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October 12, 2016

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

Serial No. NA3-16-046  
Docket No. 52-017  
COL/KJM

**DOMINION VIRGINIA POWER**  
**NORTH ANNA UNIT 3 COMBINED LICENSE APPLICATION**  
**RESPONSE TO RAI ENV-03**

On September 21, 2016, the NRC requested additional information to support the review of certain portions of the North Anna Unit 3 (NA3) Combined License Application (COLA), which consisted of two questions. The response to the Request for Additional Information (RAI) listed below is provided in Enclosure 1:

**RAI ENV-03, Severe Accident Management Alternatives**

One DVD is provided in Enclosure 2. The DVD contains the MACCS2 Version 1.13.1 code input and output electronic files (MELCOR Accident Consequence Code System 2) requested in RAI ENV-03. The files are from Base Case 1 from the 2013 ESBWR consequence analysis performed by Dominion.

As requested by the NRC, the files are submitted in the native formats required by the software in which they are utilized to support the staff's analysis. Therefore, the files on the enclosed DVD are not considered documents as defined in Section 2 of NRC's "Guidance for Electronic Submissions to the NRC," Revision 6, dated May 17, 2010.

Please contact Keith Miller at (804) 273-2569 (keith.j.miller@dom.com) if you have questions.

Very truly yours,

Mark D. Mitchell

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NRD

Enclosures:

1. Response to NRC RAI ENV-03
2. One DVD containing the following files:
  - ESB72ATMOS.INP
  - ESBCHRONC.INP
  - ESBEARLY.INP
  - NMET08.INP
  - NSITE30.INP
  - ESBOUT01.OUT

Commitments made by this letter:

1. None.

COMMONWEALTH OF VIRGINIA

COUNTY OF HENRICO

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Mark D. Mitchell, who is Vice President-Generation Construction 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 12 day of OCTOBER, 2016

My registration number is 253183 and my

Commission expires: SEPTEMBER 30, 2020

Kathy W. Prokopis  
Notary Public



cc: U. S. Nuclear Regulatory Commission, Region II (without Enclosure 2)  
J. J. Shea, Jr., NRC (without Enclosure 2)  
M. A. Eudy, NRC (without Enclosure 2)  
T. S. Dozier, NRC  
G. Croon, NRC (without Enclosure 2)  
D. Paylor, VDEQ (without Enclosure 2)  
M. K. Brandon, DTE (without Enclosure 2)  
R. J. Bell, NEI (without Enclosure 2)

**ENCLOSURE 1**

**Response to NRC RAI ENV-03**

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## **RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION**

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**North Anna Unit 3**

**Dominion**

**Docket No. 52-017**

**RAI NO.: ENV-03**

**APPLICATION SECTION: Part 3 – Environmental Report, Chapter 7**

**DATE OF RAI ISSUE: 9/21/2016**

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### **QUESTIONS**

On May 4, 2016, the Commission issued a decision (CLI-16-07; Agencywide Documents Access and Management System (ADAMS) Accession No. ML16125A150) in the Indian Point license renewal proceeding. The Commission found that none of the parties involved in the Indian Point Severe Accident Mitigation Alternatives (SAMA) contention could provide a documented description outlining the technical foundation for two inputs (the time to decontaminate, TIMDEC, and the cost to decontaminate non-farmland, CDNFRM) used in the MACCS computer analyses. It was noted by the Commission that sensitivity analyses help demonstrate whether and to what extent variations in an uncertain input value might affect the overall cost-benefit conclusions. The Commission therefore directed the staff to perform additional sensitivity analyses varying the TIMDEC and CDNFRM input parameters using specific values.

The TIMDEC and CDNFRM parameters used in the Indian Point SAMA analysis are also commonly used in the off-site risk calculations applied in the Severe Accident Mitigation Design Alternatives (SAMDA) cost-benefit analyses performed for new reactor standard design certification and combined license applications, such as the North Anna Unit 3 Combined License (COL) application. These two input values were generally based on the values provided in NUREG 1150, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants," and NUREG/CR-3673, "Economic Risks of Nuclear Power Reactor Accidents." The TIMDEC input value defines the time required for completing decontamination to a specified degree. The CDNFRM input parameter defines the cost (on a per person basis) of decontaminating non-farmland by a specified decontamination factor. The input values applied are set based on the level of contamination as specified by the decontamination factor parameter, DF. The CDNFRM values used in NUREG-1150 stem from decontamination cost estimates provided in NUREG/CR-3673, the same 1984 economic risk study referenced in support of the decontamination time inputs. These decontamination cost inputs are commonly set to specific values associated with different levels of contamination and escalated to account for inflation. Because the North Anna SAMA analysis uses the same basis for the TIMDEC and CDNFRM values as the Indian Point SAMA analysis, the staff intends to perform sensitivity on the above MACCS input parameters for the specific North Anna Unit 3 site conditions.

Additionally, since the publication of NUREG-1917, *Supplemental Environmental Impact Statement for the Combined License (COL) for North Anna Power Station Unit 3*, the NRC completed the ESBWR standard design certification rulemaking as incorporated into Appendix E to Part 52. For NUREG-1917, the SAMDA was based on Revision 1 of GEH Nuclear Energy's ESBWR SAMDA report, NEDO-33306. The ESBWR standard design certification is based on Revision 4 of NEDO-33306. The staff reviewed the changes made in NEDO-33306 from Revision 1 to Revision 4 by GEH Nuclear Energy and found revisions in technical data that would contribute to the off-site risk calculations (i.e., changes in the reactor design input parameters for the MACCS severe accident code). The staff also notes, as documented in Section 7.3 of Revision 7 of the North Anna COL Environmental Report, the revisions to the ESBWR SAMDA analysis for design certification apparently changed the maximum averted risk benefit for North Anna Unit 3.

The staff requires the following additional information in order to perform sensitivity analyses and complete its review of new information related to the environmental impacts of severe accidents and the SAMDA analysis for the North Anna Unit 3 COL:

1. Provide the North Anna Unit 3 site-specific MACCS input and output files which incorporated the ESBWR reactor design technical information from GEH Nuclear Energy's Revision 4 of NEDO-33306 and Revision 6 of NEDO-33201, "ESBWR Certification Probabilistic Risk Assessment."
2. Provide the individual averted cost component values per NUREG/BR-0184 that support the values of the maximum averted risk benefits for the 7 percent and 3 percent discount rates in Revision 7 of the ER, (i.e., the quantitative attributes of public health; offsite property damage; occupational health; onsite costs for cleanup and decontamination; and replacement power; see Table M-3 on page M-9 of NUREG-1917). In the response, provide a discussion of any changes in the cost-benefit methodology or assumptions that may be different from the prior site-specific ESBWR design cost-benefit SAMDA analysis in Revision 2 of the North Anna COL ER.

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### **Dominion Response**

Dominion's responses to the two questions in RAI ENV-03 are provided below.

1. The North Anna Unit 3 site-specific MACCS input and output files requested by the RAI are contained on the DVD provided as Enclosure 2. These files are from Base Case 1 from the offsite consequence analysis performed in 2013 to support the updated discussion of severe accident mitigation alternatives in Revision 7 of the Environmental Report. The five input files and one output file are:

Case-1 Input Files:

ESB72ATMOS, ESBEARLY, ESBCHRONC, NMET08, and NSITE30

Case-1 Output File:  
ESBOUT01

Base Case 1 assumes a source-term release fraction (STRF) start time of 72 hours after onset of core damage, 2010 economic data, population data based on the 2000 and 2010 census extrapolated to the year 2030, and 2008 meteorological data.

2. Table 1 identifies the individual averted cost component values per NUREG/BR-0184 that support the values of the maximum averted risk benefits for the 7 percent and 3 percent discount rates in Revision 7 of the Environmental Report (ER).

**Table 1: Summary of Estimated Averted Costs for the NAPS Site**

| Quantitative Attributes     |              | Present Value Estimate (\$) |             |
|-----------------------------|--------------|-----------------------------|-------------|
|                             |              | 7% Discount                 | 3% Discount |
| Health                      | Public       | 39,680                      | 78,461      |
|                             | Occupational | 96                          | 219         |
| Offsite Property Damage     |              | 36,443                      | 72,061      |
| Cleanup and Decontamination |              | 2914                        | 6923        |
| Replacement Power           |              | 17,694                      | 11,896      |
| Total                       |              | 96,827                      | 169,560     |

The cost-benefit methodology did not change from the prior site-specific ESBWR design cost-benefit SAMDA analysis in Revision 2 of the North Anna COLA ER.

Several changes were made in both the inputs to the MACCS analysis and the assumptions in the averted cost analysis since Revision 2 of the North Anna COLA ER. The following MACCS analysis input changes were made:

- Meteorological inputs for the MACCS2 code were developed with more recent 2006, 2007, and 2008 data
- Revised population inputs were generated using the SECPOP2000 code with more current 2000 and 2010 census data extrapolated to year 2030
- Revised source term release fractions and core inventory data were obtained from NEDO-33201, Revision 6

- Revised economic data were generated using the SECPOP2000 code, and the regional economic values were updated to 2007 using data from the Bureau of the Census and the Department of Agriculture 2007 Census of Agriculture
- Additional economic data parameters in the MACCS2 CHRONC input file were adjusted for inflation. The adjustment was based on 2011 CPI data from the US Department of Labor Statistics.

The following averted cost analysis assumption changes were made:

- The plant capacity factor was increased from 60% to 95% and the electric power rating was assumed to be 1600 MWe rather than the 910 MWe reference plant. A capacity factor multiplier of 1.58 was applied to the replacement power cost.
- The replacement power cost was adjusted to 2010 dollars by applying a ratio of the average Price Index for Electric Power for years 1993 and 2010. The 2010 dollars scaling factor was calculated to be 1.43, and this factor was applied to the replacement power cost.

### **Proposed COLA Revision**

None.



**ENCLOSURE 2**

**DVD CONTAINING MACCS2 Version 1.13.1 Code Input and Output files**