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Dominion®

August 21, 2008

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

Serial No. NA3-08-085R
Docket No. 52-017
COL/BCB

DOMINION VIRGINIA POWER
NORTH ANNA UNIT 3 COMBINED LICENSE APPLICATION
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 016

On July 9, 2008, the NRC requested additional information 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 in Enclosures 1 through 6:

- RAI Question 08.02-27 Confirm Switchyard Voltage Limits
- RAI Question 08.02-28 Capacity and Capability of Offsite Power System
- RAI Question 09.05.04-3 Diesel Generator Fuel Oil Quantity Monitoring
- RAI Question 09.05.04-4 Fuel Oil Transfer System Corrosion Control
- RAI Question 09.05.04-5 Fuel Oil Testing and Inspection
- RAI Question 12.02-3 Liquid Doses Offsite

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,

Eugene S. Grecheck

D089
NRO

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 21st day of August, 2008
My registration number is 7173057 and my
Commission expires: August 31, 2012

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. 016, RAI Question No. 08.02-27
2. Response to NRC RAI Letter No. 016, RAI Question No. 08.02-28
3. Response to NRC RAI Letter No. 016, RAI Question No. 09.05.04-3
4. Response to NRC RAI Letter No. 016, RAI Question No. 09.05.04-4
5. Response to NRC RAI Letter No. 016, RAI Question No. 09.05.04-5
6. Response to NRC RAI Letter No. 016, RAI Question No. 12.02-3

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. 016

RAI Question No. 08.02-27

NRC RAI 08.02-27

FSAR Section 8.2.2.1, Reliability and Stability Analysis, NAPS COL 8.2.4-10A, identified maximum and minimum switchyard voltage limits of 534 kV and 505 kV. Please explain how these limits were established and confirm that these voltage limits are acceptable for auxiliary power system equipment operation including safety-related battery chargers and safety-related uninterruptible power supplies during different operating conditions. The confirmation should include the following (assumptions, acceptance criteria and summary of results): load flow analysis (bus and load terminal voltages of the station auxiliary system), short circuit analysis, equipment sizing studies, protective relay setting and coordination, and motor starting with minimum and maximum grid voltage conditions. A separate set of calculations should be performed for each available connection to offsite power supply. In addition, please discuss how the results of the calculations will be verified.

Dominion Response

This RAI is related to RAI 14.02-1 from NRC Letter No. 006, which also addresses the design limits of switchyard voltages. Dominion responded to RAI 14.02-1 in a letter dated July 14, 2008 and is engaged in continuing discussions with NRC on this subject. Following the completion of these discussions, Dominion will provide a response to this RAI, in conjunction with a follow-up response to RAI 14.02-1.

Proposed COLA Revision

None.

ENCLOSURE 2

Response to NRC RAI Letter No. 016

RAI Question No. 08.02-28

NRC RAI 08.02-28

Since all North Anna units share the same switchyard, the offsite power system provided for the site should have sufficient capacity and capability to safely shutdown all units. As documented in NRC generic communications (e.g., NRC Generic Letter 2007-01, "Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients" NRC Information Notice 98-07, "Offsite Power Reliability Challenges from Industry Deregulation," and NRC Information Notice. 95-37, "Inadequate Offsite Power Voltages During Design-Basis Events") operational experience has shown the need to demonstrate that the offsite power system operation supports equipment important to safety and avoids plant transients. In addition, NRC Generic Letter 2006-02, Grid Reliability and the Impact on Plant Risk and the Operability of Offsite Power, states that "For nuclear plants licensed in accordance with the GDC in Appendix A to 10 CFR Part 50, the design criteria for onsite and offsite electrical power systems are provided in GDC 17... which requires, among other things, that an offsite electric power system be provided to permit the functioning of certain SSCs important to safety in the event of anticipated operational occurrences." Please discuss the capacity and capability of the offsite system (i.e., the 500 kV lines and associated switchyard equipment) to mitigate the consequences of anticipated abnormal operational occurrences associated with unit operation.

Dominion Response

NRC issued DCD RAI Letter No. 202 on May 21, 2008. This letter included RAI 14.3-394, which requested GEH to provide interface requirements for the offsite power system. In a letter dated July 7, 2008, GEH committed to respond to this RAI by September 1, 2008.

RAI 08.02-28 is related to the subject matter of DCD RAI 14.3-394. As such, Dominion will submit the response to RAI 08.02-28 within 45 days following GEH's response to DCD RAI 14.3-394 to ensure the response is consistent and complete.

Proposed COLA Revision

None.

ENCLOSURE 3

Response to NRC RAI Letter No. 016

RAI Question No. 09.05.04-3

NRC RAI 09.05.04-3

FSAR Section 9.5.4, Diesel Generator Fuel Oil Storage and Transfer System, addresses STD COL 9.5.4-1-A ("Fuel Oil Capacity") of the ESBWR DCD by describing in general terms how the fuel oil quantity will be monitored and stating that the procedures will be developed in accordance with the milestone and processes described in FSAR Section 13.5. However, Section 13.5 does not include specifics about the fuel quantity monitoring. Please identify the document in which the procedures for fuel quantity monitoring will be located and if known, the anticipated date for development of these procedures.

Dominion Response

FSAR Section 9.5.4.2 states that procedures require that the quantity of DG fuel oil in the standby and ancillary DG fuel oil storage tanks is monitored on a periodic basis, and that these procedures will be developed in accordance with FSAR Section 13.5.

FSAR Section 13.5 incorporates by reference DCD Section 13.5.2, which states that plant operating procedures "shall include, as necessary, the elements described in American National Standards Institute (ANSI)/American Nuclear Society (ANS)-3.2-1994; R1999."

FSAR Section 13.5 does not define the specific Operating Procedures for the plant, but rather describes the types (e.g., General, Abnormal, etc.), and provides the guidance and milestones for their development. The procedures for fuel quantity monitoring will be Operating Procedures and will be developed at least six months prior to fuel load, as stated in FSAR Section 13.5.2.1.

Proposed COLA Revision

None.

ENCLOSURE 4

Response to NRC RAI Letter No. 016

RAI Question No. 09.05.04-4

NRC RAI 09.05.04-4

FSAR Section 9.5.4, Diesel Generator Fuel Oil Storage and Transfer System, addresses NAPS COL 9.5.4-2-A. The staff notes that the ESBWR DCD, Subsections 9.5.4.2 and 9.5.4.3, is to be revised such that corrosion protection will be addressed for the underground portion of the system rather than only the piping. This DCD revision is to address the staff's concern that portions of fuel oil storage tanks could be placed underground. Please revise NAPS COL 9.4.5-2-A consistent with the DCD regarding corrosion control for underground portions of the fuel oil transfer system.

Dominion Response

DCD Revision 5, Section 9.5.4 requires the applicant to describe the material and corrosion protection for the underground portion of the fuel oil transfer system. DCD Revision 4 required the applicant to address only the underground *piping* portion.

The only underground component of the fuel oil transfer system is carbon steel piping. As stated in FSAR Section 9.5.4.2, the buried section of the piping is provided with a waterproof protected coating and an impressed current type cathodic protection to control external corrosion.

Proposed COLA Revision

FSAR Section 9.5.4.2 will be revised to clarify that the only underground component of the fuel oil transfer system is carbon steel piping. This change is shown on the attached FSAR markup.

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.

9.5.2.5 **COL Information**

9.5.2.5-1-A **Offsite Interfaces**

NAPS COL 9.5.2.5-1-A

This COL item is addressed in Section 9.5.2.2.

9.5.2.5-2-A **Grid Transmission Operator**

NAPS COL 9.5.2.5-2-A

This COL item is addressed in Section 9.5.2.2.

9.5.3 **Lighting System**

This section of the referenced DCD is incorporated by reference with no departures or supplements.

9.5.4 **Diesel Generator Fuel Oil Storage and Transfer System**

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

9.5.4.2 **System Description**

Detailed System Description

Standby Diesel Generators

Replace the third to last sentence in the first paragraph with the following.

STD COL 9.5.4-1-A

Procedures require that the quantity of DG fuel oil in the standby DG fuel oil storage tanks is monitored on a periodic basis. The diesel fuel oil usage is tracked against planned deliveries. Regular transport replenishes the fuel oil inventory during periods of high demand and ensures continued supply in the event of adverse weather conditions. These procedures ensure sufficient diesel fuel oil inventory is available on site so that the standby DGs can operate continually for seven days with each operating at its calculated design load, with appropriate design margins. The procedures will be developed in accordance with the milestone and processes described in Section 13.5.

Replace the third paragraph with the following.

NAPS COL 9.5.4-2-A

~~The material for the underground piping portion of the fuel oil transfer system is carbon steel.~~ The only underground component of the fuel oil transfer system is carbon steel piping. A corrosion protection system is provided for internal and external surfaces of buried piping systems. The buried section of the piping is provided with waterproof protected coating

ENCLOSURE 5

Response to NRC RAI Letter No. 016

RAI Question No. 09.05.04-5

NRC RAI 09.05.04-5

Staff review of FSAR Section 9.5.4, Diesel Generator Fuel Oil Storage and Transfer System, indicates that the FSAR does not identify that controls are in place to ensure periodic fuel oil testing and inspection is performed as described in ESBWR DCD Section 9.5.4.4. Please revise the FSAR to address fuel oil testing and inspection. This information is needed to determine if the system meets the design requirements of providing a supply of fuel to operate the diesel generators to support RTNSS functions.

Dominion Response

FSAR Section 9.5.4 incorporates by reference DCD Section 9.5.4.4, which describes the periodic fuel oil testing and inspection requirements. The detailed requirements will be controlled through plant procedures. FSAR Section 13.5 provides the guidance for the development of plant procedures and the milestones for their development. Incorporating the DCD requirements into the FSAR and controlling the requirements through plant procedures ensures the system can provide a supply of fuel to operate the diesel generators, as required to support RTNSS functions.

Proposed COLA Revision

None.

ENCLOSURE 6

Response to NRC RAI Letter No. 016

RAI Question No. 12.02-3

NRC RAI 12.02-3

The staff's review of FSAR Section 12.2.2.4, Liquid Doses Offsite, identifies apparent inconsistencies in the supporting data and results on source terms and doses as compared with the ESBWR DCD, North Anna Environmental Report – Combined License Stage, and the North Anna ESP Environmental Report. Specifically, please address and resolve the following:

a. *The ESP-ER doses and Unit 3 doses listed in FSAR Table 12.2-20bR are lower by a factor of 100 as compared to Table 5.4-2 of the Applicant's Environmental Report – Combined License Stage (Rev. 0, Nov. 2007).*

b. *To demonstrate compliance with the unity rule of Table 2 (Column 2) of Appendix B to Part 20, add a listing to FSAR Table 12.2-19bR 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.*

c. *The comparison of radionuclides with higher activity levels between the North Anna ESP-ER and the FSAR (p.12-8) indicates that Table 12.2.19bR lists only 11 highlighted radionuclides and not 12 as stated in the FSAR. Confirm whether Ba-139 should be highlighted as well in Table 12.2-19bR to be consistent with Table 5.4-1 of the Applicant's Environmental Report – Combined License Stage (Rev. 0, Nov. 2007).*

d. *FSAR Table 12.2-19bR indicates that the source term (Ci/yr) is based on a plant capacity factor of 0.8 while the ESBWR design is rated at 0.92. The staff's analysis reveals that all FSAR results are low by a factor of 1.15 (0.92/0.8).*

e. *FSAR Table 12.2-19bR indicates that "Unit 3 Concentrations" (Bq/ml) for nine radionuclides were found to be higher than the staff's analysis by factors ranging from 1.11 to 1.7. The radionuclides are tritium, Mn-54, Fe-55, Co-60, Zn-65, Sr-90, Zr-95, Cs-134, and Cs-137. Note that the staff's analysis matches the corresponding FSAR liquid effluent source terms (Ci/yr) for the same radionuclides, as presented in Table 12.2-19bR.*

f. *Provide the technical basis and year of data in FSAR Table 12.2-19bR for the incremental liquid effluent concentrations for North Anna Units 1 and 2 in making up the total effluent concentration from all three units, listed as "Units 1, 2 & 3 Concentration" in the tabulation. This information is not included in this subsection, nor included as a footnote to the table.*

Dominion Response

a. FSAR Table 12.2-20bR identifies the unit of measure as mrem/yr, but erroneously lists the dose values in mSv/yr (a factor of 100 difference). Table 12.2-20bR will be corrected by revising the dose values to units of mrem/yr.

b. FSAR Table 12.2-19bR will be revised to add a column showing the ratio of each radionuclide to the effluent concentration limit (ECL) as well as the sum-of-the-ratios for all radionuclides. FSAR Table 12.2-17R will also be revised to include the corresponding information for gaseous concentrations.

c. Although FSAR Section 12.2.2.4.6 indicates that activities increased for 12 radionuclides, only 11 are highlighted (i.e., in bold font) in Table 12.2.19bR. Ba-139 was inadvertently not highlighted. Table 12.2-19bR will be revised to highlight the Ba-139 annual activity releases.

d. As explained in the GEH response to DCD RAI Number 12.2-15S02 (Reference: GEH Letter MFN 06-305 Supplement 2, dated May 16, 2008), the liquid effluent doses due to the annual activity releases in FSAR Table 12.2-19b would not be appreciably affected by changing the default capacity factor of 0.8 in NUREG-0016 to the ESBWR design rating of 0.92. FSAR Table 12.2-202 shows that there is substantial margin between the calculated Unit 3 doses and the limits in 10 CFR 50, Appendix I. Therefore, the annual activity release source terms do not need to be adjusted for capacity factor.

e. The radionuclide concentrations due to Unit 3 liquid effluents, as presented in FSAR Table 12.2-19bR, are calculated using the same methodology as in the ESP-ER. ESP-ER Section 5.4.2.1 indicates that liquid effluent concentrations are calculated using the methodology presented in the NAPS Updated Final Safety Analysis Report (UFSAR), Section 11.2.5.1. This methodology assumes that some of the effluents released from the plant through the discharge canal to the waste heat treatment facility are recirculated back into the discharge canal via the plant circulating water system from the North Anna Reservoir. Over time, this recirculation flow has the effect of building up the activities of long-lived radionuclides such as tritium, Mn-54, Fe-55, Co-60, Zn-65, Sr-90, Zr-95, Cs-134, and Cs-137. The largest increases in activities are observed for those isotopes with the longest half-lives, such as tritium, Sr-90, and Cs-137.

f. The radionuclide concentrations due to liquid effluents from Units 1 and 2 are unchanged from the ESP-ER. As indicated in ESP-ER Section 5.4.2.1, the concentrations from the existing units are obtained from UFSAR Table 11.2-14. FSAR Table 12.2-19bR will be revised to add a footnote explaining the source of the radionuclide concentrations from Units 1 and 2.

Proposed COLA Revision

FSAR Tables 12.2-17R, 12.2-19bR, and 12.2-20bR will be revised as stated in the above response. These changes are shown on the attached FSAR markup.

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 12.2-2-A
NAPS ESP COL 11.1-1

Table 12.2-17R Comparison of Airborne Release Concentrations with 10 CFR 20 Limit

Nuclide	Unit 3 Annual Release		Unit 3 Concentration		Units 1, 2 & 3 Concentration	~~10 CFR 20~~ ~~Concentration~~ ~~Limit~~ ECL	Units 1, 2, & 3 Fraction of ECL
	MBq/yr	Ci/yr	Bq/m^3	µCi/ml	µCi/ml	µCi/ml	
Kr-83m	8.5E+01	2.3E-03	1.0E-05	2.7E-16	2.7E-16	5.0E-05	5.4E-12
Kr-85m	6.6E+05	1.8E+01	7.7E-02	2.1E-12	7.2E-11	1.0E-07	7.2E-04
Kr-85	5.2E+06	1.4E+02	6.1E-01	1.6E-11	1.3E-09	7.0E-07	1.8E-03
Kr-87	1.4E+06	3.8E+01	1.6E-01	4.4E-12	4.4E-11	2.0E-08	2.2E-03
Kr-88	2.1E+06	5.7E+01	2.5E-01	6.7E-12	1.3E-10	9.0E-09	1.5E-02
Kr-89	1.4E+07	3.8E+02	1.6E+00	4.4E-11	4.4E-11	1.0E-09	4.4E-02
Xe-131m	1.5E+05	4.1E+00	1.8E-02	4.8E-13	2.3E-12	2.0E-06	1.1E-06
Xe-133m	1.9E+02	5.1E-03	2.2E-05	6.0E-16	1.0E-10	6.0E-07	1.7E-04
Xe-133	4.1E+07	1.1E+03	4.8E+00	1.3E-10	9.3E-09	5.0E-07	1.9E-02
Xe-135m	2.2E+07	5.9E+02	2.6E+00	7.0E-11	7.7E-11	4.0E-08	1.9E-03
Xe-135	2.8E+07	7.6E+02	3.3E+00	8.9E-11	3.0E-10	7.0E-08	4.3E-03
Xe-137	2.8E+07	7.6E+02	3.3E+00	8.9E-11	8.9E-11	1.0E-09	8.9E-02
Xe-138	2.3E+07	6.2E+02	2.7E+00	7.3E-11	9.5E-11	2.0E-08	4.7E-03
I-131	8.4E+03	2.3E-01	9.9E-04	2.7E-14	2.6E-13	2.0E-10	1.3E-03
I-132	5.8E+04	1.6E+00	6.8E-03	1.8E-13	2.3E-13	2.0E-08	1.1E-05
I-133	4.2E+04	1.1E+00	4.9E-03	1.3E-13	4.2E-13	1.0E-09	4.2E-04
I-134	1.1E+05	3.0E+00	1.3E-02	3.5E-13	3.7E-13	6.0E-08	6.1E-06

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

Table 12.2-17R Comparison of Airborne Release Concentrations with 10 CFR 20 Limit

Nuclide	Unit 3 Annual Release		Unit 3 Concentration		Units 1, 2 & 3 Concentration	~~10 CFR 20 Concentration Limit~~ ECL	Units 1, 2, & 3 Fraction of ECL
	MBq/yr	Ci/yr	Bq/m^3	µCi/ml	µCi/ml	µCi/ml	
I-135	5.9E+04	1.6E+00	6.9E-03	1.9E-13	3.0E-13	6.0E-09	5.0E-05
H-3	2.8E+06	7.6E+01	3.3E-01	8.9E-12	8.9E-12	1.0E-07	8.9E-05
C-14	5.3E+05	1.4E+01	6.2E-02	1.7E-12	1.7E-12	3.0E-09	5.6E-04
Na-24	5.4E+00	1.5E-04	6.3E-07	1.7E-17	1.7E-17	7.0E-09	2.4E-09
P-32	1.3E+00	3.5E-05	1.5E-07	4.1E-18	4.1E-18	5.0E-10	8.2E-09
Ar-41	1.4E+03	3.8E-02	1.6E-04	4.4E-15	4.4E-15	1.0E-08	4.4E-07
Cr-51	1.8E+02	4.9E-03	2.1E-05	5.7E-16	5.7E-16	3.0E-08	1.9E-08
Mn-54	1.5E+02	4.1E-03	1.8E-05	4.8E-16	4.8E-16	1.0E-09	4.8E-07
Mn-56	1.1E+01	3.0E-04	1.3E-06	3.5E-17	3.5E-17	2.0E-08	1.7E-09
Fe-55	4.7E+01	1.3E-03	5.5E-06	1.5E-16	1.5E-16	3.0E-09	5.0E-08
Fe-59	2.0E+01	5.4E-04	2.3E-06	6.3E-17	6.3E-17	5.0E-10	1.3E-07
Co-58	4.0E+01	1.1E-03	4.7E-06	1.3E-16	1.3E-16	1.0E-09	1.3E-07
Co-60	3.2E+02	8.6E-03	3.8E-05	1.0E-15	1.0E-15	5.0E-11	2.0E-05
Ni-63	4.7E-02	1.3E-06	5.5E-09	1.5E-19	1.5E-19	1.0E-09	1.5E-10
Cu-64	6.9E+00	1.9E-04	8.1E-07	2.2E-17	2.2E-17	3.0E-08	7.3E-10
Zn-65	3.2E+02	8.6E-03	3.8E-05	1.0E-15	1.0E-15	4.0E-10	2.5E-06
Rb-89	2.0E-01	5.4E-06	2.3E-08	6.3E-19	6.3E-19	2.0E-07	3.2E-12

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

Table 12.2-17R Comparison of Airborne Release Concentrations with 10 CFR 20 Limit

Nuclide	Unit 3 Annual Release		Unit 3 Concentration		Units 1, 2 & 3 Concentration	~~10 CFR 20~~ Concentration ~~Limit~~ ECL	Units 1, 2, & 3 Fraction of ECL
	MBq/yr	Ci/yr	Bq/m^3	µCi/ml	µCi/ml	µCi/ml	
Sr-89	1.5E+02	4.1E-03	1.8E-05	4.8E-16	4.8E-16	2.0E-10	2.4E-06
Sr-90	1.0E+00	2.7E-05	1.2E-07	3.2E-18	3.2E-18	6.0E-12	5.3E-07
Y-90	8.1E-02	2.2E-06	9.5E-09	2.6E-19	2.6E-19	9.0E-10	2.9E-10
Sr-91	6.7E+00	1.8E-04	7.9E-07	2.1E-17	2.1E-17	5.0E-09	4.2E-09
Sr-92	4.6E+00	1.2E-04	5.4E-07	1.5E-17	1.5E-17	9.0E-09	1.6E-09
Y-91	1.7E+00	4.7E-06	2.0E-08	5.5E-19	5.5E-19	2.0E-10	2.7E-08
Y-92	3.7E+00	1.0E-04	4.3E-07	1.2E-17	1.2E-17	1.0E-08	1.2E-09
Y-93	7.2E+00	1.9E-04	8.4E-07	2.3E-17	2.3E-17	3.0E-09	7.6E-09
Zr-95	4.4E+01	1.2E-03	5.2E-06	1.4E-16	1.4E-16	4.0E-10	3.5E-07
Nb-95	2.4E+02	6.5E-03	2.8E-05	7.6E-16	7.6E-16	2.0E-09	3.8E-07
Mo-99	1.7E+03	4.6E-02	2.0E-04	5.4E-15	5.4E-15	2.0E-09	2.7E-06
Tc-99m	2.2E+00	5.9E-05	2.6E-07	7.0E-18	7.0E-18	2.0E-07	3.5E-11
Ru-103	1.0E+02	2.7E-03	1.2E-05	3.2E-16	3.2E-16	9.0E-10	3.5E-07
Rh-103m	3.5E-03	9.5E-08	4.1E-10	1.1E-20	1.1E-20	2.0E-06	5.5E-15
Ru-106	1.4E-01	3.8E-06	1.6E-08	4.4E-19	4.4E-19	2.0E-11	2.2E-08
Rh-106	4.5E-06	1.2E-10	5.3E-13	1.4E-23	1.4E-23	1.0E-09	1.4E-14
Ag-110m	1.0E-01	2.7E-06	1.2E-08	3.2E-19	3.2E-19	1.0E-10	3.2E-09
Sb-124	5.3E+00	1.4E-04	6.2E-07	1.7E-17	1.7E-17	3.0E-10	5.6E-08

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

Table 12.2-17R Comparison of Airborne Release Concentrations with 10 CFR 20 Limit

	Unit 3 Annual Release		Unit 3 Concentration		Units 1, 2 & 3 Concentration	~~10 CFR 20 Concentration Limit~~ ECL	Units 1, 2, & 3 Fraction of ECL
Nuclide	MBq/yr	Ci/yr	Bq/m^3	µCi/ml	µCi/ml	µCi/ml	
Te-129m	1.6E+00	4.3E-05	1.9E-07	5.1E-18	5.1E-18	3.0E-10	1.7E-08
Te-131m	5.5E-01	1.5E-05	6.5E-08	1.7E-18	1.7E-18	1.0E-09	1.7E-09
Te-132	1.4E-01	3.8E-06	1.6E-08	4.4E-19	4.4E-19	9.0E-10	4.9E-10
Cs-134	1.8E+02	4.9E-03	2.1E-05	5.7E-16	5.7E-16	2.0E-10	2.9E-06
Cs-136	1.5E+01	4.1E-04	1.8E-06	4.8E-17	4.8E-17	9.0E-10	5.3E-08
Cs-137	2.7E+02	7.3E-03	3.2E-05	8.6E-16	8.6E-16	2.0E-10	4.3E-06
Cs-138	8.5E-01	2.3E-05	1.0E-07	2.7E-18	2.7E-18	8.0E-08	3.4E-11
Ba-140	7.8E+02	2.1E-02	9.2E-05	2.5E-15	2.5E-15	2.0E-09	1.2E-06
La-140	1.3E+01	3.5E-04	1.5E-06	4.1E-17	4.1E-17	2.0E-09	2.1E-08
Ce-141	2.6E+02	7.0E-03	3.1E-05	8.2E-16	8.2E-16	8.0E-10	1.0E-06
Ce-144	1.3E-01	3.5E-06	1.5E-08	4.1E-19	4.1E-19	2.0E-11	2.1E-08
Pr-144	1.6E-04	4.3E-09	1.9E-11	5.1E-22	5.1E-22	2.0E-07	2.5E-15
W-187	1.3E+00	3.5E-05	1.5E-07	4.1E-18	4.1E-18	1.0E-08	4.1E-10
Np-239	8.3E+01	2.2E-03	9.7E-06	2.6E-16	2.6E-16	3.0E-09	8.8E-08
Total w/o H-3	1.7E+08	4.5E+03	2.0E+01	5.3E-10	1.2E-08	NA	1.8E-01
Total w/ H-3	1.7E+08	4.6E+03	2.0E+01	5.4E-10	1.2E-08	NA	1.8E-01

Note: Concentrations for Units 1 and 2 are based on the activity releases in NAPS UFSAR Table 11.3-2. Effluent concentration limits (ECLs) are from 10 CFR 20, Appendix B, Table 2, Column 1.

Table 12.2-19bR Comparison of Annual Liquid Release Concentrations with 10 CFR 20 Limit

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

	Unit 3 Annual Release		Unit 3 Concentration		Units 1, 2 & 3 Concentration	~~10 CFR 20 Concentration Limit~~ ECL	Units 1, 2, & 3 Fraction of ECL
Nuclide	**MBq/yr**	**Ci/yr**	**Bq/ml**	**µCi/ml**	**µCi/ml**	**µCi/ml**	
I-131	1.55E+02	4.2E-03	7.8E-07	2.1E-11	5.6E-08	1.0E-06	5.6E-02
I-132	3.03E+01	8.2E-04	1.5E-07	4.1E-12	8.5E-09	1.0E-04	8.5E-05
I-133	7.77E+02	2.1E-02	4.1E-06	1.1E-10	6.2E-08	7.0E-06	8.9E-03
I-134	1.48E+00	4.0E-05	7.4E-09	2.0E-13	1.2E-09	4.0E-04	3.0E-06
I-135	2.00E+02	5.4E-03	1.0E-06	2.7E-11	3.6E-09	3.0E-05	1.2E-04
H-3	5.18E+05	1.4E+01	4.4E-03	1.2E-07	5.6E-06	1.0E-03	5.6E-03
Na-24	**1.89E+02**	**5.1E-03**	9.6E-07	2.6E-11	2.6E-11	5.0E-05	5.1E-07
P-32	1.55E+01	4.2E-04	7.8E-08	2.1E-12	2.1E-12	9.0E-06	2.3E-07
Cr-51	4.81E+02	1.3E-02	2.4E-06	6.6E-11	8.9E-11	5.0E-04	1.8E-07
Mn-54	5.92E+00	1.6E-04	3.7E-08	1.0E-12	4.0E-11	3.0E-05	1.3E-06
Mn-56	4.81E+01	1.3E-03	2.4E-07	6.5E-12	6.5E-12	7.0E-05	9.3E-08
Fe-55	8.51E+01	2.3E-03	6.3E-07	1.7E-11	1.7E-11	1.0E-04	1.7E-07
Fe-59	2.59E+00	7.0E-05	1.3E-08	3.6E-13	2.6E-11	1.0E-05	2.6E-06
Co-58	1.63E+01	4.4E-04	8.9E-08	2.4E-12	7.4E-10	2.0E-05	3.7E-05
Co-60	3.33E+01	9.0E-04	2.7E-07	7.2E-12	6.7E-11	3.0E-06	2.2E-05
Cu-64	**4.81E+02**	**1.3E-02**	2.4E-06	6.5E-11	6.5E-11	2.0E-04	3.3E-07
Zn-65	1.67E+01	4.5E-04	1.0E-07	2.8E-12	2.8E-12	5.0E-06	5.6E-07
Zn-69m	**3.40E+01**	**9.2E-04**	1.7E-07	4.6E-12	4.6E-12	6.0E-05	7.7E-08

Table 12.2-19bR Comparison of Annual Liquid Release Concentrations with 10 CFR 20 Limit

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

	Unit 3 Annual Release		Unit 3 Concentration		Units 1, 2 & 3 Concentration	~~10 CFR 20 Concentration Limit~~ ECL	Units 1, 2, & 3 Fraction of ECL
Nuclide	**MBq/yr**	**Ci/yr**	**Bq/ml**	**µCi/ml**	**µCi/ml**	**µCi/ml**	
Br-83	**3.33E+00**	**9.0E-05**	1.7E-08	4.5E-13	4.5E-13	9.0E-04	5.0E-10
Sr-89	8.14E+00	2.2E-04	4.4E-08	1.2E-12	1.1E-10	8.0E-06	1.4E-05
Sr-90	7.40E-01	2.0E-05	6.3E-09	1.7E-13	1.2E-11	5.0E-07	2.4E-05
Sr-91	**4.44E+01**	**1.2E-03**	2.2E-07	6.0E-12	2.5E-11	2.0E-05	1.3E-06
Y-91	5.18E+00	1.4E-04	2.7E-08	7.4E-13	1.3E-10	8.0E-06	1.6E-05
Sr-92	1.07E+01	2.9E-04	5.6E-08	1.5E-12	1.5E-12	4.0E-05	3.6E-08
Y-92	**4.07E+01**	**1.1E-03**	2.0E-07	5.5E-12	5.5E-12	4.0E-05	1.4E-07
Y-93	**4.44E+01**	**1.2E-03**	2.2E-07	6.0E-12	6.0E-12	2.0E-05	3.0E-07
Zr-95	7.40E-01	2.0E-05	4.1E-09	1.1E-13	2.1E-11	2.0E-05	1.1E-06
Nb-95	7.40E-01	2.0E-05	3.7E-09	1.0E-13	2.2E-11	3.0E-05	7.4E-07
Mo-99	1.11E+02	3.0E-03	5.6E-07	1.5E-11	9.9E-08	2.0E-05	5.0E-03
Tc-99m	**2.04E+02**	**5.5E-03**	1.0E-06	2.8E-11	8.5E-08	1.0E-03	8.5E-05
Ru-103	1.48E+00	4.0E-05	7.8E-09	2.1E-13	2.1E-13	3.0E-05	6.9E-09
Ru-105	**6.29E+00**	**1.7E-04**	3.1E-08	8.5E-13	8.5E-13	7.0E-05	1.2E-08
Te-129m	3.33E+00	9.0E-05	1.7E-08	4.6E-13	4.6E-13	7.0E-06	6.6E-08
Te-131m	3.70E+00	1.0E-04	1.9E-08	5.0E-13	5.0E-13	8.0E-06	6.3E-08
Te-132	7.40E-01	2.0E-05	3.7E-09	1.0E-13	4.8E-09	9.0E-06	5.3E-04
Cs-134	2.52E+01	6.8E-04	1.9E-07	5.0E-12	1.8E-08	9.0E-07	2.0E-02

Table 12.2-19bR Comparison of Annual Liquid Release Concentrations with 10 CFR 20 Limit

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

Nuclide	Unit 3 Annual Release MBq/yr	Unit 3 Annual Release Ci/yr	Unit 3 Concentration Bq/ml	Unit 3 Concentration µCi/ml	Units 1, 2 & 3 Concentration µCi/ml	~~10 CFR 20 Concentration Limit~~ ECL µCi/ml	Units 1, 2, & 3 Fraction of ECL
Cs-136	1.52E+01	4.1E-04	7.8E-08	2.1E-12	2.6E-09	6.0E-06	4.3E-04
Cs-137	6.66E+01	1.8E-03	5.6E-07	1.5E-11	1.2E-07	1.0E-06	1.2E-01
Ba-139	**1.48E+00**	**4.0E-05**	7.4E-09	2.0E-13	2.0E-13	2.0E-04	1.0E-09
Ba-140	3.03E+01	8.2E-04	1.5E-07	4.1E-12	9.6E-11	8.0E-06	1.2E-05
Ce-141	2.59E+00	7.0E-05	1.3E-08	3.6E-13	3.6E-13	3.0E-05	1.2E-08
La-142	**1.11E+00**	**3.0E-05**	5.6E-09	1.5E-13	1.5E-13	1.0E-04	1.5E-09
Ce-143	1.11E+00	3.0E-05	5.6E-09	1.5E-13	1.5E-13	2.0E-05	7.5E-09
Pr-143	3.33E+00	9.0E-05	1.7E-08	4.5E-13	4.5E-13	2.0E-05	2.3E-08
W-187	**8.88E+00**	**2.4E-04**	4.4E-08	1.2E-12	1.2E-12	3.0E-05	4.0E-08
Np-239	4.07E+02	1.1E-02	2.0E-06	5.5E-11	5.5E-11	2.0E-05	2.8E-06
Total w/o H-3	3.62E+03	9.80E-02	1.9E-05	5.1E-10	4.6E-07	NA	2.1E-01
Total w/ H-3	5.22E+05	1.41E+01	4.5E-03	1.2E-07	6.1E-06	NA	2.2E-01

Note: Concentrations for Units 1 and 2 are obtained from NAPS UFSAR Table 11.2-14. ECLs are from 10 CFR 20, Appendix B, Table 2, Column 2.

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

Table 12.2-20bR Liquid Pathway Doses from Unit 3 for Maximally Exposed Individuals at Lake Anna

	ESP-ER Dose (mrem/yr)			Unit 3 Dose (mrem/yr)		
Pathway	Total Body	Thyroid	Bone	Total Body	Thyroid	Bone
Fish	5.1E-01	NA	2.3E-00	7.8E-02	NA	1.2E-00
Invertebrate	6.6E-02	NA	1.5E-01	8.3E-03	NA	6.5E-02
Drinking	2.0E-01	6.5E-01	2.7E-02	4.1E-03	1.8E-01	5.6E-03
Shoreline	3.0E-02	3.0E-02	3.0E-02	3.0E-03	3.0E-03	3.0E-03
Swimming	3.2E-04	3.2E-04	3.2E-04	1.2E-04	1.2E-04	1.2E-04
Boating	4.0E-04	4.0E-04	4.0E-04	1.5E-04	1.5E-04	1.5E-04
Total	8.1E-01	6.8E-01	2.5E-00	9.4E-02	1.8E-01	1.3E-00
Age group receiving maximum dose	Adult	Infant	Child	Adult	Infant	Child

Notes: 1. Bone of the child is the organ receiving the maximum dose.
2. There are no infant doses for the fish and invertebrate pathways because infants do not consume these foods.
3. "NA" denotes "not applicable."
4. 1 mrem = 0.01 mSv