UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 17, 2016

Mr. David A. Heacock
President and Chief Nuclear Officer
Virginia Electric and Power Company
Innsbrook Technical Center
5000 Dominion Blvd.
Glen Allen, VA 23060-6711

SUBJECT: NORTH ANNA POWER STATION, UNIT NOS. 1 AND 2 – ISSUANCE OF AMENDMENTS TO REVISE TECHNICAL SPECIFICATIONS TO ADDRESS ISSUES IDENTIFIED IN WESTINGHOUSE NSAL-09-5. REVISION 1, AND NSAL-15-I, REVISION 0 (CAC NOS. MF7186 AND MF7187)

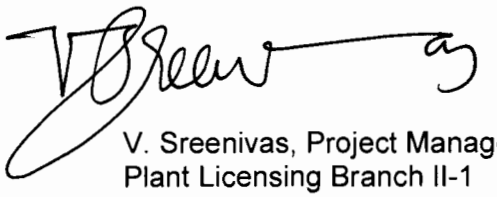
Dear Mr. Heacock:

The U.S. Nuclear Regulatory Commission has issued the enclosed Amendment Nos. 278 and 261 to Renewed Facility Operating License Nos. NPF-4 and NPF-7 for the North Anna Power Station (NAPS), Unit Nos. 1 and 2, respectively. These amendments are in response to your application dated December 10, 2015, as supplemented by letter dated June 15, 2016, to address the issues identified in Westinghouse Nuclear Safety Advisory Letter (NSAL)-09-5, Revision 1, "Relaxed Axial Offset Control FQ Technical Specification Actions," and NSAL-15-1, Revision 0, "Heat Flux Hot Channel Factor Surveillance Requirements."

The amendments modify the NAPS, Unit Nos. 1 and 2, Technical Specification (TS) 3.2.1, "Heat Flux Hot Channel Factor ($F_Q(Z)$)." The amendments relocate required operating space reductions to the Core Operating Limits Report, accompanied by verification for each reload cycle, and define TS surveillance requirements for steady-state and transient $F_Q(Z)$ and corresponding actions with which to apply an appropriate penalty factor to measured results.

A copy of the related Safety Evaluation is also enclosed. A Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,



V. Sreenivas, Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-338 and 50-339

Enclosures:
1. Amendment No. 278 to NPF-4
2. Amendment No. 261 to NPF-7
3. Safety Evaluation

cc w/enclosures: Distribution via Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

VIRGINIA ELECTRIC AND POWER COMPANY

DOCKET NO. 50-338

NORTH ANNA POWER STATION, UNIT NO. 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 278
Renewed License No. NPF-4

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Virginia Electric and Power Company et al., (the licensee) dated December 10, 2015, as supplemented by letter dated June 15, 2016, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations as set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to paragraph 2.C (2) of Renewed Facility Operating License No. NPF-4, as indicated in the attachment to this license amendment, and is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 278, are hereby incorporated in the renewed license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented before September 30, 2017.

FOR THE NUCLEAR REGULATORY COMMISSION

Shawn Williams for

Michael T. Markley, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Operation

Attachment:
Changes to License No. NPF-7
and Technical Specifications

Date of Issuance: October 17, 2016

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

VIRGINIA ELECTRIC AND POWER COMPANY

DOCKET NO. 50-339

NORTH ANNA POWER STATION, UNIT NO. 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 261
Renewed License No. NPF-7

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Virginia Electric and Power Company et al., (the licensee) dated December 10, 2015, as supplemented by letter dated June 15, 2016, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations as set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to paragraph 2.C (2) of Renewed Facility Operating License No. NPF-7, as indicated in the attachment to this license amendment, and is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 261, are hereby incorporated in the renewed license. The licensee shall operate the facility in accordance with the Technical Specifications.

Enclosure 2

3. This license amendment is effective as of its date of issuance and shall be implemented before September 30, 2017.

FOR THE NUCLEAR REGULATORY COMMISSION

Shawn Williams for

Michael T. Markley, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Operation

Attachment:
Changes to License No. NPF-4
and Technical Specifications

Date of Issuance: October 17, 2016

ATTACHMENT TO

NORTH ANNA POWER STATION, UNIT NOS. 1 AND 2

LICENSE AMENDMENT NO. 278

RENEWED FACILITY OPERATING LICENSE NO. NPF-4

DOCKET NO. 50-338

AND LICENSE AMENDMENT NO. 261

RENEWED FACILITY OPERATING LICENSE NO. NPF-7

DOCKET NO. 50-339

Replace the following pages of the Renewed Facility Operating Licenses with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove	Insert
NPF-4, page 3	NPF-4, page 3
NPF-7, page 3	NPF-7, page 3

Replace the following pages of the Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove	Insert
3.2.1-1	3.2.1-1
3.2.1-2	3.2.1-2
3.2.1-3	3.2.1-3
3.2.1-4	3.2.1-4
3.2.1-5	3.2.1-5

(2) Pursuant to the Act and 10 CFR Part 70, VEPCO to receive, possess, and use at any time special nuclear material as reactor fuel, in accordance with the limitations for storage and amounts required for reactor operation, as described in the Updated Final Safety Analysis Report;

(3) Pursuant to the Act and 10 CFR Parts 30, 40, and 70, VEPCO to receive, possess, and use at any time any byproduct, source, and special nuclear material as sealed neutron sources for reactor startup, sealed sources for reactor instrumentation and radiation monitoring equipment calibration, and as fission detectors in amounts as required;

(4) Pursuant to the Act and 10 CFR Parts 30, 40, and 70, VEPCO to receive, possess, and use in amounts as required any byproduct, source, or special nuclear material, without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or component; and

(5) Pursuant to the Act and 10 CFR Parts 30 and 70, VEPCO to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility.

C. This renewed operating license shall be deemed to contain and is subject to the conditions specified in the following Commission regulations in 10 CFR Chapter I; Part 20, Section 30.34 of Part 30, Section 40.41 of Part 40, Sections 50.54 and 50.59 of Part 50, and Section 70.32 of Part 70; is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

VEPCO is authorized to operate the North Anna Power Station, Unit No. 1, at reactor core power levels not in excess of 2940 megawatts (thermal).

(2) Technical Specifications

Technical Specifications contained in Appendix A, as revised through Amendment No. 278 are hereby incorporated in the renewed license. The licensee shall operate the facility in accordance with the Technical Specifications.

(3) Pursuant to the Act and 10 CFR Parts 30, 40, and 70, VEPCO to receive possess, and use at any time any byproduct, source, and special nuclear material as sealed neutron sources for reactor startup, sealed sources for reactor instrumentation and radiation monitoring equipment calibration, and as fission detectors in amounts as required;

(4) Pursuant to the Act and 10 CFR Parts 30, 40, and 70, VEPCO to receive, possess, and use in amounts as required any byproduct, source, or special nuclear material, without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or component; and

(5) Pursuant to the Act and 10 CFR Parts 30, 40, and 70, VEPCO to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility.

C. This renewed license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations as set forth in 10 CFR Chapter I and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

VEPCO is authorized to operate the facility at steady state reactor core power levels not in excess of 2940 megawatts (thermal).

(2) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 261 are hereby incorporated in the renewed license. The licensee shall operate the facility in accordance with the Technical Specifications.

(3) Additional Conditions

The matters specified in the following conditions shall be completed to the satisfaction of the Commission within the stated time periods following the insurance of the condition or within the operational restrictions indicated. The removal of these conditions shall be made by an amendment to the renewed license supported by a favorable evaluation by the Commission:

a. If VEPCO plans to remove or to make significant changes in the normal operation of equipment that controls the amount of radioactivity in effluents from the North Anna Power Station, the

3.2 POWER DISTRIBUTION LIMITS

3.2.1 Heat Flux Hot Channel Factor ($F_Q(Z)$)

LCO 3.2.1 $F_Q(Z)$, as approximated by $F_Q^E(Z)$ and $F_Q^T(Z)$, shall be within the limits specified in the COLR.

APPLICABILITY: MODE 1.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ---------NOTE--------- Required Action A.4 shall be completed whenever this Condition is entered. SR 3.2.1.2 is not required to be performed if this Condition is entered prior to THERMAL POWER exceeding 75% RTP after a refueling. ---------- $F_Q^E(Z)$ not within limit.	A.1 Reduce THERMAL POWER $\geq$ 1% RTP for each 1% $F_Q^E(Z)$ exceeds limit.	15 minutes after each $F_Q^E(Z)$ determination
	AND	
	A.2 Reduce Power Range Neutron Flux–High trip setpoints $\geq$ 1% for each 1% that THERMAL POWER is limited below RTP by Required Action A.1.	72 hours after each $F_Q^E(Z)$ determination
	AND	
	A.3 Reduce Overpower ΔT trip setpoints $\geq$ 1% for each 1% that THERMAL POWER is limited below RTP by Required Action A.1.	72 hours after each $F_Q^E(Z)$ determination
	AND	
	A.4 Perform SR 3.2.1.1 and SR 3.2.1.2.	Prior to increasing THERMAL POWER above the limit of Required Action A.1

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. ---------NOTE--------- Required Action B.5 shall be completed whenever this Condition is entered. ---------- $F_Q^T(Z)$ not within limit.	B.1 Reduce AFD limits as specified in the COLR.	4 hours after each $F_Q^T(Z)$ determination
	AND	
	B.2 Reduce THERMAL POWER as specified in the COLR.	4 hours after each $F_Q^T(Z)$ determination
	AND	
	B.3 Reduce Power Range Neutron Flux-High trip setpoints $\geq$ 1% for each 1% that THERMAL POWER is limited below RTP by Required Action B.2	72 hours after each $F_Q^T(Z)$ determination
	AND	
	B.4 Reduce Overpower ΔT trip setpoints $\geq$ 1% for each 1% that THERMAL POWER is limited below RTP by Required Action B.2.	72 hours after each $F_Q^T(Z)$ determination
	AND	
	B.5 Perform SR 3.2.1.1 and SR 3.2.1.2.	Prior to increasing THERMAL POWER and AFD limits above the limits of Required Actions B.1 and B.2
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 2.	6 hours

SURVEILLANCE REQUIREMENTS

NOTE

During power escalation, THERMAL POWER may be increased until a power level for extended operation has been achieved, at which a power distribution map is obtained.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.2.1.1 Verify $F_Q^E(Z)$ is within limit.	Once after each refueling prior to THERMAL POWER exceeding 75% RTP AND Once within 12 hours after achieving equilibrium conditions after exceeding, by ≥ 10% RTP, the THERMAL POWER at which $F_Q^E(Z)$ was last verified AND In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.2.1.2	----------NOTE---------- If measurements indicate that either the maximum over z $\left[\frac{F_Q^E(Z)}{K(Z)}\right]$ OR maximum over z $\left[\frac{F_Q^T(Z)}{K(Z)}\right]$ has increased since the previous evaluation of $F_Q(Z)$ or is expected to increase prior to the next evaluation: A. Increase $F_Q^T(Z)$ by the appropriate factor, as specified in the COLR, and verify $F_Q^T(Z)$ is still within limits or B. Repeat SR 3.2.1.2 once per 7 EFPD until a. Above (A) is met or b. Two successive flux maps indicate that the maximum over z $\left[\frac{F_Q^E(Z)}{K(Z)}\right]$ AND maximum over z $\left[\frac{F_Q^T(Z)}{K(Z)}\right]$ has not increased. ----------	(continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.2.1.2	(continued) Verify $F_Q^T(Z)$ is within limit.	Once after each refueling within 12 hours after achieving equilibrium conditions after THERMAL POWER exceeds 75% RTP AND Once within 12 hours after achieving equilibrium conditions after exceeding, by ≥ 10% RTP, the THERMAL POWER at which $F_Q^T(Z)$ was last verified AND In accordance with the Surveillance Frequency Control Program

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO

AMENDMENT NO. 278 TO RENEWED FACILITY OPERATING LICENSE NO. NPF-4

AND

AMENDMENT NO. 261 TO RENEWED FACILITY OPERATING LICENSE NO. NPF-7

VIRGINIA ELECTRIC AND POWER COMPANY

NORTH ANNA POWER STATION, UNIT NOS. 1 AND 2

DOCKET NOS. 50-338 AND 50-339

1.0 INTRODUCTION

By letter dated December 10, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15352A108), as supplemented by letter dated June 15, 2016 (ADAMS Accession No. ML16174A098), Virginia Electric and Power Company (Dominion) (the licensee) submitted a license amendment request (LAR) for the North Anna Power Station (NAPS), Unit Nos. 1 and 2. The proposed license amendment revises the NAPS, Unit Nos. 1 and 2, Technical Specifications (TSs) to address the issues identified in the following Westinghouse Nuclear Safety Advisory Letters:

(1) NSAL-09-5, Revision 1, "Relaxed Axial Offset Control FQ Technical Specification Actions," dated September 23, 2009; and
(2) NSAL-15-1, Revision 0, "Heat Flux Hot Channel Factor Surveillance Requirements," dated February 3, 2015.

The licensee has proposed the following changes to NAPS TSs:

- Revise TS 3.2.1, "Heat Flux Hot Channel Factor ($F_Q(Z)$)," limiting condition for operation (LCO) by removing the former F_Q term $F_Q^M(Z)$ and splitting that term into a steady-state component $F_Q^E(Z)$ and a transient component $F_Q^T(Z)$;
- Revise the TS 3.2.1 Actions table to allow a separate Condition/Required Action (RA)/Completion Time (CT) structure so each term could be evaluated individually to address NSAL-15-1, thereby allowing continued operation when the LCO is not met; and
- Revise TS 3.2.1 surveillance requirements (SRs) by replacing the single SR with separate SRs that address the steady-state and transient components of the F_Q term.

The supplemental letter dated June 15, 2016, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the U.S. Nuclear Regulatory Commission (NRC) staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on March 1, 2016 (81 FR 10682).

2.0 REGULATORY EVALUATION

The applicable regulations and guidance are listed below.

Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.34, "Contents of applications; technical information," requires that safety analysis reports analyze the design and performance of structures, systems, and components provided for the prevention of accidents and the mitigation of the consequences of accidents. As part of the core reload process, licensees perform reload safety evaluations to ensure that their safety analyses remain bounding for the design cycle. To confirm that the analyses remain bounding, they confirm that the inputs to the safety analyses are conservative with respect to the current design cycle. These inputs are checked using analytical models, and if key safety analysis parameters are not bounded, further analysis of the affected transients or accidents is performed to ensure that the applicable acceptance criteria are satisfied.

The regulation in 10 CFR 50.36, "Technical specifications," establishes NRC regulatory requirements related to the content of TSs. Section 50.36(b) requires that each license authorizing the operation of a facility will include TSs and that said TSs will be derived from the safety analyses. Section 50.36(c) specifies the categories that are to be included in the TSs, including LCOs, SRs, and administrative controls.

The regulation in 10 CFR 50.36 further requires that, "When a limiting condition for operation of a nuclear reactor is not met, the licensee shall shut down the reactor or follow any remedial action permitted by the technical specifications until the condition can be met."

The regulation in 10 CFR 50.36(c)(2)(ii)(B) requires that an LCO be established for, "A process variable, design feature, or operating restriction that is an initial condition or a design-basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier."

The regulations in 10 CFR 50.3(d)(2), (d)(3), and (d)(5) state that TSs will include LCOs, SRs, and administrative controls. LCOs are the lowest functional capability or performance levels of equipment required for safe operation of the facility. Administrative controls are the provisions relating to organization and management, procedures, recordkeeping, review and audit, and reporting necessary to assure operation of the facility in a safe manner. SRs establish requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, facility operation will be within safety limits, and the LCO will be met.

NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition" (ADAMS Accession No. ML070810350), Section 16, Revision 3.0, "Technical Specifications," provides applicable guidance.

NUREG-1431, Volume 1, Revision 4.0, "Standard Technical Specifications (STS) Westinghouse Plants" (ADAMS Accession Nos. ML12100A222 and ML12100A228, respectively), provides applicable guidance.

Generic Letter (GL) 88-16, "Removal of Cycle-Specific Parameter Limits from Technical Specifications" (ADAMS Accession No. ML031200485), provides guidance for removal of cycle-specific parameter limits from TSs.

3.0 TECHNICAL EVALUATION

3.1 Background

NSAL-09-5, Revision 1, notified Westinghouse customers of an issue associated with the RAs for Condition B of TS 3.2.1B, "Heat Flux Hot Channel Factor ($F_Q(Z)$)" (RAOC [relaxed axial offset control]-W(Z) Methodology)," in NUREG-1431, Revision 4, for plants that have implemented the RAOC methodology. In certain situations where transient $F_Q(Z)$ is not within its limit, the existing RAs may be insufficient to restore $F_Q(Z)$ to within the limit. NSAL-09-5, Revision 1, provides clarification regarding the applicability of the recommended interim actions to address this issue and how they should be implemented, including potential inclusion in plant-specific TS changes. The licensee's evaluation of NSAL-09-5, Revision 1, determined that it was applicable to NAPS based on the similarities between the RAOC and the licensee's relaxed power distribution control (RPDC) methodologies.

NSAL-15-1, Revision 0, notified Westinghouse customers of an issue associated with SR 3.2.1.2 in TS 3.2.1B of NUREG-1431, Revision 4. For certain trends in measured $F_Q(Z)$ and non-equilibrium factor W(Z), the existing SR may not ensure that the transient F_Q, $F_Q^W(Z)$, limit will be met between the performance of the monthly flux map measurement for those plants that use W(Z) F_Q surveillance methodology. The licensee's evaluation of NSAL-15-1, Revision 0, determined that it was also applicable to NAPS based on the similarities between RAOC and RPDC methodologies.

The NRC staff conducted an audit on May 4, 2016, to review detailed calculations and examine the supporting licensee's analysis and Westinghouse references (ADAMS Accession No. ML16091A454). The purpose of the audit was to 1) review detailed calculations, analyses, and technical bases; 2) identify further information that may be necessary to reach a licensing or regulatory decision; 3) discuss possible requests for additional information; and 4) examine Core Operating Limits Report (COLR) Reference List of Analysis Methods in meeting GL 88-16 guidance. As a result, the licensee submitted additional information to supplement the original LAR by its letter dated June 15, 2016.

3.2 Licensee's Proposed Changes

In Section 2.0 of the submittal dated December 10, 2015, the licensee described the proposed TS changes. The licensee has proposed the following revisions to NAPS TSs to address the issues identified in the Westinghouse Nuclear Safety Advisory Letters, as follows:

- Revise TS 3.2.1, "Heat Flux Hot Channel Factor ($F_Q(Z)$)," LCO by removing the former F_Q term $F_Q^M(Z)$ and splitting that term into a steady-state component $F_Q^E(Z)$ and a transient component $F_Q^T(Z)$;

- Revise the TS 3.2.1 Actions table to allow a separate Condition/RA/CT structure so each term could be evaluated individually to address NSAL-15-1, thereby allowing continued operation when the LCO is not met; and

- Revise TS 3.2.1 SRs by replacing the single SR with separate SRs that address the steady-state and transient components of the F_Q term.

The NRC staff reviewed the proposed changes by comparing the licensee's proposed TSs and SRs to the regulatory criteria using the guidance documents specified above. The NRC staff examined the licensee's reasoning for departures from the current technical specifications (CTSs), or the TSs of NUREG 1431, Revision 4, to determine the acceptability of the proposed TSs and SRs to meet the requirements of 10 CFR 50.36.

3.3 NRC Staff Evaluation

3.3.1 TS 3.2.1, "Heat Flux Hot Channel Factor ($F_Q(Z)$)"

LCO 3.2.1 splitting $F_Q^M(Z)$ into its steady-state component ($F_Q^E(Z)$) and transient component ($F_Q^T(Z)$)

LCO 3.2.1 is modified from:

> $F_Q(Z)$, as approximated by $F_Q^M(Z)$, shall be within the limits specified in the COLR.
>
> to:
>
> $F_Q(Z)$, as approximated by $F_Q^E(Z)$ and $F_Q^T(Z)$, shall be within the limits specified in the COLR.

The licensee defines $F_Q^E(Z)$ as the measured value of $F_Q(Z)$ that incorporates manufacturing tolerances and measurement uncertainties. $F_Q^T(Z)$ is defined as $F_Q^E(Z)$ incorporating a non-equilibrium factor that accounts for possible power distribution transients during normal operation.

The NRC staff questioned the licensee as to why separate terms were being introduced. The licensee responded by stating that following a review of NSAL-15-1, Revision 0, it was concluded that the current TS structure, which combined the steady-state and transient F_Q terms into one LCO and one F_Q term, $F_Q^M(Z)$, was not adequate to address the issues of NSAL-15-1, Revision 0. Additionally, the licensee stated that, in particular, the proposed requirement to trend measured and predicted, steady-state and transient F_Q separately was not feasible using only the single term $F_Q^M(Z)$. Splitting $F_Q^M(Z)$ into its steady-state component ($F_Q^E(Z)$) and transient component ($F_Q^T(Z)$) allows each quantity to be evaluated individually, thus ensuring periods of decreasing margin are evaluated. Splitting $F_Q^M(Z)$ into individual components allows RAs to be specified in the event either $F_Q^E(Z)$ or $F_Q^T(Z)$ exceeds its limit. The licensee stated that the separation of variables is consistent with NUREG-1431, Revision 4, and satisfactorily addresses the issues in NSAL-15-1, Revision 0. The NRC staff determined that the reasons for departure from CTS are acceptable and that the proposed LCO will be similar to STS.

The licensee additionally proposed changes to the Actions table consisting of separation of the conditions, RAs, and CTs for each $F_Q^E(Z)$ not within its limits and $F_Q^T(Z)$ not within its limits. This was consistent with the separation of the terms in the LCO.

The licensee proposed to revise Condition A by replacing $F_Q^M(Z)$ with $F_Q^E(Z)$. This allows Condition A to apply when $F_Q^E(Z)$ is not within its limits.

RA A.1 is proposed to be removed. The currently used $F_Q^M(Z)$ term varied with a factor, N(Z), which accounted for worst-case transient core conditions. Adjustment of axial flux difference (AFD) limits could be expected to be necessary for a transient term, but since the new proposed term $F_Q^E(Z)$ is a steady-state term, adjustment of AFD limits will not be necessary. The licensee simply states that since Condition A now applies to steady-state term, $F_Q^E(Z)$, RA A.1 does not apply, and that this is consistent with STS LCO 3.2.1, Actions Condition A, for RAOC. Existing RA A.2.1 becomes RA A.1. The CT of 15 minutes is unchanged and consistent with STS. The NRC staff found this reasoning consistent with that used for the RAs in STS for Condition A of LCO 3.2.1 steady-state term $F_Q^C(Z)$ for RAOC and, therefore, acceptable.

RAs A.2.2 and A.2.3 are revised to RAs A.2 and A.3. The RAs are proposed to be changed. The licensee proposes to change the trip setpoints for Power Range Neutron Flux-High and Overpower delta-T each from a reduction of 1 percent for each 1 percent the F_Q term exceeds the limit to 1 percent for each 1 percent that thermal power is limited below rated thermal power (RTP) by proposed RA A.1. This change was made to address the concerns of NSAL-09-5, Revision 1. The licensee's analysis showed that a 1 for 1 reduction using the F_Q term was not always sufficient, and the licensee determined that a reduction in thermal power was necessary to limit the operating space. While this is not consistent with the corresponding RAs of STS, NSAL-09-5, Revision 1, determined that the existing actions in STS could be non-conservative in some situations. The licensee asserts that the changes address the concerns of NSAL-09-5 Revision 1. CTs are left unchanged at 72 hours, except they are made to apply to $F_Q^E(Z)$.

RA A.2.4 is revised to RA A.4. It is changed from requiring performance of only SR 3.2.1.1 to require performance of both SR 3.2.1.1 and SR 3.2.1.2. The changes to the SRs are discussed in the next section. Requiring performance of the SR to determine the steady-state F_Q term, as well as the SR to determine the transient F_Q term, is more conservative since $F_Q^E(Z)$ is used to derive $F_Q^T(Z)$. This also agrees with the STS guidance for the similar RA for RAOC. The CT is left unchanged.

The licensee proposes that a note be added before Condition A. This note is similar to the STS note except for the explicit wording that SR 3.2.1.2 is not required to be performed if this condition is entered prior to exceeding 75 percent RTP after a refueling. The licensee explained that thermal power levels below 75 percent are typically non-limiting with respect to the limit for $F_Q^T(Z)$. Also, startups following a refueling outage are typically slow and well-controlled for startup physics testing and flux symmetry measurements. The licensee stated that the initial startup following a refueling outage will not result in non-equilibrium power shapes that could challenge the $F_Q^T(Z)$ limit. Per STS, SRs 3.2.1.1 or 3.2.1.2 are normally only required to be initially performed prior to exceeding 75 percent RTP.

Existing Condition B is proposed to be changed to Condition C so that a new Condition B for $F_Q^T(Z)$ not within limits could be added. This change is administrative in nature, and the NRC staff finds it acceptable.

The licensee's proposed Condition B is similar to STS for RAOC with respect to CTs. Proposed RAs B.1 and B.2 will reduce AFD limits and thermal power, respectively, as designated in the COLR. Each has a CT of 4 hours. RAs B.3 and B.4 require adjustment of the trip setpoints for each 1 percent that thermal power is reduced in proposed RA B.2. According to the licensee, these changes were made to address the concerns of NSAL-09-5, Revision 1. The licensee stated that analysis showed that actions for a 1 percent reduction of power, or AFD limits for each 1 percent reduction in F_Q term, was not always adequate for restoring margin.

The licensee's analysis performed during the review of NSAL-09-5, Revision 1, determined that a combination of reductions in power and AFD limits were necessary to regain the required margins to satisfy the LCO for $F_Q^T(Z)$. RAs B.1 (AFD limits) and B.2 (thermal power limits) reduce the required operating space by the application of a power reduction and an AFD limit reduction. The operating space envelopes are determined by the licensee using its NRC-approved methodology RPDC on a cycle-specific basis and are presented graphically and tabularly in the COLR. RAs B.3 and B.4 require identical reductions in the trip setpoints for Power Range Neutron Flux–High and Overpower delta-T, respectively. While this is not consistent with the corresponding RAs for RAOC of STS, NSAL-09-5, Revision 1, determined that the existing actions were non-conservative in some situations. The NRC staff verified that the proposed Condition B fits the licensee's approved RPDC analysis method and addresses the issues of NSAL-09-5, Revision 1, and, therefore, the change is acceptable.

The NRC staff inquired as to why the proposed CTs RAs B.1 and B.2 (4 hours), which would apply to the condition of the transient F_Q term ($F_Q^T(Z)$) not within its limits would now differ from CTS (15 minutes) since $F_Q^M(Z)$ is also a transient F_Q term. The licensee responded as follows:

> The most limiting normal operational transients require multiple changes in core conditions and considerable time to develop, since it is the impact of the build-up and decay of fission products that make the transients extreme. Xenon, the most significant of the fission product contributors, has over a 9 hour half-life; therefore, its fission product time scale will significantly limit the severity of potential transients when restricted to 4-hours prior to the new THERMAL POWER and AFD limits being in place. A 15-minute Completion Time is not necessary since the 4-hour Completion Time is short enough to preclude FQ limiting transients. The use of a 4-hour completion time to restrict plant conditions such that $F_Q^T(Z)$ is within its limits allows adequate time for operators to make planned and controlled maneuvers while effectively preventing the extreme transients that would be necessary to produce the FQ limiting conditions.
>
> Conversely, reducing power and controlling/reducing AFD to be within new limits (and any resultant actions such as the insertion of control rods) within a 15-minute time frame from a condition that may be quite stable (and unlikely to result in future peaking factor issues if maintained) could lead to the initiation of a normal operational transient and increase the probability of exceeding the FQ limits. A 4-hour Completion Time (versus 15-minutes) allows time for operator actions to be performed to minimize the initiation of a normal operational transient.

The NRC staff finds the reasoning for the 4-hour CT for RAs B.1 and B.2 acceptable.

The NRC staff inquired as to why the additional words, "... after each determination," are added to the CTs of each RA of Condition B. The licensee explained that the use of these words is meant to provide consistency with the existing language in CTS CTs of Condition A. The licensee further explained that while the proposed phrase is inconsistent with STS, the CTs are functionally equivalent. The NRC staff finds that the phrase is consistent with CTS and accepts this reasoning.

The NRC staff finds that the proposed revisions for the LCOs and Action table for TS 3.2.1 are consistent with STS to the extent explained above and concludes that including the proposed changes it will meet the requirements of 10 CFR 50.36(c)(2).

3.3.2 Surveillance Requirement 3.2.1.1

SR 3.2.1.1 had to be revised since the formerly specified SR dealt with $F_Q^M(Z)$, which will no longer be used. SR 3.2.1.1 will be revised to be more similar to the STS for RAOC. SR 3.2.1.1 is revised from:

---------- NOTE ----------
If $F_Q^M(Z)$ measurements indicate

$$\text{maximum over z} \quad \frac{F_Q^M(Z)}{K(Z)}$$

has increased since the previous evaluation of $F_Q^M(Z)$:

a. Increase $F_Q^M(Z)$ by the appropriate factor and verify $F_Q^M(Z)$ is still within limits; or
b. Repeat SR 3.2.1.1 once per 7 EFPD until two successive flux maps indicate

$$\text{maximum over z} \quad \frac{F_Q^M(Z)}{K(Z)}$$

has not increased.

Verify $F_Q^M(Z)$ is within limit.

to:

Verify $F_Q^E(Z)$ is within limit.

The $F_Q^M(Z)$ term in the frequency column was replaced by $F_Q^E(Z)$. The licensee proposed separate SRs for $F_Q^E(Z)$ and $F_Q^T(Z)$ to be the same as those numbered SRs in STS for the comparable $F_Q^C(Z)$ and $F_Q^W(Z)$ used in the RAOC method. The NRC staff finds this reasoning for proposed SR 3.2.1.1 acceptable.

SR 3.2.1.2 is structurally similar to the former SR 3.2.1.1 for $F_Q^M(Z)$. The proposed SR 3.2.1.2 is revised to state:

---------- NOTE ----------
If measurements indicate that either the

$$\text{maximum over z} \quad \frac{F_Q^E(Z)}{K(Z)}$$

OR

$$\text{maximum over z} \quad \frac{F_Q^T(Z)}{K(Z)}$$

has increased since the previous evaluation of $F_Q(Z)$ or is expected to increase prior to the next evaluation:

A. Increase $F_Q^T(Z)$ by the appropriate factor, as specified in the COLR, and verify $F_Q^T(Z)$ is still within limits or

B. Repeat SR 3.2.1.2 once per 7 EFPD until:

   a. Above (A) is met or
   b. Two successive flux maps indicate that the

$$\text{maximum over z} \quad \frac{F_Q^E(Z)}{K(Z)}$$

AND

$$\text{maximum over z} \quad \frac{F_Q^T(Z)}{K(Z)}$$

has not increased.

Verify $F_Q^T(Z)$ is within limit.

This new SR 3.2.1.2 for $F_Q^T(Z)$ includes a note preceding the SR that describes the actions to be taken for a situation in which either $F_Q^E(Z)$ or $F_Q^T(Z)$ have increased since the last evaluation or are expected to increase prior to the next evaluation.

The licensee states that this approach, although different in the details of application from that recommended in NSAL-15-1, Revision 0, has been deemed to be more suitable for use with the licensee's methods. For RAOC plants, the SR in STS addresses the appropriate application of an appropriate factor in the event that the measured F_Q (designated $F_Q^C(Z)$) has increased since

the previous evaluation. NSAL-15-1, Revision 0, notified customers of the potential for $F_Q^W(Z)$ to increase while $F_Q^C(Z)$ decreases, in which case the SR may be insufficient to ensure that the $F_Q^W(Z)$ LCO is met. NSAL-15-1, Revision 0, effectively notified customers that the measured trend of steady-state F_Q is not necessarily indicative of the transient F_Q.

The licensee states that the proposed SR 3.2.1.2 involves looking for increases in the steady-state, or transient measured and predicted $F_Q(Z)$, to determine if a penalty factor should be applied. Penalty factors will be determined by cycle-specific analysis and specified in the COLR. The licensee further states that the proposed SR 3.2.1.2 has been confirmed by analysis with its methods for representative NAPS reload cores to ensure that $F_Q^E(Z)$ and $F_Q^T(Z)$ will satisfy their respective limits and resolve the issue of undetected loss of margin identified in NSAL-15-1, Revision 0. The licensee indicates that its approach to address the issues in NSAL-15-1, Revision 0, for NAPS has the following desirable aspects: (1) directly addresses the issues of NSAL-15-1, Revision 0; (2) retains the existing F_Q TSs surveillance scheme and structure; (3) retains the existing axial control calculation methodology RPDC; and (4) allows a cycle-specific determination of appropriate penalty factors, thereby continually validating the approach. Therefore, this approach was deemed more suitable for use with the licensee's methods versus adopting the WCAP-17661-P approach.

The NRC staff finds that the proposed revisions for the SRs for TS 3.2.1 are consistent with STS to the extent explained above and concludes that including the proposed changes in the SRs will comply with 10 CFR 50.36(c)(3).

The RPDC methodology is discussed in the LAR and Dominion's Topical Report VEP-NE-1, Rev. 0.1-A relating to the licensee's method for axial power distribution control with a variable AFD (delta-I) band. This method provides an increasing delta-I band with decreasing power in order to maintain approximately constant analysis margin to the design-bases limits at all power levels.

The RPDC analysis process consists of (1) generation of power shapes that bound the delta-I range; (2) selection of delta-I bands such that all bands satisfy the COLR height-dependent hot channel factor, $F_Q(Z)$, limit, with verification that the proposed delta-I bands satisfy loss-of-coolant accident F_Q and loss-of-flow accident thermal-hydraulic evaluations; (3) analysis of limiting Condition II events to ensure the power shapes within the final delta-I band are used as initial conditions; (4) verification to confirm that over-power delta temperature ($OP\Delta T$) and over-temperature delta-T ($OT\Delta T$) limits are conservative to ensure that margin to fuel design limits is maintained; and (5) formulation of N(Z) functions (non-equilibrium power distribution multiplier) to support the implementation of F_Q TS SRs.

The NRC safety evaluation report approving the licensee's Topical Report VEP-NE-1, Rev. 0.1-A accepted the licensee's RPDC method for use at NAPS and SPS, and also allowed the RPDC method for use at plants with reload cores similar to those of NAPS and SPS. Therefore, the use of the RPDC method discussed in the LAR is acceptable.

3.4 NRC Staff Conclusion

The NRC staff concludes that the change in TS 3.2.1 ensures that the RAs will be taken in the event that transient $F_Q(Z)$ surveillance limits are not met. Changes are also proposed that define separate terms, action steps, and SRs for steady-state and transient $F_Q(Z)$, denoted as

$F_Q^E(Z)$ and $F_Q^T(Z)$, respectively. The use of separate SRs in this manner is consistent with the NRC-approved STS (NUREG-1431, Revision 4). The revised SRs provide guidance for application of, and determining the magnitude of, a penalty factor for the measured $F_Q(Z)$. The factor will be applied if the trend in measured values indicates decreasing margin to the applicable limit, since performing the previous surveillance or if the trend in predicted values indicates decreasing margin to the applicable limit prior to the next required surveillance. The proposed changes specify that this factor will be defined in the COLR, which allows specific numerical values of the factor to be evaluated for each reload core.

These changes are consistent with the previously NRC-approved SR. Therefore, the NRC staff concludes that the proposed changes to TS 3.2.1 are acceptable based on the following considerations that (1) the change in TS 3.2.1 ensures that the RAs will be taken in the event that transient $F_Q(Z)$ surveillance limits are not met; (2) the use of separate SRs in the proposed manner is consistent with the NRC-approved STS (NUREG-1431, Revision 4); and (3) the proposed changes are to be evaluated and validated for each reload core. The revised TSs ensures that the requirements of 10 CFR 50.34, 10 CFR 50.36, and GL 88-16 are satisfied.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, officials from the Commonwealth of Virginia were notified of the proposed issuance of the amendments. The NRC did not receive any comments from the Commonwealth officials.

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration (81 FR 10682). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

6.0 CONCLUSION

The NRC staff has concluded, based on the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that such activities will be conducted in compliance with the NRC's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: F. Forsaty
P. Snyder

Date of Issuance: October 17, 2016

A copy of the related Safety Evaluation is also enclosed. A Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

/RA/

V. Sreenivas, Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-338 and 50-339

Enclosures:
1. Amendment No. 278 to NPF-4
2. Amendment No. 261 to NPF-7
3. Safety Evaluation

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