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March 19, 2007

U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Document Control Desk

Subject: Duke Power Company LLC
d/b/a Duke Energy Carolinas, LLC
Oconee Nuclear Station
Docket Numbers 50-269, 270, and 287
Technical Specification Bases (TSB) Change

Technical Specification Bases (TSB) Change 2006-06 revises the Bases for Technical Specification 3.2.2 Axial Power Imbalance Operating Limits and 3.2.3 Quadrant Power Tilt (QPT) to clarify the use of the full incore detector system, the backup incore detector system and the excore detector system.

Attachment 1 contains the new TSB pages, Attachment 2 contains the marked up version of the TSB pages.

If any additional information is needed, please contact Reene Gambrell at 864-885-3364.

Very truly yours,

Bruce Hamilton

B. H. Hamilton, Vice President
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A001

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Attachment #1

Proposed Bases revision

Remove Page	Insert Page
B 3.2.2-1	B 3.2.2-1
B 3.2.2-2	B 3.2.2-2
B 3.2.2-3	B 3.2.2-3
B 3.2.2-4	B 3.2.2-4
B 3.2.2-5	B 3.2.2-5
B 3.2.2-6	B 3.2.2-6
B 3.2.2-7	B 3.2.2-7
B 3.2.3-1	B 3.2.3-1
B 3.2.3-2	B 3.2.3-2
B 3.2.3-3	B 3.2.3-3
B 3.2.3-4	B 3.2.3-4
B 3.2.3-5	B 3.2.3-5
B 3.2.3-6	B 3.2.3-6
B 3.2.3-7	B 3.2.3-7
B 3.2.3-8	B 3.2.3-8
B 3.2.3-9	B 3.2.3-9

B 3.2 POWER DISTRIBUTION LIMITS

B 3.2.2 AXIAL POWER IMBALANCE Operating Limits

BASES

BACKGROUND

This LCO is required to limit the core power distribution based on accident initial condition criteria.

The power density at any point in the core must be limited to maintain specified acceptable fuel design limits, including limits that satisfy the criteria specified in 10 CFR 50.46 (Ref. 1). This LCO provides limits on AXIAL POWER IMBALANCE to ensure that the core operates within the $F_Q(Z)$ and $F^N_{\Delta H}$ limits. $F_Q(Z)$ is the maximum local linear power density in the core divided by the core average fuel rod linear power density, assuming nominal fuel pellet and fuel rod dimensions. Operation within the $F_Q(Z)$ limits prevents power peaks that exceed the loss of coolant accident (LOCA) limits. $F^N_{\Delta H}$ is the ratio of the integral of linear power along the fuel rod on which minimum departure from nucleate boiling ratio occurs, to the average fuel rod power. Operation within the $F^N_{\Delta H}$ limits prevents departure from nucleate boiling (DNB) during an anticipated transient.

This LCO is required to limit fuel cladding failures that breach the primary fission product barrier and release fission products into the reactor coolant in the event of a LOCA, loss of forced reactor coolant flow accident, or other postulated accident requiring termination by a Reactor Protection System trip function. This LCO limits the amount of damage to the fuel cladding during an accident by maintaining the validity of the assumptions in the safety analyses related to the initial power distribution and reactivity.

Fuel cladding failure during a postulated LOCA is limited by restricting the maximum linear heat rate (LHR) so that the peak cladding temperature does not exceed 2200°F (Ref. 1). Peak cladding temperatures > 2200°F cause severe cladding failure by oxidation due to a Zircaloy water reaction. Other criteria must also be met (e.g., maximum cladding oxidation, maximum hydrogen generation, coolable geometry, and long term cooling). However, peak cladding temperature is usually most limiting.

Proximity to the DNB condition is expressed by the departure from nucleate boiling ratio (DNBR), defined as the ratio of the cladding surface heat flux required to cause DNB to the actual cladding surface heat flux. The minimum DNBR value during both normal operation and anticipated transients is limited to the DNBR correlation limit for the particular fuel

BASES

BACKGROUND (continued)

design in use and is accepted as an appropriate margin to DNB. The DNB correlation limit ensures that there is 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 DNB.

The measurement system independent limits on AXIAL POWER IMBALANCE are determined analytically by the reload safety evaluation analysis without adjustment for measurement system error and uncertainty. Operation beyond these limits could invalidate the assumptions used in the accident analyses regarding the core power distribution.

APPLICABLE SAFETY ANALYSES

The fuel cladding must not sustain damage as a result of normal operation and anticipated transients. The LCOs based on power distribution, LCO 3.2.1, "Regulating Rod Position Limits," LCO 3.2.2, "AXIAL POWER IMBALANCE Operating Limits," and LCO 3.2.3, "QUADRANT POWER TILT (QPT)," preclude core power distributions that would violate the following fuel design criteria:

a. During a large break LOCA, peak cladding temperature must not exceed 2200°F (Ref. 1);

b. During anticipated transients, there must be at least a 95% probability at the 95% confidence level (the 95/95 DNB criterion) that the hot fuel rod in the core does not experience a DNB condition.

The regulating rod positions, the AXIAL POWER IMBALANCE and the QPT are process variables that characterize and control the three dimensional power distribution of the reactor core.

Fuel cladding damage could result should an anticipated transient occur with simultaneous violation of one or more of the LCOs governing the three process variables cited above. This potential for fuel cladding damage exists because changes in the power distribution can cause increased power peaking and corresponding increased local LHRs.

The regulating rod position, the AXIAL POWER IMBALANCE, and the QPT are monitored and controlled during power operation to ensure that the power distribution is within the bounds set by the safety analyses. The axial power distribution is maintained primarily by the AXIAL POWER IMBALANCE limits; and the radial power distribution is maintained primarily by the QPT limits. The regulating rod position limits affect both the radial and axial power distributions.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The dependence of the core power distribution on burnup, regulating rod position, and spatial xenon distribution is taken into account when the reload safety evaluation analysis is performed.

Operation at the AXIAL POWER IMBALANCE limit must be interpreted as operating the core at the maximum allowable $F_Q(Z)$ or $F^N_{\Delta H}$ peaking factors assumed as initial conditions for the accident analyses with the allowed QPT present.

AXIAL POWER IMBALANCE satisfies Criterion 2 of 10 CFR 50.36 (Ref. 2).

LCO

The power distribution LCO limits have been established based on correlations between power peaking and easily measured process variables: regulating rod position, AXIAL POWER IMBALANCE, and QPT. The AXIAL POWER IMBALANCE envelope contained in the COLR represents the setpoints for which the core power distribution would either exceed the LOCA LHR limits or cause a reduction in the DNBR below the Safety Limit during anticipated transients with the allowable QPT present and with the regulating rod positions consistent with the limitations on regulating rod positions determined by the fuel cycle design and specified by LCO 3.2.1.

The AXIAL POWER IMBALANCE maximum allowable setpoints (measurement system dependent limits) applicable for the full Incore Detector System, the Backup Incore Detector System and the Excore Detector System are provided in the COLR.

APPLICABILITY

In MODE 1, the limits on AXIAL POWER IMBALANCE must be maintained when THERMAL POWER is > 40% RTP to prevent the core power distribution from exceeding the LOCA and anticipated transient assumptions used in the accident analyses. Applicability of these limits at ≤ 40% RTP in MODE 1 is not required. This operation is acceptable because the combination of AXIAL POWER IMBALANCE with the maximum allowable THERMAL POWER level will not result in LHRs sufficiently large to violate the fuel design limits. In MODES 2, 3, 4, 5, and 6, this LCO is not applicable because the reactor is not generating sufficient THERMAL POWER to produce fuel damage.

BASES

ACTIONS

A.1

The AXIAL POWER IMBALANCE operating limits that maintain the validity of the assumptions regarding the power distributions in the accident analyses of the LOCA and anticipated transients are provided in the COLR. Indefinite operation with the AXIAL POWER IMBALANCE outside the limits specified in the COLR is not prudent. Excessive AXIAL POWER IMBALANCE over an extended period of time may cause a potentially adverse xenon redistribution to occur. Therefore, operation is only allowed for a maximum of 2 hours. This required Completion Time is reasonable based on the low probability of a limiting event occurring simultaneously with the AXIAL POWER IMBALANCE outside the limits of this LCO. In addition, this limited Completion Time precludes long term depletion of the reactor fuel with excessive AXIAL POWER IMBALANCE and gives the operator sufficient time to reposition the APSRs or regulating rods to reduce the AXIAL POWER IMBALANCE because adverse effects of xenon redistribution and fuel depletion are limited.

B.1

If the Required Action and the associated Completion Time of Condition A are not met, the AXIAL POWER IMBALANCE may exceed its specified limits and the reactor may be operating with a global axial power distribution mismatch. Continued operation in this configuration may induce an axial xenon oscillation and may result in an increased linear heat generation rate when the xenon redistributes. Reducing THERMAL POWER to $\leq$ 40% RTP reduces the maximum LHR to a value that does not exceed the $F_Q(Z)$ and $F^N_{\Delta H}$ initial condition limits assumed in the accident analyses. The required Completion Time of 2 hours is reasonable based on limiting a potentially adverse xenon redistribution, the low probability of an accident occurring in this relatively short time period, and the number of steps required to complete this Action.

SURVEILLANCE REQUIREMENTS

The AXIAL POWER IMBALANCE can be monitored by both the Incore and Excore Detector Systems. If the Full Incore Detector System is available, this system shall be used for AXIAL POWER IMBALANCE monitoring. (The Full Incore Detector System is not available when the OAC is not available or the NAS computer is in alarm.) Reasonable completion times exist to allow the use of the Incore Detector System for AXIAL POWER IMBALANCE monitoring. If the Full Incore Detector System is not available, the Excore Detector System should be the basis for AXIAL POWER IMBALANCE monitoring. If the Full Incore Detector System is not available and 1 or more Excore Detectors are not OPERABLE (NI-5 – NI-8), then the Backup Incore Detector System should be the basis for

BASES

SURVEILLANCE REQUIREMENTS (continued)

AXIAL POWER IMBALANCE monitoring. The AXIAL POWER IMBALANCE maximum allowable setpoints are derived from their corresponding measurement system independent limits by adjustment for system observability errors and instrumentation errors. Although they may be based on the same measurement system independent limits, the setpoints for the different systems are not identical because of differences in the errors applicable for each of these systems. The uncertainty analysis that defines the required error adjustment to convert the measurement system independent limits to alarm setpoints assumes that 75% of the detectors are OPERABLE. Detectors located on the core major axes are assumed to contribute one half of their output to each quadrant; detectors in the center assembly are assumed to contribute one quarter of their output to each quadrant. AXIAL POWER IMBALANCE measurements using the Backup Incore Detector System consist of OPERABLE (Ref. 3) Incore detectors configured as follows:

a. Nine detectors shall be arranged such that there are three detectors in each of three strings and there are three detectors lying in the same axial plane, with one plane at the core midplane and one plane in each axial core half;

b. The axial planes in each core half shall be symmetrical about the core midplane; and

c. The detector strings shall not have radial symmetry.

Figure B 3.2.2-1 (Backup Incore Detector System for AXIAL POWER IMBALANCE Measurement) depicts an example of this configuration. This arrangement is chosen to reduce the uncertainty in the measurement of the AXIAL POWER IMBALANCE by the Backup Incore Detector System. For example, the requirement for placing one detector of each of the three strings at the core midplane puts three detectors in the central region of the core where the neutron flux tends to be higher. It also helps prevent measuring an AXIAL POWER IMBALANCE that is excessively large when the reactor is operating at low THERMAL POWER levels. The third requirement for placement of detectors (i.e., radial asymmetry) reduces uncertainty by measuring the neutron flux at core locations that are not radially symmetric.

The Excore Detector System consists of four detectors (one located outside each quadrant of the core). Each detector consists functionally of two six-foot uncompensated ion chambers adjacent to the top and bottom halves of the core. Comparison of the signals from the two detectors gives an indication of the core axial offset or imbalance.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.2.2.1

Verification of the AXIAL POWER IMBALANCE indication every 12 hours ensures that the AXIAL POWER IMBALANCE limits are not violated and takes into account other information and alarms available to the operator in the control room. This Surveillance Frequency is acceptable because the mechanisms that can cause AXIAL POWER IMBALANCE, such as xenon redistribution or CONTROL ROD drive mechanism malfunctions that cause slow AXIAL POWER IMBALANCE increases, can be discovered by the operator before the specified limits are violated.

REFERENCES

1. 10 CFR 50.46.
2. 10 CFR 50.36.
3. SLC 16.7.8, Incore Instrumentation

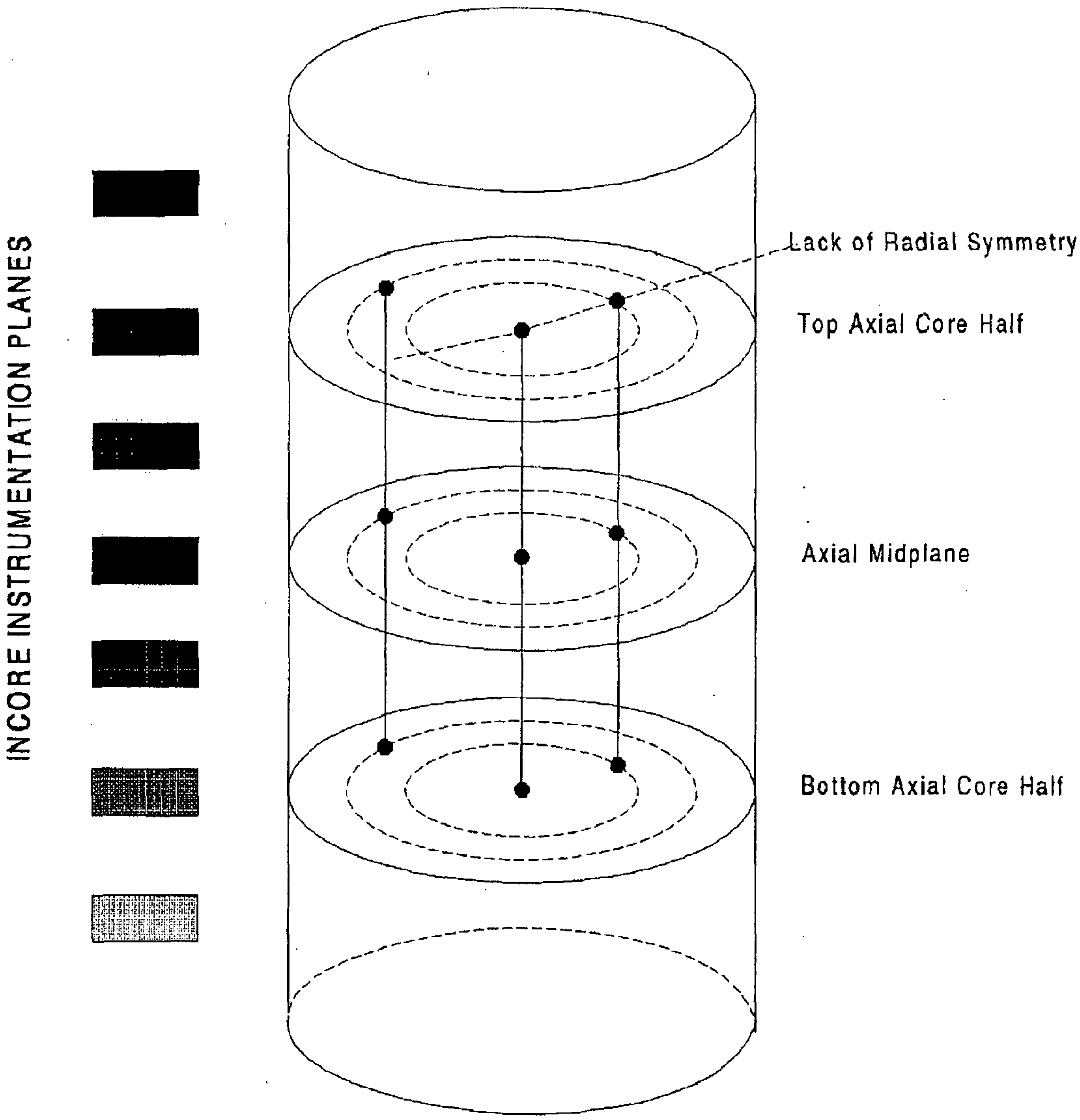


Figure B 3.2.2-1 (page 1 of 1)
Backup Incore Detector System for AXIAL POWER IMBALANCE Measurement

B 3.2 POWER DISTRIBUTION LIMITS

B 3.2.3 QUADRANT POWER TILT (QPT)

BASES

BACKGROUND

This LCO is required to limit the core power distribution based on accident initial condition criteria.

The power density at any point in the core must be limited to maintain specified acceptable fuel design limits, including limits that preserve the criteria specified in 10 CFR 50.46 (Ref. 1). Together, LCO 3.2.1, "Regulating Rod Position Limits," LCO 3.2.2, "AXIAL POWER IMBALANCE Operating Limits," and LCO 3.2.3, "QUADRANT POWER TILT (QPT)," provide limits on control component operation and on monitored process variables to ensure that the core operates within the $F_Q(Z)$ and $F^N_{\Delta H}$ limits. $F_Q(Z)$ is the maximum local linear power density in the core divided by the core average fuel rod linear power density, assuming nominal fuel pellet and fuel rod dimensions. Operation within the $F_Q(Z)$ limits prevents power peaks that exceed the loss of coolant accident (LOCA) limits. $F^N_{\Delta H}$ is the ratio of the integral of linear power along the fuel rod on which minimum departure from nucleate boiling ratio occurs, to the average fuel rod power. Operation within the $F^N_{\Delta H}$ limits prevents departure from nucleate boiling (DNB) during an anticipated transient.

This LCO is required to limit fuel cladding failures that breach the primary fission product barrier and release fission products to the reactor coolant in the event of a LOCA, loss of forced reactor coolant flow, or other accident requiring termination by a Reactor Protection System trip function. This LCO limits the amount of damage to the fuel cladding during an accident by maintaining the validity of the assumptions used in the safety analysis related to the initial power distribution and reactivity.

Fuel cladding failure during a postulated LOCA is limited by restricting the maximum linear heat rate (LHR) so that the peak cladding temperature does not exceed 2200°F (Ref. 1). Peak cladding temperatures > 2200°F cause severe cladding failure by oxidation due to a Zircaloy water reaction. Other criteria must also be met (e.g., maximum cladding oxidation, maximum hydrogen generation, coolable geometry, and long term cooling). However, peak cladding temperature is usually most limiting.

BASES

BACKGROUND (continued)

Proximity to the DNB condition is expressed by the departure from nucleate boiling ratio (DNBR), defined as the ratio of the cladding surface heat flux required to cause DNB to the actual cladding surface heat flux. The minimum DNBR value during both normal operation and anticipated transients is limited to the DNBR correlation limit for the particular fuel design in use, and is accepted as an appropriate margin to DNB. The DNBR correlation limit ensures that there is 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 DNB.

The measurement system independent limits on QPT are determined analytically by the reload safety evaluation analysis without adjustment for measurement system error and uncertainty. Operation beyond these limits could invalidate core power distribution assumptions used in the accident analysis. The error adjusted maximum allowable limits (measurement system dependent limits) for QPT are specified in the COLR.

APPLICABLE SAFETY ANALYSES

The fuel cladding must not sustain damage as a result of normal operation and anticipated transients. The LCOs based on power distribution (LCO 3.2.1, LCO 3.2.2, and LCO 3.2.3) preclude core power distributions that violate the following fuel design criteria:

a. During a large break LOCA, the peak cladding temperature must not exceed 2200°F (Ref. 1).

b. During anticipated transients, 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 DNB condition.

QPT is one of the process variables that characterize and control the three dimensional power distribution of the reactor core.

Fuel cladding damage could result if an anticipated transient occurs with simultaneous violation of one or more of the LCOs governing the core power distribution. Changes in the power distribution can cause increased power peaking and correspondingly increased local LHRs.

The dependence of the core power distribution on burnup, regulating rod insertion, and spatial xenon distribution is taken into account during the reload safety evaluation analysis. An allowance for QPT is accommodated in the analysis and resultant LCO limits. The increase in peaking taken for QPT is developed from a database of full core power distribution

BASES

APPLICABLE SAFETY ANALYSES (continued)

calculations (Ref. 2). The calculations consist of simulations of many power distributions with tilt causing mechanisms (e.g., dropped or misaligned CONTROL RODS, misloaded assemblies, and burnup gradients). An increase of < 2% peak power per 1% QPT is supported by the analysis, therefore a value of 2% peak power increase per 1% QPT is used to bound peak power increases due to QPT.

Operation at the AXIAL POWER IMBALANCE or rod position limits must be interpreted as operating the core at the maximum allowable $F_Q(Z)$ or $F^N_{\Delta H}$ peaking factors for accident initial conditions with the allowed QPT present.

QPT satisfies Criterion 2 of 10 CFR 50.36 (Ref. 3).

LCO

The power distribution LCO limits have been established based on correlations between power peaking and easily measured process variables: regulating rod position, AXIAL POWER IMBALANCE, and QPT. The regulating rod position limits and the AXIAL POWER IMBALANCE boundaries contained in the COLR represent the measurement system independent limits. These are the limits at which the core power distribution either exceeds the LOCA LHR limits or causes a reduction in DNBR below the safety limit during anticipated transients with the allowable QPT present and with regulating rod position consistent with the limitations on regulating rod positions determined by the fuel cycle design and specified by LCO 3.2.1.

The allowable limits and maximum limits for QPT applicable for the full symmetrical Incore Detector System, Backup Incore Detector System, and Excore Detector System are provided; the limits are given in the COLR. The limits for the three systems are derived by adjustment of the measurement system independent QPT limits to allow for system observability and instrumentation errors.

APPLICABILITY

In MODE 1, the limits on QPT must be maintained when THERMAL POWER is > 20% RTP to prevent the core power distribution from exceeding the design limits. The minimum power level of 20% RTP is large enough to obtain meaningful QPT indications without compromising safety. Operation at or below 20% RTP with QPT up to the maximum limit specified in the COLR is acceptable because the resulting maximum LHR is not high enough to cause violation of the LOCA LHR limit ($F_Q(Z)$ limit) or the initial condition DNB allowable peaking limit ($F^N_{\Delta H}$ limit) during accidents initiated from this power level.

BASES

APPLICABILITY (continued)

In MODE 2, the combination of QPT with maximum ALLOWABLE THERMAL POWER level does not result in LHRs sufficiently large to violate the fuel design limits, and therefore, applicability in this MODE is not required. Although not specifically addressed in the LCO, QPTs greater than the maximum limit specified in the COLR in MODE 1 with THERMAL POWER < 20% RTP are allowed for the same reason.

In MODES 3, 4, 5, and 6, this LCO is not applicable, because the reactor is not generating significant THERMAL POWER and QPT is indeterminate.

ACTIONS

A.1

The steady state limit specified in the COLR provides an allowance for QPT that may occur during normal operation. A peaking increase to accommodate QPTs up to the steady state limit is allowed by the regulating rod position limits of LCO 3.2.1 and the AXIAL POWER IMBALANCE limits of LCO 3.2.2.

The safety analysis has shown that a conservative corrective action is to reduce THERMAL POWER by 2% RTP or more from the ALLOWABLE THERMAL POWER for each 1% of QPT in excess of the steady state limit. This action limits the local LHR to a value corresponding to steady state operation, thereby reducing it to a value within the assumed accident initial condition limits. The required Completion Time of 2 hours is reasonable, based on limiting the potential for xenon redistribution, the low probability of an accident occurring, and the steps required to complete the Required Action.

If QPT can be reduced to less than or equal to the steady state limit in < 2 hours, the reactor may return to normal operation without undergoing a power reduction. Significant radial xenon redistribution does not occur within this amount of time.

A.2

Power operation is allowed to continue if THERMAL POWER is reduced in accordance with Required Action A.1. The same reduction (i.e., 2% RTP or more) is also applicable to the nuclear overpower trip setpoints (flux and flux/flow imbalance), for each 1% of QPT in excess of the steady state limit. This reduction maintains both core protection and thermal margins at the

BASES

ACTIONS

A.2 (continued)

reduced THERMAL POWER level similar to that at RTP. The required Completion Time of 10 hours is reasonable based on the need to limit the potentially adverse xenon redistribution, the low probability of an accident occurring while operating out of specification, and the number of steps required to complete the Required Action.

A.3

Although the actions directed by Required Action A.1 restore margins, if the source of the QPT is not determined and corrected, it is prudent to establish increased margins. A required Completion Time of 24 hours to reduce QPT to less than the steady state limit is a reasonable time for investigation and corrective measures.

B.1

If QPT exceeds the transient limit but is equal to or less than the maximum limit due to a misaligned CONTROL ROD or APSR, then power operation is allowed to continue if the THERMAL POWER is reduced 2% RTP or more from the ALLOWABLE THERMAL POWER for each 1% of QPT in excess of the steady state limit. Thus, the transient limit is the upper bound within which the 2% for 1% power reduction rule may be applied, but only for QPTs caused by CONTROL ROD or APSR misalignment. The required Completion Time of 30 minutes ensures that the operator completes the THERMAL POWER reduction before significant xenon redistribution occurs.

B.2

When a misaligned CONTROL ROD or APSR occurs, a local xenon redistribution may occur. The required Completion Time of 2 hours allows the operator sufficient time to relatch or realign a CONTROL ROD or APSR, but is short enough to limit xenon redistribution so that large increases in the local LHR do not occur due to xenon redistribution resulting from the QPT.

BASES

ACTIONS (continued)

C.1

If the Required Action and associated Completion Time of Condition A or B are not met, a further power reduction is required. Power reduction to < 60% RTP provides conservative protection from increased peaking due to xenon redistribution. The required Completion Time of 2 hours is reasonable to allow the operator to reduce THERMAL POWER to < 60% of ALLOWABLE THERMAL POWER without challenging unit systems.

C.2

Reduction of the nuclear overpower trip setpoints, based on flux and flux/flow imbalance, to ≤ 65.5% of ALLOWABLE THERMAL POWER after THERMAL POWER has been reduced to < 60% of ALLOWABLE THERMAL POWER maintains both core protection and thermal margin at reduced power similar to that at full power. The required Completion Time of 10 hours allows the operator sufficient time to reset the trip setpoint and is reasonable based on operating experience.

D.1

Power reduction to 60% of the ALLOWABLE THERMAL POWER is a conservative method of limiting the maximum core LHR for QPTs up to the maximum limit specified by the COLR. Although the power reduction is based on the correlation used in Required Actions A.1 and B.1, the database for a power peaking increase as a function of QPT is less extensive for tilt mechanisms other than misaligned CONTROL RODS and APSRs. Because greater uncertainty in the potential power peaking increase exists with the less extensive database, a more conservative action is taken when the tilt is caused by a mechanism other than a misaligned CONTROL ROD or APSR. The required Completion Time of 2 hours allows the operator to reduce THERMAL POWER to < 60% of the ALLOWABLE THERMAL POWER without challenging unit systems.

D.2

Reduction of the nuclear overpower trip setpoints, based on flux and flux/flow imbalance, to ≤ 65.5% of the ALLOWABLE THERMAL POWER after THERMAL POWER has been reduced to < 60% of the ALLOWABLE THERMAL POWER maintains both core protection and an operating margin at reduced power similar to that at full power. The required Completion Time of 10 hours allows the operator sufficient time to reset the trip setpoint and is reasonable based on operating experience.

BASES

ACTIONS (continued)

E.1

If the Required Action and associated Completion Time for Condition C or D are not met, then the reactor will continue in power operation with significant QPT. Either the power level has not been reduced to comply with the Required Action or the nuclear overpower trip setpoints (flux and flux/flow imbalance) have not been reduced within the required Completion Time. To preclude risk of fuel damage in any of these conditions, THERMAL POWER is reduced further. Operation at 20% RTP allows the operator to investigate the cause of the QPT and to correct it. Local LHRs with a large QPT do not violate the fuel design limits at or below 20% RTP. The required Completion Time of 4 hours is acceptable based on limiting the potential increase in local LHRs that could occur due to xenon redistribution with the QPT out of specification.

F.1

QPT in excess of the maximum limit specified in the COLR can be an indication of a severe power distribution anomaly, and a power reduction to at most 20% RTP ensures local LHRs do not exceed allowable limits while the cause is being determined and corrected.

The required Completion Time of 4 hours is reasonable to allow the operator to reduce THERMAL POWER to ≤ 20% RTP without challenging unit systems.

SURVEILLANCE REQUIREMENTS

QPT can be monitored by both the Incore and Excore Detector Systems. If the Full Incore Detector System is available, this system shall be used for QPT monitoring. (The Full Incore Detector System is not available when the OAC is not available or the NAS computer is in alarm.) The Full Incore Detector System is preferred due to Excore Detector System tilts potentially being affected (i.e., normalized to zero) anytime an Excore Detector calibration is performed. Reasonable completion times exist to allow the use of the Incore Detector System for QPT monitoring. If the Full Incore Detector System is not available, the Excore Detector System should be the basis for QPT monitoring. If the Full Incore Detector System is not available and 1 or more Excore Detectors are not OPERABLE (NI-5 – NI-8), then the Backup Incore Detector System should be the basis for QPT monitoring. The QPT limits are derived from their corresponding measurement system independent limits by adjustment for system observability errors and instrumentation errors. Although they may be based on the same measurement system independent limit, the limits for the different systems are not identical because of differences in the errors applicable for these systems. QPT measurements using the

BASES

SURVEILLANCE REQUIREMENTS (continued)

Backup Detector System consist of OPERABLE (Reference 4) Incore detectors configured as follows:

a. Two sets of four detectors shall lie in each core half. Each set of detectors shall lie in the same axial plane. The two sets in the same core half may lie in the same axial plane.

b. Detectors in the same plane shall have quarter core radial symmetry.Figure B 3.2.3-1 (Backup Incore Detector System for QPT Measurement) depicts an example of this configuration.

The Excore Detector System consists of four detectors (one located outside each quadrant of the core). Each detector consists functionally of two six-foot uncompensated ion chambers adjacent to the top and bottom halves of the core.

SR 3.2.3.1

Checking the QPT indication every 7 days ensures that the operator can determine whether the plant computer software and Incore Detector System inputs for monitoring QPT are functioning properly, and takes into account other information and alarms available to the operator in the Control Room. This procedure allows the QPT mechanisms, such as xenon redistribution, burnup gradients, and CONTROL ROD drive mechanism malfunctions, which can cause slow development of a QPT, to be detected. Operating experience has confirmed the acceptability of a Surveillance Frequency of 7 days.

Following restoration of the QPT to within the steady state limit, operation at ≥ 95% RTP may proceed provided the QPT is determined to remain within the steady state limit at the increased THERMAL POWER level. In case QPT exceeds the steady state limit for more than 24 hours or exceeds the transient limit (Condition A, B, or D), the potential for xenon redistribution is greater. Therefore, the QPT is monitored for 12 consecutive hourly intervals to determine whether the period of any oscillation due to xenon redistribution causes the QPT to exceed the steady state limit again.

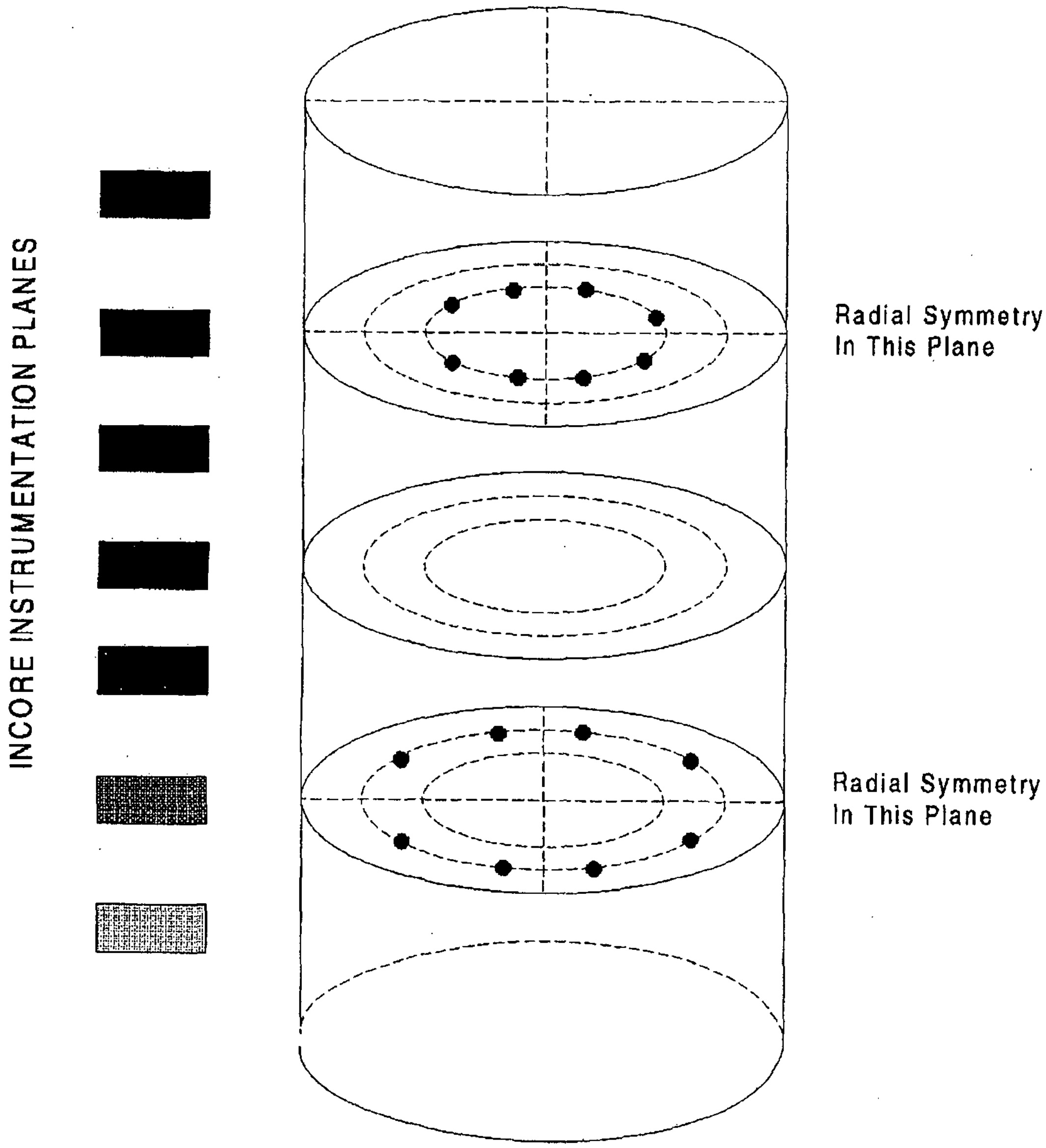
REFERENCES

1. 10 CFR 50.46.

2. BAW 10122A, "Normal Operating Controls," Rev. 1, May 1984.

3. 10 CFR 50.36.

4. SLC 16.7.8, Incore Instrumentation



1

Figure B 3.2.3-1 (page 1 of 1)
Backup Incore Detector System for QUADRANT POWER TILT Measurement

Attachment #2

Markup of current Bases

BASES (continued)

ACTIONS

A.1

The AXIAL POWER IMBALANCE operating limits that maintain the validity of the assumptions regarding the power distributions in the accident analyses of the LOCA and anticipated transients are provided in the COLR. Indefinite operation with the AXIAL POWER IMBALANCE outside the limits specified in the COLR is not prudent. Excessive AXIAL POWER IMBALANCE over an extended period of time may cause a potentially adverse xenon redistribution to occur. Therefore, operation is only allowed for a maximum of 2 hours. This required Completion Time is reasonable based on the low probability of a limiting event occurring simultaneously with the AXIAL POWER IMBALANCE outside the limits of this LCO. In addition, this limited Completion Time precludes long term depletion of the reactor fuel with excessive AXIAL POWER IMBALANCE and gives the operator sufficient time to reposition the APSRs or regulating rods to reduce the AXIAL POWER IMBALANCE because adverse effects of xenon redistribution and fuel depletion are limited.

B.1

If the Required Action and the associated Completion Time of Condition A are not met, the AXIAL POWER IMBALANCE may exceed its specified limits and the reactor may be operating with a global axial power distribution mismatch. Continued operation in this configuration may induce an axial xenon oscillation and may result in an increased linear heat generation rate when the xenon redistributes. Reducing THERMAL POWER to ≤ 40% RTP reduces the maximum LHR to a value that does not exceed the $F_Q(Z)$ and $F^N_{\Delta H}$ initial condition limits assumed in the accident analyses. The required Completion Time of 2 hours is reasonable based on limiting a potentially adverse xenon redistribution, the low probability of an accident occurring in this relatively short time period, and the number of steps required to complete this Action.

SURVEILLANCE REQUIREMENTS

INSERT 1 per attached

~~The AXIAL POWER IMBALANCE can be monitored by both the Incore and Excore Detector Systems. The AXIAL POWER IMBALANCE maximum allowable setpoints are derived from their corresponding measurement system independent limits by adjusting for both the system observability errors and instrumentation errors.~~ Although they may be based on the same measurement system independent limits, the setpoints for the different systems are not identical because of differences in the errors applicable for each of these systems. The uncertainty analysis that defines the required error adjustment to convert the measurement system

BASES

SURVEILLANCE REQUIREMENTS (continued)

independent limits to alarm setpoints assumes that 75% of the detectors are OPERABLE. Detectors located on the core major axes are assumed to contribute one half of their output to each quadrant; detectors in the center assembly are assumed to contribute one quarter of their output to each quadrant. For AXIAL POWER IMBALANCE measurements using the Incore Detector System, the Backup Incore Detector System consists of OPERABLE detectors configured as follows:

INSERT 2 per attached

a. Nine detectors shall be arranged such that there are three detectors in each of three strings and there are three detectors lying in the same axial plane, with one plane at the core midplane and one plane in each axial core half;

b. The axial planes in each core half shall be symmetrical about the core midplane; and

c. The detector strings shall not have radial symmetry.

Figure B 3.2.2-1 (Backup Incore Detector System for AXIAL POWER IMBALANCE Measurement) depicts an example of this configuration. This arrangement is chosen to reduce the uncertainty in the measurement of the AXIAL POWER IMBALANCE by the Backup Incore Detector System. For example, the requirement for placing one detector of each of the three strings at the core midplane puts three detectors in the central region of the core where the neutron flux tends to be higher. It also helps prevent measuring an AXIAL POWER IMBALANCE that is excessively large when the reactor is operating at low THERMAL POWER levels. The third requirement for placement of detectors (i.e., radial asymmetry) reduces uncertainty by measuring the neutron flux at core locations that are not radially symmetric.

The Excore Detector System consists of four detectors (one located outside each quadrant of the core). Each detector consists functionally of two six-foot uncompensated ion chambers adjacent to the top and bottom halves of the core. Comparison of the signals from the two detectors gives an indication of the core axial offset or imbalance.

SR 3.2.2.1

Verification of the AXIAL POWER IMBALANCE indication every 12 hours ensures that the AXIAL POWER IMBALANCE limits are not violated and takes into account other information and alarms available to the operator in

BASES

SURVEILLANCE REQUIREMENTS	SR 3.2.2.1 (continued) the control room. This Surveillance Frequency is acceptable because the mechanisms that can cause AXIAL POWER IMBALANCE, such as xenon redistribution or CONTROL ROD drive mechanism malfunctions that cause slow AXIAL POWER IMBALANCE increases, can be discovered by the operator before the specified limits are violated.
REFERENCES	1. 10 CFR 50.46. 2. 10 CFR 50.36. 3. SLC 16.7.8, INCORE INSTRUMENTATION

BASES

ACTIONS (continued)

E.1

If the Required Action and associated Completion Time for Condition C or D are not met, then the reactor will continue in power operation with significant QPT. Either the power level has not been reduced to comply with the Required Action or the nuclear overpower trip setpoints (flux and flux/flow imbalance) have not been reduced within the required Completion Time. To preclude risk of fuel damage in any of these conditions, THERMAL POWER is reduced further. Operation at 20% RTP allows the operator to investigate the cause of the QPT and to correct it. Local LHRs with a large QPT do not violate the fuel design limits at or below 20% RTP. The required Completion Time of 4 hours is acceptable based on limiting the potential increase in local LHRs that could occur due to xenon redistribution with the QPT out of specification.

F.1

QPT in excess of the maximum limit specified in the COLR can be an indication of a severe power distribution anomaly, and a power reduction to at most 20% RTP ensures local LHRs do not exceed allowable limits while the cause is being determined and corrected.

The required Completion Time of 4 hours is reasonable to allow the operator to reduce THERMAL POWER to ≤ 20% RTP without challenging unit systems.

SURVEILLANCE REQUIREMENTS

INSERT 3 per attached

~~QPT can be monitored by both the Incore and Excore Detector Systems. If the Incore Detector System is OPERABLE, this system shall be used for QPT monitoring. The Incore Detector System is preferred due to Excore Detector System tilts potentially being affected (i.e., normalized to zero) anytime an Excore Detector calibration is performed. Reasonable completion times exist to allow the use of the Incore Detector System for QPT monitoring. If the Incore Detector System is not OPERABLE, the Excore Detector System should be the basis for QPT monitoring.~~ The QPT limits are derived from their corresponding measurement system independent limits by adjustment for system observability errors and instrumentation errors. Although they may be based on the same measurement system independent limit, the limits for the different systems are not identical because of differences in the errors applicable for these systems. ~~For QPT measurements using the Incore Detector System, the Backup Incore Detector System consists of OPERABLE detectors configured as follows:~~

INSERT 4 per attached

BASES

SURVEILLANCE REQUIREMENTS (continued)

a. Two sets of four detectors shall lie in each core half. Each set of detectors shall lie in the same axial plane. The two sets in the same core half may lie in the same axial plane.

b. Detectors in the same plane shall have quarter core radial symmetry.Figure B 3.2.3-1 (Backup Incore Detector System for QPT Measurement) depicts an example of this configuration.

The Excore Detector System consists of four detectors (one located outside each quadrant of the core). Each detector consists functionally of two six-foot uncompensated ion chambers adjacent to the top and bottom halves of the core.

SR 3.2.3.1

Checking the QPT indication every 7 days ensures that the operator can determine whether the plant computer software and Incore Detector System inputs for monitoring QPT are functioning properly, and takes into account other information and alarms available to the operator in the Control Room. This procedure allows the QPT mechanisms, such as xenon redistribution, burnup gradients, and CONTROL ROD drive mechanism malfunctions, which can cause slow development of a QPT, to be detected. Operating experience has confirmed the acceptability of a Surveillance Frequency of 7 days.

Following restoration of the QPT to within the steady state limit, operation at ≥ 95% RTP may proceed provided the QPT is determined to remain within the steady state limit at the increased THERMAL POWER level. In case QPT exceeds the steady state limit for more than 24 hours or exceeds the transient limit (Condition A, B, or D), the potential for xenon redistribution is greater. Therefore, the QPT is monitored for 12 consecutive hourly intervals to determine whether the period of any oscillation due to xenon redistribution causes the QPT to exceed the steady state limit again.

REFERENCES

1. 10 CFR 50.46.
2. BAW 10122A, "Normal Operating Controls," Rev. 1, May 1984.
3. 10 CFR 50.36.
4. SLC 16.7.8 INCORE INSTRUMENTATION

ADD to TSB

Inserts

Insert 1
Technical Specification Bases 3.2.2 Page 3.2.2-4

The AXIAL POWER IMBALANCE can be monitored by both the Incore and Excore Detector Systems. If the Full Incore Detector System is available, this system shall be used for AXIAL POWER IMBALANCE monitoring. (The Full Incore Detector System is not available when the OAC is not available or the NAS computer is in alarm.) Reasonable completion times exist to allow the use of the Incore Detector System for AXIAL POWER IMBALANCE monitoring. If the Full Incore Detector System is not available, the Excore Detector System should be the basis for AXIAL POWER IMBALANCE monitoring. If the Full Incore Detector System is not available and the Excore Detector Systems is not OPERABLE, then the Backup Incore Detector System should be the basis for AXIAL POWER IMBALANCE monitoring. The AXIAL POWER IMBALANCE maximum allowable setpoints are derived from their corresponding measurement system independent limits by adjustment for system observability errors and instrumentation errors.

Insert 2
Technical Specification Bases 3.2.2 Page 3.2.2-5

AXIAL POWER IMBALANCE measurements using the Backup Incore Detector System consist of OPERABLE (Reference 3) Incore detectors configured as follows:

Insert 3
Technical Specification Bases 3.2.3 Page 3.2.3-7

QPT can be monitored by both the Incore and Excore Detector Systems. If the Full Incore Detector System is available, this system shall be used for QPT monitoring. (The Full Incore Detector System is not available when the OAC is not available or the NAS computer is in alarm.) The Full Incore Detector System is preferred due to Excore Detector System tilts potentially being affected (i.e., normalized to zero) anytime an Excore Detector calibration is performed. Reasonable completion times exist to allow the use of the Incore Detector System for QPT monitoring. If the Full Incore Detector System is not available, the Excore Detector System should be the basis for QPT monitoring. If the Full Incore and Excore Detector Systems are not OPERABLE, then the Backup Incore Detector System should be the basis for QPT monitoring.

Insert 4
Technical Specification Bases 3.2.3 Page 3.2.3-7

QPT measurements using the Backup Incore Detector System consist of OPERABLE (Reference 4) Incore detectors configured as follows: