VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261
December 10, 2015

10 CFR 50.90

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Serial No.	15-494
NLOS/DEA	R0
Docket Nos.:	50-338/339
License Nos.:	NPF-4/7

VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)
NORTH ANNA POWER STATION UNITS 1 AND 2
LICENSE AMENDMENT REQUEST TO ADDRESS THE ISSUES IDENTIFIED IN WESTINGHOUSE DOCUMENTS NSAL-09-5, REV. 1 AND NSAL-15-1

In accordance with the provisions of 10 CFR 50.90, Virginia Electric and Power Company (Dominion) is submitting a license amendment request to revise the North Anna Power Station Units 1 and 2 Technical Specifications (TS). The proposed changes would revise the TS to address the issues identified in two Westinghouse communication documents.

Specifically, the proposed changes will address the issues identified in:

- Westinghouse Nuclear Safety Advisory Letter NSAL-09-5, Rev. 1 (Reference 1) by relocating required operating space reductions (power and AFD) to the Core Operating Limits Report, accompanied by verification for each reload cycle
- Westinghouse Nuclear Safety Advisory Letter NSAL-15-1, Rev. 0 (Reference 2) by defining 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

Attachment 1 provides a discussion of the proposed change. The marked-up and proposed TS pages are included in Attachments 2 and 3, respectively. The marked-up and proposed TS Bases changes are provided for NRC information only in Attachment 4.

We have evaluated the proposed amendment and have determined that it does not involve a significant hazards consideration as defined in 10 CFR 50.92. The basis for this determination is included in Attachment 1. We have also determined that operation with the proposed change will not result in any significant increase in the amount of effluents that may be released offsite or any significant increase in individual or cumulative occupational radiation exposure. Therefore, the proposed amendment is eligible for categorical exclusion from an environmental assessment as set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment is needed in connection with the approval of the proposed

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change. The proposed TS change has been reviewed and approved by the Facility Safety Review Committee.

Dominion requests approval of the proposed amendment by May 31, 2017 to enable implementation of the changes by the Unit 2 refueling outage in the fall of 2017.

Should you have any questions in regard to this submittal, please contact Ms. Diane E. Aitken at (804) 273-2694.

Sincerely,

Mark D. Sartain
Vice President – Nuclear Engineering

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Mark D. Sartain, who is Vice President – Nuclear Engineering of Virginia Electric and Power Company. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 10 day of December, 2015.

My Commission Expires: August 31, 2019

GARY DON MILLER
Notary Public
Commonwealth of Virginia
Reg. # 7629412
My Commission Expires August 31, 2019

Gary Don Miller
Notary Public

References:

1. Westinghouse Nuclear Safety Advisory Letter, NSAL-09-5, Rev. 1, "Relaxed Axial Offset Control FQ Technical Specification Actions," September 23, 2009.

2. Westinghouse Nuclear Safety Advisory Letter, NSAL-15-1, Rev. 0, "Heat Flux Hot Channel Factor Technical Specification Surveillance," February 6, 2015.

Attachments:

1. Discussion of Change
2. Marked-up Technical Specifications Pages
3. Proposed Technical Specifications Pages
4. Marked-up Technical Specifications Bases Pages (for information only)

Commitments made in this letter: None

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NRC Senior Resident Inspector
North Anna Power Station

ATTACHMENT 1

DISCUSSION OF CHANGE

**Virginia Electric and Power Company
(Dominion)
North Anna Power Station Units 1 and 2**

Table of Contents

1.0 DESCRIPTION

In accordance with the provisions of 10 CFR 50.90, Virginia Electric and Power Company (Dominion) is submitting a request to amend the Technical Specifications (TS) for North Anna Power Station Units 1 and 2 (NAPS). The changes are intended to address the issues identified in Westinghouse communications NSAL-09-5, Rev. 1 (Reference 1) and NSAL-15-1 (Reference 2).

Reference 1 notified Westinghouse customers of an issue associated with the Required Actions for Condition B of TS 3.2.1B, "Heat Flux Hot Channel Factor ($F_Q(Z)$ (RAOC-W(Z) Methodology)," in Reference 3 for plants that have implemented the relaxed axial offset control (RAOC) methodology. In certain situations where transient F_Q, $F_Q^W(Z)$, is not within its limit, the existing Required Actions may be insufficient to restore $F_Q^W(Z)$ to within the limit. Revision 1 of Reference 1 provided 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 Technical Specification changes. Dominion's evaluation of Reference 1 determined that it was applicable to NAPS, based on the similarities between the RAOC and Dominion's Relaxed Power Distribution Control (RPDC) methodologies.

Reference 2 notified Westinghouse customers of an issue associated with Surveillance Requirement (SR) 3.2.1.2 in TS 3.2.1B of Reference 3. 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 measurements, for those plants that use the W(Z) F_Q surveillance methodology. Dominion's evaluation of Reference 2 determined that it was also applicable to NAPS, based on the similarities between the RAOC and Dominion's Relaxed Power Distribution Control (RPDC) methodologies.

Dominion is proposing to change TS 3.2.1, "Heat Flux Hot Channel Factor ($F_Q(Z)$)," to enhance the required actions to 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 surveillance requirements for steady-state and transient $F_Q(Z)$, denoted as $F_Q^E(Z)$ and $F_Q^T(Z)$, respectively. The use of separate surveillance requirements (SR) in this manner is consistent with Westinghouse Standard Technical Specifications, NUREG-1431, Rev. 4 (Reference 3). The revised surveillance requirements 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 changes specify that this factor will be defined in the Core Operating Limits Report (COLR), which allows specific numerical values of the factor to be evaluated for each reload core.

The Bases for TS 3.2.1 are being modified to address the proposed changes to TS 3.2.1. The TS Bases changes are provided for information only. Changes to the TS Bases will be incorporated in accordance with the TS Bases Control Program (TS 5.5.13) upon approval of this amendment request.

2.0 PROPOSED TECHNICAL SPECIFICATIONS CHANGES

The proposed TS and SR changes are detailed below. To aid review, deleted text is struck through and added text is italicized and bolded. For more extensive changes, reference is made to the TS markups in Attachment 2 and TS Bases markups in Attachment 4.

2.1 TS 3.2.1 – Heat Flux Hot Channel Factor ($F_Q(Z)$)

TS 3.2.1 currently reflects use of the Dominion Relaxed Power Distribution Control (RPDC) power distribution control methodology (Reference 4). The proposed changes detailed below revise certain specification terminology, including relocation of some equations to the TS Bases, and revision of appropriate TS Required Actions to address the issues in References 1 and 2.

The proposed changes follow:

LCO 3.2.1

- LCO 3.2.1 will be revised as follows:

  $F_Q(Z)$, as approximated by $\cancel{F_Q^M(Z)}$ ***$F_Q^E(Z)$ and $F_Q^T(Z)$***, shall be within the limits specified in the COLR.

TS 3.2.1 – CONDITION A, REQUIRED ACTIONS AND COMPLETION TIME

- TS 3.2.1 CONDITION A will be revised as follows:

  -------------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.

  A. $\cancel{F_Q^M(Z)}$ ***$F_Q^E(Z)$*** not within limit.

- Delete TS 3.2.1 REQUIRED ACTION A.1 and renumber remaining REQUIRED ACTIONS as REQUIRED ACTION A.1, A.2, A.3, and A.4

- New TS 3.2.1 REQUIRED ACTION A.1 reads as follows:

  Reduce THERMAL POWER ≥ 1% RTP for each 1% $\cancel{F_Q{}^M(Z)}$ ***$F_Q{}^E(Z)$*** exceeds limit.

  A.1 COMPLETION TIME

  15 minutes after each $\cancel{F_Q{}^M(Z)}$ ***$F_Q{}^E(Z)$*** determination

- New TS 3.2.1 REQUIRED ACTION A.2 reads as follows:

  Reduce Power Range Neutron Flux-High trip setpoints ≥ 1% for each 1% $\cancel{F_Q{}^M(Z)}$ ~~exceeds limit~~ ***that THERMAL POWER is limited below RTP by Required Action A.1***.

  A.2 COMPLETION TIME

  72 hours after each $\cancel{F_Q{}^M(Z)}$ ***$F_Q{}^E(Z)$*** determination

- New TS 3.2.1 REQUIRED ACTION A.3 reads as follows:

  Reduce Overpower ΔT trip setpoints ≥ 1% for each 1% $\cancel{F_Q{}^M(Z)}$ ~~exceeds limit~~ ***that THERMAL POWER is limited below RTP by Required Action A.1***.

  A.3 COMPLETION TIME

  72 hours after each $\cancel{F_Q{}^M(Z)}$ ***$F_Q{}^E(Z)$*** determination

- New TS 3.2.1 ACTION A.4 reads as follows:

  Perform SR 3.2.1.1 ***and SR 3.2.1.2***

  A.4 COMPLETION TIME

  Prior to increasing THERMAL POWER above the limit of Required Action A.~~2~~***1***

TS 3.2.1 – CONDITION B, REQUIRED ACTIONS and COMPLETION TIME

- New TS 3.2.1 CONDITION B will be added, to read as follows:

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 ≥ 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 ≥ 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***

- Renumber existing TS 3.2.1 CONDITION B, REQUIRED ACTION, as follows:

~~B~~*C*. Required Action and associated Completion Time not met.

~~B~~*C*.1 Be in MODE 2.

2.2 SR 3.2.1.1, SR 3.2.1.2 [new] – Heat Flux Hot Channel Factor ($F_Q(Z)$)

The changes to SR 3.2.1.1 and the addition of SR 3.2.1.2 conform with the introduction of steady-state, $F_Q^E(Z)$, and transient, $F_Q^T(Z)$, in TS 3.2.1. These changes define separate surveillance requirements for the two representations of $F_Q(Z)$.

The proposed changes follow:

SR 3.2.1.1

- The Note before SR 3.2.1.1 is deleted since it pertains to transient limits.

- SR 3.2.1.1 is revised to read as follows:

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

  SR 3.2.1.1 [FREQUENCY] (the 2nd clause):

  Once within 12 hours after achieving equilibrium conditions after exceeding, by ≥ 10% RTP, the THERMAL POWER at which ~~$F_Q^M(Z)$~~ ***$F_Q^E(Z)$*** was last verified

- New SR 3.2.1.2 will be added, to read as follows:

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.* --- *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*

2.3 TS Bases 3.2.1 – Heat Flux Hot Channel Factor ($F_Q(Z)$)

Several changes to the Bases will be required which reflect the terminology changes and relocation of items from the specific TS sections noted in the description above.

Summary list of key changes (see markup in Attachment 4):

- Revise terminology throughout to reflect use of $F_Q(Z)$, $F_Q^E(Z)$ and $F_Q^T(Z)$ as appropriate
- Changes to conform with deletion and renumbered Condition A REQUIRED ACTIONS in TS 3.2.1
- Insert 4 describes the relation for $F_Q^T(Z)$, including the N(Z) factor
- Insert 5 describes actions to reduce core power and AFD limits if $F_Q^E(Z)$ and $F_Q^T(Z)$ cannot be maintained within LCO limits
- Insert 6 describes the Condition B REQUIRED ACTIONS added in TS 3.2.1 for $F_Q^T(Z)$
- Insert 7 describes the steady-state peaking factor, $F_Q^E(Z)$ for SR 3.2.1.1
- Insert 8 describes the frequency conditions for the transient peaking factor, $F_Q^T(Z)$ for SR 3.2.1.2
- Insert 9 describes expressions for both $F_Q^E(Z)$ and $F_Q^T(Z)$ that are evaluated to determine whether to apply the appropriate penalty factor or increase the frequency of surveillance

Based on Dominion's analytical assessment of internal and external operating experiences (e.g. Westinghouse Communication 06-IC-03, Reference 5), the magnitudes of the lower and upper core regions excluded from FQ surveillances had been proactively and conservatively reduced (in approximately 2006) from what was and is currently described in the North Anna Technical Specification Bases. An update to the Technical Specification Bases to expand the FQ axial surveillance regions is being tracked by Dominion's corrective action system.

3.0 TECHNICAL ANALYSIS

The proposed TS changes identified in Section 2.0 are evaluated for technical adequacy in the following sections.

3.1 TS 3.2.1 – Heat Flux Hot Channel Factor ($F_Q(Z)$)

The proposed changes involve additions, deletions and revisions to existing TS content that are associated with LCO 3.2.1. These changes provide resolution of issues documented in Westinghouse notification documents NSAL-09-5, Rev. 1 (Reference 1) and NSAL-15-1 (Reference 2). NAPS is currently operating with compensatory actions which address the issues identified in References 1 and 2. Evaluation of the specific proposed changes is provided below.

LCO 3.2.1

The existing LCO 3.2.1 specifies that $F_Q(Z)$ is approximated by $F_Q^M(Z)$, which is described in the Bases as the steady-state measured value for $F_Q(Z)$. The COLR limit to which $F_Q^M(Z)$ is compared is adjusted by the factor, N(Z), which accounts for the calculated worst case transient core conditions. The N(Z) factor is calculated in accordance with the approved Dominion RPDC methodology (Reference 4). The proposed changes specify that $F_Q(Z)$ is approximated by $F_Q^E(Z)$ and $F_Q^T(Z)$, denoted as the steady-state and transient quantities, respectively. Separate surveillance requirements are specified for $F_Q^E(Z)$ and $F_Q^T(Z)$, which is consistent with the comparable terms $F_Q^C(Z)$ and $F_Q^W(Z)$ in Standard Technical Specifications for Westinghouse plants (Reference 3).

A Note is inserted before LCO 3.2.1 Condition A to explain that Action A.4 is always required to be performed unless SR 3.2.1.2 is performed prior to exceeding 75% RTP after a refueling outage. This note is consistent with language proposed for this LCO condition in response to an NRC Request for Additional Information during review of WCAP-17661-P (Reference 6).

Required Action A.1 in existing LCO 3.2.1 is deleted, since the revised Condition A now applies to steady-state $F_Q^E(Z)$, for which this action does not apply, per the comparable Reference 3 actions for TS 3.2.1B. The remaining actions for LCO 3.2.1 Condition A are retained, with changes to each action that reflect use of $F_Q^E(Z)$ versus $F_Q^M(Z)$.

A new Condition B with corresponding Required Actions is added to address the situation in which $F_Q^T(Z)$ is not within its limit. Proposed Required Actions B.1 through B.5 are a modified version of the interim actions identified in NSAL-09-5, Rev. 1 (Reference 1), for this situation. These changes are proposed as the resolution for the issues identified in Reference 1.

Westinghouse's proposal for the long term resolution of NSAL-09-5, Rev. 1 is to seek NRC approval for the methods described in WCAP-17661-P (Reference 6). WCAP-17661-P is intended to revise the existing RAOC and Constant Axial Offset Control (CAOC) F_Q Surveillance Technical Specifications to address several outstanding issues, one of which was NSAL-09-5. Dominion has strategically chosen not to adopt WCAP-17661-P and its subsequent Technical Specification Task Force (TSTF) traveler for North Anna.

This alternate approach was determined by Dominion evaluation to most appropriately address the issues in NSAL-09-5, Rev. 1 for NAPS. The Dominion approach has these desirable aspects: 1) it addresses directly the issues of NSAL-09-5, Rev. 1; 2) it retains the existing TS surveillance scheme and structure; and 3) it retains the existing axial control calculational methodology (RPDC). By relocating the numerical values to the COLR, Dominion's proposed resolution of NSAL-09-5 allows the required RPDC operating space (THERMAL POWER and AFD) reductions to be evaluated and modified on a cycle-specific basis. This proposed resolution is supported by current Dominion RPDC methods.

Specifically, the allowable operating space that applies to Required Action B.1 and B.2 is relocated to the COLR. A new table, entitled "Required Operating Space Reductions for $F_Q^T(Z)$ Exceeding Its Limits," will be added to the COLR to quantify the required THERMAL POWER and AFD limits associated with different amounts of $F_Q^T(Z)$ margin improvement (1%, 2%, etc.). If LCO 3.2.1, Condition B is entered, the operating space as defined in the new COLR table will ensure that sufficient margin exists. COLR Table 3.2-3 below presents a sample of the proposed table to be included in the COLR.

The values provided in the sample table below are only intended to provide a representative example of typical reload values. The determination and verification of the required $F_Q^T(Z)$ margin improvements and the corresponding required reductions in the THERMAL POWER Limit and AFD Bands will be performed on a reload specific basis in accordance with the approved methodology of VEP-NE-1-A listed in Technical Specification 5.6.5.b.

COLR Table 3.2-3
Required Operating Space Reductions for $F_Q^T(Z)$ Exceeding Its Limits

Required $FQ^T(Z)$ Margin Improvement	THERMAL POWER Reduction (% RTP)	Negative AFD Band Reduction (% AFD)	Positive AFD Band Reduction (% AFD)
≤ 1%	≥ 3%	≥ 2.0%	≥ 2.0%
> 1% and ≤ 2%	≥ 5%	≥ 3.0%	≥ 3.0%
> 2% and ≤ 3%	≥ 8%	≥ 3.5%	≥ 3.5%
> 3%	≥ 50%	N/A	N/A

3.2 SR 3.2.1.1, SR 3.2.1.2 [new] – Heat Flux Hot Channel Factor ($F_Q(Z)$)

The proposed changes to SR 3.2.1.1 address surveillance for $F_Q^E(Z)$, and the addition of new SR 3.2.1.2 addresses surveillance for $F_Q^T(Z)$. Specifying separate requirements for $F_Q^E(Z)$ and $F_Q^T(Z)$, is consistent with treatment of the comparable terms $F_Q^C(Z)$ and $F_Q^W(Z)$ in Standard Technical Specifications for Westinghouse plants (Reference 3).

The Note preceding SR 3.2.1.1 is deleted since it is not applicable to surveillance for the steady-state parameter $F_Q^E(Z)$. It relates to considerations that apply only to conducting surveillance for the transient $F_Q(Z)$ limits.

Insert 3 describes proposed new SR 3.2.1.2 for $F_Q^T(Z)$, including a Note preceding SR 3.2.1.2 that describes the actions for the situation in which either $F_Q^E(Z)$ or $F_Q^T(Z)$ have increased since the last evaluation of $F_Q(Z)$ or are expected to increase prior to the next evaluation. Required Action A of the Note involves increasing $F_Q^T(Z)$ by the appropriate factor, as specified in the COLR, if the conditions concerning either $F_Q^E(Z)$ or $F_Q^T(Z)$ are met. This approach, although different in the details of application from that recommended in Reference 2, has been deemed to be more suitable for use with Dominion methods. The proposed SR 3.2.1.2 has been confirmed by analysis with Dominion methods for representative NAPS reload cores to ensure that $F_Q^E(Z)$ and $F_Q^T(Z)$ will satisfy their respective limits and to resolve the issue of undetected loss of margin identified in Reference 2.

As applied by Dominion, SR 3.2.1.2 involves looking for increases in steady-state and transient, measured and predicted $F_Q(Z)$ to determine if the penalty factor should be applied. The application of the appropriate penalty factor will be required if any of the following conditions are met:

1. Increase in measured maximum $F_Q^E(Z)$ / K(Z) from the previous surveillance,
2. Increase in measured maximum $F_Q^T(Z)$ / K(Z) from the previous surveillance,
3. Increase in predicted maximum $F_Q^E(Z)$ / K(Z) over the next surveillance period, or
4. Increase in predicted maximum $F_Q^T(Z)$ / K(Z) over the next surveillance period.

Cycle-specific analyses will be performed to determine the appropriate penalty factor required to accommodate potential increases in $F_Q(Z)$ over the surveillance period. SR 3.2.1.2 notes that the 'appropriate factor' will be specified in the COLR. This allows for the details of the appropriate penalty factors to be evaluated and modified on a cycle-specific basis. This revised surveillance requirement will ensure an appropriate analytical penalty factor is applied during performance of SR 3.2.1.2, which addresses the issues identified in NSAL-15-1 (Reference 2).

A new table, entitled "Penalty Factors for Flux Map Analysis," will be added to the COLR. Table 3.2-2 below presents a sample of the proposed table to be included in the COLR. The values provided in the sample table below are only intended to provide a representative example of typical reload values. The determination and verification of the appropriate penalty factor will be performed on a reload specific basis in accordance with the approved methodology of VEP-NE-1-A listed in Technical Specification 5.6.5.b.

COLR Table 3.2-2
Penalty Factors for Flux Map Analysis

Burnup (MWD/MTU)	Surveillance Factor
0 – 999	4.00%
1000 – 1999	3.50%
2000 – 2999	2.00%
3000 – 3999	2.00%
4000 – 4999	2.00%
5000 – 6999	2.00%
7000 – 8999	2.00%
9000 – 10999	2.00%
11000 – 12999	2.00%
13000 – 14999	2.00%
15000 – 16999	2.00%
17000 – 18999	2.00%
19000 – EOR	2.00%

Subsequent to approval of this LAR, Dominion intends to process appropriate conforming changes, in the form of a modification (denoted VEP-NE-1, Rev. 0.2-A) to the RPDC topical report. These changes will reflect the adjustments discussed herein to address the issues in References 1 and 2. This modification will be prepared in accordance with Dominion's topical modification process, as provided for in our reload methods topical report VEP-FRD-42-A (Reference 7).

4.0 REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements and Criteria

10 CFR 50, Appendix B, General Design Criterion 10, which states:

The reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that specified acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences.

10 CFR 50.36, Technical Specifications, paragraph (c)(2) states that technical specifications will include limiting conditions for operation. Paragraph (c)(3) states that technical specifications will include surveillance requirements. Both of these paragraphs are applicable to the proposed change.

Section (c)(2)(ii)(B) provides that LCOs must be established for each item meeting one or more criteria. For the power distribution items affected by the proposed change, the following criterion applies:

(B) Criterion 2. A process variable, design feature, or operating restriction that is an initial condition of 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 association with the relevant design basis accident analysis is described below.

10 CFR 50.46, Acceptance Criteria For Emergency Core Cooling Systems For Light-Water Nuclear Power Reactors, establishes acceptable limits for the performance of emergency core cooling systems (ECCS), and requirements for the analytical models used to validate the performance. The analyses of ECCS performance use various inputs and assumptions that reflect the conditions and features of a given plant. In accordance with North Anna TS 5.6.5.b, Core Operating Limits Report, the ECCS analysis establishes limits for $F_Q(Z)$, Heat Flux Hot Channel Factor, which is the subject of the proposed TS changes.

The proposed change maintains compliance with these requirements.

4.2 No Significant Hazards Consideration

Dominion has evaluated whether a significant hazards consideration is involved with the proposed amendment by addressing the three standards set forth in 10 CFR 50.92, "Issuance of Amendment," as discussed below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No.

   The proposed change for resolution of Westinghouse notification documents NSAL-09-5, Rev. 1 and NSAL-15-1, Rev. 0 is intended to address deficiencies identified within the existing NAPS Technical Specifications and to return them to their as-designed function. Operation in accordance with the revised TS ensures that the assumptions for initial conditions of key parameter values in the safety analyses remain valid and does not result in actions that would increase the probability or consequences of any accident previously evaluated.

   Therefore, the proposed amendment does not involve a significant increase in the probability or the consequences of any accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No.

   Operation in accordance with the revised TS and its limits precludes new challenges to SSCs that might introduce a new type of accident. All design and performance criteria will continue to be met and no new single failure mechanisms will be created. The proposed change for resolution of Westinghouse notification documents NSAL-09-5, Rev. 1 and NSAL-15-1, Rev. 0 does not involve the alteration of plant equipment or introduce unique operational modes or accident precursors. It thus does not create the potential for a different kind of accident.

   Therefore, the proposed amendment does not create a new or different kind of accident from any accident previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

   Response: No.

   Operation in accordance with the revised TS and its limits preserves the margins assumed in the initial conditions for key parameters assumed in the safety analysis. This ensures that all design and performance criteria associated with the safety analysis will continue to be met and that the margin of safety is not affected.

   Therefore, the proposed amendment does not involve a significant reduction in a margin of safety.

Based on the above information, Dominion concludes that the proposed license amendment involves no significant hazards consideration under the criteria set forth in 10 CFR 50.92(c) and, accordingly, a finding of no significant hazards consideration is justified.

4.3 Precedents

The proposed changes to the North Anna Units 1 and 2 TS are fundamentally the same as those in the following submittal associated with previous application of Dominion methods:

1. Letter from Mark D. Sartain (Dominion) to USNRC, "Millstone Power Station Unit 3 License Amendment Request to Adopt Dominion Core Design and Safety Analysis Methods and to Address the Issues Identified in Westinghouse Documents NSAL-09-5, Rev. 1, NSAL-15-1 and 06-IC-03," May 8, 2015 (ADAMS Accession No. ML15134A244).

Precedent 1 included proposed TS changes that address each of the issues identified in References 1 and 2 in a comparable manner to those enclosed in this LAR. For both

Precedent 1 and this LAR, the proposed TS changes are compatible with Dominion reload core design methods.

5.0 ENVIRONMENTAL CONSIDERATIONS

Dominion has reviewed the proposed license amendment for environmental considerations. The proposed license amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion from an environmental assessment as set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6.0 REFERENCES

1. Westinghouse Nuclear Safety Advisory Letter, NSAL-09-5, Rev. 1, “Relaxed Axial Offset Control FQ Technical Specification Actions,” September 23, 2009.

2. Westinghouse Nuclear Safety Advisory Letter, NSAL-15-1, Rev. 0, "Heat Flux Hot Channel Factor Technical Specification Surveillance," February 3, 2015.

3. NUREG-1431, Revision 4, Vol. 1 and 2, “Standard Technical Specifications – Westinghouse Plants.”

4. Topical Report, VEP-NE-1, Rev. 0.1-A, "VEPCO Relaxed Power Distribution Control Methodology and Associated FQ Surveillance Technical Specifications," August 2003.

5. Westinghouse Notice 06-IC-03, “F_Q and F_{xy} Surveillance Zone Issue,” February 21, 2006.

6. WCAP-17661-P, Revision 1, “Improved RAOC and CAOC FQ Surveillance Technical Specifications,” November 2013.

7. Topical Report, VEP-FRD-42, Rev. 2.1-A, "Reload Nuclear Design Methodology," August 2003.

ATTACHMENT 2

MARKED-UP TECHNICAL SPECIFICATIONS PAGES

Virginia Electric and Power Company
(Dominion)
North Anna Power Station Units 1 and 2

3.2 POWER DISTRIBUTION LIMITS

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

$F_Q^E(Z)$ and $F_Q^T(Z)$

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

APPLICABILITY: MODE 1.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
INSERT "1" A. ~~$F_Q^M(Z)$~~ not within limit.	~~A.1 Reduce AFD limits ≥ 1% for each 1% $F_Q^M(Z)$ exceeds limit.~~ ~~OR~~	~~15 minutes after each $F_Q^M(Z)$ determination~~
	A.~~2.~~1 Reduce THERMAL POWER ≥ 1% RTP for each 1% ~~$F_Q^M(Z)$~~ exceeds limit. AND	15 minutes after each ~~$F_Q^M(Z)$~~ $F_Q^E(Z)$ determination
	A.~~2.~~2 Reduce Power Range Neutron Flux–High trip setpoints ≥ 1% for each 1% ~~$F_Q^M(Z)$ exceeds limit.~~ AND	72 hours after each ~~$F_Q^M(Z)$~~ determination
	A.~~2.~~3 Reduce Overpower ΔT trip setpoints ≥ 1% for each 1% ~~$F_Q^M(Z)$ exceeds limit.~~ that THERMAL POWER is limited below RTP by Required Action A.1 AND	72 hours after each ~~$F_Q^M(Z)$~~ determination
	A.~~2.~~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.~~2.~~1

INSERT "2"

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~B.~~ C. Required Action and associated Completion Time not met.	~~B~~ 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	~~-------------------NOTE-------------------~~ ~~If $F_Q^M(Z)$ measurements indicate~~ ~~maximum over z~~ $\left[\frac{F_Q^M(Z)}{K(Z)}\right]$ ~~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~~ ~~maximum over z~~ $\left[\frac{F_Q^M(Z)}{K(Z)}\right]$ ~~has not increased.~~ ~~--~~	
$F_Q^E(Z)$	Verify $\cancel{F_Q^M(Z)}$ is within limit.	Once after each refueling prior to THERMAL POWER exceeding 75% RTP <u>AND</u> Once within 12 hours after achieving equilibrium conditions after exceeding, by ≥ 10% RTP, the THERMAL POWER at which $\cancel{F_Q^M(Z)}$ was last verified <u>AND</u> In accordance with the Surveillance Frequency Control Program

INSERT "3"

INSERT "1"

------------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.

INSERT "2"

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. ----------NOTE--------- Required Action B.5 shall be completed whenever this Condition is entered. ---------------------------	B.1 Reduce AFD limits as specified in the COLR.	4 hours after each $F_Q^T(Z)$ determination
$F_Q^T(Z)$ not within limit.	<u>AND</u>	
	B.2 Reduce THERMAL POWER as specified in the COLR.	4 hours after each $F_Q^T(Z)$ determination
	<u>AND</u>	
	B.3 Reduce Power Range Neutron Flux-High trip setpoints ≥ 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
	<u>AND</u>	
	B.4 Reduce Overpower ΔT trip setpoints ≥ 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
	<u>AND</u>	
	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

INSERT "3"

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. --- 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 <u>AND</u> 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 <u>AND</u> In accordance with the Surveillance Frequency Control Program

ATTACHMENT 3

PROPOSED TECHNICAL SPECIFICATIONS PAGES

Virginia Electric and Power Company
(Dominion)
North Anna Power Station Units 1 and 2

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
	<u>AND</u>	
	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
	<u>AND</u>	
	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
	<u>AND</u>	
	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
	<u>AND</u>	
	B.2 Reduce THERMAL POWER as specified in the COLR.	4 hours after each $F_Q^T(Z)$ determination
	<u>AND</u>	
	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
	<u>AND</u>	
	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
	<u>AND</u>	
	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 <u>AND</u> 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 <u>AND</u> 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 <u>AND</u> 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 <u>AND</u> In accordance with the Surveillance Frequency Control Program

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ATTACHMENT 4

MARKED-UP AND PROPOSED TECHNICAL SPECIFICATIONS BASES PAGES
(for information only)

Virginia Electric and Power Company
(Dominion)
North Anna Power Station Units 1 and 2

B 3.2 POWER DISTRIBUTION LIMITS

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

BASES

BACKGROUND

The purpose of the limits on the values of $F_Q(Z)$ is to limit the local (i.e., pellet) peak power density. The value of $F_Q(Z)$ varies along the axial height (Z) of the core.

$F_Q(Z)$ is defined as the maximum local fuel rod linear power density divided by the average fuel rod linear power density, assuming nominal fuel pellet and fuel rod dimensions. Therefore, $F_Q(Z)$ is a measure of the peak fuel pellet power within the reactor core.

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

During power operation, the global power distribution is limited by LCO 3.2.3, "AXIAL FLUX DIFFERENCE (AFD)," and LCO 3.2.4, "QUADRANT POWER TILT RATIO (QPTR)," which are directly and continuously measured process variables. These LCOs, along with LCO 3.1.6, "Control Bank Insertion Limits," maintain the core limits on power distributions on a continuous basis.

$F_Q(Z)$ varies with fuel loading patterns, control bank insertion, fuel burnup, and changes in axial power distribution.

$F_Q(Z)$ is measured periodically using the incore detector system. These measurements are generally taken with the core at or near steady state conditions.

Using the measured three dimensional power distributions, it is possible to derive a measured value for steady-state $F_Q(Z)$, $F_Q^E(Z)$ ~~$F_Q(Z)$, $F_Q^M(Z)$.~~ However, because this value represents a steady state condition, it does not encompass the variations in the value of $F_Q(Z)$ that are present during nonequilibrium situations, such as load changes.

To account for these possible variations, the steady state $F_Q^E(Z)$ ~~limit for $F_Q(Z)$~~ is adjusted by an elevation dependent factor that accounts for the calculated worst case transient conditions to derive $F_Q^T(Z)$.

Core monitoring and control under nonsteady state conditions are accomplished by operating the core within the limits of the appropriate LCOs, including the limits on AFD, QPTR, and control rod insertion.

BASES

APPLICABLE SAFETY ANALYSES

This LCO precludes core power distributions that violate the following fuel design criteria:

a. During a loss of coolant accident (LOCA), the peak cladding temperature during a small break LOCA must not exceed 2200°F, and there must be a high level of probability that the peak cladding temperature does not exceed 2200°F for the large breaks (Ref. 1);

b. During a loss of forced reactor coolant flow accident, there must be at least 95% probability at the 95% confidence level (the 95/95 DNB criterion) that the hot fuel rod in the core does not experience a departure from nucleate boiling (DNB) condition;

c. During an ejected rod accident, the energy deposition to unirradiated fuel is limited to 225 cal/gm and irradiated fuel is limited to 200 cal/gm (Ref. 2); and

d. The control rods must be capable of shutting down the reactor with a minimum required SDM with the highest worth control rod stuck fully withdrawn (Ref. 3).

Limits on $F_Q(Z)$ ensure that the value of the initial total peaking factor assumed in the accident analyses remains valid. Other criteria must also be met (e.g., maximum cladding oxidation, maximum hydrogen generation, coolable geometry, and long term cooling). However, the peak cladding temperature is typically most limiting.

$F_Q(Z)$ limits assumed in the LOCA analysis are typically limiting relative to (i.e., lower than) the $F_Q(Z)$ limit assumed in safety analyses for other postulated accidents. Therefore, this LCO provides conservative limits for other postulated accidents.

$F_Q(Z)$ satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

BASES

$F_Q(Z)$

LCO

The ~~Measured~~ Heat Flux Hot Channel Factor, $\cancel{F_Q^M(Z)}$, shall be limited by the following relationships~~, as described in Reference 4~~:

$$F_Q(Z) \le \frac{CFQ\ K(Z)}{P} \text{ for } P > 0.5$$

$$F_Q(Z) \le \frac{CFQ\ K(Z)}{0.5} \text{ for } P \le 0.5$$

$$\cancel{F_Q^M(Z) \le \frac{CFQ}{P}\ \frac{K(Z)}{N(Z)} \quad \text{for } P > 0.5}$$

$$\cancel{F_Q^M(Z) \le \frac{CFQ}{0.5}\ \frac{K(Z)}{N(Z)} \quad \text{for } P \le 0.5}$$

where: CFQ is the $F_Q(Z)$ limit at RTP provided in the COLR,

K(Z) is the normalized $F_Q(Z)$ as a function of core height provided in the COLR,

~~N(Z) is a cycle dependent function that accounts for power distribution transients encountered during normal operation. N(Z) is included in the COLR; and~~

P is the fraction of RATED THERMAL POWER defined as

$$P = \frac{\text{THERMAL POWER}}{\text{RTP}}$$

and K(Z)

The actual values of CFQ~~, K(Z), and N(Z)~~ are given in the COLR; however, CFQ is normally approximately 2~~,~~ and K(Z) is a function that looks like the one provided in Figure B 3.2.1-1~~, and N(Z) is a value greater than 1.0~~.

$F_Q(Z)$ is approximated by $F_Q^E(z)$ and $F_Q^T(z)$. Thus, both $F_Q^E(z)$ and $F_Q^T(z)$ must meet the preceding limits on $F_Q(Z)$.

An $F_Q^E(Z)$ $\cancel{F_Q^M(Z)}$ evaluation requires obtaining an incore flux map in MODE 1. From the incore flux map results we obtain the measured value of $F_Q(Z)$. Then, the measured value $\cancel{F_Q^M(Z)}$ is increased by 1.03 which is a factor that accounts for fuel manufacturing tolerances and 1.05 which accounts for flux map measurement uncertainty to obtain $F_Q^E(Z)$ (Ref. 4).

INSERT "4"

The FQ(Z) limits define limiting values for core power peaking that precludes peak cladding temperatures above 2200°F during a small break LOCA and assures with a high level of probability that the peak cladding temperature does not exceed 2200°F for large breaks (Ref. 1).

This LCO requires operation within the bounds assumed in the safety analyses. Calculations are performed in the core design process to confirm that the core can be controlled in

(continued)

BASES

LCO (continued)

such a manner during operation that it can stay within the LOCA $F_Q(Z)$ limits. ~~If $F_Q(Z)$ cannot be maintained within the LCO limits, reduction of the core power is required.~~ INSERT "5"

Violating the LCO limits for $F_Q(Z)$ produces unacceptable consequences if a design basis event occurs while $F_Q(Z)$ is outside its specified limits.

APPLICABILITY

The $F_Q(Z)$ limits must be maintained in MODE 1 to prevent core power distributions from exceeding the limits assumed in the safety analyses. Applicability in other MODES is not required because there is either insufficient stored energy in the fuel or insufficient energy being transferred to the reactor coolant to require a limit on the distribution of core power.

ACTIONS

~~A.1~~

~~If $F_Q^M(Z)$ exceeds its specified limits, reducing the AFD limit by ≥ 1% for each 1% by which $F_Q^M(Z)$ exceeds its limit within the allowed Completion Time of 15 minutes, restricts the axial flux distribution such that even if a transient occurred, core peaking factors are not exceeded. The maximum AFD limits initially determined by Required Action A.1 may be affected by subsequent determinations of $F_Q^M(Z)$ and would require AFD reductions with 15 minutes of the $F_Q^M(Z)$ determination, if necessary.~~

A~~.2.1~~

Reducing THERMAL POWER by ≥ 1% RTP for each 1% by which ~~$F_Q^M(Z)$~~ exceeds its limit, maintains an acceptable absolute power density. The percent that ~~$F_Q^M(Z)$~~ exceeds the limit can be determined from:

$F_Q^E(Z)$

$$\left\{\text{maximum over } z \left(\frac{\cancel{F_Q^M(Z)}}{\frac{CFQ\ K(Z)}{P\ \cancel{N(Z)}}}\right) - 1.0\right\} \times 100 \quad \text{for } P > 0.5$$

$$\left\{\text{maximum over } z \left(\frac{\cancel{F_Q^M(Z)}}{\frac{CFQ\ K(Z)}{0.5\ \cancel{N(Z)}}}\right) - 1.0\right\} \times 100 \quad \text{for } P \le 0.5$$

(continued)

BASES

ACTIONS

A~~.2.~~1 (continued)

$F_Q^E(Z)$

~~$F^M_Q(Z)$~~ is the measured $F_Q(Z)$ multiplied by factors accounting for manufacturing tolerances and measurement uncertainties. ~~$F^M_Q(Z)$ is the measured value of $F_Q(Z)$.~~ The Completion Time of 15 minutes provides an acceptable time to reduce power in an orderly manner and without allowing the unit to remain in an unacceptable condition for an extended period of time. The maximum allowable power level initially determined by Required Action A~~.2.~~1 may be affected by subsequent determinations of ~~$F^M_Q(Z)$~~ and would require power reductions within 15 minutes of the ~~$F^M_Q(Z)$~~ determination, if necessary to comply with the decreased maximum allowable power level. Decreases in ~~$F^M_Q(Z)$~~ would allow increasing the maximum allowable power level and increasing power up to this revised limit.

that THERMAL POWER is limited below RTP by Required Action A.1

A~~.2.~~2

A reduction of the Power Range Neutron Flux-High trip setpoints by ≥ 1% for each 1% ~~by which $F^M_Q(Z)$ exceeds its limit~~, is a conservative action for protection against the consequences of severe transients with unanalyzed power distributions. The Completion Time of 72 hours is sufficient considering the small likelihood of a severe transient in this time period and the preceding prompt reduction in THERMAL POWER in accordance with Required Action A~~.2.~~1. The maximum allowable Power Range Neutron Flux-High trip setpoints initially determined by Required Action A~~.2.~~2 may be affected by subsequent determinations of ~~$F^M_Q(Z)$~~ and would require Power Range Neutron Flux-High trip setpoint reductions within 72 hours of the ~~$F^M_Q(Z)$~~ determination, if necessary to comply with the decreased maximum allowable Power Range Neutron Flux-High trip setpoints. Decreases in ~~$F^M_Q(Z)$~~ would allow increasing the maximum allowable Power Range Neutron Flux-High trip setpoints.

A~~.2.~~3

Reduction in the Overpower ΔT trip setpoints (value of K_4) by ≥ 1% (in ΔT span) for each 1% ~~by which $F^M_Q(Z)$ exceeds its limit~~, is a conservative action for protection against the consequences of severe transients with unanalyzed power distributions. The Completion Time of 72 hours is sufficient considering the small likelihood of a severe transient in this time period, and the preceding prompt reduction in THERMAL POWER in accordance with Required Action A~~.2.~~1. The

(continued)

BASES

ACTIONS

A.~~2.~~3 (continued)

maximum allowable Overpower ΔT trip setpoints initially determined by Required Action A.~~2.~~3 may be affected by subsequent determinations of ~~$F_Q^M(Z)$~~ $F_Q^E(Z)$ and would require Overpower ΔT trip setpoint reductions within 72 hours of the ~~$F_Q^M(Z)$~~ determination, if necessary to comply with the decreased maximum allowable Overpower ΔT trip setpoints. Decreases in ~~$F_Q^M(Z)$~~ would allow increasing the maximum Overpower ΔT trip setpoints.

A.~~2.~~4

Verification that ~~$F_Q^M(Z)$~~ has been restored to within its limit, by performing SR 3.2.1.1 and SR 3.2.1.2 prior to increasing THERMAL POWER above the limit imposed by Required Action A.~~2.~~1, ensures that core conditions during operation at higher power levels are consistent with safety analyses assumptions.

INSERT "6"

~~B.1~~

If Required Actions ~~A.1, A.2.1, A.2.2, A.2.3, or A.2.4~~ A.1 through A.4 and B.1 through B.5 are not met within their associated Completion Times, the unit must be placed in a MODE or condition in which the LCO requirements are not applicable. This is done by placing the unit in at least MODE 2 within 6 hours.

This allowed Completion Time is reasonable based on operating experience regarding the amount of time it takes to reach MODE 2 from full power operation in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.2.1.1 ~~is~~ and SR 3.2.1.2 are modified by a Note. It states that during power escalation, THERMAL POWER may be increased until a power level for extended operation has been achieved at which a power distribution map can be obtained. This allowance is modified, however, by one of the Frequency conditions that requires verification that ~~$F_Q^M(Z)$~~ $F_Q(Z)$ is within its specified limit after a power rise of more than 10% RTP over the THERMAL POWER at which it was last verified to be within specified limits. In the absence of this Frequency condition, it is possible to increase power to RTP and operate for 31 days without verification of ~~$F_Q^M(Z)$~~. The Frequency condition is not intended to require verification of these parameters after every 10% increase in power level above the last verification. It only requires

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

verification after a power level is achieved for extended operation that is 10% higher than that power at which F_Q was last measured.

SR 3.2.1.1

INSERT "7"

The nuclear design process includes calculations performed to determine that the core can be operated within the $F_Q(Z)$ limits. Because flux maps are taken in steady state conditions, the variations in power distribution resulting from normal operational maneuvers are not present in the flux map data. These variations are, however, conservatively calculated by considering a wide range of unit maneuvers in normal operation. The maximum peaking factor increase over steady state values, calculated as a function of core elevation, Z, is called N(Z).

$F_Q^T(Z)$

The limit with which ~~$F_Q^M(Z)$~~ is compared varies inversely with power above 50% RTP and N(Z) and directly with a function called K(Z) provided in the COLR.

INSERT "8"

~~Performing this Surveillance in MODE 1 prior to exceeding 75% RTP ensures that the $F_Q^M(Z)$ limit is met when RTP is achieved, because peaking factors generally decrease as power level is increased.~~

If THERMAL POWER has been increased by ≥ 10% RTP since the last determination of ~~$F_Q^M(Z)$~~, another evaluation of this factor is required 12 hours after achieving equilibrium conditions at this higher power level (to ensure that ~~$F_Q^M(Z)$~~ values are being reduced sufficiently with power increase to stay within the LCO limits).

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

Flux map data are taken for multiple core elevations. ~~$F_Q^M(Z)$~~ evaluations are not applicable for the following axial core regions, measured in percent of core height:

a. Lower core region, from 0 to 15% inclusive; and

b. Upper core region, from 85 to 100% inclusive.

BASES

SURVEILLANCE REQUIREMENTS

SR ~~3.2.1.1~~ 3.2.1.2 (continued)

The top and bottom 15% of the core are excluded from the evaluation because of the low probability that these regions would be more limiting in the safety analyses and because of the difficulty of making a precise measurement in these regions.

expressions below are

$F_Q^T(Z)$

This Surveillance has been modified by a Note that may require that more frequent surveillances be performed. An evaluation of the ~~expression below is~~ required to account for any increase to ~~$F_Q^M(Z)$~~ that may occur and cause the ~~$F_Q^M(Z)$~~ limit to be exceeded before the next required ~~$F_Q^M(Z)$~~ evaluation.

INSERT "9"

~~If the two most recent $F_Q^M(Z)$ evaluations show an increase in the expression~~

$$\cancel{\text{maximum over } z \left[\frac{F_Q^M(Z)}{K(Z)}\right],}$$

~~it is required to meet the $F_Q^M(Z)$ limit with the last $F_Q^M(Z)$ increased by the appropriate factor, or to evaluate $F_Q^M(Z)$ more frequently, each 7 EFPD. These alternative requirements prevent $F_Q(Z)$ from exceeding its limit without detection.~~

REFERENCES

1. 10 CFR 50.46.

2. VEP-NFE-2-A, "VEPCO Evaluation of the Control Rod Ejection Transient."

3. UFSAR, Section 3.1.22.

4. VEP-NE-1-A, "VEPCO Relaxed Power Distribution Control Methodology and Associated FQ Surveillance Technical Specifications."

INSERT "4"

$F_Q^E(Z)$ is an excellent approximation for $F_Q(Z)$ when the reactor is at the steady-state power at which the incore flux map was taken.

The expression for $F_Q^T(Z)$ is:

$$F_Q^T(Z) = F_Q^E(Z)\ N(Z)$$

Where: N(Z) is a cycle dependent function that accounts for power distribution transients encountered during normal operation. N(Z) is included in the COLR. The $F_Q^T(Z)$ is calculated as described in Reference 4.

INSERT "5"

If $F_Q^E(Z)$ cannot be maintained within the LCO limits, reduction of core power is required and if $F_Q^T(Z)$ cannot be maintained within the LCO limits, reduction of the AFD limits is also required.

INSERT "6"

B.1

If it is found that the maximum calculated value of $F_Q(Z)$ that can occur during normal maneuvers, $F_Q^T(Z)$, exceeds its specified limits, there exists a potential for $F_Q^E(Z)$ to become excessively high if a normal operational transient occurs. Reducing the AFD Limit by the amount specified in the COLR within the allowed Completion Time of 4 hours, restricts the axial flux distribution such that even if a transient occurred, core peaking factors are not exceeded.

INSERT "6" (Continued)

B.2

If it is found that the maximum calculated value of $F_Q(Z)$ that can occur during normal maneuvers, $F_Q^T(Z)$, exceeds its specified limits, there exists a potential for $F_Q^E(Z)$ to become excessively high if a normal operational transient occurs. Reducing THERMAL POWER by the amount specified in the COLR within the allowed Completion Time of 4 hours, restricts the absolute power density such that even if a transient occurred, core peaking factors are not exceeded. The percent that $F_Q^T(Z)$ exceeds the limit can be determined from:

$$\left\{\textbf{maximum over Z}\left(\frac{F_Q^T(Z)}{\frac{CFQ\ K(Z)}{P}}\right)-1\right\}\ \textbf{x 100 for } P > 0.5$$

$$\left\{\textbf{maximum over Z}\left(\frac{F_Q^T(Z)}{\frac{CFQ\ K(Z)}{0.5}}\right)-1\right\}\ \textbf{x 100 for } P \leq 0.5$$

B.3

A reduction of the Power Range Neutron Flux-High trip setpoints by ≥ 1% for each 1% by which the maximum allowable power is reduced, is a conservative action for protection against the consequences of severe transients with unanalyzed power distributions. The Completion Time of 72 hours is sufficient considering the small likelihood of a severe transient in this time period and the preceding prompt reduction in THERMAL POWER and AFD limits in accordance with Required Actions B.1 and B.2.

B.4

Reduction in the Overpower ΔT trip setpoints (value of K_4) by ≥ 1% for each 1% by which the maximum allowable power is reduced, is a conservative action for protection against the consequences of severe transients with unanalyzed power distributions. The Completion Time of 72 hours is sufficient considering the small likelihood of a severe transient in this time period, and the preceding prompt reduction in THERMAL POWER and AFD limits in accordance with Required Actions B.1 and B.2.

INSERT "6" (Continued)

B.5

Verification that $F_Q^T(Z)$ has been restored to within its limit, by performing SR 3.2.1.1 and SR 3.2.1.2 prior to increasing THERMAL POWER and AFD limits above the maximum allowable power and AFD limits imposed by Required Actions B.1 and B.2 ensures that core conditions during operation at higher power levels and future operation are consistent with safety analyses assumptions.

C.1

INSERT "7"

Verification that $F_Q^E(Z)$ is within its specified limits involves increasing $F_Q(Z)$ to allow for manufacturing tolerance and measurement uncertainties in order to obtain $F_Q^E(Z)$. Specifically, $F_Q^E(Z)$ is the measured value of $F_Q(Z)$ obtained from incore flux map results multiplied by manufacturing and measurement uncertainties (1.05 x 1.03 = 1.0815). $F_Q^E(Z)$ is then compared to its specified limits.

The limit with which $F_Q^E(Z)$ is compared varies inversely with power above 50% RTP and directly with a function called K(Z) provided in the COLR.

Performing this Surveillance in MODE 1 prior to exceeding 75% RTP ensures that the $F_Q^E(Z)$ limit is met when RTP is achieved, because peaking factors generally decrease as power level is increased.

If THERMAL POWER has been increased by ≥ 10% RTP since the last determination of $F_Q^E(Z)$, another evaluation of this factor is required 12 hours after achieving equilibrium conditions at this higher power level (to ensure that $F_Q^E(Z)$ values are being reduced sufficiently with power increase to stay within the LCO limits).

SR 3.2.1.2

INSERT "8"

SR 3.2.1.2 requires a Surveillance of $F_Q^T(Z)$ during the initial startup following each refueling within 12 hours after achieving equilibrium conditions after exceeding 75% RTP. THERMAL POWER levels below 75% are typically non-limiting with respect to the limit for $F_Q^T(Z)$. Also, initial startups following a refueling are slow and well controlled due to startup ramp rate limitations and fuel conditioning requirements. Furthermore, startup physics testing and flux symmetry measurements, also performed at low power, provide confirmation that the core is operating as expected. Consequently, the initial startup following a refueling will not result in non-equilibrium power shapes that could challenge the $F_Q^T(Z)$ limit. This Frequency ensures that verification of $F_Q^T(Z)$ is performed prior to extended operation at high power levels where the maximum permitted peak LHR could be challenged by non-equilibrium operation.

If a previous Surveillance of $F_Q^T(Z)$ was performed at part power conditions (below RTP), SR 3.2.1.2 also requires that $F_Q^T(Z)$ be verified at power levels ≥ 10% RTP above the THERMAL POWER of its last verification within 12 hours after achieving equilibrium conditions. This ensures that $F_Q^T(Z)$ is within its limit using radial peaking factors measured at the higher power level.

INSERT "9"

If the two most recent $F_Q(Z)$ evaluations show that either the

$$\textbf{maximum over Z} \left[\frac{F_Q^E(Z)}{K(Z)}\right]$$

OR

$$\textbf{maximum over Z} \left[\frac{F_Q^T(Z)}{K(Z)}\right],$$

has increased or is expected to increase prior to the next evaluation then it is required to increase the $F_Q^T(Z)$ by the appropriate factor, as specified in the COLR, and verify $F_Q^T(Z)$ is still within limits or evaluate $F_Q(Z)$ every 7 EFPD until SR 3.2.1.2 is satisfied. These alternate requirements prevent $F_Q(Z)$ from exceeding its limit without detection.

B 3.2 POWER DISTRIBUTION LIMITS

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

BASES

BACKGROUND

The purpose of the limits on the values of $F_Q(Z)$ is to limit the local (i.e., pellet) peak power density. The value of $F_Q(Z)$ varies along the axial height (Z) of the core.

$F_Q(Z)$ is defined as the maximum local fuel rod linear power density divided by the average fuel rod linear power density, assuming nominal fuel pellet and fuel rod dimensions. Therefore, $F_Q(Z)$ is a measure of the peak fuel pellet power within the reactor core.

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

During power operation, the global power distribution is limited by LCO 3.2.3, "AXIAL FLUX DIFFERENCE (AFD)," and LCO 3.2.4, "QUADRANT POWER TILT RATIO (QPTR)," which are directly and continuously measured process variables. These LCOs, along with LCO 3.1.6, "Control Bank Insertion Limits," maintain the core limits on power distributions on a continuous basis.

$F_Q(Z)$ varies with fuel loading patterns, control bank insertion, fuel burnup, and changes in axial power distribution.

$F_Q(Z)$ is measured periodically using the incore detector system. These measurements are generally taken with the core at or near steady state conditions.

Using the measured three dimensional power distributions, it is possible to derive a measured value for steady state $F_Q(Z)$, $F_Q^E(Z)$. However, because this value represents a steady state condition, it does not encompass the variations in the value of $F_Q(Z)$ that are present during nonequilibrium situations, such as load changes.

(continued)

BASES

BACKGROUND (continued)

To account for these possible variations, the steady state $F_Q^E(Z)$ is adjusted by an elevation dependent factor that accounts for the calculated worst case transient conditions to derive $F_Q^T(Z)$.

Core monitoring and control under nonsteady state conditions are accomplished by operating the core within the limits of the appropriate LCOs, including the limits on AFD, QPTR, and control rod insertion.

APPLICABLE SAFETY ANALYSES

This LCO precludes core power distributions that violate the following fuel design criteria:

a. During a loss of coolant accident (LOCA), the peak cladding temperature during a small break LOCA must not exceed 2200°F, and there must be a high level of probability that the peak cladding temperature does not exceed 2200°F for the large breaks (Ref. 1);

b. During a loss of forced reactor coolant flow accident, there must be at least 95% probability at the 95% confidence level (the 95/95 DNB criterion) that the hot fuel rod in the core does not experience a departure from nucleate boiling (DNB) condition;

c. During an ejected rod accident, the energy deposition to unirradiated fuel is limited to 225 cal/gm and irradiated fuel is limited to 200 cal/gm (Ref. 2); and

d. The control rods must be capable of shutting down the reactor with a minimum required SDM with the highest worth control rod stuck fully withdrawn (Ref. 3).

Limits on $F_Q(Z)$ ensure that the value of the initial total peaking factor assumed in the accident analyses remains valid. Other criteria must also be met (e.g., maximum cladding oxidation, maximum hydrogen generation, coolable geometry, and long term cooling). However, the peak cladding temperature is typically most limiting.

$F_Q(Z)$ limits assumed in the LOCA analysis are typically limiting relative to (i.e., lower than) the $F_Q(Z)$ limit assumed in safety analyses for other postulated accidents. Therefore, this LCO provides conservative limits for other postulated accidents.

$F_Q(Z)$ satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

BASES

LCO

The Heat Flux Hot Channel Factor, $F_Q(Z)$, shall be limited by the following relationships:

$$F_Q(Z) \le \frac{CFQ\ K(Z)}{P} \quad \text{for } P > 0.5$$

$$F_Q(Z) \le \frac{CFQ\ K(Z)}{0.5} \quad \text{for } P \le 0.5$$

where: CFQ is the $F_Q(Z)$ limit at RTP provided in the COLR,

K(Z) is the normalized $F_Q(Z)$ as a function of core height provided in the COLR and

P is the fraction of RATED THERMAL POWER defined as

$$P = \frac{\text{THERMAL POWER}}{\text{RTP}}$$

The actual values of CFQ and K(Z) are given in the COLR; however, CFQ is normally approximately 2 and K(Z) is a function that looks like the one provided in Figure B 3.2.1-1.

$F_Q(Z)$ is approximated by $F_Q^E(Z)$ and $F_Q^T(Z)$. Thus, both $F_Q^E(Z)$ and $F_Q^T(Z)$ must meet the preceding limits on $F_Q(Z)$.

An $F_Q^E(Z)$ evaluation requires obtaining an incore flux map in MODE 1. From the incore flux map results we obtain the measured value of $F_Q(Z)$. Then, the measured value is increased by 1.03 which is a factor that accounts for fuel manufacturing tolerances and 1.05 which accounts for flux map measurement uncertainty to obtain $F_Q^E(Z)$ (Ref. 4).

$F_Q^E(Z)$ is an excellent approximation for $F_Q(Z)$ when the reactor is at the steady state power at which the incore flux map was taken.

The expression for $F_Q^T(Z)$ is:

$$F_Q^T(Z) = = F_Q^E(Z)\ N(Z)$$

Where: N(Z) is a cycle dependent function that accounts for power distribution transients encountered during normal operation. N(Z) is included in the COLR. The $F_Q^T(Z)$ is calculated as described in Reference 4.

(continued)

BASES

LCO (continued)

The $F_Q(Z)$ limits define limiting values for core power peaking that precludes peak cladding temperatures above 2200°F during a small break LOCA and assures with a high level of probability that the peak cladding temperature does not exceed 2200°F for large breaks (Ref. 1).

This LCO requires operation within the bounds assumed in the safety analyses. Calculations are performed in the core design process to confirm that the core can be controlled in such a manner during operation that it can stay within the LOCA $F_Q(Z)$ limits. If $F_Q^E(Z)$ cannot be maintained within the LCO limits, reduction of core power is required and if $F_Q^T(Z)$ cannot be maintained within the LCO limits, reduction of the AFD limits is also required.

Violating the LCO limits for $F_Q(Z)$ produces unacceptable consequences if a design basis event occurs while $F_Q(Z)$ is outside its specified limits.

APPLICABILITY

The $F_Q(Z)$ limits must be maintained in MODE 1 to prevent core power distributions from exceeding the limits assumed in the safety analyses. Applicability in other MODES is not required because there is either insufficient stored energy in the fuel or insufficient energy being transferred to the reactor coolant to require a limit on the distribution of core power.

ACTIONS

A.1

Reducing THERMAL POWER by ≥ 1% RTP for each 1% by which $F_Q^E(Z)$ exceeds its limit, maintains an acceptable absolute power density. The percent that $F_Q^E(Z)$ exceeds the limit can be determined from:

$$\left\{\text{maximum over } z \left(\frac{F_Q^E(Z)}{\frac{CFQ\ K(Z)}{P}}\right) - 1.0\right\} \times 100 \quad \text{for } P > 0.5$$

$$\left\{\text{maximum over } z \left(\frac{F_Q^E(Z)}{\frac{CFQ\ K(Z)}{0.5}}\right) - 1.0\right\} \times 100 \quad \text{for } P \le 0.5$$

(continued)

BASES

ACTIONS (continued)

A.1 (continued)

$F_Q^E(Z)$ is the measured $F_Q(Z)$ multiplied by factors accounting for manufacturing tolerances and measurement uncertainties. The Completion Time of 15 minutes provides an acceptable time to reduce power in an orderly manner and without allowing the unit to remain in an unacceptable condition for an extended period of time. The maximum allowable power level initially determined by Required Action A.1 may be affected by subsequent determinations of $F_Q^E(Z)$ and would require power reductions within 15 minutes of the $F_Q^E(Z)$ determination, if necessary to comply with the decreased maximum allowable power level. Decreases in $F_Q^E(Z)$ would allow increasing the maximum allowable power level and increasing power up to this revised limit.

A.2

A reduction of the Power Range Neutron Flux—High trip setpoints by ≥ 1% for each 1% that THERMAL POWER is limited below RTP by Required Action A.1, is a conservative action for protection against the consequences of severe transients with unanalyzed power distributions. The Completion Time of 72 hours is sufficient considering the small likelihood of a severe transient in this time period and the preceding prompt reduction in THERMAL POWER in accordance with Required Action A.1. The maximum allowable Power Range Neutron Flux—High trip setpoints initially determined by Required Action A.2 may be affected by subsequent determinations of $F_Q^E(Z)$ and would require Power Range Neutron Flux—High trip setpoint reductions within 72 hours of the $F_Q^E(Z)$ determination, if necessary to comply with the decreased maximum allowable Power Range Neutron Flux—High trip setpoints. Decreases in $F_Q^E(Z)$ would allow increasing the maximum allowable Power Range Neutron Flux—High trip setpoints.

A.3

Reduction in the Overpower ΔT trip setpoints (value of K_4) by ≥ 1% (in ΔT span) for each 1% that THERMAL POWER is limited below RTP by Required Action A.1, is a conservative action

(continued)

BASES

ACTIONS (continued)

A.3 (continued)

for protection against the consequences of severe transients with unanalyzed power distributions. The Completion Time of 72 hours is sufficient considering the small likelihood of a severe transient in this time period, and the preceding prompt reduction in THERMAL POWER in accordance with Required Action A.1. The maximum allowable Overpower ΔT trip setpoints initially determined by Required Action A.3 may be affected by subsequent determinations of $F_Q^E(Z)$ and would require Overpower ΔT trip setpoint reductions within 72 hours of the $F_Q^E(Z)$ determination, if necessary to comply with the decreased maximum allowable Overpower ΔT trip setpoints. Decreases in $F_Q^E(Z)$ would allow increasing the maximum Overpower ΔT trip setpoints.

A.4

Verification that $F_Q^E(Z)$ has been restored to within its limit, by performing SR 3.2.1.1 and SR 3.2.1.2 prior to increasing THERMAL POWER above the limit imposed by Required Action A.1, ensures that core conditions during operation at higher power levels are consistent with safety analyses assumptions.

B.1

If it is found that the maximum calculated value of $F_Q(Z)$ that can occur during normal maneuvers, $F_Q^T(Z)$, exceeds its specified limits, there exists a potential for $F_Q^E(Z)$ to become excessively high if a normal operational transient occurs. Reducing the AFD Limit by the amount specified in the COLR within the allowed Completion Time of 4 hours, restricts the axial flux distribution such that even if a transient occurred, core peaking factors are not exceeded.

B.2

If it is found that the maximum calculated value of $F_Q(Z)$ that can occur during normal maneuvers, $F_Q^T(Z)$, exceeds its specified limits, there exists a potential for $F_Q^E(Z)$ to become excessively high if a normal operational transient occurs. Reducing THERMAL POWER by the amount specified in the COLR within the allowed Completion Time of 4 hours,

(continued)

BASES

ACTIONS (continued)

B.2 (continued)

restricts the absolute power density such that even if a transient occurred, core peaking factors are not exceeded. The percent that $F_Q^T(Z)$ exceeds the limits can be determined from:

$$\left\{ \text{maximum over } Z \left(\frac{\frac{F_Q^T(Z)}{CFQ\ K(Z)}}{P} \right) - 1 \right\} \times 100 \quad \text{for } P > 0.5$$

$$\left\{ \text{maximum over } Z \left(\frac{\frac{F_Q^T(Z)}{CFQ\ K(Z)}}{0.5} \right) - 1 \right\} \times 100 \quad \text{for } P \le 0.5$$

B.3

A reduction of the Power Range Neutron Flux-High trip setpoints by $\geq 1\%$ for each 1% by which the maximum allowable power is reduced, is a conservative action for protection against the consequences of severe transients with unanalyzed power distributions. The Completion Time of 72 hours is sufficient considering the small likelihood of a severe transient in this time period and the preceding prompt reduction in THERMAL POWER and AFD limits in accordance with Required Actions B.1 and B.2.

B.4

Reduction in the Overpower ΔT trip setpoints (value of K_4) by $\geq 1\%$ for each 1% by which the maximum allowable power is reduced, is a conservative action for protection against the consequences of severe transients with unanalyzed power distributions. The Completion Time of 72 hours is sufficient considering the small likelihood of a severe transient in this time period, and preceding prompt reduction in THERMAL POWER and AFD limits in accordance with Required Actions B.1 and B.2.

(continued)

BASES

ACTIONS (continued)

B.5

Verification that $F_Q^T(Z)$ has been restored to within its limit, by performing SR 3.2.1.1 and SR 3.2.1.2 prior to increasing THERMAL POWER and AFD limits above the maximum allowable power and AFD limits imposed by Required Actions B.1 and B.2 ensures that core conditions during operation at higher power levels and future operation are consistent with safety analyses assumptions.

C.1

If Required Actions A.1 through A.4 and B.1 through B.5 are not met within their associated Completion Times, the unit must be placed in a MODE or condition in which the LCO requirements are not applicable. This is done by placing the unit in at least MODE 2 within 6 hours.

This allowed Completion Time is reasonable based on operating experience regarding the amount of time it takes to reach MODE 2 from full power operation in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.2.1.1 and SR 3.2.1.2 are modified by a Note. It states that during power escalation, THERMAL POWER may be increased until a power level for extended operation has been achieved at which a power distribution map can be obtained. This allowance is modified, however, by one of the Frequency conditions that requires verification that $F_Q(Z)$ is within its specified limit after a power rise of more than 10% RTP over the THERMAL POWER at which it was last verified to be within specified limits. In the absence of this Frequency condition, it is possible to increase power to RTP and operate for 31 days without verification of $F_Q(Z)$. The Frequency condition is not intended to require verification of these parameters after every 10% increase in power level above the last verification. It only requires verification after a power level is achieved for extended operation that is 10% higher than that power at which F_Q was last measured.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.2.1.1

Verification that $F_Q^E(Z)$ is within its specified limits involves increasing $F_Q(Z)$ to allow for manufacturing tolerance and measurement uncertainties in order to obtain $F_Q^E(Z)$. Specifically, $F_Q^E(Z)$ is the measured value of $F_Q(Z)$ obtained from incore flux map results multiplied by manufacturing and measurement uncertainties (1.05 x 1.03 = 1.0815). $F_Q^E(Z)$ is then compared to its specified limits.

The limit with which $F_Q^E(Z)$ is compared varies inversely with power above 50% RTP and directly with a function called K(Z) provided in the COLR.

Performing this Surveillance in MODE 1 prior to exceeding 75% RTP ensures that the $F_Q^E(Z)$ limit is met when RTP is achieved, because peaking factors generally decrease as power level is increased.

If THERMAL POWER has been increased by $\geq$ 10% RTP since the last determination of $F_Q^E(Z)$, another evaluation of this factor is required 12 hours after achieving equilibrium conditions at this higher power level (to ensure that $F_Q^E(Z)$ values are being reduced sufficiently with power increase to stay within the LCO limits).

SR 3.2.1.2

The nuclear design process includes calculations performed to determine that the core can be operated within the $F_Q(Z)$ limits. Because flux maps are taken in steady state conditions, the variations in power distribution resulting from normal operational maneuvers are not present in the flux map data. These variations are, however, conservatively calculated by considering a wide range of unit maneuvers in normal operation. The maximum peaking factor increase over steady state values, calculated as a function of core elevation, Z, is called N(Z).

The limit with which $F_Q^T(Z)$ is compared varies inversely with power above 50% RTP and N(Z) and directly with a function called K(Z) provided in the COLR.

SR 3.2.1.2 requires a Surveillance of $F_Q^T(Z)$ during the initial startup following each refueling within 12 hours after achieving equilibrium conditions after exceeding 75%

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.2.1.2 (continued)

RTP. THERMAL POWER levels below 75% are typically non-limiting with respect to the limit for $F_Q^T(Z)$. Also, initial startups following a refueling are slow and well controlled due to startup ramp rate limitations and fuel conditioning requirements. Furthermore, startup physics testing and flux symmetry measurements, also performed at low power, provide confirmation that the core is operating as expected. Consequently, the initial startup following a refueling will not result in non-equilibrium power shapes that could challenge the $F_Q^T(Z)$ limit. This Frequency ensures that verification of $F_Q^T(Z)$ is performed prior to extended operation at high power levels where the maximum permitted peak LHR could be challenged by non-equilibrium operation.

If a previous Surveillance of $F_Q^T(Z)$ was performed at part power conditions (below RTP), SR 3.2.1.2 also requires that $F_Q^T(Z)$ be verified at power levels $\geq$ 10% RTP above the THERMAL POWER of its last verification within 12 hours after achieving equilibrium conditions. This ensures that $F_Q^T(Z)$ is within its limit using radial peaking factors measured at the higher power level.

If THERMAL POWER has been increased by ≥ 10% RTP since the last determination of $F_Q^T(Z)$, another evaluation of this factor is required 12 hours after achieving equilibrium conditions at this higher power level (to ensure that $F_Q^T(Z)$ values are being reduced sufficiently with power increase to stay within the LCO limits).

The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program.

Flux map data are taken for multiple core elevations. $F_Q^T(Z)$ evaluations are not applicable for the following axial core regions, measured in percent of core height:

a. Lower core region, from 0 to 15% inclusive; and

b. Upper core region, from 85 to 100% inclusive.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.2.1.2 (continued)

The top and bottom 15% of the core are excluded from the evaluation because of the low probability that these regions would be more limiting in the safety analyses and because of the difficulty of making a precise measurement in these regions.

This Surveillance has been modified by a Note that may require that more frequent surveillances be performed. An evaluation of the expressions below are required to account for any increase to $F_Q^T(Z)$ that may occur and cause the $F_Q^T(Z)$ limit to be exceeded before the next required $F_Q^T(Z)$ evaluation.

If the two most recent $F_Q(Z)$ evaluations show that either the

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

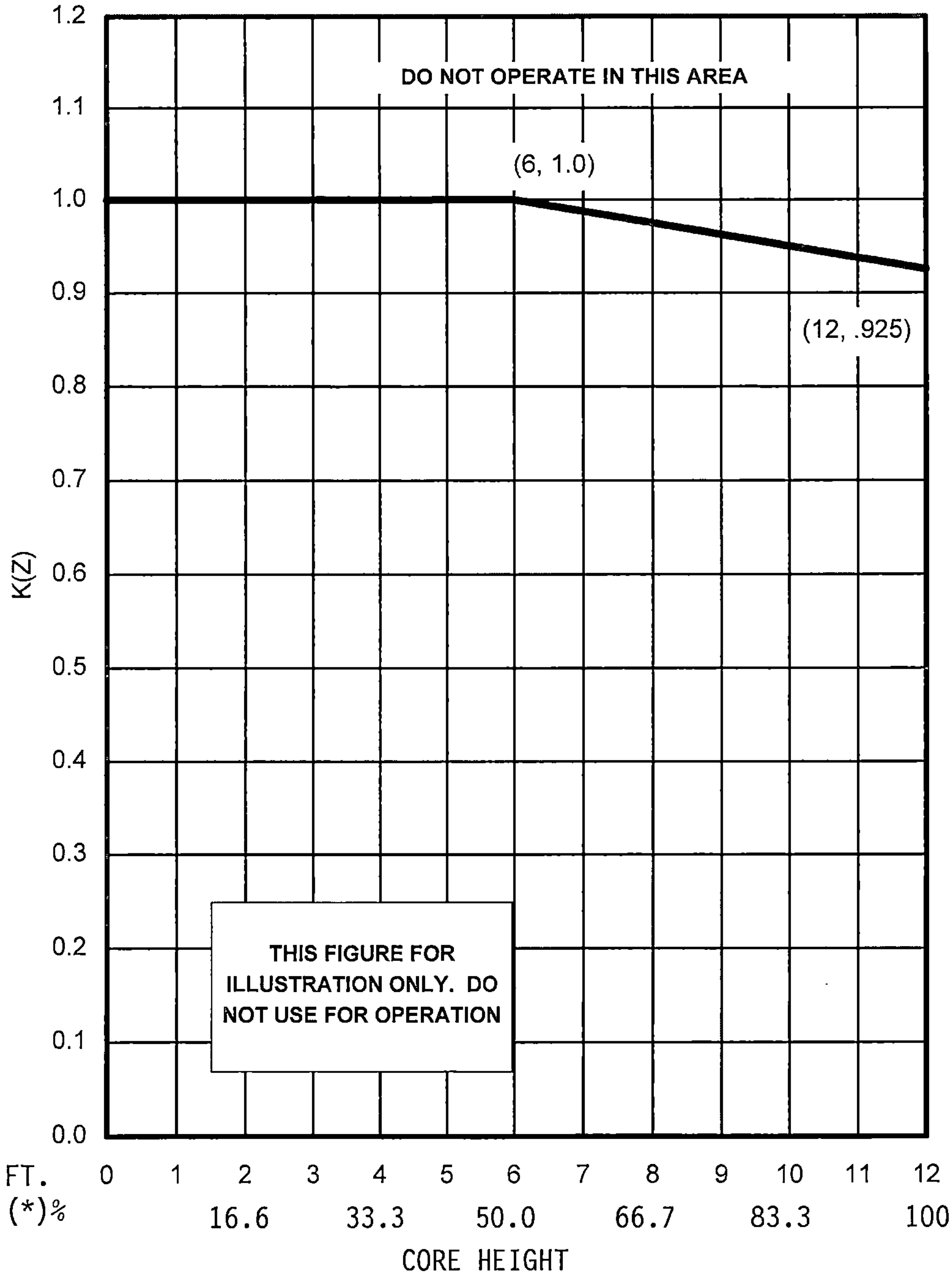
OR

$$\text{maximum over z} \quad \left[\frac{F_Q^T(Z)}{K(Z)}\right],$$

has increased or is expected to increase prior to the next evaluation then it is required to increase the $F_Q^T(Z)$ by the appropriate factor, as specified in the COLR, and verify $F_Q^T(Z)$ is still within limits or evaluate $F_Q(Z)$ every 7 EFPD until SR 3.2.1.2 is satisfied. These alternate requirements prevent $F_Q(Z)$ from exceeding its limit without detection.

REFERENCES

1. 10 CFR 50.46.
2. VEP-NFE-2-A, "VEPCO Evaluation of the Control Rod Ejection Transient."
3. UFSAR, Section 3.1.22.
4. VEP-NE-1-A, "VEPCO Relaxed Power Distribution Control Methodology and Associated FQ Surveillance Technical Specifications."



* FOR CORE HEIGHT OF 12 FEET

Figure B 3.2.1-1 (page 1 of 1)
K(Z)—Normalized $F_Q(Z)$ as a Function of Core Height