type of Dose	ESP Site Total(1)	Unit 3 (ESBWR) Liquid	Gaseous	Total	Existing Units(2)	Site Total(3)	40 CFR 190 Limit
Total Body (mrem/yr)	6.8	0.094	1.9	~~1.9~~ 2.0	**5.0**	**6.9**	25
Thyroid (mrem/yr)	27	0.18	~~11~~ 13	~~11~~ 13	**5.1**	18	75
Bone (mrem/yr)	12	1.3	~~7.9~~ 8.0	9.2	**5.1**	**14**	25

Notes:

(1) The ESP site total doses are for two new units and two existing units, and do not include a dose contribution from the ISFSI.

(2) The doses from existing units include ISFSI contribution and an assumed dose of 1 mrem/yr due to direct radiation from the existing units.

(3) This site total dose includes the Unit 3 total dose and the dose from the existing units.

(4) 1 mrem = 0.01 msv

NAPS ESP VAR 12.2-3 - Annual Liquid Effluent Releases
NAPS ESP VAR 12.2-4 - Existing Units' and Site Total Doses

Variance: NAPS ESP VAR 2.0-1 – Long-Term Dispersion Estimates (χ/Q and D/Q)

Request

This is a request to use the Unit 3 maximum long-term dispersion estimates (χ/Q and D/Q values) provided in FSAR Table 2.3-16R for types of locations other than the EAB rather than the corresponding ESP values in FSER Supplement 1, Appendix A and in SSAR Table 2.3-16. The Unit 3 values do not fall within (are larger than) the ESP and SSAR values.

This variance results from a review of the Radiological Environmental Monitoring Program (FSAR Reference 2.3-201). The review determined that since the time of the SSAR, distances to several of the "closest receptors" had changed. FSAR Table 2.3-15R shows the closest of all receptors to be a residence in the Northwest direction. The χ/Q and D/Q evaluation, and the subsequent normal gaseous effluent dose evaluation, conservatively assumed that each receptor (meat animal, vegetable garden, residence) is at the distance of that closest receptor and in the East-Southeast direction, which is the direction with the maximum annual average χ/Q value at that distance.

Justification

This variance is acceptable because all estimated annual doses from normal gaseous effluent releases remain within applicable limits as shown in FSAR Table 12.2-201.

Because of the change in Unit 3 maximum long-term dispersion estimates, some of the gaseous effluent doses are higher than the corresponding ESP value. See related variance NAPS ESP VAR 12.2-1, which is addressed below.

Variance: NAPS ESP VAR 2.0-2 – Hydraulic Conductivity

Request

This is a request to use the Unit 3 maximum hydraulic conductivity value provided in FSAR Section 2.4.12.1.2 rather than the corresponding ESP value in FSER Supplement 1, Appendix A and in SSAR Table 1.9-1. The Unit 3 value does not fall within (is larger than) the ESP and SSAR value.

The ESP value of 1.04 m/day (3.4 ft/day) represents the upper limit of the values obtained by in situ hydraulic conductivity testing of observation wells installed for the ESP subsurface investigation. These values varied from 0.076 to 1.04 m/day (0.25 to 3.4 ft/day) as shown in SSAR Table 2.4-16. The corresponding maximum hydraulic conductivity value reported in FSAR Section 2.4.12.1.2 is 3.0 m/day (9.9 ft/day) based on an expanded range from 0.076 to 3.0 m/day (0.25 to 9.9 ft/day).

Variance: NAPS ESP VAR 12.2-2 – [Deleted]

Variance: NAPS ESP VAR 12.2-3 – Annual Liquid Effluent Releases

Request

This is a request to use the Unit 3 maximum annual liquid release values provided in FSAR Table 12.2-19bR rather than the corresponding ESP value in EIS Appendix I and ESP-ER Table 5.4-6. The Unit 3 values for some nuclides do not fall within (are larger than) the ESP and ER values, as shown in bold font in FSAR Table 12.2-19bR.

This variance results from a change in the annual release values for the ESBWR since the ESP-ER table was submitted. ESP-ER Table 5.4-6 presented the annual release values for a single unit nuclear plant, based on a composite of possible radionuclide releases from a number of reactor designs including the ESBWR. ESP-ER Table 5.4-6 also contained more radionuclides than FSAR Table 12.2-19bR, due to the use of the composite set of nuclides from multiple reactor designs.

Justification

This variance is acceptable because the estimated Unit 3 concentrations of normal liquid effluent releases remain within the applicable concentration limits and the annual doses from normal liquid effluent releases remain within applicable limits.

The estimated Unit 3 concentrations of normal liquid effluent releases for all nuclides meet the 10 CFR 20 concentration limits as shown in FSAR Table 12.2-19bR.

The estimated annual doses from Unit 3 to the MEI from liquid effluents are compared with the applicable limit in FSAR Table 12.2-202. The Unit 3 dose meets the 10 CFR Part 50, Appendix I, limit, and the Unit 3 dose estimates are lower than the corresponding ESP values.

Variance: NAPS ESP VAR 12.2-4 - Existing Units' and Site Total Doses

Request

This is a request to use updated information for doses for the existing units and the site total doses in FSAR Table 12.2-203 rather than the information in SSAR Section 2.3.5.1 that refers to ESP ER Section 5.4, which contains ESP ER Table 5.4-11.

The doses for total body, thyroid, and bone due to the existing units, as shown in FSAR Table 12.2-203, do not fall within (are greater than) the corresponding values in ESP ER Table 5.4-11. Because these values are higher, they are shown in bold font in FSAR Table 12.2-203. Also, the total body and bone doses for the site, as shown in FSAR Table 12.2-203, do not fall within (are greater than) the corresponding site total values in

ESP ER Table 5.4-11. Because the two values are higher, they are shown in bold font in FSAR Table 12.2-203.

This variance is due to the conservative dose estimates for direct radiation from Units 1 and 2 and the Independent Spent Fuel Storage Installation (ISFSI), which were added to the doses for liquid and gaseous effluents from Units 1 and 2. The direct radiation dose contributions were included in the FSAR dose estimates, but not in the ESP Application dose estimates. The addition of these direct radiation doses to the existing units' doses (annual total body, thyroid, and bone) caused the FSAR values to exceed the SSAR values. This addition of direct radiation doses had the same effect on site total dose values for annual total body and bone doses.

Justification

This variance is acceptable because the dose estimates are more conservative and complete with the addition of the dose contributions from direct radiation from the existing units and the ISFSI. As shown in FSAR Table 12.2-203, the annual total body, thyroid, and bone doses for the site, including the doses from the existing units and the ISFSI, meet the applicable 40 CFR 190 limits.

Reference

~~NUREG 1835, Safety Evaluation Report for an~~ Early Site Permit (ESP) ~~at~~ for the North Anna ESP Site, ~~Supplement 1~~ ESP-003, U.S. Nuclear Regulatory Commission, November ~~2006~~ 2007.

ENCLOSURE 5

Response to NRC RAI Letter No. 025

RAI Question No. 15.06.05-1

NRC RAI 15.06.05-1

10 CFR 100.21 and 10 CFR 52.79 require that the COL application meet the radiological dose consequences of postulated accidents set forth in 10 CFR 50.34(a)(1) and 10 CFR 52.79(a)(1)(vi), respectively. General Design Criteria (GDC) 19 in 10 CFR Part 50 Appendix A, requires that in regard to control room access and occupancy, the COL applicant that does not reference a standard design approval or certification, is to provide adequate radiation protection so that radiation exposures shall not exceed 0.05 Sv (5 rem TEDE).

The bounding values for isotopic activity release rates to the environment for the design basis accidents (DBAs) are documented as a permit condition in Appendix B, "Controlling Values of Parameters and Design-Basis Accident Source Term Plant Parameters," in Early Site Permit No. ESP-003. Demonstrate how these values are met by the isotopic activity releases per time period specified in the radiological consequence analyses for each DBA analyzed in the ESBWR DCD, Revision 5, Section 15.4 and Chapter 15 of North Anna Site Safety Analysis Report (SSAR) of the North Anna Early Site Permit Application.

If the isotopic release rates specified in the ESBWR DCD, Chapter 15, Revision 5 and Chapter 15 of North Anna SSAR of the North Anna Early Site Permit Application are not bounded by those specified in Appendix B to the North Anna Early Site Permit, provide the site-specific radiological consequence doses for exclusion area boundary, low population zone, and control room for each DBA to demonstrate that North Anna site still meets the dose evaluation factors set forth in 10 CFR 50.34(a)(1)(ii)(D), 10 CFR 52.79(a)(1)(vi), and GDC 19 even though the isotopic activity releases per time period specified in the radiological consequence analyses for each DBA analyzed in the ESBWR DCD, Revision 5, Section 15.4 and Chapter 15 of North Anna Site Safety Analysis Report of the North Anna Early Site Permit Application are not bounded by those specified in North Anna Early Site Permit Appendix B.

Dominion Response

COLA References Design Certification Application

FSAR Revision 0, Section 1.1.1.1, explains that the North Anna Unit 3 COL Application (COLA) follows NRC Regulatory Guide 1.206, *Combined License Applications for Nuclear Power Plants (LWR Edition)*, Regulatory Position C.III.6, with regard to referencing a design certification application rather than a certified design. The guidance indicates that Regulatory Positions C.III.1 and C.III.2 are applicable for a COLA referencing a design certification application and urges the applicant to exercise caution to ensure the information in the COLA is synchronized with the DCD.

Accordingly, Regulatory Position C.III.2, *Information Needed for a Combined License Application Referencing a Certified Design and an Early Site Permit*, of RG 1.206 applies to Unit 3.

Regulatory Position C.III.2, Chapter 15, *Transient and Accident Analyses*, refers to Regulatory Position C.III.1, Chapter 15 for information needed to prepare FSAR Chapter 15. Regulatory Position C.III.1, Chapter 15, Section C.I.15.6.5, *Radiological Consequences*, states that the COL applicant should: "Show that site-specific short-term χ/Qs for the EAB, LPZ, and control room provided in Section 2.3.4 of the FSAR are within the χ/Qs assumed in the DCD." This comparison is shown in FSAR Table 2.0-201 and is discussed below.

Regulatory Position C.III.1, Chapter 15, Subsection C.I.15.1, *Transient and Accident Classification*, requires the COL applicant to: "Identify design differences from the referenced certified design, including fuel design, design parameter values, and operating conditions." As noted below, Unit 3 has a difference in operating controls for conditions indicative of a fuel handling accident. Therefore, the information required by RG 1.206 will be added in the next revision of the COLA to supplement the FSAR Table 2.0-201 χ/Q comparisons.

<u>On-Site χ/Q Values</u>

Standard Review Plan (SRP) Section 15.0.3, *Design Basis Accident Radiological Consequence Analyses for Advanced Light Water Reactors*, provides guidance in Subsection III.3 for COL applications that reference both an ESP and a standard reactor design certified by NRC:

A. The staff verifies that no changes from the site-specific short-term χ/Q values specified in the ESP application have occurred due to changes in plant design, plant location on the site, building orientation, or fission product release points.

B. Should the site-specific characteristic short-term χ/Q values specified in the ESP fall within the postulated short-term χ/Qs for the chosen certified design, the staff concludes that the COL applicant has satisfied the radiological consequence evaluation factors identified in 10 CFR 50.34(a)(1).

FSAR Table 2.0-201 shows that with regard to control room access and occupancy, the on-site accident χ/Q values for Unit 3 fall within the DCD Revision 4 site parameter values. The DCD Revision 5 site parameters for on-site accident χ/Q values remain bounding, except for those associated with the new DCD COL Item 2A.2-2-A, *Confirmation of Reactor Building χ/Q Values.* This COL Item specifies administrative controls to be implemented if the χ/Q values for a release from certain Reactor Building or Fuel Building doors are not

bounded by the ESBWR χ/Q values for a release in the Reactor Building. As a result, administrative controls will be added in the COLA to promptly close the appropriate doors and personnel air locks under conditions indicative of a fuel handling accident. With these controls, the on-site doses in DCD Chapter 15 will apply and be bounding for the Unit 3 control room.

As a result of changes in DCD Revision 5, Dominion will compare the on-site accident χ/Q values for Unit 3 to the DCD Revision 5 site parameter values in the next COLA submittal. This comparison (with the COL Item 2A.2-2-A administrative controls) will confirm that the design and operation of Unit 3 will provide adequate radiation protection at the Unit 3 site such that radiation exposures would not exceed 0.05 Sv (5 rem TEDE).

Isotopic Activity Release Rates for DBAs

The bounding values for isotopic activity release rates to the environment for the DBAs in Early Site Permit No. ESP-003, Appendix B, were not available for inclusion in FSAR Revision 0 because the ESP was issued on the same day that the Unit 3 COLA was submitted. The DBA accident source terms were also not contained in NUREG-1835 Supplement 1, *Safety Evaluation Report for an Early Site Permit (ESP) at the North Anna ESP Site*, Appendix A, *Permit Conditions, COL Action Items, Site Characteristics, and Bounding Parameters*.

A review of the COLA with respect to the as-issued ESP identified that the DBA source terms evaluated in DCD Revision 5, Chapter 15 are not bounded by the ESP-003 source terms in all cases. As a result, Dominion will revise the COLA to address DCD Revision 5 DBA source terms and will include a request for a variance to use the Unit 3 source terms from DCD Revision 5, Chapter 15 analyses in lieu of the ESP values.

Offsite χ/Q Values for DBAs

FSAR Table 2.0-201 shows that the χ/Q values for Unit 3 fall within the DCD χ/Q values for the exclusion area boundary (EAB) and low population zone (LPZ). Because these χ/Q values for Unit 3 will not change in the next FSAR revision, the offsite doses determined in DCD Chapter 15 apply and are within the limits for the EAB and LPZ.

Conclusion

Based on the above discussion, the radiological dose consequences for the EAB, the LPZ, and the control room for each DBA will meet the dose evaluation requirements in 10 CFR 50.34(a)(1)(ii)(D), 10 CFR 52.79(a)(1)(vi), and GDC 19.

Proposed COLA Revision

FSAR Tables 1.8-202 and 2.0-201, and the Departures Report will be revised to identify and address the variance from ESP-003 DBA source term values described in the above response. The Departures Report is also being revised to clarify the criteria under which a variance is requested. These changes are shown on the attached FSAR and Departures Report markups.

Markup of North Anna COLA

The attached markup represents Dominion's good faith effort to show how the COLA will be revised in a future COLA submittal in response to the subject RAI. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be somewhat different than as presented herein.

NAPS SUP 1.8-3

Table 1.8-201 Departures from the Referenced Certified Design

Number	Subject	FSAR Section
None		

NAPS SUP 1.8-4

Table 1.8-202 Variances from the SSAR

Number	Subject	FSAR Location
NAPS ESP VAR 2.0-1a-l	Long-Term Dispersion Estimates (χ/Q and D/Q)	Section 2.3.5, Table 2.0-201
NAPS ESP VAR 2.0-2	Hydraulic Conductivity	Section 2.4.12.1.2, Table 2.0-201
NAPS ESP VAR 2.0-3	Hydraulic Gradient	Section 2.4.12.1.2, Table 2.0-201
NAPS ESP VAR 2.0-4	Vibratory Ground Motion	Section 2.5.2.5, Table 2.0-201
NAPS ESP VAR 2.0-5a-h	Distribution Coefficients (K_d)	Table 2.0-201
NAPS ESP VAR 2.0-6	DBA Source Term Parameters	Table 2.0-201
NAPS ESP VAR 2.4-1	Void Ratio, Porosity, and Seepage Velocity	Section 2.4.12.1.2
NAPS ESP VAR 2.4-2	NAPS Water Supply Well Information	Table 2.4-17R
NAPS ESP VAR 2.5-1	Stability of Slopes	Section 2.5.5
NAPS ESP VAR 12.2-1	Gaseous Pathway Doses	Section 12.2.2.2.6, Table 12.2-18bR
NAPS ESP VAR 12.2-2	[Deleted]	
NAPS ESP VAR 12.2-3	Annual Liquid Effluent Releases	Section 12.2.2.4.6, Table 12.2-19bR
NAPS ESP VAR 12.2-4	Existing Units' and Site Total Doses	Table 12.2-203

Table 2.0-201 Evaluation of Site/Design Parameters and Characteristics

	Subject[16]	DCD Site Parameter Value[1][16]	Site Characteristic	Evaluation
NAPS SUP 2.0-1	**Part 2 – Evaluation of ESP Site Characteristics and Design Parameters For Which There is No Corresponding DCD Site Parameter**			
	Bounding Parameters		In the ~~next two~~ rows below, this column contains ESP Design Parameters and Unit 3 Design Characteristics	
	Maximum Cooling Water Flow Rate – Unit 3	No value provided	**ESP and Unit 3** 5056.3 m^3/h (49.6 cfs)	The ESP bounding design parameter value is defined as the maximum instantaneous withdrawal rate from the North Anna reservoir. The Unit 3 design characteristic value is provided in SSAR Section 2.4.1 and falls within (is the same as) the ESP bounding design parameter value.
	Minimum Site Grade	No value provided	**ESP** 82.6 m (271 ft) msl **Unit 3** 88.4 m (290 ft) msl	The ESP bounding design parameter value is defined as the finished site grade. The Unit 3 design characteristic value is provided in Figure 2.1-201 and falls within (is greater than) the ESP bounding design parameter value.

Table 2.0-201 Evaluation of Site/Design Parameters and Characteristics

	Subject[16]	DCD Site Parameter Value[1][16]	Site Characteristic	Evaluation
NAPS SUP 2.0-1	**Part 2 – Evaluation of ESP Site Characteristics and Design Parameters For Which There is No Corresponding DCD Site Parameter**			
NAPS ESP VAR 2.0-6	**Source Term**			
	Gaseous (Post Accident)	See Evaluation column	**ESP** Values in ESP Appendix B tables **SSAR Table 1.9-1** Values in SSAR Section 15.4 tables (maximum values) **Unit 3** Values in DCD Section 15.4 tables	ESP (design) controlling parameters superseded. Design basis accident (DBA) analyses evaluated in SSAR Chapter 15 were based on accidents and associated source terms for the AP1000, ABWR, and the ESBWR plant designs. The source terms for the DBAs evaluated for the ESBWR in DCD Chapter 15 are not bounded by the ESP source terms (included in ESP-003, Appendix B) in all cases. This is variance NAPS ESP VAR 2.0-6. Calculated doses are shown in DCD Chapter 15 to be within limits set by regulatory guidance documents and applicable regulations. Unit 3 site-specific short term (accident) meteorological dispersion values (χ/Q) are demonstrated in Part 1 of this table to fall within the associated DCD site parameter values except for Reactor Building unfiltered leakage. However, administrative controls described in Section 2A.2.5 limit exposures in the event of a fuel handling accident. Therefore, the doses for the accidents evaluated in DCD Chapter 15 are bounding for Unit 3 and are within limits set by regulatory guidance documents and applicable regulations.

Table 2.0-201 Evaluation of Site/Design Parameters and Characteristics

	Subject[16]	DCD Site Parameter Value[1][16]	Site Characteristic	Evaluation
NAPS SUP 2.0-2	**Part 3 – Evaluation of SSAR Bounding Site Characteristics and Design Parameters For Which There is No Corresponding ESP or DCD Value**			
	~~**Source Term**~~			
	~~Gaseous (Post Accident)~~	~~See Evaluation column~~	~~**SSAR Table 1.9-1** Values in SSAR Section 15.4 tables (maximum values)~~ ~~**Unit 3** Values in DCD Section 15.4 tables~~	~~Gaseous (post accident) source terms from tables in SSAR Section 15.4 and DCD Section 15.4 are addressed in rows below.~~
	~~**Source Term (continued)**~~			
	~~Feedwater System Pipe Break~~	~~See Evaluation column~~	~~**SSAR Table 1.9-1** Values in SSAR Table 15.4-5c~~ ~~**Unit 3** Values in DCD Table 15.4-15~~	~~The Unit 3 design characteristic values for the source term for the feedwater system pipe break DBA are provided in DCD Table 15.4-15. These values fall within (are less than) the SSAR Table 1.9-1 design parameter values in SSAR Table 15.4-5c. The doses are below the acceptance criteria as shown in DCD Table 15.4-16.~~

Table 2.0-201 Evaluation of Site/Design Parameters and Characteristics

	Subject[16]	DCD Site Parameter Value[1][16]	Site Characteristic	Evaluation
NAPS SUP 2.0-2	**Part 3 – Evaluation of SSAR Bounding Site Characteristics and Design Parameters For Which There is No Corresponding ESP or DCD Value**			
	~~Failure of Small Lines Carrying Primary Coolant Outside Containment (FSLCPCOC)~~	~~See Evaluation column~~	~~**SSAR Table 1.9-1** Values in SSAR Table 15.4-12a~~ ~~**Unit 3** Values in DCD Table 15.4-18~~	~~The Unit 3 design characteristic values for the source term for an FSLCPCOC DBA are provided in DCD Table 15.4-18. These values do not fall within (are not less than) the SSAR Table 1.9-1 design parameter values in SSAR Table 15.4-12a. Some source term activities have increased and additional radionuclides have been identified. This difference is addressed by the analysis of radiological consequences of an accidental release from this DBA in DCD Section 15.4. The doses remain below the acceptance criteria as shown in DCD Table 15.4-19.~~
	~~Main Steam Line Break (MSLB)~~	~~See Evaluation column~~	~~**SSAR Table 1.9-1** Values in SSAR Table 15.4-19a~~ ~~**Unit 3** Values in DCD Table 15.4-12~~	~~The Unit 3 design characteristic values for the source term for a MSLB DBA are provided in DCD Table 15.4-12. These values do not fall within (are not less than) the SSAR Table 1.9-1 design parameter values in SSAR Table 15.4-19a. Although source term activities have decreased for the nuclides listed in SSAR Table 15.4-19a, additional radionuclides are identified in DCD Table 15.4-12. This difference is addressed by the analysis of radiological consequences of an accidental release from this DBA in DCD Section 15.4. The doses remain below the acceptance criteria as shown in DCD Table 15.4-13.~~

Table 2.0-201 Evaluation of Site/Design Parameters and Characteristics

	Subject[16]	DCD Site Parameter Value[1][16]	Site Characteristic	Evaluation
NAPS SUP 2.0-2	**Part 3 – Evaluation of SSAR Bounding Site Characteristics and Design Parameters For Which There is No Corresponding ESP or DCD Value**			
	~~**Source Term (continued)**~~			
	~~Loss of Coolant Accident (LOCA)~~	~~See Evaluation column~~	~~**SSAR Table 1.9-1** Values in SSAR Table 15.4-23a~~ ~~**Unit 3** Values in DCD Table 15.4-7~~	~~The Unit 3 design characteristic values for the source term for a LOCA are provided in DCD Table 15.4-7. These values do not fall within (are not less than) the SSAR Table 1.9-1 design parameter values in SSAR Table 15.4-23a. Some source term activities have increased for the nuclides listed in SSAR Table 15.4-23a and additional radionuclides are identified in DCD Table 15.4-7. This difference is addressed by the analysis of radiological consequences of an accidental release from this DBA in DCD Section 15.4. The doses remain below the acceptance criteria as shown in DCD Table 15.4-9.~~
	~~Fuel Handling Accident (FHA)~~	~~See Evaluation column~~	~~**SSAR Table 1.9-1** Values in SSAR Table 15.4-28~~ ~~**Unit 3** Values in DCD Table 15.4-3a~~	~~The Unit 3 design characteristic values for the source term for a FHA are provided in DCD Table 15.4-3a. These values fall within (are less than) the SSAR Table 1.9-1 design parameter values in SSAR Table 15.4-28. The doses are below the acceptance criteria as shown in DCD Table 15.4-4.~~

Table 2.0-201 Evaluation of Site/Design Parameters and Characteristics

	Subject[16]	DCD Site Parameter Value[1][16]	Site Characteristic	Evaluation
NAPS SUP 2.0-2	**Part 3 – Evaluation of SSAR Bounding Site Characteristics and Design Parameters For Which There is No Corresponding ESP or DCD Value**			
	~~Cleanup Water Line Break (CWLB)~~	~~See Evaluation column~~	~~**SSAR Table 1.9-1** Values in SSAR Table 15.4-30~~ ~~**Unit 3** Values in DCD Table 15.4-22~~	~~The Unit 3 design characteristic values for the source term for a CWLB DBA are provided in DCD Table 15.4-22. These values do not fall within (are not less than) the SSAR Table 1.9-1 design parameter values in SSAR Table 15.4-30. Some source term activities have increased for the nuclides listed in SSAR Table 15.4-30 and additional radionuclides are identified in DCD Table 15.4-22. This difference is addressed by the analysis of radiological consequences of an accidental release from this DBA in DCD Section 15.4. The doses remain below the acceptance criteria as shown in DCD Table 15.4-23.~~
	Plant Characteristics			
	Megawatts Thermal	See Evaluation column	**SSAR Table 1.9-1** ≤4500 MWt **Unit 3** 4500 MWt	This Unit 3 design characteristic value of 4500 MWt is the rated reactor thermal power, as described in DCD Section 1.1.2.7. The Unit 3 design characteristic value falls within (is the same as) the SSAR Table 1.9-1 design parameter value.

VARIANCES

Introduction

A *variance* is a plant-specific deviation from one or more of the site characteristics, design parameters, or terms and conditions of an ESP or from the site safety analysis report (SSAR). A variance to an ESP is analogous to a departure from a standard design certification.

The following sections provide requests for variances from the ~~proposed~~ site characteristics for the North Anna ESP (Reference) and from the ESPA SSAR. The requests comply with the requirements of 10 CFR 52.39 and 10 CFR 52.93. To support a decision whether to grant a variance, each variance request provides the technical justification and supporting cross-references to the Unit 3 FSAR information that meet the technically relevant regulatory acceptance criteria.

This COLA complies with the requirements of 10 CFR 52.79, *Contents of Applications; Technical Information in Final Safety Analysis Report*, and 10 CFR 52.39, *Finality of Early Site Permit Determinations*. In accordance with 10 CFR 52.79(b)(2) and 10 CFR 52.39(d), this COLA requests a variance where the Unit 3 FSAR references the North Anna ESP and: a) the Unit 3 FSAR does not demonstrate that the design of Unit 3 falls within the ESP site characteristics~~, i.e, the proposed ESP site characteristics from FSER Supplement 1, Appendix A (Reference)~~; or b) the Unit 3 FSAR does not demonstrate that the design of Unit 3 falls within the ESP (design) controlling parameters; or c) the Unit 3 FSAR does not incorporate the ESP SSAR information by reference without the need for certain changes. Accordingly, this COLA includes the following requests for variances ~~from the proposed ESP site characteristics~~:

NAPS ESP VAR 2.0-1 - Long-Term Dispersion Estimates (X/Q and D/Q)
NAPS ESP VAR 2.0-2 - Hydraulic Conductivity
NAPS ESP VAR 2.0-3 - Hydraulic Gradient
NAPS ESP VAR 2.0-4 - Vibratory Ground Motion

~~This COLA complies with the requirements of 10 CFR 52.39, *Finality of Early Site Permit Determinations*. In accordance with 10 CFR 52.39(d), where the Unit 3 FSAR references the North Anna ESP and does not incorporate the ESPA SSAR information by reference without the need for certain changes, this COLA requests the following variances from the ESPA SSAR information:~~

NAPS ESP VAR 2.0-5 - Distribution Coefficients (K_d)
NAPS ESP VAR 2.0-6 - DBA Source Term Parameters
NAPS ESP VAR 2.4-1 - Void Ratio, Porosity, and Seepage Velocity
NAPS ESP VAR 2.4-2 - NAPS Water Supply Well Information
NAPS ESP VAR 2.5-1 - Stability of Slopes
NAPS ESP VAR 12.2-1 - Gaseous Pathway Doses
NAPS ESP VAR 12.2-2 - [Deleted]

Justification

The variance in spectral acceleration (g) values is acceptable because the ESBWR certified seismic design response spectra (CSDRS) is used for design of Unit 3 Seismic Category I structures, and not the Unit 3 site-specific SSE spectra at the top of competent material. FSAR Table 2.0-201 demonstrates Unit 3 foundation input response spectra (FIRS) for Unit 3 Seismic Category I structures fall within the ESBWR CSDRS. See "SSE Horizontal Ground Response Spectra" and "SSE Vertical Ground Response Spectra" under Seismology in Part 1 of that table.

Variance: NAPS ESP VAR 2.0-5 – Distribution Coefficients (K_d)

Request

This is a request to use the Unit 3 distribution coefficient (K_d) values provided in FSAR Table 2.4-209 (10% K_d) rather than the corresponding values in SSAR Table 1.9-1 and SSAR Table 2.4-20. The Unit 3 values do not fall within (are smaller than) the SSAR values and therefore would predict higher doses than the K_d values in the SSAR.

This variance in K_d values results from a more conservative approach to selecting Unit 3 values for estimating the radionuclide migration to surface waters via subsurface pathways. Both the SSAR and the Unit 3 K_d values were assigned using literature values. However, the Unit 3 K_d values were selected assuming the literature data to be log-normally distributed and then selecting the 10th percentile of the distribution to conservatively assign a low value for the radionuclide transport analysis. NUREG/CR-6697 (Reference 2.4-215), Attachment C, Table 3.9-1, was used to assign the mean and standard deviation for each of the distributions.

Justification

The variance in K_d values is acceptable because compliance with 10 CFR 20 is demonstrated in FSAR Section 2.4.13 with the use of the lower K_d values to evaluate radionuclide concentrations as a result of a postulated accidental release of liquid effluents in the groundwater pathways. Also, samples from the Unit 3 site were analyzed and the measured K_d values are presented in FSAR Table 2.4-208. The measured results show that the Unit 3 site characteristic values are conservative.

Variance: NAPS ESP VAR 2.0-6 – DBA Source Term Parameters

Request

This is a request to use the Unit 3 source terms from DCD Chapter 15 analyses of design basis accidents (DBAs). DCD Chapter 15 provides the required analyses of design basis accidents for the ESBWR. The DCD Chapter 15 source terms replace the ESBWR accident source terms in ESP-003, Appendix B, and in SSAR Chapter 15.

10 CFR 52.17(a)(1) required that the SSAR demonstrate the acceptability of the ESP site under the radiological consequences evaluation factors identified in 10 CFR 50.34(a)(1) and that site characteristics comply with 10 CFR 100. Specifically, 10 CFR 100.21(c)(2) requires that radiological dose consequences of postulated accidents meet the criteria set forth in 10 CFR 50.34(a)(1). Therefore, SSAR Chapter 15 analyzed a set of postulated accidents to demonstrate that a reactor or reactors bounded by parameters defined therein could be operated on the ESP site without undue risk to the health and safety of the public. Accident analyses evaluated in SSAR Chapter 15 were based on accidents and associated source terms for a range of possible reactor designs, including the AP1000, ABWR, and the ESBWR plant designs. Based on these analyses, the DBA source term parameters were established for the site in ESP-003, Appendix B.

A comparison of DBA source terms evaluated for the ESBWR in DCD Chapter 15 shows that they are not bounded by the ESP-003 source terms in all cases. Some Unit 3 values do not fall within (are larger than) the ESP and SSAR values.

Justification

This variance in DBA source term parameters is acceptable because calculated doses for the ESBWR design are shown in DCD Chapter 15 to be within limits set by regulatory guidance documents and applicable regulations. These DCD analyses determined DBA dose results based on assumed site parameters for short term (accident) meteorological dispersion factors (χ/Q). Unit 3 site-specific short term χ/Q values are demonstrated in FSAR Table 2.0-201 to fall within (are less than) the associated DCD site parameter values except for Reactor Building unfiltered inleakage. However, administrative controls described in FSAR Section 2A.2.5 limit exposures in the event of a fuel handling accident. Therefore, the dose consequences for the DBAs evaluated in DCD Chapter 15 are bounding and applicable for the Unit 3 site, and as shown in DCD Chapter 15 analyses, are within limits set by regulatory guidance documents and applicable regulations.

Variance: NAPS ESP VAR 2.4-1 – Void Ratio, Porosity, and Seepage Velocity

Request

This is a request to use the Unit 3 values for void ratio, porosity, and seepage velocity of saprolite rather than the SSAR values. The Unit 3 values are as follows from FSAR Section 2.4.12.1.2: void ratio equals 0.45, total porosity equals 31 percent, effective porosity equals 25 percent, and seepage velocity equals 0.085 m/day (0.28 ft/day). Corresponding SSAR Section 2.4.12.1.2 values for saprolite are as follows: void ratio equals 0.7, total porosity equals 41 percent, effective porosity equals 33 percent, and seepage velocity equals 0.037 m/day (0.12 ft/day). The Unit 3 values result in a seepage velocity that does not fall within (is larger than) the SSAR value.

The variance in Unit 3 values for void ratio, porosity, and seepage velocity from the SSAR values results from the use of additional data collected from the Unit 3 subsurface investigation.

- RAI Question 02.03.05-1 χ/Q and D/Q Values
- RAI Question 02.03.05-2 Clarification of χ/Q and D/Q Values
- RAI Question 02.03.05-3 χ/Q and D/Q Values Out to 50 Miles
- RAI Question 12.02-10 Clarification of FSAR Tables in Chapter 12
- RAI Question 15.06.05-1 Dose Evaluation Factors