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Dominion®

April 25, 2008

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

Serial No. NA3-08-042
Docket No. 52-017
COL/JPH

DOMINION VIRGINIA POWER
NORTH ANNA UNIT 3 COMBINED LICENSE APPLICATION
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 002

On March 28, 2008, the NRC requested additional information to support the review of certain portions of the North Anna Unit 3 Combined License Application (COLA). The response to the following RAI is provided in Enclosure 1:

- RAI Question 02.03.02-1, Local Meteorology

This information will be incorporated into a future submission of the North Anna Unit 3 COLA. The detailed analysis inputs and assumptions requested by the RAI are provided on a separate CD (Enclosure 2).

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

Very truly yours,

Eugene S. Grecheck

D079
NRO

Enclosures:

1. Response to RAI Letter Number 002 (RAI Question 02.03.02-1)
2. CD containing SACTI input files

Commitments made by this letter:

1. Incorporate proposed changes in a future COLA Submission.

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 25th day of April, 2008

My registration number is 354302 and my

Commission expires: August 31, 2008

Margaret B. Bennett
Notary Public

MARGARET B. BENNETT
Notary Public
Commonwealth of Virginia
My Commission Expires Aug 31, 2008

cc with all Enclosures:

T. A. Kevern, NRC

cc with Enclosure 1 only:

U. S. Nuclear Regulatory Commission, Region II
J. T. Reece, NRC
J. J. Debiec, ODEC
G. A. Zinke, NuStart/Entergy
T. L. Williamson, Entergy
J. C. Kinsey, GEH
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ENCLOSURE 1

Response to NRC RAI Letter No. 002

RAI Question 02.03.02-1

NRC RAI 02.03.02-1

Please describe the quantitative analysis used to evaluate the potential impacts of the Unit 3 cooling tower on Unit 3 plant design and operation. Please discuss the effects of local increases in ambient temperature and humidity due to the cooling tower on electrical transmission lines and other electrical equipment, including transformers and the switchyard, and HVAC intakes. Please discuss the effects of salt and moisture deposition on the items identified above. Please provide enough detailed information concerning the analysis inputs and assumptions to allow the staff to perform its own confirmatory calculations.

Dominion Response

Effects of Increases in Ambient Air Temperature

In addition to the Circulating Water System (CIRC) hybrid cooling tower and service water cooling tower, the CIRC dry cooling tower was considered when evaluating the potential for local ambient air temperature increases. The evaluation was based on the following assumptions:

1) CIRC hybrid cooling tower height is 55 m (180 ft)
2) CIRC dry cooling tower height is 19.8 m (65 ft)
3) Service water cooling tower height is 18.5 m (61 ft)
4) The highest control room HVAC air intakes height is approximately 8 m (26.2 ft)
5) Exhaust plume temperatures of the CIRC hybrid and dry cooling towers are no greater than the maximum inlet water temperature of 51.6°C (125°F)
6) Exhaust plume temperature of the service water cooling tower is no greater than the maximum inlet water temperature of 39°C (103°F)

The Unit 3 site characteristic 0% exceedance value for ambient design temperature is 40.5°C (104.9°F) dry-bulb. As shown in DCD Table 3.2-1, the control building HVAC system is classified as Safety Class 3 and is the only HVAC system with safety class components, other than isolation equipment. Operation of the control building HVAC system maintains the control room habitability area (CRHA) within the temperature and relative humidity ranges in DCD Table 9.4-1, which shows the limiting outside air design condition temperature for the control room HVAC intakes is 47.2°C (117°F) dry bulb.

A cooling tower plume would need to raise the local ambient temperature associated with the surrounding air mass at the control room HVAC intakes by more than 6.7°C (12.1°F) to exceed the design value. However, cooling tower plume temperatures are higher than the local ambient air temperatures, so buoyancy causes the thermal plume to rise under low wind conditions whereas high wind conditions that could direct a plume towards the intakes would result in rapid air dispersion and mixing that cools the plume. Because the Unit 3 control room HVAC intakes are at a lower elevation than the exhaust plenums of the CIRC hybrid and dry cooling towers, and because the control room HVAC intakes are located approximately 500 m (1,640 ft) from the CIRC towers, the thermal plumes from the towers are not expected to raise the local ambient air temperatures at intakes for the control room HVAC systems above the design value. The maximum inlet water temperature of 39°C (103°F) for the service water cooling tower is lower than the limiting outside air design condition temperature of 47.2°C (117°F) for the control room HVAC systems. Therefore, exhaust from the service water cooling tower will not adversely affect the control room HVAC systems due to increases in surrounding ambient air temperature.

Similarly, the exhausts from the cooling towers are not expected to affect local ambient air temperatures near Unit 3 electrical equipment, including the transformers and switchyard equipment, which are at lower elevations than the Unit 3 main control room HVAC intakes. As with the HVAC intakes, high wind conditions that could direct a plume towards the outdoor electrical equipment would result in rapid air dispersion and mixing that cools the plume. Therefore, exhausts from the cooling towers will not adversely affect such Unit 3 electrical equipment due to increases in surrounding ambient air temperature.

Effects of Salt Deposition and Increases in Moisture

The potential impacts on Unit 3 plant design and operation due to salt deposition, fogging, and icing from the (CIRC) hybrid cooling tower and from the Plant Service Water System cooling tower were assessed using the Seasonal/Annual Cooling Tower Impact (SACTI) computer code.

Salt Deposition

The service water cooling tower produces higher salt deposition rates than the CIRC hybrid cooling tower even though the CIRC hybrid cooling tower is modeled with a higher drift rate of 0.001%. Therefore, only the limiting SACTI analysis for the effects of salt deposition from the service water cooling tower on the Unit 3 electrical transformers is discussed below. The following assumptions were made in the SACTI model for the service water cooling tower:

1) Drift loss is 0.0005 %
2) Total dissolved solids concentration of the cooling water is 9.0×10^{-4} g salt/cm^3
3) Salt density is 2.17 g/cm^3

Salt deposition from evaporative cooling towers has the potential to build up on bushings of electrical equipment such as Unit 3 transformers, switchyard equipment, and transmission lines. A highest deposition rate of 0.0216 mg/cm^2-month is predicted to occur near the Unit 3 transformers during the summer season. The transmission lines and switchyard have lower predicted maximum deposition rates than the transformers. Several months of buildup at this rate would be needed before such deposits would accumulate to 0.08 mg/cm^2, which is the upper end of the "Light Contamination Level" range defined by the applicable IEEE Standard C57.19.100-1995 (R2003), "Guide for Application of Power Apparatus Bushings." However, due to the service water cooling tower location with respect to prevailing wind directions, and natural wash off from local precipitation, total deposits are not expected to reach a level requiring attention. Therefore, cooling tower plume generated salt deposits are not expected to adversely affect any electrical equipment at the North Anna Site.

Moisture

Added humidity and potential moisture impacts due to CIRC hybrid cooling tower and service water cooling tower operation are predicted by the hours of fogging and icing produced by each tower as determined in the SACTI analysis. The following assumptions were used in the analysis:

1) Plume abatement is not accounted for in the SACTI model
2) Total airflow for wet and dry sections of the CIRC hybrid cooling tower is considered
3) The CIRC hybrid cooling tower is modeled as one cell with a combined flow rate of all fans

A maximum of 9.5 hours of fogging per year at any location due to cooling tower operation is predicted for both the CIRC hybrid cooling tower and service water cooling tower. Because the HVAC intakes, onsite transmission lines, switchyard equipment, and transformers are designed for outdoor operations which include environmental conditions such as rain, fog and snow, added fog and moisture from cooling tower plumes are not expected to have an adverse affect on these plant features. Both cooling towers incorporate plume-limiting technology; therefore, the predicted annual hours of fogging due to cooling tower operation are conservative. Additionally, the SACTI analysis predicts no icing will occur.

A new FSAR Section 2.3.2.3.2 will address the potential impacts on Unit 3 plant design and operation due to the potential for local ambient air temperature increases by demonstrating that the temperature increases cannot have adverse effects.

Analysis Inputs and Assumptions

SACTI input files are provided via a CD accompanying this RAI response. These files provide detailed information concerning the analysis inputs and assumptions to allow the staff to perform its own confirmatory calculations.

COLA Impact

Two new subsections will be added in FSAR Section 2.3.2.3 in response to the RAI.

The new FSAR Section 2.3.2.3.1 will address the potential impacts on Unit 3 plant design and operation due to salt deposition, fogging, and icing using the Seasonal/ Annual Cooling Tower Impact (SACTI) computer code. The new FSAR Section 2.3.2.3.2 will address the potential impacts on Unit 3 plant design and operation due to the potential for local ambient air temperature increases by demonstrating that the temperature increases cannot have adverse effects. See the attached markups for FSAR Table 1.9-204, FSAR Section 2.3.2.3, and FSAR Section 2.3 References.

Markup of North Anna COLA

The attached COLA markup represents Dominion's good faith effort to show how the COLA will be revised in response to the subject RAI in a future COLA revision. 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 revision may be somewhat different than as presented herein.

Table 1.9-204 Industrial Codes and Standards

Code or Standard Number	Year	Title
American Society of Mechanical Engineers (ASME)		
A 17.1	2007	Safety Code for Elevators and Escalators
B31.1	2007	Power Piping
NQA-1	2004	Quality Assurance Programs Requirements for Nuclear Facilities
Boiler and Pressure Vessel Code, Section IX	2007	Qualification Standard for Welding and Brazing Procedures, Welder, Brazers and Welding and Brazing Operators
American Society for Testing and Materials (ASTM)		
ASTM E-84	2007	Method of Test of Surface Burning Characteristics of Building Materials
ASTM E-119	2007	Fire Test of Building Construction Materials
ASTM E-814	2006	Standard Test Method for Fire Tests for Through-Penetration Fire Stops
Applicable Building Codes		
International Building Code	As defined in the Virginia Uniform Statewide Building Code edition of record	International Building Code
International Fire Code	As defined in the Virginia Uniform Statewide Building Code edition of record	International Fire Code
28 CFR 36		American Disability Act (ADA) Accessibility Guidelines
	2003	Virginia Uniform Statewide Building Code, Part I (Virginia Construction Code)
Factory Mutual		
Data Sheet 7-42	2006	Guidelines for Evaluating the Effects of Vapor Cloud Explosions Using a TNT Equivalency Method
	2007	Approval Guide
Institute of Electrical and Electronics Engineers (IEEE)		
C2	2007	National Electric Safety Code
Add > C57.19.100-1995 (R2003)	2004	IEEE Guide For Application of Power Apparatus Bushings

and electrical equipment, including transformers and switchyard. Also, the separation of the wet and dry towers from Unit 3 buildings considered potential effects on air ambient conditions at HVAC air intakes, including consideration of prevailing winds. The site layout shown in Figure 2.1-201 ensures minimal impacts on Unit 3 operation from local increases in ambient air temperature, moisture content, and moisture and salt deposition resulting from the operation of the Unit 3 cooling towers, including wet cooling tower drift and plume condensation.

INSERT SECTIONS 2.3.2.3.1 AND 2.3.2.3.2 HERE

NAPS COL 2.0-9-A

2.3.3 Onsite Meteorological Measurements Program

The information needed to address the DCD COL Item 2.0-9-A is included in SSAR Section 2.3.3, which is incorporated by reference with the following supplement.

2.3.3.1.2 Location, Elevation, and Exposure of Instruments

The second paragraph of this SSAR section is supplemented as follows with information to address the acceptability of distances from Unit 3 to the wind measurement towers.

The highest structure at the Unit 3 site is the Turbine Building at 57.9 m (190 ft) above design plant grade level of 88.4 m (290 ft). The primary meteorological measurements tower is located about 733.4 m (2406 ft) east of the plant facility boundary. Since the primary tower is located more than 10 building heights away from the tallest structure at the Unit 3 site, the Unit 3 turbine building does not influence the meteorological measurements. The backup meteorological tower is located about 744 m (2440 ft) away from the highest structure. Therefore, the turbine building also does not influence the meteorological measurements taken at the backup meteorological measurements tower.

2.3.2.3.1 Salt Deposition and Moisture

The potential impacts on Unit 3 plant design and operation due to salt deposition, fogging, and icing from the Circulating Water System (CIRC) hybrid cooling tower and from the Plant Service Water System cooling tower were assessed using the Seasonal/Annual Cooling Tower Impact (SACTI) computer code (Reference 2.3-202). See Section 10.4.5.8 for further description of the hybrid cooling tower design and see Section 9.2.1.2 for the service water cooling tower design.

a. Salt Deposition

The service water cooling tower produces higher salt deposition rates than the CIRC hybrid cooling tower even though the CIRC hybrid cooling tower is modeled with a higher drift rate of 0.001%. Therefore, only the limiting SACTI analysis for the effects of salt deposition from the service water cooling tower on the Unit 3 electrical transformers is discussed below. The following assumptions were made in the SACTI model for the service water cooling tower:

1) Drift loss is 0.0005 %
2) Total dissolved solids concentration of the cooling water is 9.0×10^{-4} g salt/cm^3
3) Salt density is 2.17 g/cm^3

Salt deposition from evaporative cooling towers has the potential to build up on bushings of electrical equipment such as Unit 3 transformers, switchyard equipment, and transmission lines (see Figure 8.2-202). A highest deposition rate of 0.0216 mg/cm^2-month is predicted to occur near the Unit 3 transformers during the summer season. The transmission lines and switchyard have lower predicted maximum deposition rates than the transformers. Several months of buildup at this rate would be needed before such deposits would accumulate to 0.08 mg/cm^2, which is the upper end of the "Light Contamination Level" range defined by the applicable IEEE standard (Reference 2.3-203). However, due to the service water cooling tower location with respect to prevailing wind directions, and natural wash off from local precipitation, total deposits are not expected to reach a level requiring attention. Therefore, cooling tower plume generated salt deposits are not expected to adversely affect any electrical equipment at the North Anna Site.

b. Moisture

Added humidity and potential moisture impacts due to CIRC hybrid cooling tower and service water cooling tower operation are predicted by the hours of fogging and icing produced by each tower as determined in the SACTI analysis. The following assumptions were used in the analysis:

1) Plume abatement is not accounted for in the SACTI model
2) Total airflow for wet and dry sections of the CIRC hybrid cooling tower is considered
3) The CIRC hybrid cooling tower is modeled as one cell with a combined flow rate of all fans

A maximum of 9.5 hours of fogging per year at any location due to cooling tower operation is predicted for both the CIRC hybrid cooling tower and service water cooling tower. Because the control room HVAC intakes, onsite transmission lines, switchyard equipment, and transformers are designed for outdoor operations which include environmental conditions such as rain, fog and snow, added fog and moisture from cooling tower plumes are not expected to have an adverse affect on these plant features. Both cooling towers incorporate plume-limiting technology; therefore, the predicted annual hours of fogging due to cooling tower operation are conservative. Additionally, the SACTI analysis predicts no icing will occur.

2.3.2.3.2 Ambient Air Temperature Increases

In addition to the CIRC hybrid cooling tower and service water cooling tower, the CIRC dry cooling tower was considered when evaluating the potential for local ambient air temperature increases. The evaluation was based on the following assumptions:

1) CIRC hybrid cooling tower height is 55 m (180 ft)
2) CIRC dry cooling tower height is 19.8 m (65 ft)
3) Service water cooling tower height is 18.5 m (61 ft)
4) The highest control room HVAC air intakes height is approximately 8 m (26.2 ft)
5) Exhaust plume temperatures of the CIRC hybrid and dry cooling towers are no greater than the maximum inlet water temperature of 51.6°C (125°F)
6) Exhaust plume temperature of the service water cooling tower is no greater than the maximum inlet water temperature of 39°C (103°F)

The Unit 3 site characteristic 0% exceedance value for ambient design temperature is 40.5°C (104.9°F) dry-bulb. As shown in DCD Table 9.4-1, the limiting outside air design condition temperature for the control room HVAC intakes is 47.2°C (117°F) dry bulb.

A cooling tower plume would need to raise the local ambient temperature associated with the surrounding air mass at the control room HVAC intakes by more than 6.7°C (12.1°F) to exceed the design value. However, cooling tower plume temperatures are higher than the local ambient air temperatures, so buoyancy causes the thermal plume to rise under low wind conditions; whereas, high wind conditions that could direct a plume towards the intakes, would result in rapid air dispersion and mixing that cools the plume. Because the Unit 3 control room HVAC intakes are at a lower elevation than the exhaust plenums of the CIRC hybrid and dry cooling towers, and because the control room HVAC intakes are located approximately 500 m (1,640 ft) from the CIRC towers, the thermal plumes from the towers are not expected to raise the local ambient air temperatures at intakes for the control room HVAC systems above the design value. The maximum inlet water temperature of 39°C (103°F) for the service water cooling tower is lower than the limiting outside air design condition temperature of 47.2°C (117°F) for the control room HVAC systems. Therefore, exhaust from the service water cooling tower will not adversely affect the control room HVAC systems due to increases in surrounding ambient air temperature.

Similarly, the exhausts from the cooling towers are not expected to affect local ambient air temperatures near Unit 3 electrical equipment, including the transformers and switchyard equipment, which are at lower elevations than the Unit 3 main control room HVAC intakes. As with the HVAC intakes, high wind conditions that could direct a plume towards the outdoor electrical equipment would result in rapid air dispersion and mixing that cools the plume. Therefore, exhausts from the cooling towers will not adversely affect such Unit 3 electrical equipment due to increases in surrounding ambient air temperature.

2.3.5.1 Basis

The fifth paragraph of this SSAR section is supplemented as follows with information to address the receptors near the Unit 3 site.

NAPS ESP COL 2.3-3

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 the NW direction at a distance of 1.20 km (3930 ft). Therefore, one of each type of receptor was assumed to be at 1.20 km (3930 ft). 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 evaluation performed for this FSAR, the distance to the 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) 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). 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.

Section 2.3 References

2.3-201 Dominion North Anna Power Station 2006 Annual Radiological Environmental Operating Report, prepared by Dominion North Anna Power Station, January 2006-December 2006.

INSERT References 2.3-202 AND 2.3-203 HERE

[Insert for Section 2.3 References]

2.3-202 SACTI User's Manual: Cooling-Tower-Plume Prediction Code, EPRI CS-3403-CCM, April 1984.

2.3-203 Institute of Electrical and Electronics Engineers, Std C57.19.100-1995 (R2003), "IEEE Guide for Application of Power Apparatus Bushings," April 26, 2004.

ENCLOSURE 2

SACTI Input Files