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December 8, 2015

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

Serial No. 15-564
NL&OS/GDM: R0
Docket No. 50-281
License No. DPR-37

VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)
SURRY POWER STATION UNIT 2
CORE OPERATING LIMITS REPORT
SURRY 2 CYCLE 27 PATTERN HGG REVISION 1

Pursuant to Surry Technical Specification (TS) 6.2.C, attached is a copy of Dominion's Core Operating Limits Report (COLR) for Surry Unit 2 Cycle 27, Pattern HGG, Revision 1.

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:

Core Operating Limits Report, Surry Unit 2 Cycle 27, Pattern HGG, Revision 1,
November 2015

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

A001
NRR

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CORE OPERATING LIMITS REPORT

Surry Unit 2 Cycle 27

Pattern HGG

Revision 1

November 2015

1.0 INTRODUCTION

This Core Operating Limits Report (COLR) for Surry Unit 2 Cycle 27 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 ΔT
- TS 2.3.A.2.e – Overpower ΔT
- 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 REFERENCES

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

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

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. DOM-NAF-2-P-A, Rev. 0.3, "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," 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 ΔT

TS 2.3.A.2.e – Overpower ΔT

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 ΔT (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:

ΔT is measured RCS ΔT , °F.

ΔT_0 is the indicated ΔT 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, $\leq 573.0^\circ\text{F}$.

P is the measured pressurizer pressure, psig.

P' is the nominal RCS operating pressure ≥ 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 ΔT (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:

ΔT is measured RCS ΔT , °F.

ΔT_0 is the indicated ΔT 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, $\leq 573.0^\circ\text{F}$.

$K_4 \leq 1.0965$

$K_5 \geq 0.0198$ /°F for increasing T_{avg}

$K_6 \geq 0.001074$ /°F for $T > T'$

≥ 0 /°F for decreasing T_{avg}

≥ 0 for $T \leq T'$

$t_3 \geq 9.0$ seconds

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

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 ≥ 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 $\geq 274,000 \text{ gpm}$ (COLR Limit)

Figure A-1

REACTOR CORE SAFETY LIMITS THREE LOOP OPERATION, 100% FLOW

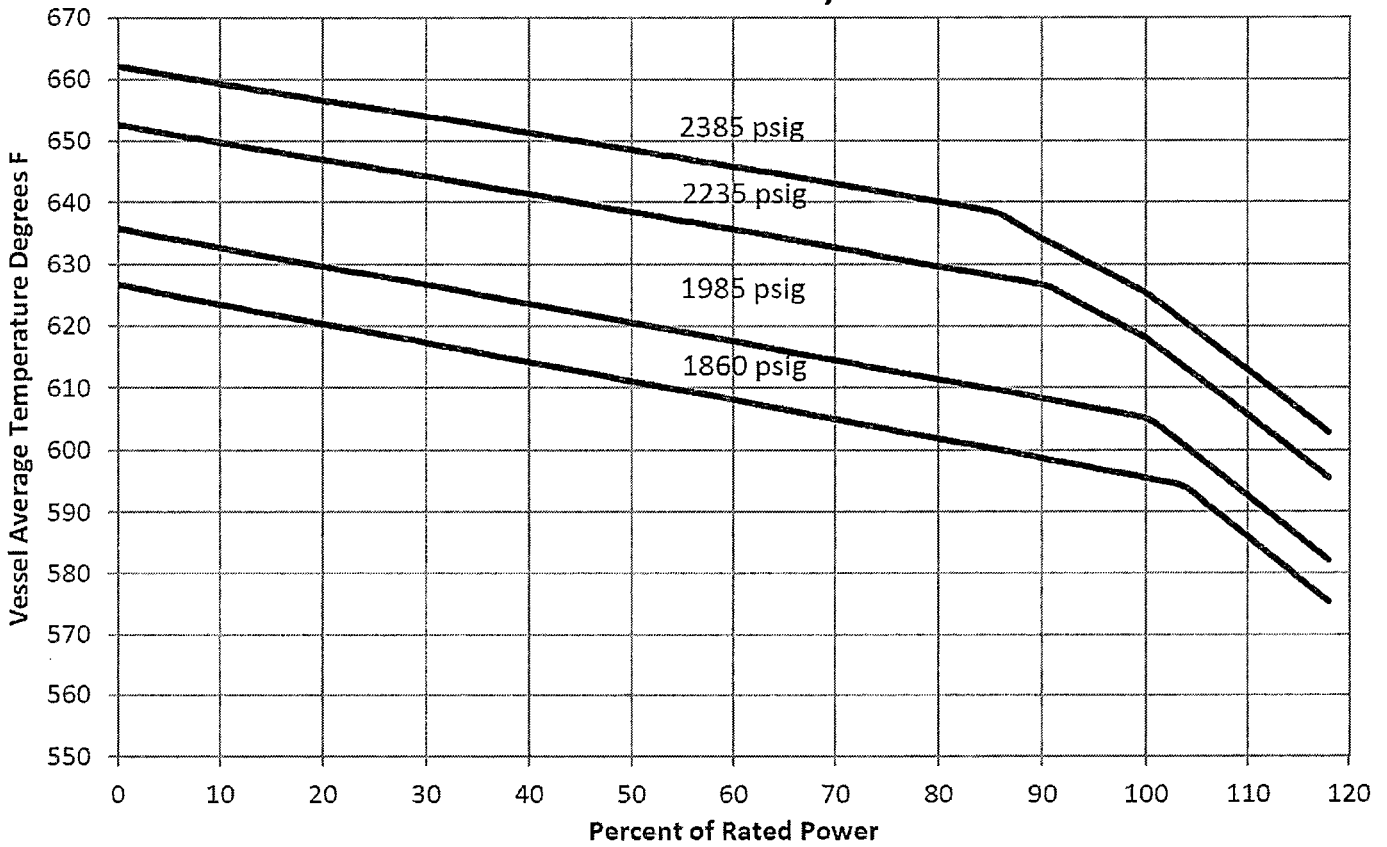


Figure A-2

