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Dominion®

August 4, 2008

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

Serial No. NA3-08-063R
Docket No. 52-017
COL/MEP

DOMINION VIRGINIA POWER
NORTH ANNA UNIT 3 COMBINED LICENSE APPLICATION
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 011

On June 19, 2008, the NRC requested additional information on seven items to support the review of certain portions of the North Anna Unit 3 Combined License Application (COLA). The responses to the following RAIs are provided as Enclosures 1 through 6:

- RAI Question 02.05.04-10, Liquefaction Analyses
- RAI Question 02.05.04-11, Allowable Bearing Capacity for Structures
- RAI Question 08.03.02-1, SBO Response Procedures
- RAI Question 08.03.02-2, RGs 1.41, 1.128, 1.129 Conformance Clarification
- RAI Question 09.02.05-1, UHS Procedure Clarification
- RAI Question 12.02-2, Dose Analysis and EPA Standards

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

The response to RAI 13.01.02-13.01.03-1, which involves the fire protection organization, is being coordinated with the responses to RAI Letter 021. This letter also requests information about the Unit 3 organization. Therefore, the response to this RAI will be provided with the responses to RAI Letter 021.

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

Very truly yours,

Eugene S. Grecheck

D089
NRO

Enclosures:

1. Response to RAI Letter Number 011, RAI Question 02.05.04-10
2. Response to RAI Letter Number 011, RAI Question 02.05.04-11
3. Response to RAI Letter Number 011, RAI Question 08.03.02-1
4. Response to RAI Letter Number 011, RAI Question 08.03.02-2
5. Response to RAI Letter Number 011, RAI Question 09.02.05-1
6. Response to RAI Letter Number 011, RAI Question 12.02-2

Commitments made by this letter:

1. Incorporate proposed changes in a future COLA submission.
2. Information in FSAR Table 2.3-15R for some of the receptors will be updated to reflect recent surveys.
3. Respond to 13.01.02-13.01.03-1 via response to RAI Letter 21.

COMMONWEALTH OF VIRGINIA

COUNTY OF HENRICO

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Eugene S. Grecheck, who is Vice President-Nuclear Development 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 4th day of August, 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

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 011

RAI Question 02.05.04-10

NRC RAI 02.05.04-10

FSAR Section 2.5.4.8.1, Liquefaction Analyses Performed for Unit 3, states that "Using the method outlined in Tokimatsu and Seed (SSAR Reference 179), the maximum estimated dynamic settlement of the Zone IIA saprolite due to earthquake shaking was about 41 mm (1.6 in)." However, the ESP SSAR Section 2.5.4.8.5, Conclusions about Liquefaction, states that "Estimated maximum dynamic settlements due to earthquake shaking are about 5 inches." Please explain the apparent significant difference between the FSAR and SSAR information for the same soil and same method.

Dominion Response

The following two reasons explain why the maximum estimated settlements are different between the ESP SSAR and the COL FSAR.

1. The cone penetrometer test (CPT) soundings which form the basis of the maximum computed amounts of dynamic settlement in the SSAR and the FSAR are a substantial distance apart, and the soils identified in these CPTs, although both saprolites, do not have identical properties.

2. The peak ground accelerations used in the FSAR analysis were more than 40 percent lower than those used in the SSAR analysis. The value of cyclic stress ratio used as input to the dynamic settlement analysis is directly proportional to the peak ground acceleration. Although the relationship between cyclic stress ratio and dynamic settlement is non-linear, smaller peak accelerations will always give equal or lower dynamic settlement values.

Proposed COLA Revision

None.

ENCLOSURE 2

Response to NRC RAI Letter 011

RAI Question 02.05.04-11

NRC RAI 02.05.04-11

FSAR Section 2.5.4.10.1.c, Allowable Bearing Capacity for Structures, states "For soils, the values represent an increase of one third over the allowable static bearing capacity values." Please justify why dynamic bearing capacity can be estimated by adding one third over static bearing capacity.

Dominion Response

In order to respond to the RAI, the concept of the capacity-to-demand ratio (c/d) adjustment for static pressures must first be explained. The foundation bearing pressure is the pressure (or demand, d) that is applied to the soil. The ability of the soil beneath the foundation to resist the applied pressure is expressed in terms of bearing capacity (or capacity, c). The static foundation bearing pressure is continuously imposed over the lifetime of the structure – 40 years or longer in the case of nuclear power plants. Thus, the c/d adopted for static pressures needs to be very conservative. For static bearing pressures on soils, c/d is typically taken as 3.

Dynamic foundation bearing pressures occur infrequently over the lifetime of the structure in the case of design wind loading, and extremely infrequently (possibly never) in the case of the design earthquake load. Thus, it is reasonable to adopt a lower c/d for dynamic bearing pressures. A lower c/d for a given soil is equivalent to a higher applied bearing pressure. The International Building Code (Reference 1) has quantified this higher applied pressure in Table 1804.2 – Allowable Foundation and Lateral Pressure. Note d. of this table states, "An increase of one-third is permitted when using the alternate load combinations in Section 1605.3.2 that include wind or earthquake loads". Note that an increase of one-third in applied load reduces the c/d from 3 to 2.25.

Reference

1. International Code Council, Inc. (2003), *International Building Code*.

Proposed COLA Revision

None.

ENCLOSURE 3

Response to NRC RAI Letter 011

RAI Question 08.03.02-1

NRC RAI 08.03.02-1

FSAR Section 8.3.2.1.1, with NAPS SUP 8.3-2, states that training and procedures to mitigate an SBO event are implemented in accordance with Sections 13.2 and 13.5. According to NUMARC 87-00, endorsed by Regulatory Guide (RG) 1.155 and referenced by SRP 8.4, the SBO response procedures include (1) Station Blackout Response Guidelines, (2) AC Power Restoration, and (3) Severe Weather Guidelines. Please confirm that the training and procedures addressed in Section 8.3.2.1.1 include these three topics.

Dominion Response

The training and procedures addressed in Section 8.3.2.1.1 will include the three topics listed in the RAI. Training of licensed and non-licensed plant personnel and plant procedures are discussed in the COLA FSAR Sections 13.2 and 13.5 respectively, however, these discussions do not specifically address Station Blackout (SBO) events. In general, training is described in the FSAR in sufficient detail to assure plant staff receives adequate training for responding to all plant events, both normal and abnormal, and such training would encompass an SBO event. The FSAR will be revised to indicate that procedures will include (1) station blackout response guidelines, (2) AC power restoration, and (3) severe weather guidelines, as recommended by NUMARC 87-00.

Proposed COLA Revision

FSAR Section 8.3.2.1.1 will be revised as discussed in the above response.

The markups of the FSAR pages are attached.

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.

8.3 Onsite Power Systems

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

8.3.1.1 Description

Insert the following as the first paragraph.

NAPS SUP 8.3-1

An intermediate switchyard is utilized to transition off-site power from the NAPS switchyard to the Unit 3 main power transformers, and unit auxiliary transformers (UATs). This intermediate switchyard contains the main generator circuit breaker, and a supply circuit breaker, which provides power to 500/230 kV intermediate transformers used to supply power to the UATs. These intermediate transformers consist of three single phase transformers and include an installed spare transformer. Also included in the intermediate switchyard is a transmission tower which supports a 500 kV disconnect switch that is identified as the point of interconnection between the onsite power sources and the offsite power sources. This point of interconnection is the demarcation between Unit 3 and the NAPS switchyard and transmission system. (See Figure 8.2-201)

8.3.2.1.1 Safety-Related Station Batteries and Battery Chargers

Station Blackout

Add the following paragraph at the end of this section.

NAPS SUP 8.3-2

NA3 RAI 08.03.02-1
(Draft 07/22/08)

Training and procedures to mitigate an SBO event are implemented in accordance with Sections 13.2 and 13.5. As recommended by NUMARC 87-00 (Reference 8.3-201), SBO event mitigation procedures address SBO response (e.g., restoration of on-site standby power sources), AC power restoration (e.g., coordination with transmission system load dispatcher), and severe weather guidance (e.g., identification of site-specific actions to prepare for the onset of severe weather such as an impending tornado), as applicable. The ESBWR is a passive design and does not rely on offsite or onsite AC sources of power for at least 72 hours after an SBO event, as described in DCD Section 15.5.5, Station Blackout. In addition, there are no nearby large power sources, such as a gas turbine or black start fossil fuel plant, that can directly connect to the station to mitigate the SBO event.

Restoration from an SBO event will be contingent upon power being made available from any one of the following sources:

NA3 RAI 08.03.02-1 (Draft 07/22/08)

- ~~Either of the station~~ Any of the standby or ancillary diesel generators.
- Restoration of any one of the four 500 kV transmission lines described in Section 8.2.
- Restoration of the 230 kV transmission line described in Section 8.2.

NA3 RAI 08.03.02-1 (Draft 07/22/08)

8.3.5 References

8.3-201 Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors, NUMARC 87-00, Revision 1, August 1991.

Appendix 8A Miscellaneous Electrical Systems

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

8A.2.1 Description

Replace Section 8A.2.1 with the following:

NAPS COL 8A.2.3-1-A A cathodic protection system is provided to the extent required. The system is designed in accordance with the requirements of the National Association of Corrosion Engineers (NACE) Standards (DCD Reference 8A-5).

8A.2.3 COL Information

8A.2.3-1-A Cathodic Protection System

NAPS COL 8A.2.3-1-A This COL item is addressed in Section 8A.2.1.

ENCLOSURE 4

Response to NRC RAI Letter 011

RAI Question 08.03.02-2

NRC RAI 08.03.02-2

FSAR Chapter 1, Table 1.9-202, identifies the title of RG 1.41 as "Qualification Tests of Continuous-Duty Motors Installed Inside the Containment of Water-Cooled Nuclear Power Plants" and identifies this regulatory guide as "not applicable." However, the correct title of RG 1.41 is "Preoperational Testing of Redundant On-Site Electric Power Systems To Verify Proper Load Group Assignments" (ML003740090). Please revise Table 1.9-202 and address the applicability of, and conformance with, RG 1.41. In addition, please provide supplemental information to clarify conformance with RG 1.128 and RG 1.129 as identified in Table 1.9-202.

Dominion Response

RG 1.41

It was determined that the error in the title of RG 1.41 in COLA FSAR Table 1.9-202 and the conformance evaluation for RG 1.41 that is listed in FSAR Table 1.9-202 was the result of an editing error in COLA Rev 0. The title, revision, date, RG position, and evaluation columns for RG 1.40 were copied and used in error for RG 1.41; the resultant entries for RG 1.41 in FSAR Table 1.9-202 were not the intended entries. The evaluation of RG 1.41 will be changed from "Not Applicable" to "Conforms with the following exception: There are no safety-related DGs for ESBWR". This conformance evaluation will then be consistent with ESBWR DCD Rev 5 Tables 1.9-21 and 1.9-21a.

RG 1.128 and RG 1.129

The RAI also asks for additional information to clarify the conformance with RG 1.128 and RG 1.129 as stated in FSAR Table 1.9-202.

Review of FSAR Table 1.9-202 indicates that the evaluation columns for RG 1.128 Revision 2 and RG 1.129 Revision 2 both contain "Conforms" with no clarifying information.

Review of ESBWR DCD Revision 5 indicates that RG 1.128 Revision 1 and RG 1.129 Revision 1 were evaluated for conformance. ESBWR DCD Rev 5, Table 1.9-8 for RG 1.128 Revision 1 states that: "The ESBWR design allows for installation design and installation of batteries in accordance with IEEE 1187. IEEE 484 is not applicable for Valve-Regulated Lead-Acid (VRLA) batteries." Similarly, ESBWR DCD Rev 5, Table 1.9-8 for RG 1.129 Revision 1 states that: "The ESBWR design allows for periodic testing, maintenance, and replacement of batteries in accordance with IEEE 1188. IEEE 450 is not applicable for Valve-Regulated Lead-Acid (VRLA) batteries."

Review of RG 1.128 Revision 2 indicates that it endorses the use of IEEE 484-2002. As stated in DCD Revision 5, IEEE 484 is not applicable for VRLA batteries, IEEE 1187 (IEEE Recommended Practice for Installation Design and Installation of Valve-Regulated Lead-Acid Storage Batteries for Stationary Applications) is; therefore, RG 1.128 is not applicable to the ESBWR. Therefore, the evaluation for RG 1.128 should say "Not Applicable. IEEE 484 does not apply to ESBWR VRLA batteries, therefore, RG 1.128 is not applicable. IEEE 1187 applies to VRLA batteries." FSAR Table 1.9-202 will be revised accordingly.

Review of RG 1.129 Revision 2 indicates that it endorses the use of IEEE 450-2002. As stated in DCD Revision 5, IEEE 450 is not applicable for VRLA batteries, IEEE 1188

(IEEE Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications) is; therefore, RG 1.129 is not applicable to the ESBWR. Therefore, the evaluation for RG 1.129 should say "Not Applicable. IEEE 450 does not apply to ESBWR VRLA batteries, therefore, RG 1.129 is not applicable. IEEE 1188 applies to VRLA batteries." FSAR Table 1.9-202 will be revised accordingly.

Proposed COLA Revision

FSAR Table 1.9-202 has been revised to incorporate the following changes:

- The title for RG 1.41 has been corrected and the conformance evaluation has been revised to say: "Conforms with the following exception: There are no safety-related DGs for ESBWR."
- The evaluation for RG 1.128 Revision 2 has been revised to say: "Not Applicable. IEEE 484 does not apply to ESBWR VRLA batteries, therefore, RG 1.128 is not applicable. IEEE 1187 applies to VRLA batteries."
- The evaluation for RG 1.129 Revision 2 has been revised to say: "Not Applicable. IEEE 450 does not apply to ESBWR VRLA batteries, therefore, RG 1.129 is not applicable. IEEE 1188 applies to VRLA batteries."

The markups of the FSAR pages are attached.

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 1.9-3-A

Table 1.9-202 Conformance with Regulatory Guides

RG Number	Title	Revision	Date	RG Position	Evaluation
1.38	Quality Assurance Requirements for Packaging, Shipping, Receiving, Storage, and Handling of Items for Water-Cooled Nuclear Power Plants	Rev. 2	May-77	General	Exception. Section 17.5 identifies equivalent quality assurance standards.
1.39	Housekeeping Requirements for Water-Cooled Nuclear Power Plants	Rev. 2	Sep-77	General	Exception. Section 17.5 identifies equivalent quality assurance standards.
1.40	Qualification Tests of Continuous-Duty Motors Installed Inside the Containment of Water-Cooled Nuclear Power Plants	Rev. 0	Mar-73	General	Not applicable
1.41	~~Qualification Tests of Continuous-Duty Motors Installed Inside the Containment of Water-Cooled Nuclear Power Plants~~ Preoperational Testing of Redundant On-Site Electric Power Systems to Verify Proper Load Group Assignments	Rev. 0	Mar-73	General	~~Not applicable~~ Conforms with the following exception: There are no safety-related DGs for ESBWR.
1.43	Control of Stainless Steel Weld Cladding of Low-Alloy Steel Components	Rev. 0	May-73	General	Conforms

NA3 RAI 08.03.02-2 (Draft 07/22/08)

NAPS COL 1.9-3-A

Table 1.9-202 Conformance with Regulatory Guides

RG Number	Title	Revision	Date	RG Position	Evaluation
1.122	Development of Floor Design Response Spectra for Seismic Design of Floor-Supported Equipment or Components	Rev. 1	Feb-78	General	Conforms
1.124	Service Limits and Loading Combinations for Class 1 Linear-Type Component Supports	Rev. 2	Feb-07	General	Conforms
1.125	Physical Models for Design and Operation of Hydraulic Structures and Systems for Nuclear Power Plants	Rev. 1	Oct-78	General	Conforms
1.126	An Acceptable Model and Related Statistical Methods for the Analysis of Fuel Densification	Rev. 1	Mar-78	General	Conforms
1.127	Inspection of Water-Control Structures Associated with Nuclear Power Plants	Rev. 1	Mar-78	General	Conforms
1.128	Installation Design and Installation of Large Lead Storage Batteries for Nuclear Power Plants	Rev. 2	Feb-07	General	~~Conforms~~ Not Applicable. IEEE 484 does not apply to ESBWR VRLA batteries, therefore, RG 1.128 is not applicable. IEEE 1187 applies to VRLA batteries.

NA3 RAI 08.03.02-2
(Draft 07/22/08)

NAPS COL 1.9-3-A

Table 1.9-202 Conformance with Regulatory Guides

NA3 RAI 08.03.02-2
(Draft 07/22/08)

RG Number	Title	Revision	Date	RG Position	Evaluation
1.129	Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Nuclear Power Plants	Rev. 2	Feb-07	General	~~Conforms~~ Not Applicable. IEEE 450 does not apply to ESBWR VRLA batteries, therefore, RG 1.129 is not applicable. IEEE 1188 applies to VRLA batteries.
1.130	Service Limits and Loading Combinations for Class 1 Plate-and-Shell-Type Component Supports	Rev. 2	Mar-07	General	Conforms
1.131	Qualification Tests of Electric Cables, Field Splices, and Connections for Light-Water-Cooled Nuclear Power Plants	Rev. 0	Aug-77	General	Conforms

ENCLOSURE 5

Response to NRC RAI Letter No. 011

RAI Question Number 09.02.05-1

NRC RAI 09.02.05-1

FSAR Section 9.2.5, Ultimate Heat Sink, to address COL Item 9.2.5-1-A regarding the need to develop procedures that will ensure the capability to establish UHS makeup at seven days post-accident, states the following: "Procedures that identify and prioritize available makeup sources seven days after an accident, and provide instructions for establishing necessary connections, will be developed in accordance with the procedure development milestone in Section 13.5." Staff review indicates that it is not clear to what extent the other provisions of Section 13.5 will be implemented (e.g., what makeup considerations will be addressed, what criteria will be satisfied, how soon after an accident the makeup capability will be assessed). Please provide additional information to address the procedures.

Dominion Response

FSAR Section 13.5 was not written to provide the level of detail assumed in the question. Rather, it was intended to describe the procedure development plan, which in turn depends on the outcome of the HFE plan (see Section 13.5.2.1.4). The requested detail will be developed through the implementation of those processes. The following is a description of the likely result. However, it should be recognized that actual details may vary.

Procedures that ensure the capability to establish adequate makeup to the UHS following seven days after an accident will address the consideration of available diverse onsite and offsite sources and provide instructions for making the necessary connections to the FAPCS.

Assessment of available makeup sources will be completed as soon as practical following an accident, consistent with the hierarchy of prioritized actions developed for the emergency operating procedures. This assessment will determine which, if any, onsite sources are available and the capacity and water quality associated with each available source. The procedure will prioritize the available means of makeup delivery considering (1) the permanent plant systems and components that are operational following the accident, (2) those systems that can be placed into service using temporary connections and any necessary portable equipment (e.g., pumps, hoses, filtering/treatment components), and (3) temporary delivery/processing systems using designated equipment stored onsite or at a location where delivery and assembly can be assured within seven days of an accident. The availability of electric power and fuel, if needed, will be considered. The procedure will also consider the adequacy of diverse onsite sources and whether offsite sources are required to provide additional margin or redundancy of supply.

In addition to the availability of the makeup source and means of supply, the source's makeup capacity and water quality must be considered. The minimum makeup rate required after seven days is less than the 200 gpm required at 72 hours. The makeup water quality must meet, as a minimum, the requirements of the primary Fire Protection System or the Station Water System, as stated in Section 9.2.5 of DCD, Revision 5.

Proposed COLA Revision

None.

ENCLOSURE 6

Response to NRC RAI Letter No. 011

RAI Question Number 12.02-2

NRC RAI 12.02-2

FSAR Section 12.2.2.4.4, Compliance with 10 CFR Part 20.1301 and 20.1302, presents an updated analysis of doses to the maximally exposed individual and compares dose results against the EPA environmental dose standards of 40 CFR Part 190, as implemented under Part 20.1301(e). Discussion is presented on page 12-7 and the results presented in Table 12.2-203. Although the discussion points out that the dose from direct external radiation has been considered in the evaluation, it is not clear if the analysis considered increased external radiation levels at the nearest residence associated with the use of hydrogen water chemistry. The FSAR discussion (p.12-7) addresses annual dose rates at the EAB (ESE at 1416 m), while the distance to the nearest resident is closer to the site (ESE at 1191 m, FSAR Table 12.2-18bR, p.12-16). DCD, Revision 4, Section 12.2.1.3 acknowledges increased external radiation levels whenever hydrogen water chemistry is used and presents the results of a generic analysis (OCD Table 12.2-21) using arbitrary site conditions and distance only for the EAB. Accordingly, please revise Section 12.2.2.4.4 to demonstrate that, when added to the dose contribution from all other direct sources of external radiation to the nearest residence, the sum of all direct sources of radiation will not exceed the dose standards of 40 CFR Part 190 and 10 CFR Part 20.1301(e). In addition, please provide sufficient information for the staff to evaluate the basis and assumptions used in this analysis for the purpose of conducting an independent confirmation of compliance with NRC and EPA regulations.

Dominion Response

FSAR Section 12.2.2.4.4 addresses the dose contributions from direct external radiation due to operation of Unit 3 (including the use of hydrogen water chemistry), operation of Units 1 and 2, and operation of the NAPS Independent Spent Fuel Storage Installation (ISFSI). These three sources contribute to direct external radiation doses both at the residence nearest each type of source and at the site boundary location with the highest gaseous effluent annual doses. FSAR Section 12.2.2.4.4 will be revised to more clearly account for direct radiation dose contributions at both types of receptor locations due to these three sources. Please refer to the attached figure, Source and Receptor Locations, which helps visualize the locations described below.

Direct Radiation Dose Contribution Due to Operation of Unit 3

Revision 0 of FSAR Section 12.2.2.4.4 considers the use of hydrogen water chemistry for Unit 3. This FSAR section identifies that DCD Table 12.2-21 provides an annual dose rate of 1.66E-06 mSv/yr (1.66E-04 mrem/yr) at 1000 m (0.62 mi). In DCD Section 12.2.1.3, in the subsection titled, *N-16 Skyshine Offsite Dose Contribution*, the DCD explains that the turbine building source terms for the ESBWR design take into account hydrogen and noble metal injection chemistry, and that the values for skyshine contribution to offsite dose are provided in DCD Table 12.2-21. FSAR Section 12.2.2.4.4 will be revised to clarify that it does account for use of hydrogen water chemistry at Unit 3.

To account for the receptor at the residence nearest to Unit 3, FSAR Section 12.2.2.4.4 will be revised to add the distance from Unit 3 to the nearest residence. FSAR Section 2.3.5 provides this distance as 1.20 km (3930 ft). This distance is also identified as 1191 m (0.74 mi) in FSAR Table 12.2-18bR. In comparison with the DCD value of 1000 m (0.62 mi), the nearest residence is 191 m (0.12 mi) further. The FSAR will be revised to provide this distance and state that the Unit 3 dose rate at the location of the residence nearest to Unit 3 is even lower than the very low dose rate specified in the DCD for 1000 m (0.62 mi).

The direct radiation dose contribution at the site boundary as currently described in FSAR Section 12.2.2.4.4 will be revised. There is a need to clarify that the distance being considered is not the closest distance from Unit 3 to the site boundary (which is about 885 m [0.55 mi] west from Unit 3), but is the distance from Unit 3 to the site boundary location with the highest gaseous effluent annual doses. This is the location where direct sources of external radiation are summed with effluent doses for comparison with dose standards in the regulations. This location has the highest dose because direct radiation contribution is negligible compared to gaseous effluents. This distance is 1416 m (0.88 mile) in the ESE direction and is greater than the 1000 m (0.62 mi) corresponding to the dose rate from the DCD. The Unit 3 direct radiation dose rate at this location is also lower than the very low rate from the DCD.

Direct Radiation Dose Contribution Due to Operation of Units 1 and 2

Revision 0 of FSAR Section 12.2.2.4.4 considers the direct radiation dose contribution due to operation of Units 1 and 2. This FSAR section cites the NRC evaluation in NUREG-1437 showing that the dose rates in the vicinity of light water reactors are generally undetectable and are less than 1 mrem/year at the site boundary. The site boundaries considered by the NRC evaluation are those for existing nuclear power plants and distances from a plant to the site boundary vary depending on site layout. For the NAPS site, the nearest residence is at a distance typical of a site boundary as evaluated by NRC in NUREG-1437. To clarify that the direct external dose contribution for operation of Units 1 and 2 accounts for a receptor at the location of the residence nearest to Unit 3, an explanation will be added to FSAR Section 12.2.2.4.4. Also, Table 12.2-203 will be revised to add 1 mrem/yr as the assumed annual dose from operation of Units 1 and 2 for the MEI at the nearest residence.

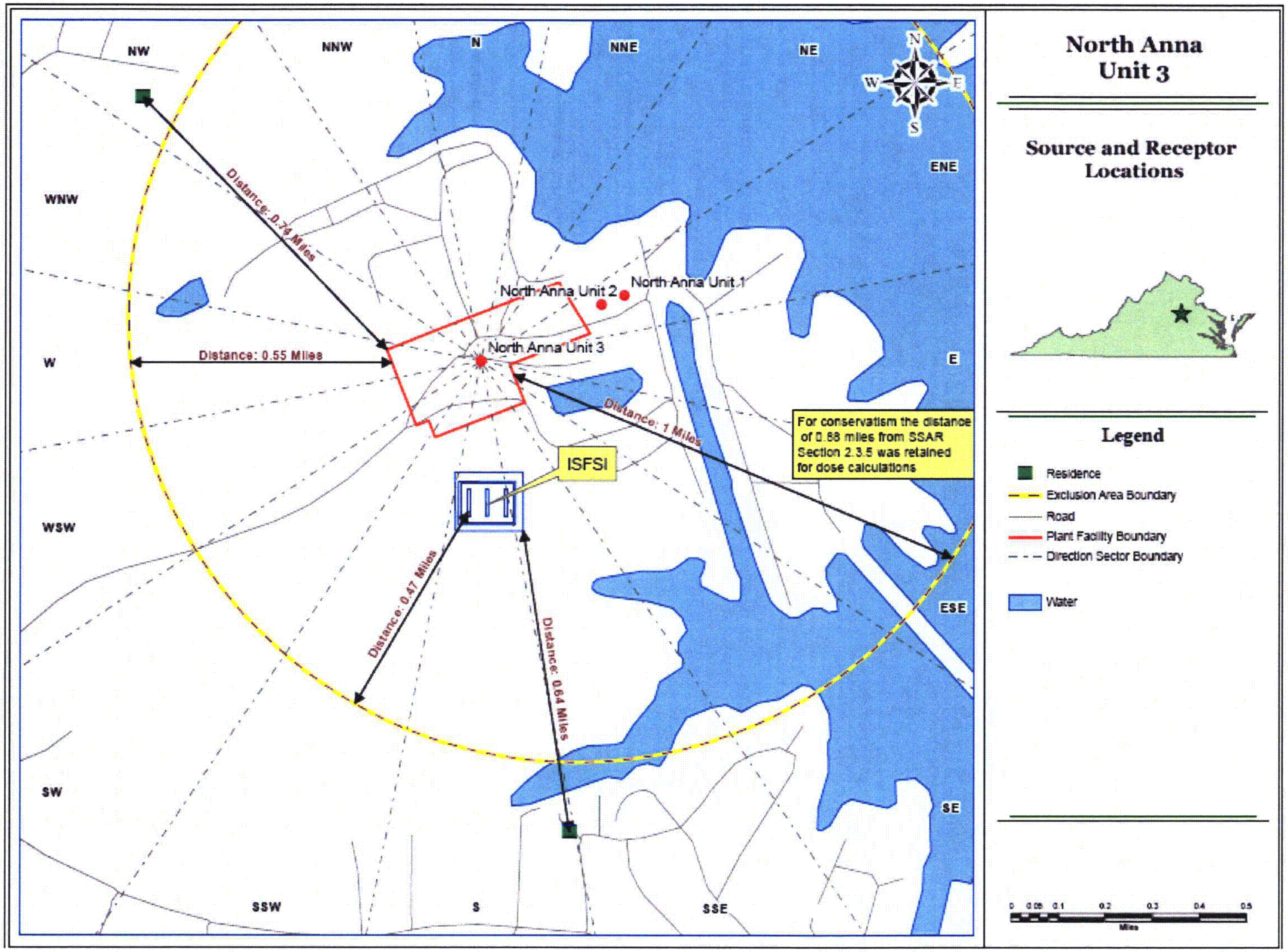
Direct Radiation Dose Contribution Due to Operation of NAPS ISFSI

Revision 0 of FSAR Section 12.2.2.4.4 considers the direct radiation dose contribution due to operation of the NAPS ISFSI. This FSAR section provides the dose rate at the closest point to the site boundary of 1.7 mrem/yr. Because of the site layout, the distance from the ISFSI to the site boundary (which is approximately 760 m [0.47 mi]) is closer than the distance from the ISFSI to the residence nearest the ISFSI (which is about 1030 m [0.64 mi]). To clarify the ISFSI direct external dose contribution, FSAR Section 12.2.2.4.4 will be revised and the site boundary annual dose will be conservatively applied at the residence nearest Unit 3, which is 1191 m (0.74 mi) in the NW direction from Unit 3 and even further from the ISFSI.

Proposed COLA Revision

COLA FSAR Section 12.2.2.4.4 and Table 12.2-203 will be revised as described in the response above. ER Table 5.4-6, which is similar to FSAR Table 12.2-203, will also be revised to reflect a dose contribution of 1 mrem/yr to the MEI from Units 1 and 2.

Note that the attached figure, Source and Receptor Locations, shows the residence nearest the ISFSI is located in the S sector from Unit 3. This location was obtained this year from a survey of receptor locations for Unit 3 and is a revision for the S sector from what is presented in FSAR Table 2.3-15R. That table shows no residence in the S sector. FSAR Table 2.3-15R will be updated for the next submittal of the FSAR, but the conclusion from that table will not change. The closest receptor to Unit 3 remains the residence in the NW sector. Because it was conservatively assumed that each receptor (meat animal, vegetable garden, residence) is at the distance of the closest receptor but in the direction of the maximum X/Q values, there will be no impacts on the gaseous effluent doses estimated for Unit 3. That is, although information for some of the receptors in FSAR Table 2.3-15R will be changing in the next FSAR submittal, the significant value in that table for the dose calculation, the distance of 0.74 mi to the receptor (residence in the NW sector), was confirmed and has not changed.



Response to RAI 12.02-2, Figure: Source and Receptor Locations

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.

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. ~~The~~ That table shows the annual dose ~~of~~ at 1000 m (0.62 mi) to be 1.66E-06 mSv/yr (1.66E-04 mrem/yr) ~~at 1000 m (0.62 mi) is negligible~~. 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

~~to~~ from Unit 3 to the nearest residence is 1191 m (0.74 mi) in the NW direction, as shown in Table 2.3-15R. The distance from Unit 3 to the location on the site boundary with the highest gaseous effluent annual dose ~~from Unit 3~~ is ~~at least~~ 1416 m (0.88 mile) ~~and the increase in distance further reduces the low dose rate.~~ 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 ~~at the site boundary~~ 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 1.7E-02 mSv/yr (1.7 mrem/yr). This value is based on a conservatively estimated peak dose rate from 40 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. 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

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

Table 12.2-203 Comparison of Site Doses to the MEI

Type of Dose	ESP Site Total(1)	Unit 3 (ESBWR)			Existing Units(2)	Site Total(3)	40 CFR 190 Limit
		Liquid	Gaseous	Total			
Total Body (mrem/yr)	6.8	0.094	1.9	1.9	~~2.1~~ 3.1	~~4.0~~ 5.0	25
Thyroid (mrem/yr)	27	0.18	11	11	~~2.2~~ 3.2	~~13~~ 14	75
Bone (mrem/yr)	12	1.3	7.9	9.2	~~2.2~~ 3.2	~~11~~ 12	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