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United States Nuclear Regulatory Commission Attention: Document Control Desk Washington, D.C. 20555 Serial No.: 20-166 NRA/GDM: R0 Docket No.: 50-281 License No.: DPR-37

### VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION ENERGY VIRGINIA) SURRY POWER STATION UNIT 2 CORE OPERATING LIMITS REPORT SURRY 2 CYCLE 30 PATTERN SYK REVISION 0

Pursuant to Surry Technical Specification (TS) 6.2.C, attached is a copy of the Core Operating Limits Report (COLR) for Surry Power Station Unit 2, Cycle 30, Pattern SYK, Revision 0.

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

Sincerely,

B.E. Starly

B. E. Standley, Director Nuclear Regulatory Affairs Dominion Energy Services, Inc. for Virginia Electric and Power Company

Attachment:

Core Operating Limits Report, Surry Unit 2 Cycle 30 Pattern SYK, Revision 0

Commitment Summary: There are no new commitments contained in this letter.

Serial No. 20-166 Docket No. 50-281 COLR S2C30 Page 2 of 2

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Serial No. 20-166 Docket No. 50-281 COLR S2C30 bc page 1 of 1

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# Action Plan/Commitments (Stated or Implied):

None

# Verification of Accuracy:

1. EVAL-ENG-RSE-S2C30, Revision 0, "Reload Safety Evaluation, Surry Unit 2 Cycle 30 Pattern SYK," approved by FSRC on 4/14/2020.

# **Required Changes to the UFSAR or QA Topical Report:**

None

Serial No. 20-166 Docket No. 50-281

Attachment

# CORE OPERATING LIMITS REPORT

Surry Unit 2 Cycle 30 Pattern SYK

**Revision 0** 

### 1.0 INTRODUCTION

This Core Operating Limits Report (COLR) for Surry Unit 2 Cycle 30 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 (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

# 2.0 <u>REFERENCES</u>

1. VEP-FRD-42-A, Revision 2, Minor Revision 2, "Reload Nuclear Design Methodology," October 2017.

Methodology for:

TS 2.1 – Safety Limit, Reactor Core

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), 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

- 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. DOM-NAF-2-P-A, Revision 0, Minor Revision 3, "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," and Appendix D, "Qualification of the ABB-NV and WLOP CHF Correlations in the Dominion VIPRE-D Computer Code," September 2014.

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

9. 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)

$$\Delta \mathbf{T} \leq \Delta \mathbf{T}_0 \left[ K_1 - K_2 \left( \frac{1 + t_1 s}{1 + t_2 s} \right) (T - T') + K_3 (P - P') - f(\Delta I) \right]$$

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,  $\sec^{-1}$ .

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

T' is the nominal  $T_{avg}$  at RATED POWER,  $\leq$ **573.0°F**.

P is the measured pressurizer pressure, psig.

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

K <sub>1</sub> ≤1.1425	K <sub>2</sub> ≥ <b>0.01059</b> /°F	$K_3 \ge 0.000765 / psig$
$t_1 \geq 29.7$ seconds	$t_2 \leq 4.4$ seconds	

$$\begin{split} f(\Delta I) \geq & \textbf{0.0268} \{-24 - (q_t - q_b)\}, \text{ when } (q_t - q_b) < \textbf{-24.0\% RATED POWER} \\ & \textbf{0}, \text{ when -24.0\% RATED POWER} \leq & (q_t - q_b) \leq \textbf{+8.0\% RATED POWER} \\ & \textbf{0.0188} \{(q_t - q_b) - \textbf{8.0}\}, \text{ when } (q_t - q_b) > \textbf{+8.0\% RATED POWER} \end{split}$$

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 <u>Overpower ΔT</u> (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,  $\sec^{-1}$ .

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

T' is the nominal  $T_{avg}$  at RATED POWER,  $\leq$ **573.0°F**.

K₄ ≤1.0965	$K_5 \ge 0.0198 / ^{\circ}F$ for increasing $T_{avg}$	$K_6 \ge 0.001074 / {}^{\circ}F \text{ for } T > T'$
	$\geq 0 / {}^{\circ}F$ for decreasing $T_{avg}$	$\geq 0$ for T $\leq$ T'

 $t_3 \ge 9.0$  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** <u>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))</u>

- 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** <u>Shutdown Margin</u> (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 <u>Power Distribution Limits (TS 3.12.B.1 and TS 3.12.B.2</u>)

3.7.1 Heat Flux Hot Channel Factor - FQ(z)

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

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

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

CFQ = 2.5

K(z) = 1.0 for all core heights, z

3.7.2 Nuclear Enthalpy Rise Hot Channel Factor - 
$$F\Delta H(N)$$

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

$$where: P = \frac{THERMAL \ POWER}{RATED \ POWER}$$
= 1.635

CFDH = 1.635PFDH = 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<sub>avg</sub> ≤577.0 °F
- Pressurizer Pressure ≥2205 psig
- Reactor Coolant System Total Flow Rate  $\geq$  273,000 gpm (Tech Spec Limit)

and  $\geq$  274,000 gpm (COLR Limit)

# Figure A-1



# Figure A-2

# Surry 2 Cycle 30 Rod Group Insertion Limits

Max w/d position = 227 steps

