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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 24 PATTERN OWL REVISION 1**

Pursuant to Surry Technical Specification (TS) 6.2.C, enclosed is a copy of Dominion's Core Operating Limits Report (COLR) for Surry Unit 1 Cycle 24 Pattern OWL, Revision 1. The revision incorporates changes associated with the recently approved Surry Units 1 and 2 Technical Specifications (TS) Amendments 275/275 that relocate the Shutdown Margin (SDM) value in TS 3.12 and its basis from the TS to the COLR. Also, several editorial changes were made to improve readability.

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

Sincerely,

C. L. Funderburk, Director  
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Dominion Resources Services, Inc. for  
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Enclosure

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

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**ENCLOSURE**

**CORE OPERATING LIMITS REPORT  
Surry 1 Cycle 24 Pattern OWL  
Revision 1**

**August 2011**

## **1.0 INTRODUCTION**

This Core Operating Limits Report (COLR) for Surry Unit 1 Cycle 24 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 Limit  
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), June 1990.

Methodology for:

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

6. 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

7. 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

8. 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.

#### 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,  $\leq 573.0^\circ\text{F}$ .

$$K_4 \leq 1.0965$$

$$K_5 \geq 0.0198 / ^\circ\text{F} \text{ for increasing } T_{\text{avg}} \\ \geq 0 / ^\circ\text{F} \text{ for decreasing } T_{\text{avg}}$$

$$K_6 \geq 0.001074 / ^\circ\text{F} \text{ for } T > T' \\ \geq 0 \text{ for } T \leq T'$$

$$t_3 \geq 9.0 \text{ seconds}$$

$f(\Delta I)$  = 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)

Whenever the reactor is subcritical the 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 -  $F\Delta H(N)$

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

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

$$CFDH = 1.56$$

$$PFDH = 0.3$$

**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

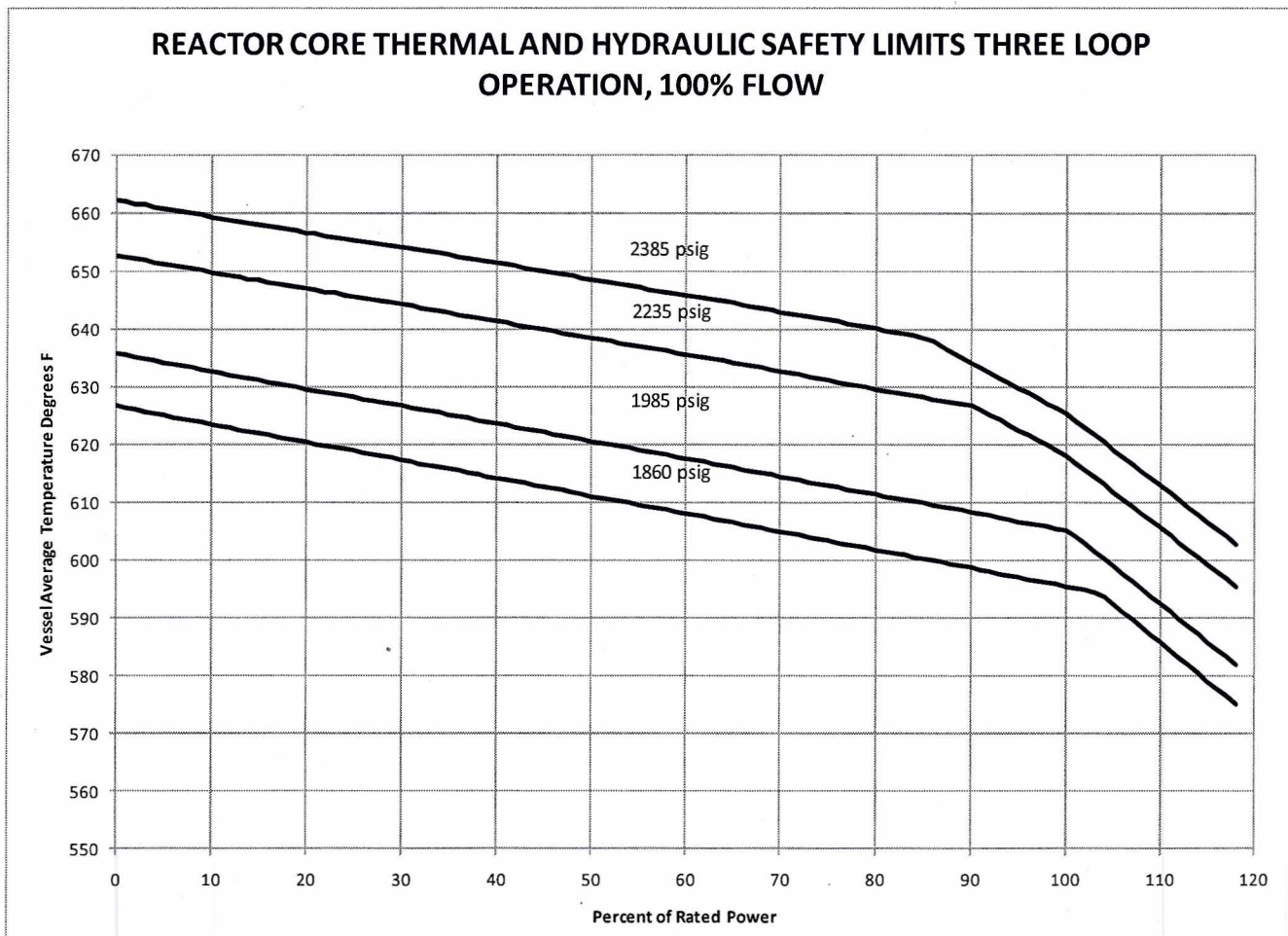


Figure A-2

**SURRY UNIT 1 CYCLE 24  
ROD GROUP INSERTION LIMITS**

