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ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Ref 10 CFR 50.90
10 CFR 50.91

Subject: Comanche Peak Nuclear Power Plant (CPNPP)
Docket Nos. 50-445 and 50-446
Non-Voluntary License Amendment Request to Revise Technical Specifications 3.2.1, $F_Q(Z)$, to Implement Methodology from WCAP-17661, Revision 1, "Improved RAOC and CAOC F_Q Surveillance Technical Specifications." LAR 22-001

References:

1. NRC Letter to PWROG, "Verification Letter of the Approval Version of the Pressurized Water Reactor Owners Group Topical Report WCAP-17661, Revision 1, 'Improved RAOC and CAOC FQ Surveillance Technical Specifications,'" dated August 23, 2019 (ML19225D179)

2. WCAP-17661-P-A, Revision 1, "Improved RAOC and CAOC FQ Surveillance Technical Specifications," dated February 2019 (ML19225C079)

3. NUREG-1431, Revision 4, Volume 1, "Standard Technical Specifications Westinghouse Plants, Revision 4.0 Volume 1, Specifications," dated April 2012

4. Westinghouse Nuclear Safety Advisory Letter (NSAL-09-05), Revision 1, "Relaxed Axial Offset Control FQ Technical Specification Actions," dated September 23, 2009

5. Westinghouse Nuclear Safety Advisory Letter (NSAL-15-1), "Heat Flux Hot Channel Factor Technical Specification Surveillance" dated February 3, 2015

Dear Sir or Madam:

Pursuant to 10 CFR 50.90, Vistra Operations Company LLC ("Vistra OpCo") is submitting a request for an amendment to the Technical Specifications (TS) for Comanche Peak, Units 1 and 2. The enclosed license amendment request (LAR) proposes to modify Technical Specification (TS) 3.2.1, "Heat Flux Hot Channel Factor ($F_Q(Z)$)," to implement the methodology in WCAP-17661-P-A, Revision 1, "Improved RAOC and CAOC F_Q Surveillance Technical Specifications," (References 1 and 2). The proposed revised TS 3.2.1 are also consistent with NUREG-1431, Revision 4, "Standard Technical Specifications Westinghouse Plants," (Reference 3). Additionally, this LAR modifies TS 5.6.5.b to include Reference 2 in the list of the Nuclear Regulatory Commission (NRC) approved methodologies used to develop the cycle specific Core Operating Limits Report (COLR).

Nuclear Safety Advisory Letter (NSAL) 09-05, Revision 1, (Reference 4) and NSAL-15-1, (Reference 5) noted there are non-conservatisms in the methodology in Westinghouse Standard TS (STS) 3.2.1B, "Heat Flux Hot Channel Factor (FQ(Z) (RAOC-W(Z) Methodology)," for plants that have implemented the Relaxed Axial Offset Control (RAOC) methodology. Therefore, in accordance with the guidance in NRC Administrative Letter 98-10, "Dispositioning of Technical Specifications that are Insufficient to Assure Plant Safety," this LAR is required to resolve non-conservative TS and is not a voluntary request from a licensee to change its licensing basis. Therefore, this request is not subject to "forward fit" considerations as described in the letter from S. Burns (NRC) to E. Ginsberg (NEI), dated July 14, 2010 (ML101960180). Vistra OpCo has implemented compensatory measures in accordance with References 4 and 5.

The enclosure to this submittal provides a description and assessment of the proposed change, including technical analyses, regulatory analyses, environmental considerations, and Vistra OpCo's determination that the proposed changes involve no significant hazards. Attachment 1 to the Enclosure provides markup pages of TS to show the proposed change. Attachment 2 to the Enclosure provides retyped TS pages. Attachment 3 to the Enclosure provides the TS Bases markups. Changes to the TS Bases are provided for information only and will be implemented under the Technical Specification Bases Control Program.

The changes in this LAR are not required to address an immediate safety concern. Vistra OpCo requests approval of this non-voluntary LAR within one year of completion of the NRC's acceptance review. Due to the core design and safety analysis evaluation needed to support each core design using the methodology in WCAP-17661-P-A, Revision 1, implementation of this amendment for each unit will be prior to Mode 4 entry for CPNPP Unit 2 Cycle 22 (Fall 2024) and CPNPP Unit 1 Cycle 25 (Spring 2025). CPNPP Unit 2 Cycle 22 is currently planned to begin in November 2024 and CPNPP Unit 1 cycle 25 is currently planned to begin in May 2025.

There are no new regulatory commitments made in this submittal.

In accordance with 10 CFR 50.91, a copy of this application, with attachments, is being provided to the designated State of Texas Official.

Should you have any questions, please contact Nic Boehmisch at (254) 897-5064 or nicholas.boehmisch@luminant.com.

I state under penalty of perjury that the foregoing is true and correct.

Executed on November 21, 2022.

Sincerely,

Steven K. Sewell

Steven K. Sewell

Enclosure: Description and Assessment

Attachments:
1. Technical Specification Markup
2. Technical Specification Retyped Pages
3. Proposed Technical Specification Bases Changes (information only)

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License Amendment Request (LAR) 22-001 Application to Adopt WCAP-17661, Improved RAOC and CAOC F_Q Surveillance Technical Specifications (TS) for TS 3.2.1, Heat Flux Hot Channel ($F_Q(Z)$) (RAOC-W(Z) Methodology)

Enclosure 1

DESCRIPTION and ASSESSMENT

1.0 SUMMARY DESCRIPTION

In accordance with the provisions of Title 10 of the Code of Federal Regulations (10 CFR) 50.90, "Application for amendment of license, construction permit, or early site permit," Vistra Operations Company LLC (Vistra OpCo) is requesting a license amendment to the Comanche Peak Nuclear Power Plant (CPNPP) Unit 1 and Unit 2 Technical Specifications (TS) 3.2.1, “Heat Flux Hot Channel Factor (F_Q(Z)) (RAOC-W(Z) Methodology),” to implement the improved F_Q Surveillance TS methodology. This license amendment request (LAR) proposes to revise CPNPP Units 1 and 2 TS 3.2.1, “Heat Flux Hot Channel Factor (F_Q(Z)) (RAOC-W(Z) Methodology),” to implement the methodology in WCAP-17661-P-A, Revision 1, “Improved RAOC and CAOC FQ Surveillance Technical Specifications,” (References 1 and 2), with deviations to the Condition B Required Action Completion Times.

No changes to the CPNPP Final Safety Analysis Report are anticipated as a result of this License Amendment Request.

2.0 DETAILED DESCRIPTION

2.1 Background

The purpose of the F_Q Surveillance TS is to provide assurance that the heat flux hot channel factor F_Q(Z), will remain within the limits assumed in the plant safety analyses when the core is operated within its allowed operating space. Key operating space limits include Rated Thermal Power (RTP), control bank Rod Insertion Limits (RILs), and Axial Flux Difference (AFD) limits. Together, these operating space limits restrict the range of potential non-equilibrium core power shapes during normal operation, thereby limiting the maximum non-equilibrium F_Q(Z).

The current F_Q Surveillance formulation relies on a combination of analytical factors and periodic measurements to provide assurance that core operation within the allowed operating space will be acceptable. When an F_Q surveillance is performed, the equilibrium F_Q(Z) is measured at or near steady-state conditions. F_Q(Z) is then multiplied by an analytical factor, W(Z), which characterizes the increase in F_Q(Z) for non-equilibrium operation. The result, when uncertainties are included, is the maximum postulated transient F_Q(Z), which is then compared to the F_Q(Z) limit.

The above formulation has been shown to be problematic for Relaxed Axial Offset Control (RAOC) plants. The accuracy of the analytically derived W(Z) value is sensitive to how well the surveillance axial power shape is predicted. While the predicted axial power shape can be inaccurate under nominal full power conditions, the accuracy of predicting the axial power shape for part-power surveillances is even more problematic. Additionally, the current Required Action of CPNPP Units 1 and 2 TS 3.2.1, to reduce the AFD limits if the transient F_Q (F_Q^W(Z)) limit is not met, may be insufficient to ensure that the peaking factor basis assumed in the licensing basis analysis is maintained under all conditions.

Nuclear Safety Advisory Letters (NSAL) 09-5 (Reference 3) and NSAL-15-1 (Reference 4) document specific issues with regards to these general problems with the current TS. Reference 3 notified Westinghouse customers of an issue associated with the Required Actions for Condition B of Standard TS (STS) 3.2.1B, "Heat Flux Hot Channel Factor (F_Q(Z) (RAOC-W(Z) Methodology)" for plants that have implemented the RAOC methodology. In certain situations where transient F_Q^W(Z) is not within its limit, the existing Required Actions may be insufficient to restore F_Q^W(Z) to within its limit. Reference 3 provided clarification regarding the applicability of the recommended interim actions to address this issue in accordance with NRC Administrative Letter (AL) 98-10, "Dispositioning of Technical Specifications That Are Insufficient to Assure Plant Safety."

Reference 4 notified Westinghouse customers of an issue associated with STS 3.2.1B and 3.2.1C (Heat Flux Hot Channel Factor (F_Q(Z)). Specifically, STS Surveillance Requirement (SR) 3.2.1.2 in STS 3.2.1B and 3.2.1C may not ensure that the transient F_Q meets the limiting condition for operation (LCO) limit between the performance of the 31 effective full power days (EFPD) flux map measurements, under some conditions, for those plants that use the W(Z) F_Q surveillance methodology.

The improved F_Q surveillance methodology in Reference 2 resolves the above issues. The new surveillance methodology requires the measurement of F_{XY}(Z), which is then multiplied by factors that characterize the maximum transient P(Z) values postulated to occur during non-equilibrium operation. This formulation essentially eliminates the sensitivity of the surveillance to the surveillance axial power shape. Additionally, the improved F_Q surveillance methodology incorporates various RAOC operating spaces, consisting of combinations of control bank rod insertion, AFD, and thermal power limits that provides sufficient F_Q margin for future operation.

2.2 Description of Proposed Change

The current Technical Specification proposed to be changed is Limiting Condition for Operation (LCO), 3.2.1, Heat Flux Hot Channel (FQ(Z)) (RAOC-W(Z) Methodology).

The LAR proposes changes to CPNPP Unit 1 and Unit 2 TS 3.2.1 that implement the methodology and TS changes in Reference 2 with deviations to the Condition B Required Action Completion Times. Further description of the proposed changes is provided in Section 3.2 of this enclosure.

Attachment 1 of this enclosure provides the existing CPNPP Units 1 and 2 TS pages marked-up to show the proposed changes. Attachment 2 of this enclosure provides the existing CPNPP Units 1 and 2 TS pages retyped to show the proposed changes. Attachment 3 to this enclosure provides the existing CPNPP Units 1 and 2 TS Bases pages marked-up to show the proposed changes. Changes to the existing TS Bases are provided "for information only" and will be implemented under the Technical Specification Bases Control Program.

As CPNPP is a dual unit plant, each unit will implement the proposed change during a refueling outage. So, the current LCO 3.2.1 will be labeled as LCO 3.2.1A and the improved LCO to be implemented will be labeled as LCO 3.2.1B. Once the changes are completed on both units a license amendment request will be submitted to delete LCO 3.2.1A and re-label LCO 3.2.1B as LCO 3.2.1.

2.3 Reason for Proposed Change

The proposed LAR is requested to resolve issues discussed in References 3 and 4 and align the CPNPP Units 1 and 2 TS with the STS changes in Reference 2. The new F_Q formulation will remove the surveillance sensitivity to the predicted axial power shapes and remove any potential non-conservatism in TS 3.2.1.

3.0 TECHNICAL EVALUATION

3.1 Process Parameter Limitations

3.1.1 Heat Flux Hot Channel Factor - $F_Q(Z)$

$F_Q(Z)$ is defined as the maximum local fuel rod linear power density divided by the average fuel rod linear power density and is a measure of the peak fuel pellet power within the reactor core. The values of F_Q vary along the axial height (Z) of the core. $F_Q(Z)$ also varies with fuel loading patterns, control bank insertion, fuel burnup, and changes in axial power distribution. The purpose of the limits on the values of $F_Q(Z)$ is to limit the local (i.e. pellet) peak power density.

$F_Q(Z)$ is measured periodically using either the movable incore detector system (MIDS) or the power distribution monitoring system (PDMS). Because these measurements are generally taken with the core at or near equilibrium conditions, the measured $F_Q(Z)$ does not include the variations which would be present during non-equilibrium situations, such as load following or power ascension.

To account for these possible variations, the equilibrium values of $F_Q(Z)$ are adjusted by elevation dependent factors that account for the expected maximum values postulated to occur during RAOC operation.

The proposed changes to TS 3.2.1 involve a re-formulation of these elevation dependent factors, designated as $[T(Z)]^{COLR}$. The proposed TS 3.2.1 incorporates various RAOC Operation Spaces (ROS) that define the corresponding elevation dependent factors, $[T(Z)]^{COLR}$. Each ROS is composed of corresponding COLR limits associated with TS 3.2.3, “AXIAL FLUX DIFFERENCE (AFD),” and TS 3.1.7, “CONTROL BANK Insertion Limits,” assumed in the calculation of each particular $[T(Z)]^{COLR}$ function.

3.1.2 Axial Flux Difference - AFD

The purpose of TS 3.2.3 is to establish limits on the values of AFD in order to limit the amount of axial power distribution skewing to either the top or bottom of the core. By limiting the amount of power distribution skewing, core peaking factors are consistent with the assumption used in the safety analyses. Limiting power distribution skewing over time also minimizes the xenon distribution skewing, which is a significant factor in axial power distribution control.

AFD is the difference in normalized flux signals between the top and bottom halves of a two-section excore neutron detector. AFD is a measure of the axial power distribution skewing to either the top or bottom half of the core. AFD is sensitive to many core related parameters such as control bank positions, core power level, axial burnup, axial xenon distribution, and, to a lesser extent, reactor coolant temperature and boron concentration.

The allowed range of AFD is used in the nuclear design process to confirm that operation within these limits produces core peaking factors and axial power distributions that meet safety analysis requirements. The limits on AFD ensure that $F_Q(Z)$ is not exceeded during either normal operation or in the event of xenon redistribution following power changes. The limits on AFD also restrict the range of power distributions that are used as initial conditions in the analyses of Condition II, III, or IV events as described in Chapter 15 of the CPNPP dual unit Final Safety Analysis Report.

RAOC, as described in WCAP-10216-P-A, Revision 1A, “Relaxation of Constant Axial Offset Control/FQ Surveillance Technical Specification,” (Reference 8), is a calculational procedure that defines the allowed operational space of the AFD versus THERMAL POWER. AFD limits are selected by considering a range of axial xenon distributions that may occur as a result of large variations of AFD. Subsequently, power peaking factors and power distributions are examined to ensure that the loss of coolant accident (LOCA), loss of flow accident, and anticipated transient limits are met. Violation of the AFD limits invalidates the conclusions of the accident and transient analyses with regard to fuel cladding integrity.

The RAOC methodology establishes a xenon distribution library with tentatively wide AFD limits. One dimensional axial power distribution calculations are then performed to demonstrate that normal operation power shapes are acceptable for LOCA and loss of flow accident and for initial conditions of anticipated transients. The tentative limits are adjusted as necessary to meet the safety analysis requirements.

3.1.3 Control Bank Insertion Limits

The insertion of the control rods directly affects core power and fuel burnup distributions and assumptions of available ejected rod worth, shutdown margin (SDM), and initial reactivity insertion rate. RILs are established and rod positions are monitored against the RILs and controlled during power operation to ensure that the power distribution and reactivity limits defined by the design power peaking and SDM limits are preserved.

The rod cluster control assemblies (RCCAs) are divided among control banks and shutdown banks. Each bank may be further subdivided into two groups to provide for precise reactivity control (shutdown banks C, D, and E have only one group each). A group consists of two or more RCCAs that are electrically paralleled to step simultaneously. Except for shutdown banks C, D, and E a bank of RCCAs consists of two groups that are moved in a staggered fashion, but always within one step of each other. There are four control banks and five shutdown banks. TS 3.1.4, “Rod Group Alignment Limits” requires that any individual rod shall be within 12 steps of their group step counter demand position.

TS 3.1.5, “Shutdown Bank Insertion Limits” requires each shutdown bank to be within the insertion limits as specified in the COLR. TS 3.1.6, “Control Bank Insertion Limits” requires the control banks to be within the insertion, sequence, and overlap limits as specified in the COLR. The control banks are operated in sequence by withdrawal of Bank A, Bank B, Bank C, and then Bank D. The control banks are sequenced in reverse order upon insertion.

Overlap is the distance travelled together by two control banks. Upon initiation of control bank withdrawal, control bank A is withdrawn by itself. At a predetermined position, control bank B begins withdrawing, resulting in both banks withdrawing simultaneously until control bank A is fully withdrawn. Control bank B will continue withdrawing until, at a subsequent predetermined position, control bank C begins withdrawing. This process continues until control bank D is fully withdrawn or the demand for rod withdrawal ceases. As such, each bank’s overlap is the number of steps that each bank travelled from the following bank’s predetermined position to the fully withdrawn position.

The power density at any point in the core must be limited so that the fuel design criteria are maintained. Together, TS 3.1.4, “Rod Group Alignment Limits,” TS 3.1.5, “Shutdown Bank Insertion Limits”, TS 3.1.6, “Control Bank Insertion Limits”, TS 3.2.3, “AXIAL FLUX DIFFERENCE (AFD) (Relaxed Axial Offset Control (RAOC) Methodology)” and TS 3.2.4, “QUADRANT POWER TILT RATIO (QPTR),” provide limits on control component operation and on monitored process variables, which ensure that the core operates within the fuel design criteria. The alignment limits, shutdown and control bank insertion limits, AFD, and QPTR are process variables that together characterize and control the three dimensional power distribution of the reactor core.

3.2 Evaluation of Proposed TS Change

The CPNPP Unit 1 and Unit 2 TS 3.2.1 will differ due to implementing the proposed change during a refueling outage on each unit. The CPNPP Unit 1 TS 3.2.1 (TS 3.2.1A) reflects the original RAOC methodology contained in Reference 8. The CPNPP Unit 2 TS 3.2.1 (TS 3.2.1B) will reflect the improved RAOC F_Q Surveillance Technical Specifications contained in Reference 9 and will be implemented prior to Unit 1.

The inputs to formulations for determining $F_Q^W(Z)$ on CPNPP Units 1 and 2 may be obtained using the Power Distribution Monitoring System (PDMS) or the Movable Incore Detector System (MIDS).

3.2.1 TS 3.2.1

The title of the TS is changed from;

3.2.1 Heat Flux Hot Channel Factor ($F_Q(Z)$ (RAOC-W(Z) Methodology))

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

to;

3.2.1A Heat Flux Hot Channel Factor ($F_Q(Z)$ (RAOC-W(Z) Methodology))

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

for Unit 1, and to;

3.2.1B Heat Flux Hot Channel Factor ($F_Q(Z)$ (RAOC-T(Z) Methodology)

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

for Unit 2.

A note is added to the APPLICABILITY of LCO 3.2.1A specifying that "This LCO is only applicable to Unit 1 Cycle 24." This amendment will be implemented in Unit 2 prior to implementation in Unit 1, which is scheduled to occur during Unit 1 Cycle 24.

A note is added to the APPLICABILITY of LCO 3.2.1B specifying that "This LCO is NOT applicable to Unit 1 Cycle 24." This amendment will be implemented in Unit 2 first, and then in Unit 1, after Unit 1 Cycle 24.

Limiting Condition for Operation (LCO)

While the LCO is essentially unchanged, the underlying formulation of the approximation, $F_Q^W(Z)$, is changed.

For CPNPP, input to the formulations may come from the Power Distribution Monitoring System (PDMS) or the Moveable Incore Detector System (MIDS).

The current formulations for $F_Q^W(Z)$ are:

$$F_Q^C(Z) = F_Q^M(Z) \bullet 1.03 \bullet 1.05$$

$$F_Q^W(Z) = F_Q^C(Z) \bullet W(Z)$$

where;

$F_Q^M(Z)$ is the measured value of $F_Q(Z)$ obtained from PDMS or MIDS results, and

W(Z) is a cycle dependent function that accounts for power distribution transients during normal operations. W(Z) is included in the COLR.

The new formulations for $F_Q^W(Z)$ are:

$F_Q^C(Z) = F_Q^M(Z)$ [1.0815]

$F_Q^W(Z) = F_{XY}^M(Z)[T(Z)]^{COLR}/P \bullet A_{XY}(Z) \bullet Rj \bullet [1.0815]$ for P>0.5

$F_Q^W(Z) = F_{XY}^M(Z)[T(Z)]^{COLR}/0.5 \bullet A_{XY}(Z) \bullet Rj \bullet [1.0815]$ for P≤0.5

where;

[1.0815] is a factor that accounts for fuel manufacturing tolerances and flux map measurement uncertainty,

$F_{XY}^M(Z)$ is the measured radial peaking factor at axial location Z and is equal to the value of $F_Q^M(Z)/P^M(Z)$, where $P^M(Z)$ is the measured core average axial power shape,

$[T(Z)]^{COLR}$ is the cycle and burnup dependent function specified in the COLR which accounts for power distribution transients encountered during non-equilibrium normal operation,

P is the THEMAL POWER/RTP,

$A_{XY}(Z)$ is a function that adjusts the $F_Q^W(Z)$ Surveillance for differences between the reference core condition assumed in generating the $[T(Z)]^{COLR}$ function and the actual core condition when the Surveillance is performed, and

Rj is a cycle and burnup dependent analytical factor specified in the COLR that accounts for potential increases in $F_Q^W(Z)$ between Surveillances. Rj values are provided for each RAOC operating space.

In the new formulations, the measured parameter is $F_{XY}(Z)$, is the planar peaking factor. The new factor, $A_{XY}(Z)$, accounts for differences between the reference and surveillance conditions. The newly defined factor, Rj, is used to account for the expected decrease in margin due to operation over the allowed period of time before the next performance of SR 3.2.1.2. This factor exists in the current TS as the “appropriate factor specified in the COLR” in the Note to SR 3.2.1.2. The factor, W(Z), is replaced by the new factor, $[T(Z)]^{COLR}$. $[T(Z)]^{COLR}$ values are provided for each RAOC operating space. This new formulation reduces the sensitivity of the $F_Q^W(Z)$ evaluation to the prediction of the axial power shape at the time of the surveillance.

<u>Condition A - $F_Q^C(Z)$ not within limit.</u>

For TS 3.2.1A, the current NOTE in Condition A will be unchanged, “Required Action A.4 shall be completed whenever this Condition is entered.”

For TS 3.2.1B, the current NOTE in Condition A will be revised to, “Required Action A.4 shall be completed whenever this Condition is entered prior to increasing THERMAL POWER above the limit of Required Action A.1. 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."

Required Action A.2

For TS 3.2.1A, the current Required Action A.2 will be unchanged, "Reduce Power Range Neutron Flux - High trip setpoints $\geq$ 1% for each 1% $F_Q^C(Z)$ exceeds the limit."

For TS 3.2.1B, the current Required Action A.2 will be revised to, "Reduce Power Range Neutron Flux - High trip setpoints $\geq$ 1% for each 1% that THERMAL POWER is limited below RATED THERMAL POWER by Required Action A.1."

Required Action A.3

For TS 3.2.1A, the current Required Action A.3 will be unchanged, "Reduce Overpower N-16 trip setpoints $\geq$ 1% for each 1% $F_Q^C(Z)$ exceeds the limit."

For TS 3.2.1B, the current Required Action A.3 will be revised to, "Reduce Overpower N-16 trip setpoints $\geq$ 1% for each 1% that THERMAL POWER is limited below RATED THERMAL POWER by Required Action A.1."

Condition B - $F_Q^W(Z)$ not within limits.

For TS 3.2.1A, the current NOTE in Condition B will be unchanged, "Required Action B.4 shall be completed whenever this Condition is entered."

For TS 3.2.1B, the current NOTE in Condition B will be deleted.

Required Action B.1

For TS 3.2.1A, Required Action will be unchanged.

For TS 3.2.1B, Required Action B.1 is replaced by Required Actions B.1.1 and B.1.2.

B.1.1 Implement a RAOC operating space specified in the COLR that restores $F_Q^W(Z)$ to within its limits.

AND

B.1.2 Perform SR 3.2.1.1 and SR 3.2.1.2 if control rod motion is required to comply with the new operating space.

OR

Required Actions B.2, B.3, and B.4

For TS 3.2.1A, Required Actions will be unchanged.

For TS 3.2.1B, Required Actions B.2, B.3, and B.4 are replaced by Required Actions B.2.1, B.2.2, B.2.3, and B.2.4.

B.2.1 ---NOTE---
Required Action B.2.4 shall be completed whenever Required Action B.2.1 is performed prior to increasing THERMAL POWER above the limit of Required Action B.2.1.

Limit THERMAL POWER to less than RATED THERMAL POWER and reduce AFD limits as specified in the COLR.

AND

B.2.2 Reduce Power Range Neutron Flux - High trip setpoints ≥ 1% for each 1% that THERMAL POWER is limited below RATED THERMAL POWER by Required Action B.2.1.

AND

B.2.3 Reduce Overpower N-16 trip setpoints ≥ 1% for each 1% that THERMAL POWER is limited below RATED THERMAL POWER by Required Action B.2.1.

AND

B.2.4 Perform SR 3.2.1.1 and SR 3.2.1.2.

Condition B Completion Times

For TS 3.2.1A, Completion Times will be unchanged.

For TS 3.2.1B, Completion Times will be;

Required Action B.1.1 - 4 hours

Required Action B.1.2 - 72 hours

Required Action B.2.1 - 4 hours after each $F_Q^W(Z)$ determination

Required Action B.2.2 - 72 hours after each $F_Q^W(Z)$ determination

Required Action B.2.3 - 72 hours after each $F_Q^W(Z)$ determination

Required Action B.2.4 - Prior to increasing THERMAL POWER above the limit of Required Action B.2.1

The completion Times for Required Actions B.2.1, B.2.2, and B.2.3 contain a deviation from those contained in Reference 2. They include the phrase “after each $F_Q^W(Z)$ determination.” This additional phrase has been included with these Completion Times since the THERMAL POWER initially determined by Required Action B.2.1 may be affected by subsequent determinations of $F_Q^W(Z)$ that are not within limit when Required Action B.2.4 is performed and could require additional power reductions within 4 hours of the subsequent $F_Q^W(Z)$ determination, if necessary to comply with the decreased THERMAL POWER limit. The addition of the phrase “after each $F_Q^W(Z)$ determination” to the Completion Times for Required Action B.2.1, B.2.2, and B.2.3 ensures they apply after each subsequent determination of $F_Q^W(Z)$ during performance of Required Action B.2.4, similar to the phrase “$F_Q^C(Z)$ determination” that is contained in the Completion Times for Required Actions A.1, A.2, and A.3 associated with $F_Q^C(Z)$ in Reference 2. The TS Bases for Required Actions B.2.1, B.2.2, and B.2.3 have been updated to include the reason for the inclusion of the phrase “after each $F_Q^W(Z)$ determination.”

<u>Surveillance Requirements</u>

For TS 3.2.1A, the NOTE prior to SR 3.2.1.1 will be unchanged.

For TS 3.2.1B, the NOTE prior to SR 3.2.1.1 will be deleted.

<u>SR 3.2.1.2</u>

For TS 3.2.1A, the NOTE in SR 3.2.1.2 will be unchanged.

For TS 3.2.1B, the NOTE in SR 3.2.1.2 will be deleted.

<u>SR 3.2.1.2 Frequency</u>

For TS 3.2.1A, the frequencies in SR 3.2.1.2 will be unchanged.

For TS 3.2.1B, the frequency stated prior to the first <u>AND</u> will be,
Once after each refueling within 24 hours after THERMAL POWER exceeds 75% RTP.

For TS 3.2.1B, the frequency stated prior to the second <u>AND</u> will be,
Once within 24 hours after achieving equilibrium conditions after exceeding, by $\geq$ 20% RTP, the THERMAL POWER at which $F_Q^W(Z)$ was last verified.

3.2.2 Approval Limitations

In Reference 9, the NRC stipulated two limitations for the implementation of the proposed Technical Specifications.

<u>Limitation 1: Use of A_{XY} and A_Q (NOTE: Only A_{XY} is included, since A_Q is not applicable to RAOC)</u>

Methods 1 and 2, described below, are acceptable for calculating A_{XY} when performing RAOC W(Z) surveillances, subject to the following limitations:

Method 1: $A_{XY}(Z)$ is Unity

The current F_Q Surveillance formulation makes no adjustment in the radial peaking factors when the surveillance conditions differ from the reference conditions. This has not led to frequent or significant margin issues. Consequently, assuming that $A_{XY}(Z)$ = 1.0 is a reasonable option that will in all likelihood result in conservative surveillances for off-nominal conditions. Setting $A_{XY}(Z)$ = 1.0 is a viable option and the simplest one. This will be the default option presented in the COLR; that is, if explicit values for $A_{XY}(Z)$ or its sub-factors are not determined via other methods.

Method 2: Direct Calculation of $A_{XY}(Z)$ for the Surveillance Condition

First $A_{XY}(Z)$ is determined directly through two core calculations: one at the reference conditions assumed for the COLR T(z) factors, e.g., HFP, ARO, EQXE, and a second at the actual surveillance conditions, which may have a reduced power level and some lead control bank insertion. Since surveillances are typically performed at or near equilibrium conditions, equilibrium xenon may be assumed in this second calculation for simplicity.

Newer methods with similar capabilities may be considered acceptable provided the NRC staff specifically approves them for calculating A_{XY} factors.

1. *The NRC-approved methods provided must be used to perform the surveillance-specific A_{XY} calculations.*
2. *The depletion calculation used to determine the numerator and denominator of the A_{XY} factor must be performed similarly to the original design calculation.*

Vistra OpCo Response

WCAP-17661-P-A and the Technical Specification Bases are revised to limit the methods to calculate A_{XY} to Methods 1 and 2. Method 1 sets $A_{XY}(Z)$ to 1.0. Method 2 calculates $A_{XY}(Z)$ for the conditions existing at the time of the surveillance. The NRC approved methods are Advanced Nodal Code (ANC) and Best Estimate Analysis of Core Operations (BEACON), which use the same neutronic methodology as the design ANC model that was used as the base model for calculating the F_Q surveillance factors. There are no plans at this time to add an additional method to calculate the $A_{XY}(Z)$ values but doing so would require a revision to the TS, which would require NRC approval.

When BEACON is used to calculate surveillance condition specific $A_{XY}(Z)$ values, the calculation will be performed without using nodal calibration factors and the core depletion assumptions will be the same as used in the original core model to generate the T(Z) factors.

When ANC is used to calculate the surveillance condition specific $A_{XY}(Z)$ values, the calculation will use the same nuclear model and depletion basis that was used to generate the original T(Z) factors.

Limitation 2: Power Level Reduction to 50 Percent RTP

The use of 50 percent as the final power level reduction in the event of a failed F_Q

surveillance is not included in TS 3.2.1 but is included in the TS Bases and the COLR. The final power level of 50 percent must be implemented on a plant specific basis and included in the COLR input generated using this methodology.

Vistra OpCo Response

WCAP-17661-P-A provides sample COLR input, which specifies 50% RTP as the final power level reduction in the event of a failed FQ surveillance. All COLR input for CPNPP Units 1 and 2 fuel cycles will also specify 50% RTP as the final power level reduction in the event of a failed F_Q surveillance.

3.3 Conclusions

This evaluation concludes that the changes to the $F_Q(Z)$ surveillance methodology in TS 3.2.1, to implement the methodology in Reference 9, are acceptable. The changes provide a more robust means of performing the $F_Q^W(Z)$ surveillance. A bounding RAOC Operating Space (ROS), selected from a set of previously evaluated ROSs, is implemented if $F_Q^W(Z)$ does not meet the $F_Q(Z)$ limit. The SRs and Required Actions are more clearly defined. The changes also provide reasonable assurance that a core operated in accordance with the new requirements will remain within the power distribution limits assumed in the safety analyses.

4.0 REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements

General Design Criteria

CPNPP Units 1 and 2 were designed to meet the intent of the "Proposed General Design Criteria for Nuclear Power Plant Construction Permits" published in July 1967. The CPNPP construction permit was issued in January 1973. The dual-unit UFSAR, however, addresses the NRC General Design Criteria (GDC) published as Appendix A to 10 CFR 50 in July 1971, including Criterion 4 as amended October 27, 1987.

Each criterion listed below is followed by a discussion of the design features and procedures that meet the intent of the criteria.

Criterion 10 - Reactor Design

“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 conditions of normal operation, including the effects of anticipated operational occurrences.”

Conformance with GDC 10 is described in Section 3.1.2.1 of the CPNPP FSAR. 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.

The reactor core and associated coolant, control, and protection systems are designed with adequate margins to do the following:

1. To preclude significant fuel damage during normal core operation and operational transients (Condition I)[a] or during transient conditions arising from occurrences of moderate frequency (Condition II).[a]

2. To ensure return of the reactor to a safe state following infrequent faults (Condition III)[a] with only a small fraction of fuel rods damaged, although sufficient fuel damage can occur to preclude resumption of operation without considerable outage time.

3. To ensure that the core is intact, with acceptable heat transfer geometry, following transients arising from occurrences of limiting faults (Condition IV).[a]

CPNPP FSAR Chapter 4 discusses the design bases and design evaluation of reactor components, including the fuel, reactor vessel internals, and reactivity control systems. Details of the control and protection systems instrumentation design and logic are discussed in CPNPP FSAR Chapter 7. This information supports the accident analyses of FSAR Chapter 15, which show that the acceptable fuel design limits are not exceeded for Condition I and II occurrences.

(a) Defined by ANSI N18.2-1973

<u>Criterion 13 - Instrumentation and Control</u>

“Instrumentation and control shall be provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions as appropriate to assure adequate safety, including those variables and systems that can affect the fission process, the integrity of the reactor core, the reactor coolant pressure boundary, and the containment and its associated systems. Appropriate controls shall be provided to maintain these variables and systems within prescribed operating ranges.”

To ensure adequate safety, instrumentation and control systems are provided to monitor and control significant variables over their anticipated range for all conditions in the Reactor Core, Reactor Coolant System (RCS), steam and power conversion system, radioactive waste systems, engineered safety features (ESF) systems, and the Containment Building. Parameters that must be provided for operator use under normal operating and accident conditions are indicated in the Control Room in close proximity to the controls which maintain the indicated parameters in the proper range.

The quantity and types of process instrumentation provided ensures safe and orderly operation of all systems over the full design range of the plant. These systems are described in CPNPP FSAR Chapters 6, 7, 8, 9, 10, 11, and 12.

Criterion 20 - Protection System Functions

"The protection systems shall be designed (1) to initiate automatically the operation of appropriate systems, including the reactivity control systems, and to assure that specified acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences and (2) to sense accident conditions and to initiate the operation of systems and components important to safety."

A fully automatic protection system with appropriate redundant channels is provided to cope with transients where insufficient time is available for manual corrective action. The design basis for all protection systems is in accordance with the intent of Institute of Electrical and Electronic Engineers (IEEE) 279-1971 and IEEE 379-1972. The Reactor Protection System automatically initiates a reactor trip when any variable monitored by the system or combination of monitored variables exceeds the normal operating range. Set points are designed to provide an envelope of safe operating conditions with adequate margin for uncertainties to ensure that fuel design limits are not exceeded.

Reactor trip is initiated by removing power to the control rod drive mechanisms (CRDM) of all full-length rod cluster control assemblies (RCCA). This causes the rods to insert by the force of gravity, rapidly reducing the reactor power output. The response and adequacy of the protection system has been verified by analysis of anticipated transients.

Refer to CPNPP FSAR Chapter 7, Instrumentation and Controls, for additional information regarding actuating devices to the protection system.

The ESF Actuation System automatically initiates emergency core cooling and other safeguards functions by sensing accident conditions using redundant analog channels measuring diverse variables. In addition, manual actuation of safeguards can be performed where ample time is available for operator action. In either case, the ESF Actuation System automatically trips the reactor on manual or automatic safety injection signal generation.

Criterion 26 - Reactivity Control System Redundancy and Capability

"Two independent reactivity control systems of different design principles shall be provided. One of the systems shall use control rods, preferably including a positive means for inserting the rods, and shall be capable of reliably controlling reactivity changes to assure that under conditions of normal operation, including anticipated operational occurrences, and with appropriate margin for malfunctions such as stuck rods, specified acceptable fuel design limits are not exceeded. The second reactivity control system shall be capable of reliably controlling the rate of reactivity changes resulting from planned, normal power changes (including xenon burnout) to assure acceptable fuel design limits are not exceeded. One of the systems shall be capable of holding the reactor core subcritical under cold conditions."

Two reactivity control methods are provided. These are rod control cluster assemblies (RCCA) and chemical shim (boric acid). The RCCAs are inserted into the core by the force of gravity.

During operation the shutdown rod banks are fully withdrawn. The full-length control rod system automatically maintains a programmed average reactor temperature compensating for reactivity effects associated with scheduled and transient load changes. The shutdown rod banks, along with the full-length control banks, are designed to shut down the reactor with adequate margin under conditions of normal operation and anticipated operational occurrences, thereby ensuring that specified fuel design limits are not exceeded. The most restrictive period in core life is assumed in all analyses and the most reactive rod cluster is assumed to be in the fully withdrawn position.

The boron system maintains the reactor in the cold shutdown state independent of the position of the control rods and can compensate for xenon burnout transients.

Details of the construction of the RCCA are presented in CPNPP FSAR Chapter 4; the operation is discussed in CPNPP FSAR Chapter 7. The means of controlling the boric acid concentration are described in CPNPP FSAR Chapter 9; performance analyses under accident conditions are included in CPNPP FSAR Chapter 15.

4.2 Precedent

WATTS BAR NUCLEAR PLANT, UNITS 1 AND 2 - ISSUANCE OF AMENDMENT NOS. 142 AND 49 REGARDING REVISION TO TECHNICAL SPECIFICATIONS TO IMPLEMENT WCAP-17661-P-A, REVISION 1, “IMPROVED RAOC AND CAOC F_Q SURVEILLANCE TECHNICAL SPECIFICATIONS” (EPID L-2020-LLA-0037) (ADAMS Accession No. ML20232C622), dated February 11, 2021 (Reference 10)

4.3 No Significant Hazards Consideration Determination

The proposed change revises TS 3.2.1, “Heat Flux Hot Channel Factor ($F_Q(Z)$),” and associated references in TS 5.6.5, “Core Operating Limits Report (COLR),” to implement the new $F_Q(Z)$ surveillance methodology of WCAP-17661-P-A, Revision 1. The proposed changes will re-formulate the $F_Q^W(Z)$ approximation for $F_Q(Z)$, revise the surveillance requirements, and revise the required actions when $F_Q(Z)$ is not within limits. These changes remove the potential non-conservatisms documented in Westinghouse Nuclear Safety Advisory Letter (NSAL-15-1), "Heat Flux Hot Channel Factor Technical Specification Surveillance," and NSAL-09-05, Revision 1, "Relaxed Axial Offset Control F_Q Technical Specification Actions."

Vistra OpCo has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, “Issuance of amendment,” as discussed below:

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

   Response: No

The proposed change will re-formulate the $F_Q^W(Z)$ approximation for $F_Q(Z)$, revise the surveillance requirements, and revise the required actions when $F_Q(Z)$ is not within limits. This change does not result in any physical changes to plant safety-related structures, systems, or components (SSC).

As such, the proposed change does not involve an increase in the probability of any accident previously evaluated.

The proposed changes affect the Surveillance Requirements performed to ensure the Heat Flux Hot Channel Factor, $F_Q(Z)$, is within the limits assumed in the safety analyses for previously evaluated accidents. The new surveillance activity involves a reformulation of the transient hot channel factor approximation, $F_Q^W(Z)$, and a more conservative application of applied factors to ensure $F_Q^W(Z)$ remains within limit during subsequent operation up until the next surveillance performance. Both of these changes to the surveillance activity provide assurance that the $F_Q^W(Z)$ remains within the accident analyses assumptions.

The proposed changes also affect the Required Actions and Completion Times should $F_Q(Z)$ be found to not be within limit. The new Required Actions and Completion Times ensure the plant is placed in a condition whereby $F_Q(Z)$ is restored to within limit in a timely manner. Should $F_Q^C(Z)$ be found not within limit, thermal power is reduced and the NIS and OPN-16 reactor trip setpoints are reduced a conservative amount that retains the margin between the nominal thermal power and reactor trip setpoints. Should $F_Q^W(Z)$ be found not within limit, the core power distribution is constrained by reduced AFD limits, more limiting Rod Insertion Limits, and/or thermal power reductions. These changes to the Required Actions and Completion Times restore $F_Q(Z)$ to within the safety analyses assumptions in a timely manner.

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

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

Response: No

The proposed change will re-formulate the $F_Q^W(Z)$ approximation for $F_Q(Z)$, revise the surveillance requirements, and revise the required actions when $F_Q(Z)$ is not within limits. This change does not result in any physical changes to plant safety-related structures, systems, or components (SSCs). Neither does this change alter the modes of plant operation in a manner that is outside the bounds of those previously evaluated.

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

3. Do the proposed changes involve a significant reduction in a margin of safety?

Response: No

The proposed change will re-formulate the $F_Q^W(Z)$ approximation for $F_Q(Z)$, revise the surveillance requirements, and revise the required actions when $F_Q(Z)$ is not within limits. This change does not result in any physical changes to plant safety-related structures, systems, or components (SSCs).

The proposed changes affect the Surveillance Requirements performed to ensure the Heat Flux Hot Channel Factor, $F_Q(Z)$, is within the limits assumed in the safety analyses for previously evaluated accidents. The new surveillance activity involves a reformulation of the transient hot channel factor approximation, $F_Q^W(Z)$, and a more conservative application of applied factors to ensure $F_Q^W(Z)$ remains within limit during subsequent operation up until the next surveillance performance. Both of these changes to the surveillance activity provide assurance that the $F_Q^W(Z)$ remains within the accident analyses assumptions.

The proposed changes also affect the Required Actions and Completion Times should $F_Q(Z)$ be found to not be within limit. The proposed Required Actions and Completion Times ensure the plant is placed in a condition whereby $F_Q(Z)$ is restored to within limit in a timely manner. Should $F_Q^C(Z)$ be found not within limit, thermal power is reduced and the NIS and OP N-16 reactor trip setpoints are reduced a conservative amount that retains the margin between the nominal thermal power and reactor trip setpoints. Should $F_Q^W(Z)$ be found not within limit, the core power distribution is constrained by reduced AFD limits, more limiting Rod Insertion Limits, and/or thermal power reductions. These changes to the Required Actions and Completion Times restore $F_Q(Z)$ to within the safety analyses assumptions in a timely manner.

The proposed changes do not affect the $F_Q(Z)$ limit to which the $F_Q^C(Z)$ and $F_Q^W(Z)$ approximations are compared.

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

Based on the above evaluations, Vistra OpCo concludes that the propose amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c) and, accordingly, a finding of “no significant hazards consideration” is justified.

4.4 Conclusions

The requirements of GDC 10, 13, 20, and 26 continue to be met since no changes are being proposed which would affect reactor design, instrumentation and control, protection system functions, or reactivity control system redundancy or capability.

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be adverse to the common defense and security or to the health and safety of the public.

5.0 ENVIRONMENTAL CONSIDERATIONS

Vistra OpCo has determined that the proposed amendment would change requirements with respect to the installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amount of effluent that may be released offsite, or (iii) a significant increase in the individual or cumulative occupational radiation exposure. Accordingly, the proposed change meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), an environmental assessment of the proposed change is not required.

6.0 REFERENCES

1. NRC Letter to PWROG, "Verification Letter of the Approval Version of the Pressurized Water Reactor Owners Group Topical Report WCAP-17661, Revision 1, 'Improved RAOC and CAOC F_Q Surveillance Technical Specifications'," dated August 23, 2019 (ADAMS Accession No. ML19225D179)
2. PWROG Letter to NRC, to transmit the NRC Approved version of Pressurized Water Reactor Owners Group (PWROG) Topical Report (TR), WCAP-17661-P-A / WCAP-17661-NP-A, Revision 1, "Improved RAOC and CAOC F_Q Surveillance Technical Specifications," that contains the NRC Final Safety Evaluation (FSE), dated March 2019 (ADAMS Accession No. ML19225C079)
3. Westinghouse Nuclear Safety Advisory Letter (NSAL-09-05), Revision 1, "Relaxed Axial Offset Control F_Q Technical Specification Actions," dated September 23, 2009
4. Westinghouse Nuclear Safety Advisory Letter (NSAL-15-1), "Heat Flux Hot Channel Factor Technical Specification Surveillance," dated February 3, 2015
5. NUREG-1431, Revision 5, Volume 1, "Standard Technical Specifications Westinghouse Plants, Revision 5.0 Volume 1, Specifications," dated September 2021 (ADAMS Accession No. ML21259A155)
6. NUREG-0797, Safety Evaluation Report: "Related to the Operation of Comanche Peak Steam Electric Station, Units 1 and 2," dated July 1981
7. NUREG-0797 Supplement 26, Safety Evaluation Report: "Related to the Operation of Comanche Peak Steam Electric Station, Units 1 and 2," dated February 1993
8. WCAP-10216-P-A, Revision 1A, "Relaxation of Constant Axial Offset Control/F_Q Surveillance Technical Specification," dated February 1994
9. WCAP-17661-P-A, Revision 1, "Improved RAOC and CAOC F_Q Surveillance Technical Specifications," dated February 2019

10. NRC letter to TVA, Watts Bar Nuclear Plant, Units 1 and 2 - Issuance of Amendment Nos. 142 And 49 Regarding Revision to Technical Specifications To Implement WCAP-17661-P-A, REVISION 1, “Improved RAOC and CAOC F_Q Surveillance Technical Specifications,” dated February 2021 (ADAMS Accession No. ML20232C622)

7.0 ATTACHMENTS

1. Proposed Technical Specification Markup
2. Proposed Technical Specification Retype
3. Proposed Technical Specification Bases Markup (For Information Only)

3.2 POWER DISTRIBUTION LIMITS

3.2.1A Heat Flux Hot Channel ($F_Q(Z)$) (RAOC-W(Z) Methodology)

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

APPLICABILITY: MODE 1

-----------------------------------NOTE---------------------------------
This LCO is only applicable to Unit 1 Cycle 24

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. -------------NOTE--------------- Required Action A.4 shall be completed whenever this Condition is entered. ------------------------------------ $F_Q^C(Z)$ not within limit.	A.1 Reduce THERMAL POWER ≥ 1% RTP for each 1% $F_Q^C(Z)$ exceeds limit. <u>AND</u> A.2 Reduce Power Range Neutron Flux--High trip setpoints ≥ 1% for each 1% $F_Q^C(Z)$ exceeds limit. <u>AND</u>	15 minutes after each $F_Q^C(Z)$ determination 72 hours after each $F_Q^C(Z)$ determination

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.3 Reduce Overpower N-16 trip setpoints ≥ 1% for each 1% $F_Q^C(Z)$ exceeds limit.	72 hours after each $F_Q^C(Z)$ 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 (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. --------------NOTE-------------- Required Action B.4 shall be completed whenever this Condtion is entered. ------------------------------------		
$F_Q^W(Z)$ not within limits.	B.1 Reduce AFD limits ≥ 1% for each 1% $F_Q^W(Z)$ exceeds limit.	4 hours
	<u>AND</u>	
	B.2 Reduce Power Range Neutron Flux--High trip setpoints ≥ 1% for each 1% that the maximum allowable power of the AFD limits is reduced.	72 hours
	<u>AND</u>	
	B.3 Reduce Overpower N-16 trip setpoints ≥ 1% for each 1% that the maximum allowable power of the AFD limits is reduced.	72 hours
	<u>AND</u>	
	B.4 Perform SR 3.2.1.1 and SR 3.2.1.2.	Prior to increasing THERMAL POWER above the maximum allowable power of the AFD limits.
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 2.	6 hours

SURVEILLANCE REQUIREMENTS

---NOTE---
During power escalation following shutdown, THERMAL POWER may be increased until an equilibrium power level has been achieved at which a power distribution measurement is obtained.

SURVEILLANCE		FREQUENCY
SR 3.2.1.1	Verify $F_Q^C(Z)$ is within limit.	Once after each refueling prior to THERMAL POWER exceeding 75% RTP <u>AND</u> Once within 24 hours after achieving equilibrium conditions after exceeding, by $\geq$ 20% RTP, the THERMAL POWER at which $F_Q^C(Z)$ was last verified <u>AND</u> In accordance with the Surveillance Frequency Control Program.

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.2.1.2	---------------------------------NOTE--------------------------------- If $F_Q^C(Z)$ measurements indicate maximum over z $\left[\frac{F_Q^C(Z)}{K(Z)}\right]$ has increased since the previous evaluation of $F_Q^C(Z)$: a. Increase $F_Q^W(Z)$ by an appropriate factor specified in the COLR and reverify $F_Q^W(Z)$ is within limits; or b. Repeat SR 3.2.1.2 once per 7 EFPD until either a. above is met or two successive power distribution measurements indicate maximum over z $\left[\frac{F_Q^C(Z)}{K(Z)}\right]$ has not increased. --	
	Verify $F_Q^W(Z)$ is within limit.	Once after each refueling prior to THERMAL POWER exceeding 75% RTP <u>AND</u>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.2.1.2 (continued)	Once within 24 hours after achieving equilibrium conditions after exceeding, by ≥ 20% RTP, the THERMAL POWER at which $F_Q^C(Z)$ was last verified <u>AND</u> In accordance with the Surveillance Frequency Control Program.

3.2 POWER DISTRIBUTION LIMITS

3.2.1B Heat Flux Hot Channel ($F_Q(Z)$) (RAOC-T(Z) Methodology)

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

APPLICABILITY: MODE 1

--------------------------------NOTE--------------------------------
This LCO is NOT applicable to Unit 1 Cycle 24

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. -------------NOTE--------------- Required Action A.4 shall be completed whenever this Condition is entered prior to increasing THERMAL POWER above the limit of Required Action A.1. 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. ------------------------------------ $F_Q^C(Z)$ not within limit.	A.1 Reduce THERMAL POWER ≥ 1% RTP for each 1% $F_Q^C(Z)$ exceeds limit.	15 minutes after each $F_Q^C(Z)$ determination
	AND	
	A.2 Reduce Power Range Neutron Flux--High trip setpoints ≥ 1% for each 1% ~~$F_Q^C(Z)$ exceeds limit.~~ that THERMAL POWER is limited below RATED THERMAL POWER by Required Action A.1.	72 hours after each $F_Q^C(Z)$ determination
	AND	

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.3 Reduce Overpower N-16 trip setpoints ≥ 1% for each 1% ~~$F^C_Q(Z)$ exceeds limit.~~ that THERMAL POWER is limited below RATED THERMAL POWER by Required Action A.1. AND A.4 Perform SR 3.2.1.1 and SR 3.2.1.2.	72 hours after each $F^C_Q(Z)$ determination Prior to increasing THERMAL POWER above the limit of Required Action A.1

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. ~~------------NOTE------------ Required Action B.4 shall be completed whenever this Condtion is entered. -----------------------------~~ $F_Q^W(Z)$ not within limits.	~~B.1 Reduce AFD limits ≥ 1% for each 1% $F_Q^W(Z)$ exceeds limit.~~	
	B.1.1 Implement a RAOC operating space specified in the COLR that restores F_Q^W (Z) to within its limits.	4 hours
	AND	
	B.1.2 Perform SR 3.2.1.1 and SR 3.2.1.2 if control rod motion is required to comply with the new operating space.	72 hours
	OR	
	B.2.1 --------------------NOTE--------------------- Required Action B.2.4 shall be completed whenever Required Action B.2.1 is performed prior to increasing THERMAL POWER above the limit of Required Action B.2.1. -- Limit THERMAL POWER to less than RATED THERMAL POWER and reduce AFD limits as specified in the COLR.	4 hours after each $F_Q^W(Z)$ determination
	AND	
	B.2.2 Reduce Power Range Neutron Flux-High trip setpoints ≥ 1% for each 1% that ~~the maximum allowable power of the AFD limits is reduced~~. THERMAL POWER is limited below RATED THERMAL POWER by Required Action B.2.1.	72 hours after each $F_Q^W(Z)$ determination
	AND	

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
	$\boxed{B.2.3}$ Reduce Overpower N-16 trip setpoints ≥ 1% for each 1% that ~~the maximum allowable power of the AFD limits is reduced.~~ THERMAL POWER is limited below RATED THERMAL POWER by Required Action B.2.1.	72 hours after each $F_Q^W(Z)$ determination
	$\boxed{AND}$	
	$\boxed{B.2.4}$ Perform SR 3.2.1.1 and SR 3.2.1.2.	Prior to increasing THERMAL POWER above the ~~maximum allowable power of the AFD limits.~~ limit of Required Action B.2.1.
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 2.	6 hours

SURVEILLANCE REQUIREMENTS

~~NOTE~~

~~During power escalation following shutdown, THERMAL POWER may be increased until an equilibrium power level has been achieved at which a power distribution measurement is obtained.~~

SURVEILLANCE		FREQUENCY
SR 3.2.1.1	Verify $F_Q^C(Z)$ is within limit.	Once after each refueling prior to THERMAL POWER exceeding 75% RTP <u>AND</u> Once within 24 hours after achieving equilibrium conditions after exceeding, by ≥ 20% RTP, the THERMAL POWER at which $F_Q^C(Z)$ was last verified <u>AND</u> In accordance with the Surveillance Frequency Control Program.

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.2.1.2	~~NOTE~~ ~~If $F_Q^C(Z)$ measurements indicate~~ ~~maximum over z~~ $\cancel{\left[\frac{F_Q^C(Z)}{K(Z)}\right]}$ ~~has increased since the previous evaluation of $F_Q^C(Z)$:~~ ~~a. Increase $F_Q^W(Z)$ by an appropriate factor specified in the COLR and reverify $F_Q^W(Z)$ is within limits; or~~ ~~b. Repeat SR 3.2.1.2 once per 7 EFPD until either a. above is met or two successive power distribution measurements indicate maximum over z~~ $\cancel{\left[\frac{F_Q^C(Z)}{K(Z)}\right]}$ ~~has not increased.~~	
	Verify $F_Q^W(Z)$ is within limit.	Once after each refueling ~~prior to THERMAL POWER exceeding 75% RTP~~ within 24 hours after THERMAL POWER exceeds 75% RTP. AND

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.2.1.2 (continued)	Once within 24 hours after achieving equilibrium conditions after exceeding, by ≥ 20% RTP, the THERMAL POWER at which $F_Q^W(Z)$ was last verified <u>AND</u> In accordance with the Surveillance Frequency Control Program.

5.6 Reporting Requirements

5.6.5 Core Operating Limits Report (COLR) (continued)

11. WCAP-10054-P-A, "Westinghouse Small Break ECCS Evaluation Model Using the NOTRUMP Code," August 1985.

12. WCAP-10054-P-A, Addendum 2, Revision 1, "Addendum to the Westinghouse Small Break ECCS Evaluation Model Using the NOTRUMP Code: Safety Injection into the Broken Loop and COSI Condensation Model," July 1997.

13. WCAP-10079-P-A, "NOTRUMP, A Nodal Transient Small Break and General Network Code," August 1985.

14. WCAP-16009-P-A, "Realistic Large-Break LOCA Evaluation Methodology Using the Automated Statistical Treatment of Uncertainty Method (ASTRUM)," January 2005.

15. WCAP-12472-P-A, "BEACON Core Monitoring and Operations Support System," August 1994.

16. WCAP-17661-P-A, Revision 1, "Improved RAOC and CAOC F_Q Surveillance Technical Specifications," February 2019.

c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met.

d. The COLR, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

5.6.6 Reactor Coolant System (RCS) PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)

a. RCS pressure and temperature limits for heat up, cooldown, low temperature operation, criticality, and hydrostatic testing, and PORV lift settings as well as heatup and cooldown rates shall be established and documented in the PTLR for the following:

1. Specification 3.4.3, "RCS Pressure and Temperature (P/T) Limits," and

2. Specification 3.4.12, "Low Temperature Overpressure Protection (LTOP) System."

b. The analytical methods used to determine the RCS pressure and temperature limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

3.2 POWER DISTRIBUTION LIMITS

3.2.1A Heat Flux Hot Channel ($F_Q(Z)$) (RAOC-W(Z) Methodology)

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

APPLICABILITY: MODE 1

---------------------------------NOTE---------------------------------
This LCO is only applicable to Unit 1 Cycle 24

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. -------------NOTE--------------- Required Action A.4 shall be completed whenever this Condition is entered. ------------------------------------ $F_Q^C(Z)$ not within limit.	A.1 Reduce THERMAL POWER ≥ 1% RTP for each 1% $F_Q^C(Z)$ exceeds limit.	15 minutes after each $F_Q^C(Z)$ determination
	<u>AND</u>	
	A.2 Reduce Power Range Neutron Flux--High trip setpoints ≥ 1% for each 1% $F_Q^C(Z)$ exceeds limit.	72 hours after each $F_Q^C(Z)$ determination
	<u>AND</u>	

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.3 Reduce Overpower N-16 trip setpoints ≥ 1% for each 1% $F_Q^C(Z)$ exceeds limit.	72 hours after each $F_Q^C(Z)$ 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 (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. --------------NOTE-------------- Required Action B.4 shall be completed whenever this Condtion is entered. ------------------------------------ $F_Q^W(Z)$ not within limits.	B.1 Reduce AFD limits ≥ 1% for each 1% $F_Q^W(Z)$ exceeds limit.	4 hours
	AND	
	B.2 Reduce Power Range Neutron Flux--High trip setpoints ≥ 1% for each 1% that the maximum allowable power of the AFD limits is reduced.	72 hours
	AND	
	B.3 Reduce Overpower N-16 trip setpoints ≥ 1% for each 1% that the maximum allowable power of the AFD limits is reduced.	72 hours
	AND	
	B.4 Perform SR 3.2.1.1 and SR 3.2.1.2.	Prior to increasing THERMAL POWER above the maximum allowable power of the AFD limits.
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 2.	6 hours

SURVEILLANCE REQUIREMENTS

----------NOTE----------
During power escalation following shutdown, THERMAL POWER may be increased until an equilibrium power level has been achieved at which a power distribution measurement is obtained.

SURVEILLANCE		FREQUENCY
SR 3.2.1.1	Verify $F_Q^C(Z)$ is within limit.	Once after each refueling prior to THERMAL POWER exceeding 75% RTP <u>AND</u> Once within 24 hours after achieving equilibrium conditions after exceeding, by $\geq$ 20% RTP, the THERMAL POWER at which $F_Q^C(Z)$ was last verified <u>AND</u> In accordance with the Surveillance Frequency Control Program.

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.2.1.2	---------------------------------NOTE---------------------------------- If $F_Q^C(Z)$ measurements indicate maximum over z $\left[\frac{F_Q^C(Z)}{K(Z)}\right]$ has increased since the previous evaluation of $F_Q^C(Z)$: a. Increase $F_Q^W(Z)$ by an appropriate factor specified in the COLR and reverify $F_Q^W(Z)$ is within limits; or b. Repeat SR 3.2.1.2 once per 7 EFPD until either a. above is met or two successive power distribution measurements indicate maximum over z $\left[\frac{F_Q^C(Z)}{K(Z)}\right]$ has not increased. --	
	Verify $F_Q^W(Z)$ is within limit.	Once after each refueling prior to THERMAL POWER exceeding 75% RTP <u>AND</u>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.2.1.2 (continued)	Once within 24 hours after achieving equilibrium conditions after exceeding, by ≥ 20% RTP, the THERMAL POWER at which $F_Q^C(Z)$ was last verified AND In accordance with the Surveillance Frequency Control Program.

3.2 POWER DISTRIBUTION LIMITS

3.2.1B Heat Flux Hot Channel ($F_Q(Z)$) (RAOC-T(Z) Methodology)

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

APPLICABILITY: MODE 1

----------------------------------NOTE----------------------------------
This LCO is NOT applicable to Unit 1 Cycle 24

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. -------------NOTE--------------- Required Action A.4 shall be completed whenever this Condition is entered prior to increasing THERMAL POWER above the limit of Required Action A.1. 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. ------------------------------------		
$F_Q^C(Z)$ not within limit.	A.1 Reduce THERMAL POWER ≥ 1% RTP for each 1% $F_Q^C(Z)$ exceeds limit.	15 minutes after each $F_Q^C(Z)$ determination
	<u>AND</u>	
	A.2 Reduce Power Range Neutron Flux--High trip setpoints ≥ 1% for each 1% that THERMAL POWER is limited below RATED THERMAL POWER by Required Action A.1.	72 hours after each $F_Q^C(Z)$ determination
	<u>AND</u>	

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.3 Reduce Overpower N-16 trip setpoints ≥ 1% for each 1% that THERMAL POWER is limited below RATED THERMAL POWER by Required Action A.1.	72 hours after each $F_Q^C(Z)$ 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 (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. $F_Q^W(Z)$ not within limits.	B.1.1 Implement a RAOC operating space specified in the COLR that restores $F_Q^W(Z)$ to within limits.	4 hours
	<u>AND</u>	
	B.1.2 Perform SR 3.2.1.1 and SR 3.2.1.2 if control rod motion is required to comply with the new operating space.	72 hours
	<u>OR</u>	
	B.2.1 -------------------NOTE-------------------- Required Action B.2.4 shall be completed whenever Required Action B.2.1 is performed prior to increasing THERMAL POWER above the limit of Required Action B.2.1. ---	
	Limit THERMAL POWER to less than RATED THERMAL POWER and reduce AFD limits as specified in the COLR.	4 hours after each $F_Q^W(Z)$ determination
	<u>AND</u>	
	B.2.2 Reduce Power Range Neutron Flux-High trip setpoints ≥ 1% for each 1% that THERMAL POWER is limited below RATED THERMAL POWER by Required Action B.2.1.	72 hours after each $F_Q^W(Z)$ determination
	<u>AND</u>	

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.2.3 Reduce Overpower N-16 trip setpoints ≥ 1% for each 1% that THERMAL POWER is limited below RATED THERMAL POWER by Required Action B.2.1.	72 hours after each $F_Q^W(Z)$ determination
	AND	
	B.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 B.2.1.
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 2.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.2.1.1	Verify $F_Q^C(Z)$ is within limit.	Once after each refueling prior to THERMAL POWER exceeding 75% RTP <u>AND</u> Once within 24 hours after achieving equilibrium conditions after exceeding, by ≥ 20% RTP, the THERMAL POWER at which $F_Q^C(Z)$ was last verified <u>AND</u> In accordance with the Surveillance Frequency Control Program.

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.2.1.2	Verify $F_Q^W(Z)$ is within limit.	Once after each refueling within 24 hours after THERMAL POWER exceeds 75% RTP. <u>AND</u> Once within 24 hours after achieving equilibrium conditions after exceeding, by ≥ 20% RTP, the THERMAL POWER at which $F_Q^W(Z)$ was last verified <u>AND</u> In accordance with the Surveillance Frequency Control Program.

5.6 Reporting Requirements

5.6.5 Core Operating Limits Report (COLR) (continued)

11. WCAP-10054-P-A, "Westinghouse Small Break ECCS Evaluation Model Using the NOTRUMP Code," August 1985.

12. WCAP-10054-P-A, Addendum 2, Revision 1, "Addendum to the Westinghouse Small Break ECCS Evaluation Model Using the NOTRUMP Code: Safety Injection into the Broken Loop and COSI Condensation Model," July 1997.

13. WCAP-10079-P-A, "NOTRUMP, A Nodal Transient Small Break and General Network Code," August 1985.

14. WCAP-16009-P-A, "Realistic Large-Break LOCA Evaluation Methodology Using the Automated Statistical Treatment of Uncertainty Method (ASTRUM)," January 2005.

15. WCAP-12472-P-A, "BEACON Core Monitoring and Operations Support System," August 1994.

16. WCAP-17661-P-A, Revision 1, "Improved RAOC and CAOC F_Q Surveillance Technical Specifications," February 2019.

c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met.

d. The COLR, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

5.6.6 Reactor Coolant System (RCS) PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)

a. RCS pressure and temperature limits for heat up, cooldown, low temperature operation, criticality, and hydrostatic testing, and PORV lift settings as well as heatup and cooldown rates shall be established and documented in the PTLR for the following:

1. Specification 3.4.3, "RCS Pressure and Temperature (P/T) Limits," and

2. Specification 3.4.12, "Low Temperature Overpressure Protection (LTOP) System."

b. The analytical methods used to determine the RCS pressure and temperature limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

B 3.2 POWER DISTRIBUTION LIMITS

B 3.2.1A Heat Flux Hot Channel Factor ($F_Q(Z)$) (RAOC-W(Z) Methodology)

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.

During power operation, the global power distribution is limited by LCO 3.2.3, "AXIAL FLUX DIFFERENCE (AFD)," and LCO 3.2.4, "QUADRANT TILT POWER RATIO (QPTR)," which are directly and continuously measured process variables. These LCOs, along with LCO 3.1.7, "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 or an OPERABLE PDMS. These measurements are generally taken with the core at or near equilibrium conditions.

Using the measured three dimensional power distributions, it is possible to derive a measured value for $F_Q(Z)$. However, because this value represents an equilibrium condition, it does not include the variations in the value of $F_Q(Z)$ that are present during non-equilibrium situations, such as load following. To account for these possible variations, the steady state value of $F_Q(Z)$ is adjusted by an elevation dependent factor, W(Z), that accounts for calculated worse case transient conditions.

Core monitoring and control under non-steady 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's principal effect is to preclude core power distributions that could lead to violation of the following fuel design criterion:

a. During a large break loss of coolant accident (LOCA), the peak cladding temperature must not exceed 2200°F (Ref. 1); and

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

b. During an ejected rod accident, the energy deposition to the fuel must not exceed 280 cal/gm, and

c. 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.

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 LOCA 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 the 10 CFR 50.36(c)(2)(ii).

LCO

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

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

$$F_Q(Z) \le \frac{F_Q^C}{0.5} K(Z) \qquad \text{for } P \le 0.5$$

where:

F_Q^C 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 = THERMAL POWER/RTP

The actual values of F_Q^C and K(Z) are given in the COLR.

(continued)

BASES

LCO (continued)

For Relaxed Axial Offset Control operation, $F_Q(Z)$ is approximated by $F_Q^C(Z)$ and $F_Q^W(Z)$. Thus, both $F_Q^C(Z)$ and $F_Q^W(Z)$ must meet the preceding limits on $F_Q(Z)$.

An $F_Q^C(Z)$ evaluation requires obtaining a core power distribution measurement in MODE 1. From the core power distribution measurement results we obtain the measured value ($F_Q^M(Z)$) of $F_Q(Z)$.

If the PDMS is used to measure $F_Q^C(Z)$, the appropriate measurement uncertainty and manufacturing allowance are automatically calculated and applied to the measured F_Q (Ref. 7). If the PDMS is used to measure $F_Q^W(Z)$, the measured F_Q is increased by 3% to account for manufacturing tolerances and further increased by 5% to account for measurement uncertainties.

If the movable incore detector system is used, the computed heat flux hot channel factor, $F_Q^C(Z)$, is obtained by the equation:

$$F_Q^C(Z) = F_Q^M(Z) \bullet 1.03 \bullet 1.05.$$

$F_Q^M(Z)$ is increased by 3% to account for manufacturing tolerances and further increased by 5% to account for measurement uncertainties.

$F_Q^C(Z)$ 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 $F_Q^W(Z)$ is:

$$F_Q^W(Z) = F_Q^C(Z) \bullet W(Z)$$

where W(Z) is a cycle dependent function that accounts for power distribution transients during normal operations. W(Z) is included in the COLR.

(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 either a large or small break LOCA.

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 $F_Q^C(Z)$ cannot be maintained within the LCO limits, a reduction of the core power is required and if $F_Q^W(Z)$ cannot be maintained within the LCO limits, reduction of the AFD limits is required. Note that sufficient reduction of the AFD limits will also result in a reduction of the core power.

Violating the LCO limits of $F_Q(Z)$ may produce 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 $F_Q^C(Z)$ exceeds its limit, maintains an acceptable absolute power density. $F_Q^C(Z)$ is $F_Q^M(Z)$ multiplied by factors that account for manufacturing tolerances and measurement uncertainties. $F_Q^M(Z)$ 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 plant 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 $F_Q^C(Z)$ and would require power reductions within 15 minutes of the $F_Q^C(Z)$ determination, if necessary to comply with the decreased maximum allowable power level. Decreases in $F_Q^C(Z)$ would allow increasing the maximum allowable power level and increasing power up to this revised limit.

(continued)

BASES

ACTIONS (continued)

A.2

A reduction of the Power Range Neutron Flux-High trip setpoints by ≥ 1% for each 1% by which $F_Q^C(Z)$ 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.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 $F_Q^C(Z)$ and would require Power Range Neutron Flux - High trip setpoint reductions within 72 hours of the $F_Q^C(Z)$ determination, if necessary to comply with the decreased maximum allowable Power Range Neutron Flux-High trip setpoints. Decreases in $F_Q^C(Z)$ would allow increasing the maximum allowable Power Range Neutron Flux-High trip setpoints.

A.3

Reduction in the Overpower N-16 trip setpoints by ≥ 1% for each 1% by which $F_Q^C(Z)$ 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.1. The maximum allowable Overpower N-16 trip setpoints initially determined by Required Action A.3 may be affected by subsequent determinations of $F_Q^C(Z)$ and would require Overpower N-16 trip setpoint reductions within 72 hours of the $F_Q^C(Z)$ determination, if necessary to comply with the decreased maximum allowable Overpower N-16 trip setpoints. Decreases in $F_Q^C(Z)$ would allow increasing the maximum Overpower N-16 trip setpoints.

(continued)

BASES

ACTIONS (continued)

A.4

Verification that $F_Q^C(Z)$ 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.

Condition A is modified by a Note that requires Required Action A.4 to be performed whenever the Condition is entered. This ensures that SR 3.2.1.1 and SR 3.2.1.2 will be performed prior to increasing THERMAL POWER above the limit of Required Action A.1, even when Condition A is exited prior to performing Required Action A.4. Performance of SR 3.2.1.1 and SR 3.2.1.2 are necessary to assure $F_Q(Z)$ is properly evaluated prior to increasing THERMAL POWER.

B.1

If it is found that the maximum calculated value of $F_Q(Z)$ that can occur during normal maneuvers, $F_Q^W(Z)$, exceeds its specified limits, there exists a potential for $F_Q^C(Z)$ to become excessively high if a normal operational transient occurs. Reducing the AFD limits by ≥ 1% for each 1% by which $F_Q^W(Z)$ exceeds its limit within the allowed Completion Time of 4 hours, restricts the axial flux distribution such that even if a transient occurred, core peaking factor limits are not exceeded.

B.2

A reduction of the Power Range Neutron Flux-High trip setpoints ≥ 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 reductions in THERMAL POWER as a result of reducing AFD limits in accordance with Required Action B.1.

(continued)

BASES

ACTIONS (continued)

B.3

Reduction in the Overpower N-16 setpoints value 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 reductions in THERMAL POWER as a result of reducing AFD limits in accordance with Required Action B.1.

B.4

Verification that $F_Q W(Z)$ 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 maximum allowable power limit imposed by Required Action B.1 ensures that core conditions during operation at higher power levels and future operation are consistent with safety analysis assumptions.

Condition B is modified by a Note that requires Required Action B.4 to be performed whenever the Condition is entered. This ensures that SR 3.2.1.1 and SR 3.2.1.2 will be performed prior to increasing THERMAL POWER above the limit of Required Action B.1, even when Condition A is exited prior to performing Required Action B.4. Performance of SR 3.2.1.1 and SR 3.2.1.2 is necessary to ensure $F_Q(Z)$ is properly evaluated prior to increasing THERMAL POWER.

C.1

If Required Actions A.1 through A.4 or B.1 through B.4 are not met within their associated Completion Times, the plant must be placed in a mode or condition in which the LCO requirements are not applicable. This is done by placing the plant 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 plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.2.1.1 and SR 3.2.1.2 are modified by a Note. The Note applies during power ascensions following a plant shutdown (leaving Mode 1). The note allows for power ascensions if the surveillances are not current. It states that THERMAL POWER may be increased until an equilibrium power level has been achieved at which a power distribution measurement can be obtained.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

This allowance is modified, however, by one of the Frequency conditions that requires verification that $F_Q^C(Z)$ and $F_Q^W(Z)$ are within their specified limits after a power rise of more than 20% RTP over the THERMAL POWER at which they were last verified to be within specified limits. Because $F_Q^C(Z)$ and $F_Q^W(Z)$ could not have previously been measured for a reload core, there is a second Frequency condition, applicable only for reload cores, that requires determination of these parameters before exceeding 75% RTP. This ensures that some determination of $F_Q^C(Z)$ and $F_Q^W(Z)$ are made at a lower power level at which adequate margin is available before going to 100% RTP. Also, this Frequency condition, together with the Frequency condition requiring verification of $F_Q^C(Z)$ and $F_Q^W(Z)$ following a power increase of more than 20%, ensures that they are verified as soon as RTP (or any other level for extended operation) is achieved. In the absence of these Frequency conditions, it is possible to increase power to RTP and operate for extended periods without verification of $F_Q^C(Z)$ and $F_Q^W(Z)$. The Frequency condition is not intended to require verification of these parameters after every 20% increase in power level above the last verification. It only requires verification after a power level is achieved for extended operation that is 20% higher than that power at which F_Q was last measured.

<u>SR 3.2.1.1</u>

Verification that $F_Q^C(Z)$ is within its specified limits involves increasing $F_Q^M(Z)$ to allow for manufacturing tolerance and measurement uncertainties in order to obtain $F_Q^C(Z)$. If the PDMS is used, the appropriate measurement uncertainty and manufacturing allowance are automatically calculated and applied to the measured F_Q (Ref. 7). If the movable incore detector system is used, $F_Q^M(Z)$ is the measured value of $F_Q(Z)$ obtained from incore flux map results and $F_Q^C(Z) = F_Q^M(Z) \bullet 1.03 \bullet 1.05$ (Ref. 4). $F_Q^C(Z)$ is then compared to its specified limits.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.2.1.1 (continued)

The limit with which $F_Q^C(Z)$ 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, provides assurance that the $F_Q^C(Z)$ limit is met when RTP is achieved, because peaking factors generally decrease as power level is increased.

If THERMAL POWER has been increased by ≥ 20% RTP since the last determination of $F_Q^C(Z)$, another evaluation of this factor is required 24 hours after achieving equilibrium conditions at this higher power level (to ensure that $F_Q^C(Z)$ values are being reduced sufficiently with power increase to stay within the LCO limits).

The Surveillance Frequency for periodic performances during power operation is controlled under the Surveillance Frequency Control Program.

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 power distribution measurements are taken at or near equilibrium conditions, the variations in power distribution resulting from normal operational maneuvers are not present in the core power distribution measurement 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 W(Z). Multiplying the measured total peaking factor, $F_Q^C(Z)$, by W(Z) gives the maximum $F_Q(Z)$ calculated to occur in normal operation, $F_Q^W(Z)$.

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

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.2.1.2 (continued)

The W(Z) curve is provided in the COLR for discrete core elevations. Flux map data are typically taken for 30 to 75 core elevations. $F_Q^W(Z)$ 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.

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. When $F_Q^W(Z)$ is evaluated, an evaluation of the expression below is required to account for any increase to $F_Q^C(Z)$ that may occur and cause the $F_Q(Z)$ limit to be exceeded before the next required $F_Q(Z)$ evaluation.

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

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

it is required to meet the $F_Q(Z)$ limit with the last $F_Q^W(Z)$ increased by the appropriate factor of ≥ 1.02 specified in the COLR, or to evaluate $F_Q(Z)$ more frequently, each 7 EFPD. These alternative requirements prevent $F_Q(Z)$ from exceeding its limit for any significant period of time without detection.

Performing the Surveillance in MODE 1 prior to exceeding 75% RTP provides assurance that the $F_Q(Z)$ limit will be met when RTP is achieved because peaking factors are generally decreased as power level is increased.

$F_Q(Z)$ is verified at power levels ≥ 20% RTP above the THERMAL POWER of its last verification, 24 hours after achieving equilibrium conditions to ensure that $F_Q(Z)$ is within its limit at higher power levels.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.2.1.2 (continued)

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

REFERENCES

1. 10 CFR 50.46, 1974.
2. Regulatory Guide 1.77, Rev. 0, May 1974.
3. 10 CFR 50, Appendix A, GDC 26.
4. RXE-90-006-P-A, "Power Distribution Control Analysis and Overtemperature N-16 and Overpower N-16 Trip Setpoint Methodology," TU Electric, June 1994.
5. WCAP-7308-L-P-A, "Evaluation of Nuclear Hot Channel Factor Uncertainties," June 1988.
6. WCAP-10216-P-A, Rev. 1A, "Relaxation of Constant Axial Offset Control (and) FQ Surveillance Technical Specification," February 1994.
7. WCAP-12472-P-A, "BEACON Core Monitoring and Operations Support System," August 1994 (including "Addendum 1-A," January 2000).

B 3.2 POWER DISTRIBUTION LIMITS

B 3.2.1B Heat Flux Hot Channel Factor ($F_Q(Z)$) (RAOC-T(Z) Methodology)

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.

During power operation, the global power distribution is limited by LCO 3.2.3, "AXIAL FLUX DIFFERENCE (AFD)," and LCO 3.2.4, "QUADRANT TILT POWER RATIO (QPTR)," which are directly and continuously measured process variables. These LCOs, along with LCO 3.1.7, "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 or an OPERABLE PDMS. These measurements are generally taken with the core at or near equilibrium conditions.

Using the measured three dimensional power distributions, it is possible to derive a measured value for $F_Q(Z)$. However, because this value represents an equilibrium condition, it does not include the variations in the value of $F_Q(Z)$ that are present during non-equilibrium situations, such as load following.

To account for these possible variations, ~~the steady state value of $F_Q(Z)$ is adjusted by an elevation dependent factor, W(Z), that accounts for calculated worse case transient conditions.~~ the elevation dependent measured planar radial peaking factors, $F_{XY}(Z)$, are increased by an elevation dependent factor, $[T(Z)]^{COLR}$, that accounts for the expected maximum values of the transient axial power shapes postulated to occur during RAOC operation. Thus, $[T(Z)]^{COLR}$ accounts for the worst case non-equilibrium power shapes that are expected for the assumed RAOC operating space.

The RAOC operating space is defined as the combination of AFD and Control Bank Insertion Limits assumed in the calculation of a particular $[T(Z)]^{COLR}$ function. The $[T(Z)]^{COLR}$ factors are directly dependent on the AFD and Control Bank Insertion Limit assumptions. The COLR may contain

(continued)

BACKGROUND (continued)

different [T(Z)]^{COLR} functions that reflect different operating space assumptions. If the limit on $F_Q(Z)$ is exceeded, a more restrictive operating space may be implemented to gain margin for future non-equilibrium operation.

Core monitoring and control under non-~~steady state~~ equilibrium 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's principal effect is to preclude core power distributions that could lead to violation of the following fuel design criterion:

a. During a large break loss of coolant accident (LOCA), the peak cladding temperature must not exceed 2200°F (Ref. 1), ~~; and~~

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 the fuel must not exceed 280 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 LOCA 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 the 10 CFR 50.36(c)(2)(ii).

(continued)

BASES

LCO

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

$F_Q(Z) \leq (CFQ / P)\ K(Z)$ for $P > 0.5$

$F_Q(Z) \leq (CFQ / 0.5)\ K(Z)$ for $P \leq 0.5$

CFQ is the $F_Q(Z)$ limit at RTP provided in the COLR, K(Z) is the normalized $F_Q(Z)$ limit as a function of core height provided in the COLR, and

P = THERMAL POWER / RTP

For this facility, the actual values of CFQ and K(Z) are given in the COLR; however, CFQ is normally a number on the order of 2.50, and K(Z) is typically equal to 1.0 in the lower section of the core, and decreases below 1.0 in the upper section of the core.

For Relaxed Axial Offset Control operation, $F_Q(Z)$ is approximated by $F_Q^C(Z)$ and $F_Q^W(Z)$. Thus, both $F_Q^C(Z)$ and $F_Q^W(Z)$ must meet the preceding limits on $F_Q(Z)$.

An $F_Q(Z)$ evaluation requires obtaining a core power distribution measurement in MODE 1. From the core power distribution measurement results we obtain the measured value ($F_Q^M(Z)$) of $F_Q(Z)$.

If the PDMS is used to measure $F_Q(Z)$, the appropriate measurement uncertainty and manufacturing allowance are automatically calculated and applied to the measured F_Q (Ref. 7). If the PDMS is used to measure $F_Q^W(Z)$, the measured F_Q is increased by 3% to account for manufacturing tolerances and further increased by 5% to account for measurement uncertainties.

If the movable incore detector system is used, the computed heat flux hot channel factor, $F_Q^C(Z)$, is obtained by the equation:

$$F_Q^C(Z) = F_Q^M(Z) \bullet 1.03 \bullet 1.05$$

$F_Q^M(Z)$ is increased by 3% to account for manufacturing tolerances and further increased by 5% to account for measurement uncertainties.

$F_Q^C(Z)$ 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 $F_Q^W(Z)$ is:

$F_Q^W(Z) = F_{XY}^M(Z)[T(Z)]^{COLR}/P \bullet A_{XY}(Z)\ Rj\ [1.0815]$ for $P>0.5$

$F_Q^W(Z) = F_{XY}^M(Z)[T(Z)]^{COLR}/0.5 \bullet A_{XY}(Z)\ Rj\ [1.0815]$ for $P\leq0.5$

(continued)

BASES

LCO (continued)

INSERT 1

The $F_Q(Z)$ limits define limiting values for core power peaking that precludes peak cladding temperatures above 2200°F during either a large or small break LOCA.

This LCO requires operation within the bounds assumed in the safety analyses. Violating the LCO limits for $F_Q(Z)$ could result in unacceptable consequences if a design basis event were to occur while $F_Q(Z)$ exceeds its specified limits. 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 $F_Q^C(Z)$ cannot be maintained within the LCO limits, reduction of the core power is required, and if $F_Q^W(Z)$ cannot be maintained within the LCO limits, reduction of the AFD limits is required. Note that sufficient reduction of the AFD limits will also result in a reduction of the core power. a more restrictive RAOC operating space must be implemented or core power limits and AFD limits must be reduced.

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

(continued)

INSERT 1

The various factors in this expression are defined below:

$F_{XY}^{M}(Z)$ is the measured radial peaking factor at axial location Z and is equal to the value of $F_{Q}^{M}(Z)$ / $P^{M}(Z)$ where $P^{M}(Z)$ is the measured core average axial power shape.

$[T(Z)]^{COLR}$ is the cycle and burnup dependent function, specified in the COLR, which accounts for power distribution transients encountered during non-equilibrium normal operation. $[T(Z)]^{COLR}$ functions are specified for each analyzed RAOC operating space (i.e., each unique combination of AFD limits and Control Bank Insertion Limits). The $[T(Z)]^{COLR}$ functions account for the limiting non-equilibrium axial power shapes postulated to occur during normal operation for each RAOC operating space. Limiting power shapes at both full and reduced power operation are considered in determining the maximum values of $[T(Z)]^{COLR}$. The $[T(Z)]^{COLR}$ functions also account for the following effects: (1) the presence of spacer grids in the fuel assembly, (2) the increase in radial peaking in rodded core planes due to the presence of control rods during non-equilibrium normal operation, (3) the increase in radial peaking that occurs during part-power operation due to reduced fuel and moderator temperatures, and (4) the increase in radial peaking due to non-equilibrium xenon effects. The $[T(Z)]^{COLR}$ functions are normally calculated assuming that the Surveillance is performed at nominal RTP conditions with all shutdown and control rods fully withdrawn, i.e., all rods out (ARO). Surveillance specific $[T(Z)]^{COLR}$ values may be generated for a given surveillance core condition.

P is the THERMAL POWER / RTP.

$A_{XY}(Z)$ is a function that adjusts the $F_{Q}^{W}(Z)$ Surveillance for differences between the reference core condition assumed in generating the $[T(Z)]^{COLR}$ function and the actual core condition that exists when the Surveillance is performed. Normally, this reference core condition is 100% RTP, all rods out, and equilibrium xenon. For simplicity, $A_{XY}(Z)$ may be assumed to be 1.0, as this will typically result in an accurate $F_{Q}^{W}(Z)$ Surveillance result for a Surveillance that is performed at or near the reference core condition, and an underestimation of the available margin to the F_Q limit for Surveillances that are performed at core conditions different from the reference condition. Alternatively, the $A_{XY}(Z)$ function may be calculated using the NRC approved methodology in Reference 8.

[1.0815] is a factor that accounts for fuel manufacturing tolerances and measurement uncertainty.

Rj is a cycle and burnup dependent analytical factor specified in the COLR that accounts for potential increases in $F_{Q}^{W}(Z)$ between Surveillances. Rj values are provided for each RAOC operating space.

BASES

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 $\geq$ 1% RTP for each 1% by which $F_Q^C(Z)$ exceeds its limit, maintains an acceptable absolute power density. $F_Q^C(Z)$ is $F_Q^M(Z)$ multiplied by a factor accounting for manufacturing tolerances and measurement uncertainties. $F_Q^M(Z)$ 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 plant 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 $F_Q^C(Z)$ and would require power reductions within 15 minutes of the $F_Q^C(Z)$ determination, if necessary to comply with the decreased maximum allowable power level. Decreases in $F_Q^C(Z)$ would allow increasing the maximum allowable power level and increasing power up to this revised limit.

If an F_Q surveillance is performed at 100% RTP conditions, and both $F_Q^C(Z)$ and $F_Q^W(Z)$ exceed their limits, the option to reduce the THERMAL POWER limit in accordance with proposed Required Action B.2.1 instead of implementing a new operating space in accordance with proposed Required Action B.1, will result in a further power reduction after Required Action A.1 has been completed. However, this further power reduction would be permitted to occur over the next 4 hours. In the event the evaluated THERMAL POWER reduction in the COLR for proposed Required Action B.2.1 did not result in a further power reduction (for example, if both Condition A and Condition B were entered at less than 100% RTP conditions), then the THERMAL POWER level established as a result of completing Required Action A.1 will take precedence, and will establish the effective operating power level limit for the unit until both Conditions A and B are exited.

A.2

A reduction of the Power Range Neutron Flux-High trip setpoints by $\geq$ 1% for each 1% ~~by which FQC(Z) exceeds its limit~~, that THERMAL POWER is limited below RATED THERMAL POWER 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

(continued)

BASES

ACTIONS

A.2 (continued)

Action A.2 may be affected by subsequent determinations of $F_Q^C(Z)$ and would require Power Range Neutron Flux - High trip setpoint reductions within 72 hours of the $F_Q^C(Z)$ determination, if necessary to comply with the decreased maximum allowable Power Range Neutron Flux-High trip setpoints. Decreases in $F_Q^C(Z)$ would allow increasing the maximum allowable Power Range Neutron Flux-High trip setpoints.

A.3

Reduction in the Overpower N-16 trip setpoints by ≥ 1% for each 1% ~~by which FQC(Z) exceeds its limit,~~ that THERMAL POWER is limited below RATED THERMAL POWER 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 Overpower N-16 trip setpoints initially determined by Required Action A.3 may be affected by subsequent determinations of $F_Q^C(Z)$ and would require Overpower N-16 trip setpoint reductions within 72 hours of the $F_Q^C(Z)$ determination, if necessary to comply with the decreased maximum allowable Overpower N-16 trip setpoints. Decreases in $F_Q^C(Z)$ would allow increasing the maximum Overpower N-16 trip setpoints.

A.4

Verification that $F_Q^C(Z)$ 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.

Condition A is modified by a Note that requires Required Action A.4 to be performed whenever the Condition is entered prior to increasing THERMAL POWER above the limit of Required Action A.1. The Note also states that 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. This ensures that SR 3.2.1.1 and SR 3.2.1.2, if required will be performed prior to increasing THERMAL POWER above the limit of Required Action A.1, even when Condition A is exited prior to performing Required Action A.4. Performance of SR 3.2.1.1 and SR 3.2.1.2 are necessary to assure $F_Q(Z)$ is properly evaluated prior to increasing THERMAL POWER.

(continued)

BASES

ACTIONS (continued)

B.1.1

If it is found that the maximum calculated value of $F_Q(Z)$ that can occur during normal maneuvers , $F_Q^W(Z)$, exceeds its specified limits, there exists a potential for $F_Q^C(Z)$ to become excessively high if a normal operational transient occurs. ~~Reducing the AFD limits by ≥ 1% for each 1% by which FQW(Z) exceeds its limit within the allowed Completion Time of 4 hours, restricts the axial flux distribution such that even if a transient occurred, core peaking factor limits are not exceeded.~~ Implementing a more restrictive RAOC operating space, as specified in the COLR, within the allowed Completion Time of 4 hours will restrict the AFD such that peaking factor limits will not be exceeded during non-equilibrium normal operation. Several RAOC operating spaces, representing successively smaller AFD envelopes and, optionally, shallower Control Bank Insertion Limits, may be specified in the COLR. The corresponding T(Z) functions for these operating spaces can be used to determine which RAOC operating space will result in acceptable non-equilibrium operation within the $F_Q^W(Z)$ limit.

B.1.2

If it is found that the maximum calculated value of $F_Q(Z)$ that can occur during normal maneuvers, $F_Q^W(Z)$, exceeds its specified limits, there exists a potential for $F_Q^C(Z)$ to become excessively high if a normal operational transient occurs. As discussed above , Required Action B.1.1 requires that a new RAOC operating space be implemented to restore $F_Q^W(Z)$ to within limits. Required Action B.1.2 requires that SR 3.2.1.1 and SR 3.2.1.2 be performed if control rod motion occurs as a result of implementing the new RAOC operating space in accordance with Required Action B.1.1. The performance of SR 3.2.1.1 and SR 3.2.1.2 is necessary to assure $F_Q(Z)$ is properly evaluated after any rod motion resulting from the implementation of a new RAOC operating space in accordance with Required Action B.1.1.

B.2.1

When $F_Q^W(Z)$ exceeds its limit, Required Action B.2.1 may be implemented instead of Required Action B.1. Required Action B.2.1 limits THERMAL POWER to less than RATED THERMAL POWER by the amount specified in the COLR. It also requires reductions in the AFD limits by the amount specified in the COLR. This maintains an acceptable absolute power density relative to the maximum power density value assumed in the safety analyses.

If the required $F_Q^W(Z)$ margin improvement exceeds the margin improvement available from the pre-analyzed THERMAL POWER and AFD reductions provided in the COLR, then THERMAL POWER must be further reduced to less than or equal to 50% RTP. In this case, reducing THERMAL POWER to less than or equal to 50% RTP will provide additional margin in the transient F_Q by the required change in

(continued)

BASES

ACTIONS

B.2.1 (continued)

THERMAL POWER and the increase in the F_Q limit. This will ensure that the F_Q limit is met during transient operation that may occur at or below 50% RTP. The Completion Time of 4 hours provides an acceptable time to reduce the THERMAL POWER and AFD limits in an orderly manner to preclude entering an unacceptable condition during future non-equilibrium operation. The limit on THERMAL POWER initially determined by Required Action B.2.1 may be affected by subsequent determinations of $F_Q^W(Z)$ and would require power reductions within 4 hours of the $F_Q^W(Z)$ determination, if necessary to comply with the decreased THERMAL POWER limit. Decreases in $F_Q^W(Z)$ would allow increasing the THERMAL POWER limit and increasing THERMAL POWER up to this revised limit.

Required Action B.2.1 is modified by a Note that states Required Action B.2.4 shall be completed whenever Required Action B.2.1 is performed prior to increasing THERMAL POWER above the limit of Required Action B.2.1. Required Action B.2.4 requires the performance of SR 3.2.1.1 and SR 3.2.1.2 prior to increasing THERMAL POWER above the limit established by Required Action B.2.1. The Note ensures that the SRs will be performed even if Condition B may be exited prior to performing Required Action B.2.4. The performance of SR 3.2.1.1 and SR 3.2.1.2 is necessary to assure FQ(Z) is properly evaluated prior to increasing THERMAL POWER.

If an FQ surveillance is performed at 100% RTP conditions, and both $F_Q^C(Z)$ and $F_Q^W(Z)$ exceed their limits, the option to reduce the THERMAL POWER limit in accordance with proposed Required Action B.2.1 instead of implementing a new operating space in accordance with proposed Required Action B.1, will result in a further power reduction after Required Action A.1 has been completed. However, this further power reduction would be permitted to occur over the next 4 hours. In the event the evaluated THERMAL POWER reduction in the COLR for proposed Required Action B.2.1 did not result in a further power reduction (for example, if both Condition A and Condition B were entered at less than 100% RTP conditions), then the THERMAL POWER level established as a result of completing Required Action A.1 will take precedence, and will establish the effective operating power level for the unit both Conditions A and B are exited.

B.2.2

A reduction of the Power Range Neutron Flux-High trip setpoints > 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 reductions in the THERMAL POWER ~~as a result of reducing~~ limit and AFD limits in accordance with Required Action ~~B.1~~B.2.1.

(continued)

BASES

ACTIONS (continued)

B.2.3

Reduction in the Overpower N-16 setpoints value 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 reductions in the THERMAL POWER ~~as a result of reducing~~ limit and AFD limits in accordance with Required Action ~~B.1~~ B.2.1.

B.2.4

Verification that $F_Q^W(Z)$ 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 maximum allowable power limit imposed by Required Action ~~B.1~~ B.2.1 ensures that core conditions during operation at higher power levels and future operation are consistent with safety analysis assumptions.

~~Condition B is modified by a Note that requires Required Action B.4 to be performed whenever the Condition is entered. This ensures that SR 3.2.1.1 and SR 3.2.1.2 will be performed prior to increasing THERMAL POWER above the limit of Required Action B.1, even when Condition A is exited prior to performing Required Action B.4. Performance of SR 3.2.1.1 and SR 3.2.1.2 is necessary to ensure FQ(Z) is properly evaluated prior to increasing THERMAL POWER.~~

C.1

If Required Actions A.1 through A.4 or B.1.1 through ~~B.4~~ B.2.4 are not met within their associated Completion Times, the plant must be placed in a mode or condition in which the LCO requirements are not applicable. This is done by placing the plant 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 plant systems.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

~~SR 3.2.1.1 and SR 3.2.1.2 are modified by a Note. The Note applies during power ascensions following a plant shutdown (leaving Mode 1). The note allows for power ascensions if the surveillances are not current. It states that THERMAL POWER may be increased until an equilibrium power level has been achieved at which a power distribution measurement can be obtained. This allowance is modified, however, by one of the Frequency conditions that requires verification that $F_Q^C(Z)$ and $F_Q^W(Z)$ are within their specified limits after a power rise of more than 20% RTP over the THERMAL POWER at which they were last verified to be within specified limits. Because $F_Q^C(Z)$ and $F_Q^W(Z)$ could not have previously been measured for a reload core, there is a second Frequency condition, applicable only for reload cores, that requires determination of these parameters before exceeding 75% RTP. This ensures that some determination of $F_Q^C(Z)$ and $F_Q^W(Z)$ are made at a lower power level at which adequate margin is available before going to 100% RTP. Also, this Frequency condition, together with the Frequency condition requiring verification of $F_Q^C(Z)$ and $F_Q^W(Z)$ following a power increase of more than 20%, ensures that they are verified as soon as RTP (or any other level for extended operation) is achieved. In the absence of these Frequency conditions, it is possible to increase power to RTP and operate for extended periods without verification of $F_Q^C(Z)$ and $F_Q^W(Z)$. The Frequency condition is not intended to require verification of these parameters after every 20% increase in power level above the last verification. It only requires verification after a power level is achieved for extended operation that is 20% higher than that power at which F_Q was last measured.~~

<u>SR 3.2.1.1</u>

Verification that $F_Q^C(Z)$ is within its specified limits involves increasing $F_Q^M(Z)$ to allow for manufacturing tolerance and measurement uncertainties in order to obtain $F_Q^C(Z)$.

If the PDMS is used, the appropriate measurement uncertainty and manufacturing allowance are automatically calculated and applied to the measured F_Q (Ref. 7).

If the movable incore detector system is used, $F_Q^M(Z)$ is the measured value of $F_Q(Z)$ obtained from incore flux map results and $F_Q^C(Z) = F_Q^M(Z)$ [1.0815] ~~• 1.03 • 1.05~~ (Ref. 4). $F_Q^C(Z)$ is then compared to its specified limits.

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

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.2.1.1 (continued)

Performing this Surveillance in MODE 1 prior to exceeding 75% RTP~~,~~ ~~provides assurance~~ following a refueling ensures that ~~the $F_Q^C(Z)$ limit is met when RTP is achieved, because peaking factors generally decrease as power level is increased~~. some determination of $F_Q^C(Z)$ is made prior to achieving a significant power level where the peak linear heat rate could approach the limits assumed in the safety analyses.

If THERMAL POWER has been increased by ≥ 20% RTP since the ~~last~~ initial or most recent determination of $F_Q^C(Z)$, another evaluation of this factor is required 24 hours after achieving equilibrium conditions at this higher power level (to ensure that $F_Q^C(Z)$ values are being reduced sufficiently with power increase to stay within the LCO limits). Equilibrium conditions are achieved when the core is sufficiently stable at the intended operating conditions required to perform the Surveillance.

The allowance of up to 24 hours after achieving equilibrium conditions at the increased THERMAL POWER level to complete the next $F_Q^C(Z)$ surveillance applies to situations where the $F_Q^C(Z)$ has already been measured at least once at a reduced THERMAL POWER level. The observed margin in the previous surveillance will provide assurance that increasing power up to the next plateau will not exceed the F_Q limit, and that the core is behaving as designed.

This Frequency condition is not intended to require verification of these parameters every 20% increase in RTP above the THERMAL POWER at which the last verification was performed. It only requires verification after a THERMAL POWER is achieved for extended operation that is 20% higher than the THERMAL POWER at which $F_Q^C(Z)$ was last measured.

The Surveillance Frequency for periodic performances during power operation is controlled under the Surveillance Frequency Control Program.

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 power distribution measurements are taken at or near equilibrium conditions, the variations in power distribution resulting from normal operational maneuvers are not present in the core power distribution measurement data. These variations are, however, conservatively calculated by

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.2.1.2 (continued)

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 W(Z). Multiplying the measured total peaking factor, $F_Q^C(Z)$, by W(Z) gives the maximum $F_Q(Z)$ calculated to occur in normal operation, $F_Q^W(Z)$.~~

INSERT 2

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

The ~~W(Z) curve is provided~~ $[T(Z)]^{COLR}$ functions are specified in the COLR for discrete core elevations. Flux map data are typically taken for 30 to 75 core elevations. $F_Q^W(Z)$ 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, ~~.~~

c. Grid plane regions, ± 2% inclusive, and

d. Core plane regions, within ± 2% of the bank demand position of the control banks.

(continued)

INSERT 2

The measured $F_Q(Z)$ can be determined through a synthesis of the measured planar radial peaking factors, $F_{XY}{}^M(Z)$, and the measured core average axial power shape, $P^M(Z)$. Thus, $F_Q{}^C(Z)$ is given by the following expression:

$F_Q{}^C(Z) = F_{XY}{}^M(Z)\ P^M(Z)\ [1.0815] = F_Q{}^M(Z)[1\ .0815]$

For RAOC operation, the analytical $[T(Z)]^{COLR}$ functions, specified in the COLR for each RAOC operating space, are used together with the measured $F_{XY}(Z)$ values to estimate $F_Q(Z)$ for non-equilibrium operation within the RAOC operating space. When the $F_{XY}(Z)$ values are measured at HFP ARO conditions ($A_{XY}(Z)$ equals 1.0), $F_Q{}^W(Z)$ is given by the following expression:

$F_Q{}^W(Z) = F_{XY}{}^M(Z)\ [T(z)]^{COLR}\ Rj\ [1.0815]$

Non-equilibrium operation can result in significant changes to the axial power shape. To a lesser extent, non-equilibrium operation can increase the radial peaking factors, $F_{XY}(Z)$, through control rod insertion and through reduced Doppler and moderator feedback at part-power conditions.

The $[T(z)]^{COLR}$ functions quantify these effects for the range of power shapes, control rod insertion, and power levels characteristic of the operating space. Multiplying $[T(z)]^{COLR}$ by the measured full power, unrodded $F_{XY}{}^M(Z)$ value, and the factor that accounts for manufacturing and measurement uncertainties gives $F_Q{}^W(Z)$, the maximum total peaking factor postulated for non-equilibrium RAOC operation.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.2.1.2 (continued)

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

The excluded regions at the top and bottom of the core are specified in the COLR and are defined to ensure that the minimum margin location is adequately surveilled. A slightly smaller exclusion zone may be specified, if necessary, to include the limiting margin location in the surveilled region of the core.

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

~~If the two most recent $F_Q(Z)$ evaluations show an increase in the expression maximum over z:~~

$$\cancel{F_Q^C(Z) / K(Z)}$$

~~it is required to meet the $F_Q(Z)$ limit with the last $F_Q^W(Z)$ increased by the appropriate factor of ≥ 1.02 specified in the COLR, or to evaluate $F_Q(Z)$ more frequently, each 7 EFPD. These alternative requirements prevent $F_Q(Z)$ from exceeding its limit for any significant period of time without detection.~~

~~Performing the Surveillance in MODE 1 prior to exceeding 75% RTP provides assurance that the $F_Q(Z)$ limit will be met when RTP is achieved because peaking factors are generally decreased as power level is increased.~~

~~$F_Q(Z)$ is verified at power levels ≥ 20% RTP above the THERMAL POWER of its last verification, 24 hours after achieving equilibrium conditions to ensure that $F_Q(Z)$ is within its limit at higher power levels.~~

SR 3.2.1.2 requires a Surveillance of $F_Q^W(Z)$ during the initial startup following each refueling within 24 hours after exceeding 75% RTP. THERMAL POWER levels below 75% are typically non-limiting with respect to the limit for $F_Q^W(Z)$.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.2.1.2 (continued)

Furthermore, startup physics testing and flux symmetry measurements, also performed at low power, provide confirmation that the core is operating as expected. This Frequency ensures that verification of $F_Q^W(Z)$ is performed prior to extended operation at power levels where the maximum permitted peak LHR could be challenged and that the first required performance of SR 3.2.1.2 after a refueling is performed at a power level high enough to provide a high level of confidence in the accuracy of the Surveillance result.

Equilibrium conditions are achieved when the core is sufficiently stable at the intended operating conditions required to perform the Surveillance.

If a previous Surveillance of $F_Q^W(Z)$ was performed at part power conditions, SR 3.2.1.2 also requires that $F_Q^W(Z)$ be verified at power levels > 20% RTP above the THERMAL POWER of its last verification within 24 hours after achieving equilibrium conditions. This ensures that $F_Q^W(Z)$ is within its limit using radial peaking factors measured at the higher power level.

The allowance of up to 24 hours after achieving equilibrium conditions will provide a more accurate measurement of $F_Q^W(Z)$ by allowing sufficient time to achieve equilibrium conditions and obtain the power distribution measurement.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

(continued)

BASES

REFERENCES

1. 10 CFR 50.46, 1974.

2. Regulatory Guide 1.77, Rev. 0, May 1974.

3. 10 CFR 50, Appendix A, GDC 26.

4. RXE-90-006-P-A, "Power Distribution Control Analysis and Overtemperature N-16 and Overpower N-16 Trip Setpoint Methodology," TU Electric, June 1994.

5. WCAP-7308-L-P-A, “Evaluation of Nuclear Hot Channel Factor Uncertainties,” June 1988.

6. WCAP-10216-P-A, Rev. 1A, “Relaxation of Constant Axial Offset Control (and) FQ Surveillance Technical Specification,” February 1994.

7. WCAP-12472-P-A, “BEACON Core Monitoring and Operations Support System,” August 1994 (including “Addendum 1-A,” January 2000).

8. WCAP-17661-P-A, “Improved RAOC and CAOC F_Q Surveillance Technical Specifications,” February 2019.