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May 16, 2012

United States Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, D.C. 20555

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NL&OS/GDM: R0  
Docket No. 50-280  
License No. DPR-32

**VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)**  
**SURRY POWER STATION UNIT 1**  
**CORE OPERATING LIMITS REPORT**  
**SURRY 1 CYCLE 25 PATTERN GNU REVISION 0**

Pursuant to Surry Technical Specification (TS) 6.2.C, attached is a copy of Dominion's Core Operating Limits Report (COLR) for Surry Unit 1 Cycle 25, Pattern GNU, Revision 0.

If you have any questions or require additional information, please contact Mr. Gary Miller at (804) 273-2771.

Sincerely,

T. R. Huber, Director  
Nuclear Licensing and Operations Support  
Dominion Resources Services, Inc. for  
Virginia Electric and Power Company

Attachment

Commitment Summary: There are no new commitments as a result of this letter.

A001  
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**Attachment**

**CORE OPERATING LIMITS REPORT  
Surry 1 Cycle 25 Pattern GNU  
Revision 0**

**May 2012**

**Virginia Electric and Power Company  
(Dominion)  
Surry Power Station Unit 1**

## **1.0 INTRODUCTION**

This Core Operating Limits Report (COLR) for Surry Unit 1 Cycle 25 has been prepared in accordance with the requirements of Surry Technical Specification 6.2.C.

The Technical Specifications affected by this report are:

TS 2.1 – Safety Limit, Reactor Core

TS 2.3.A.2.d – Overtemperature  $\Delta T$

TS 2.3.A.2.e – Overpower  $\Delta T$

TS 3.1.E - Moderator Temperature Coefficient

TS 3.12.A.1, TS 3.12.A.2, TS 3.12.A.3 and TS 3.12.C.3.b.1(b) - Control Bank Insertion Limits

TS 3.12.A.1.a, TS 3.12.A.2.a, TS 3.12.A.3.c and TS 3.12.G – Shutdown Margin

TS 3.12.B.1 and TS 3.12.B.2 - Power Distribution Limits

TS 3.12.F – DNB Parameters

TS Table 4.1-2A – Minimum Frequency for Equipment Tests: Item 22 – RCS Flow

## **2.0 REFERENCES**

1. VEP-FRD-42, Rev. 2.1-A, “Reload Nuclear Design Methodology,” August 2003.

Methodology for:

TS 3.1.E - Moderator Temperature Coefficient

TS 3.12.A.1, TS 3.12.A.2, TS 3.12.A.3 and TS 3.12.C.3.b.1(b) - Control Bank Insertion Limits

TS 3.12.A.1.a, TS 3.12.A.2.a, TS 3.12.A.3.c and TS 3.12.G – Shutdown Margin

TS 3.12.B.1 and TS 3.12.B.2 - Heat Flux Hot Channel Factor and Nuclear Enthalpy Rise Hot Channel Factor

TS 3.12.F – DNB Parameters

TS Table 4.1-2A – Minimum Frequency for Equipment Tests: Item 22 – RCS Flow

2. WCAP-16009-P-A, “Realistic Large Break LOCA Evaluation Methodology Using the Automated Statistical Treatment of Uncertainty Method (ASTRUM),” (Westinghouse Proprietary), January 2005.

Methodology for:

TS 3.12.B.1 and TS 3.12.B.2 - Heat Flux Hot Channel Factor

3. WCAP-10054-P-A, “Westinghouse Small Break ECCS Evaluation Model Using the NOTRUMP Code,” (Westinghouse Proprietary), August 1985.

Methodology for:

TS 3.12.B.1 and TS 3.12.B.2 - Heat Flux Hot Channel Factor

4. WCAP-10079-P-A, "NOTRUMP, A Nodal Transient Small Break and General Network Code," (Westinghouse Proprietary), August 1985.

Methodology for:

TS 3.12.B.1 and TS 3.12.B.2 - Heat Flux Hot Channel Factor

5. WCAP-12610-P-A, "VANTAGE+ Fuel Assembly Report," (Westinghouse Proprietary), April 1995.

Methodology for:

TS 3.12.B.1 and TS 3.12.B.2 - Heat Flux Hot Channel Factor

6. WCAP-12610-P-A and CENPD-404-P-A, Addendum 1-A, "Optimized ZIRLO," (Westinghouse Proprietary), July 2006.

Methodology for:

TS 3.12.B.1 and TS 3.12.B.2 - Heat Flux Hot Channel Factor

7. VEP-NE-2-A, Rev. 0, "Statistical DNBR Evaluation Methodology," June 1987.

Methodology for:

TS 3.12.B.1 and TS 3.12.B.2 - Nuclear Enthalpy Rise Hot Channel Factor

8. VEP-NE-3-A, Rev. 0, "Qualification of the WRB-1 CHF Correlation in the Virginia Power COBRA Code," July 1990.

Methodology for:

TS 3.12.B.1 and TS 3.12.B.2 - Nuclear Enthalpy Rise Hot Channel Factor

9. DOM-NAF-2, Rev. 0.2-P-A, "Reactor Core Thermal-Hydraulics Using the VIPRE-D Computer Code," including Appendix B, "Qualification of the Westinghouse WRB-1 CHF Correlation in the Dominion VIPRE-D Computer Code," August 2010.

Methodology for:

TS 3.12.B.1 and TS 3.12.B.2 - Nuclear Enthalpy Rise Hot Channel Factor

10. WCAP-8745-P-A, "Design Bases for Thermal Overpower Delta-T and Thermal Overtemperature Delta-T Trip Function," September 1986.

Methodology for:

TS 2.3.A.2.d – Overtemperature  $\Delta T$

TS 2.3.A.2.e – Overpower  $\Delta T$

### 3.0 OPERATING LIMITS

The cycle-specific parameter limits for the specifications listed in Section 1.0 are presented in the following subsections. These limits have been developed using the NRC-approved methodologies specified in Technical Specification 6.2.C and repeated in Section 2.0.

#### 3.1 Safety Limit, Reactor Core (TS 2.1)

The Reactor Core Safety Limits are presented in **Figure A-1**.

#### 3.2 Overtemperature $\Delta T$ (TS 2.3.A.2.d)

$$\Delta T \leq \Delta T_0 \left[ K_1 - K_2 \left( \frac{1 + t_1 s}{1 + t_2 s} \right) (T - T') + K_3 (P - P') - f(\Delta I) \right]$$

Where:

$\Delta T$  is measured RCS  $\Delta T$ , °F.

$\Delta T_0$  is the indicated  $\Delta T$  at RATED POWER, °F.

$s$  is the Laplace transform operator,  $\text{sec}^{-1}$ .

$T$  is the measured RCS average temperature ( $T_{\text{avg}}$ ), °F.

$T'$  is the nominal  $T_{\text{avg}}$  at RATED POWER,  $\leq 573.0^\circ\text{F}$ .

$P$  is the measured pressurizer pressure, psig.

$P'$  is the nominal RCS operating pressure  $\geq 2235$  psig.

$$K_1 \leq 1.1425$$

$$K_2 \geq 0.01059 / ^\circ\text{F}$$

$$K_3 \geq 0.000765 / \text{psig}$$

$$t_1 \geq 29.7 \text{ seconds}$$

$$t_2 \leq 4.4 \text{ seconds}$$

$$f(\Delta I) \geq 0.0268 \{-24 - (q_t - q_b)\}, \text{ when } (q_t - q_b) < -24.0\% \text{ RATED POWER}$$

$$0, \text{ when } -24.0\% \text{ RATED POWER} \leq (q_t - q_b) \leq 8.0\% \text{ RATED POWER}$$

$$0.0188 \{(q_t - q_b) - 8.0\}, \text{ when } (q_t - q_b) > +8.0\% \text{ RATED POWER}$$

Where  $q_t$  and  $q_b$  are percent RATED POWER in the upper and lower halves of the core, respectively, and  $q_t + q_b$  is the total THERMAL POWER in percent RATED POWER.

### 3.3 Overpower $\Delta T$ (TS 2.3.A.2.e)

$$\Delta T \leq \Delta T_0 \left[ K_4 - K_5 \left( \frac{t_3 s}{1 + t_3 s} \right) T - K_6 (T - T') - f(\Delta I) \right]$$

Where:

$\Delta T$  is measured RCS  $\Delta T$ , °F.

$\Delta T_0$  is the indicated  $\Delta T$  at RATED POWER, °F.

$s$  is the Laplace transform operator,  $\text{sec}^{-1}$ .

$T$  is the measured RCS average temperature ( $T_{\text{avg}}$ ), °F.

$T'$  is the nominal  $T_{\text{avg}}$  at RATED POWER,  $\leq 573.0^\circ\text{F}$ .

$K_4 \leq 1.0965$        $K_5 \geq 0.0198$  /°F for increasing  $T_{\text{avg}}$   
 $\geq 0$  /°F for decreasing  $T_{\text{avg}}$

$K_6 \geq 0.001074$  /°F for  $T > T'$   
 $\geq 0$  for  $T \leq T'$

$t_3 \geq 9.0$  seconds

$f(\Delta I)$  = as defined above for OT $\Delta T$

### 3.4 Moderator Temperature Coefficient (TS 3.1.E)

The Moderator Temperature Coefficient (MTC) limits are:

+6.0 pcm/°F at less than 50 percent of RATED POWER, and

+6.0 pcm/°F at 50 percent of RATED POWER and linearly decreasing to 0 pcm/°F at RATED POWER

### 3.5 Control Bank Insertion Limits (TS 3.12.A.1, TS 3.12.A.2, TS 3.12.A.3 and TS 3.12.C.3.b.1(b))

3.5.1 The control rod banks shall be limited in physical insertion as shown in **Figure A-2**.

3.5.2 The rod insertion limit for the A and B control banks is the fully withdrawn position as shown on **Figure A-2**.

3.5.3 The rod insertion limit for the A and B shutdown banks is the fully withdrawn position as shown on **Figure A-2**.

### 3.6 Shutdown Margin (TS 3.12.A.1.a, TS 3.12.A.2.a, TS 3.12.A.3.c and TS 3.12.G)

Shutdown Margin (SDM) shall be  $\geq 1.77$  % $\Delta k/k$ .

**3.7 Power Distribution Limits** (TS 3.12.B.1 and TS 3.12.B.2)

3.7.1 Heat Flux Hot Channel Factor - FQ(z)

$$FQ(z) \leq \frac{CFQ}{P} K(z) \text{ for } P > 0.5$$

$$FQ(z) \leq \frac{CFQ}{0.5} K(z) \text{ for } P \leq 0.5$$

$$\text{where: } P = \frac{\text{THERMAL POWER}}{\text{RATED POWER}}$$

$$CFQ = 2.5$$

$$K(z) = 1.0 \text{ for all core heights, } z$$

3.7.2 Nuclear Enthalpy Rise Hot Channel Factor - FΔH(N)

$$F\Delta H(N) \leq CFDH * \{1 + PFDH(1 - P)\}$$

$$\text{where: } P = \frac{\text{THERMAL POWER}}{\text{RATED POWER}}$$

$$CFDH = 1.56$$

$$PFDH = 0.3$$

**3.8 DNB Parameters** (TS 3.12.F and TS Table 4.1-2A)

Departure from Nucleate Boiling (DNB) Parameters shall be maintained within their limits during POWER OPERATION:

- Reactor Coolant System  $T_{\text{avg}} \leq 577.0 \text{ }^\circ\text{F}$
- Pressurizer Pressure  $\geq 2205 \text{ psig}$
- Reactor Coolant System Total Flow Rate  $\geq 273,000 \text{ gpm}$  (Tech Spec Limit) and  $\geq 276,000 \text{ gpm}$  (COLR Limit)



Figure A-1

### REACTOR CORE SAFETY LIMITS THREE LOOP OPERATION, 100% FLOW

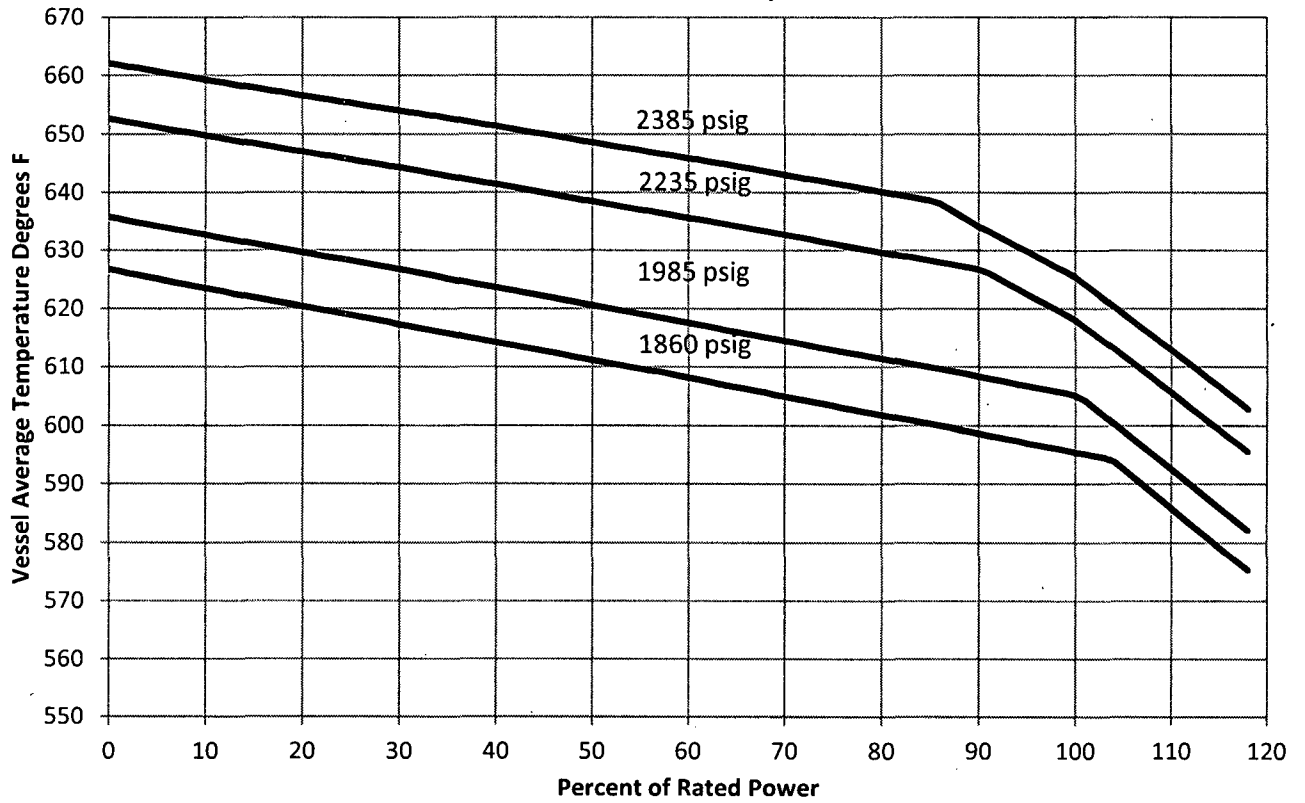
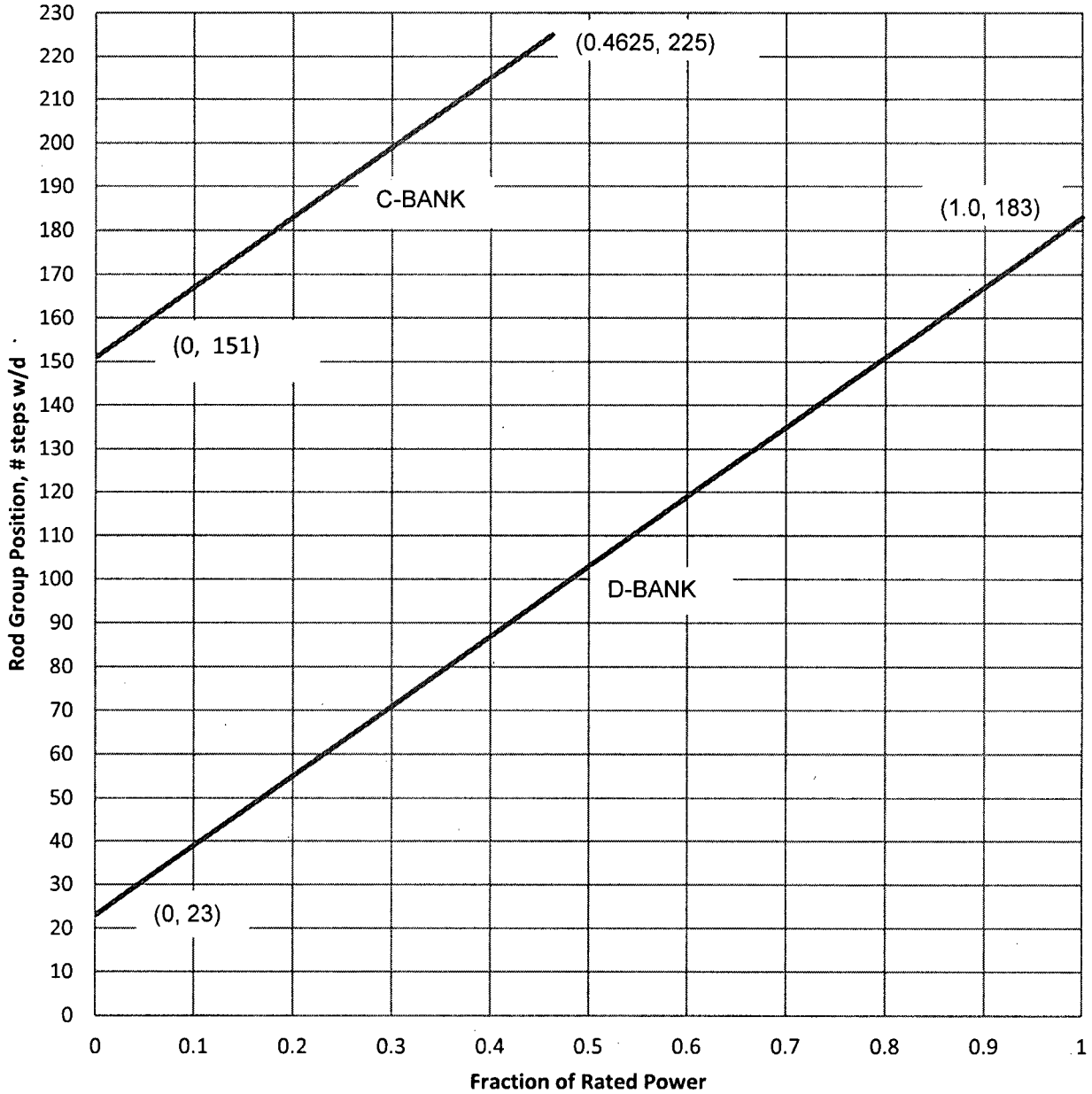


Figure A-2  
**Surry 1 Cycle 25**  
**ROD GROUP INSERTION LIMITS**



Fully w/d position = 225 steps