

Attachment 1

**Proposed Technical Specification Change
North Anna Unit 1**

Virginia Electric and Power Company

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Attachment 2

**Proposed Technical Specification Change
North Anna Unit 2**

Virginia Electric and Power Company

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REACTIVITY CONTROL SYSTEMS

3/4.1.3 MOVABLE CONTROL ASSEMBLIES

GROUP HEIGHT

LIMITING CONDITION FOR OPERATION

3.1.3.1 All shutdown and control rods shall be OPERABLE and positioned within ± 12 steps* of their group step counter demand position.

APPLICABILITY: MODES 1** and 2**.

ACTION:

- a. With one or more rods inoperable due to being immovable as a result of excessive friction or mechanical interference or known to be untrippable, determine within one hour that the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is satisfied and be in HOT STANDBY within 6 hours.
- b. With more than one rod inoperable due to causes other than those addressed by ACTION "a" above or misaligned from the group step counter demand position by more than the above alignment requirements, determine within one hour that the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is satisfied and be in HOT STANDBY within 6 hours.
- c. With a maximum of one rod inoperable due to causes other than those addressed by ACTION "a" above or misaligned from the group step counter demand position by more than the above alignment requirements, POWER OPERATION may continue provided that within one hour, either:
 1. The rod is restored to OPERABLE status within the above alignment requirements, or
 2. The rod is declared inoperable and the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is satisfied. POWER OPERATION may then continue provided that:
 - a) A reevaluation of each accident analysis for Table 3.1-1 is performed within 5 days. This reevaluation shall confirm that the previous analyzed results of these accidents remain valid for the duration of operation under these conditions, and

* For power levels below 50% of RATED THERMAL POWER, the position of each rod as determined by its individual rod position indicator may be more than ± 12 steps from its group step counter demand position for a maximum of one hour in every 24. During this hour, the indicated position of each rod may be no more than ± 24 steps from its demand position. The ± 24 step/hour limit is not applicable when control rod position is known to be greater than 12 steps from the rod group step counter demand position indication.

** See Special Test Exceptions 3.10.2 and 3.10.3.

REACTIVITY CONTROL SYSTEMS

GROUP HEIGHT

LIMITING CONDITION FOR OPERATION (Continued)

- b) The SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is determined at least once per 12 hours, and
- c) A power distribution map is obtained from the movable incore detectors and $F_Q(Z)$ and $F_{\Delta H}^N$ are verified to be within their limits within 72 hours, or

Either the THERMAL POWER level is reduced to $\leq 75\%$ of RATED THERMAL POWER within one hour and within the next 4 hours the high neutron flux trip setpoint is reduced to $\leq 85\%$ of RATED THERMAL POWER, or

The remainder of the rods in the group with the inoperable rod are aligned to within ± 12 steps of the inoperable rod within the hour while maintaining the thermal power, rod sequence, and insertion limits of Specification 3.1.3.6 during subsequent operation.

SURVEILLANCE REQUIREMENTS

4.1.3.1.1 The position of each rod shall be determined to be within the group demand limit by verifying the individual rod positions at least once per 12 hours except during time intervals when the Rod Position Deviation Monitor is inoperable, then verify the group positions at least once per 4 hours.

4.1.3.1.2 Each rod not fully inserted in the core shall be determined to be OPERABLE by movement of at least 10 steps in any one direction at least once per 31 days.

REACTIVITY CONTROL SYSTEMS

POSITION INDICATOR CHANNELS - OPERATING

LIMITING CONDITION FOR OPERATION

3.1.3.2 The shutdown and control rod position indicating system shall be OPERABLE with:

- a. Each individual rod position indicator channel, 1 per rod, accurate to within ± 12 steps* of actual rod position, and
- b. Each demand position indicator, 1 per group, accurate to within ± 2 steps of demand position, and
- c. The Automatic Rod Position Deviation Monitor with the alarm setpoint < 12 steps.

APPLICABILITY: MODES 1 and 2.

ACTION:

- a. With a maximum of one individual rod position indicator channel per group inoperable, either:
 1. Determine the position of the non-indicating rod indirectly by the movable incore detectors at least once per 8 hours and immediately after any motion of the non-indicating rod which exceeds 24 steps in one direction since the last determination of the rod's position as well as verify that the rod position requirements of Specification 3.1.3.1 are satisfied, or
 2. Reduce THERMAL POWER to $< 50\%$ of RATED THERMAL POWER within 8 hours and verify that the requirements of Specification 3.1.3.1 are satisfied.
- b. With a maximum of one demand position indicator per bank inoperable, either:
 1. Verify that all individual rod position indicators for the affected bank are OPERABLE and that the most withdrawn rod and the least withdrawn rod of the bank are within a maximum of 12 steps of each other at least once per 8 hours, or
 2. Reduce THERMAL POWER to $< 50\%$ of RATED THERMAL POWER within 8 hours and verify that the requirements of Specification 3.1.3.1 are satisfied.
- c. With the Automatic Rod Position Deviation Monitor inoperable, compare the demand position indicators and the individual rod position indicator channels at least once per 4 hours to ensure that rod position indication is within the above tolerance requirements. The provisions of Specification 3.0.4 are not applicable.

* Below 50% power each individual rod position indicator may be more than ± 12 steps from its group step counter demand position for a maximum of one hour in every 24. During this hour, each individual rod position indicator may be no more than ± 24 steps from its demand position. If either the one hour period or the ± 24 step limit is exceeded, immediately declare the individual rod position indicator channel inoperable.

REACTIVITY CONTROL SYSTEMS

POSITION INDICATOR CHANNELS - OPERATING

SURVEILLANCE REQUIREMENTS

4.1.3.2.1 Each individual rod position indicator shall be determined to be OPERABLE by:

- a. Performing a CHANNEL CHECK* by intercomparison of each individual rod position indicator and its corresponding demand position indicator at least once per 12 hours, and
- b. Performing a CHANNEL FUNCTIONAL TEST and CHANNEL CALIBRATION at least once per 18 months.

4.1.3.2.2 Each demand position indicator shall be determined to be OPERABLE by:

- a. Performing a CHANNEL CHECK of the demand position indicators within a bank at least once per 7 days, and
- b. Performing a CHANNEL CHECK by an intercomparison of the control bank benchboard demand position indicators and the rod control system logic cabinet bank overlap indicator or the rod position indicator cabinet P/A indicators, and determining their agreement within ± 2 steps, at least once per 92 days.

4.1.3.2.3 The Automatic Rod Position Deviation Monitor shall be determined to be OPERABLE by performing a functional test of the process computer alarm to demonstrate the process computer remains capable of recognizing a deviation of 12 steps or more at least once per 7 days.

* Below 50% power each individual rod position indicator may be more than ± 12 steps from its group step counter demand position for a maximum of one hour in every 24. During this hour, each individual rod position indicator may be no more than ± 24 steps from its demand position. If either the one hour period or the ± 24 step limit is exceeded, immediately declare the individual rod position indicator channel inoperable. A scan frequency of approximately once per minute, by either the plant computer or a data acquisition system, is acceptable for determining the total time that a rod position indicator has deviated more than ± 12 steps but no more than ± 24 . A rod position indicator which is found to be so deviated is assumed to have been deviated for the entire scanning period. When the scanner is unavailable to sum deviated time, the tolerance reverts to ± 12 steps.

REACTIVITY CONTROL SYSTEMS

POSITION INDICATOR CHANNELS - SHUTDOWN

LIMITING CONDITION FOR OPERATION

3.1.3.3 The rod group step counter demand position indicator shall be OPERABLE and accurate to within ± 2 steps of the demand position from the logic cabinet for each shutdown or control rod group not fully inserted.

APPLICABILITY: MODES 3*, 4* and 5*.

ACTION:

With less than the above required demand position indicators OPERABLE, open the reactor trip system breakers within 15 minutes.

SURVEILLANCE REQUIREMENTS

4.1.3.3 Each of the above required demand position indicators shall be determined to be OPERABLE by:

- a. Performing a CHANNEL CHECK of the demand position indicators within a bank at least once per 7 days, and
- b. Performing a CHANNEL CHECK by an intercomparator ^{*} the control bank benchboard demand position indicators and the rod control system logic cabinet bank overlap indicator or the rod position indicator cabinet P/A indicators, and determining their agreement within ± 2 steps, at least once per 92 days.
- c. The provisions of Specification 4.0.4 are not applicable.

* With the reactor trip system breakers in the closed position.

REACTIVITY CONTROL SYSTEMS

SHUTDOWN ROD INSERTION LIMIT

LIMITING CONDITION FOR OPERATION

3.1.3.5 All shutdown rods shall be fully withdrawn.

APPLICABILITY: MODES 1* and 2*#.

ACTION:

With a maximum of one shutdown rod not fully withdrawn, except for surveillance testing pursuant to Specification 4.1.3.1.2, within one hour either:

- a. Fully withdraw the rod, or
- b. Declare the rod to be inoperable and apply Specification 3.1.3.1.

SURVEILLANCE REQUIREMENTS

4.1.3.5 Each shutdown rod shall be determined to be fully withdrawn:

- a. Within 15 minutes prior to initial control rod bank withdrawal during an approach to reactor criticality, and
- b. At least once per 12 hours thereafter.

* See Special Test Exceptions 3.10.2 and 3.10.3.

With $K_{eff} \geq 1.0$

REACTIVITY CONTROL SYSTEMS

CONTROL ROD INSERTION LIMITS

LIMITING CONDITION FOR OPERATION

3.1.3.6 The control banks shall be limited in physical insertion as shown in Figures 3.1-1 and 3.1-2.

APPLICABILITY: MODES 1* and 2*#.

ACTION:

With the control banks inserted beyond the above insertion limits, except for surveillance testing pursuant to Specification 4.1.3.1.2, either:

- a. Restore the control banks to within the insertion limits within two hours, or
- b. Reduce THERMAL POWER within two hours to less than or equal to that fraction of RATED THERMAL POWER which is allowed by the rod group step counter demand position using the above figures, or
- c. Be in HOT STANDBY within 6 hours.

SURVEILLANCE REQUIREMENTS

4.1.3.6 The position of each control bank shall be determined to be within the insertion limits at least once per 12 hours except during time intervals when the Rod Insertion Limit Monitor is inoperable, then verify either the individual rod positions (indicated positions) or the group step counter demand position of each rod group to be within the insertion limits at least once per 4 hours.

* See Special Test Exceptions 3.10.2 and 3.10.3.

With $K_{eff} \geq 1.0$

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REACTIVITY CONTROL SYSTEMS

BASES

3/4.1.2 BORATION SYSTEMS (Continued)

The limits on contained water volume and boron concentration of the RWST also ensure a pH value of between 8.5 and 11.0 for the solution recirculated within the containment after a LOCA. This pH minimizes the evolution of iodine and minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components.

At least one charging pump must remain operable at all times when the opposite unit is in MODE 1, 2, 3, or 4. This is required to maintain the charging pump cross-connect system operational.

3/4.1.3 MOVABLE CONTROL ASSEMBLIES

The specifications of this section (1) ensure that acceptable power distribution limits are maintained, (2) ensure that the minimum SHUTDOWN MARGIN is maintained, and (3) limit the potential effects of rod misalignment on associated accident analyses. OPERABILITY of the movable control assemblies is established by observing rod motion and determining that rods are positioned within ± 12 steps (indicated position) of the respective demand step counter position. The OPERABILITY of the individual rod position indication system is established by appropriate periodic CHANNEL CHECKS, CHANNEL FUNCTIONAL TESTS, and CHANNEL CALIBRATIONS. OPERABILITY of the individual rod position indicators is required to determine control rod position and thereby ensure compliance with the control rod alignment and insertion limits. The OPERABLE condition for the individual rod position indicators is defined as being capable of indicating rod position within ± 12 steps of the associated demand position indicator. For power levels below 50 percent of RATED THERMAL POWER, the specifications of this section permit a maximum one hour in every 24 stabilization period (thermal "soak time") to allow stabilization of known thermal drift in the individual rod position indicator channels during which time the indicated rod position may vary from demand position indication by no more than ± 24 steps. This "1 in 24" feature is an upper limit on the frequency of thermal soak allowances and is available both for a continuous one hour period or one consisting of several discrete intervals. During this stabilization period, greater reliance is placed upon the demand position indicators to determine rod position. In addition, the ± 24 step/hour limit is not applicable when the control rod position is known to be greater than 12 steps from the rod group step counter demand position indication. Above 50 percent of RATED THERMAL POWER, rod motion is not expected to induce thermal transients of sufficient magnitude to exceed the individual rod position indicator instrument accuracy of ± 12 steps. Comparison of the demand position indicators to the bank insertion limits with verification of rod position by the individual rod position indicators (after thermal soak following rod motion below 50 percent of RATED THERMAL POWER) is sufficient verification that the control rods are above the insertion limits.

REACTIVITY CONTROL SYSTEMS

BASES (Continued)

The ACTION statements which permit limited variations from the basic requirements are accompanied by additional restrictions which ensure that the original design criteria are met. Misalignment of a rod requires measurement of peaking factors or a restriction in THERMAL POWER; either of these restrictions provides assurance of fuel rod integrity during continued operation. In addition, those accident analyses affected by a misaligned rod are reevaluated to confirm that the results remain valid during future operation.

Continuous monitoring of rod position with respect to insertion limits and rod deviation is provided by the rod insertion limit monitor and rod position deviation monitor, respectively. OPERABILITY of the rod position deviation monitor is verified by a functional test at least once per 7 days and by comparison of the indicated positions versus the respective demand position indicators at least once per 12 hours. If the rod position deviation monitor or the rod insertion limit monitor is inoperable, the frequency of manual comparison of indicated rod (or bank) position is increased to an interval of at least once per 4 hours.

The maximum rod drop time restriction is consistent with the assumed rod drop time used in the accident analyses. Measurement with $T_{avg} \geq 500^{\circ}\text{F}$ and with all reactor coolant pumps operating ensures that the measured drop times will be representative of insertion times experienced during a reactor trip at operating conditions.

3/4.10 SPECIAL TEST EXCEPTIONS

BASES

3/4.10.1 SHUTDOWN MARGINS

This special test exception provides that a minimum amount of control rod worth is immediately available for reactivity control when tests are performed for control rod worth measurement. This special test exception is required to permit the periodic verification of the actual versus predicted core reactivity condition occurring as a result of fuel burnup or fuel cycling operations.

3/4.10.2 GROUP HEIGHT, INSERTION, AND POWER DISTRIBUTION LIMITS

This special test exception permits individual control rods to be positioned outside of their normal group heights and insertion limits during the performance of such PHYSICS TESTS as those required to 1) measure control rod worth and 2) determine the reactor stability index and damping factor under xenon oscillation conditions.

3/4.10.3 PHYSICS TESTS

This special test exception permits PHYSICS TESTS to be performed at less than or equal to 5% of RATED THERMAL POWER and is required to verify the fundamental nuclear characteristics of the reactor core and related instrumentation.

3/4.10.4 REACTOR COOLANT LOOPS

This special test exception permits reactor criticality under no flow conditions and is required to perform certain startup and PHYSICS TESTS while at low THERMAL POWER levels.

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REACTIVITY CONTROL SYSTEMS

3/4.1.3 MOVABLE CONTROL ASSEMBLIES

GROUP HEIGHT

LIMITING CONDITION FOR OPERATION

3.1.3.1 All shutdown and control rods shall be OPERABLE and positioned within ± 12 steps* of their group step counter demand position.

APPLICABILITY: MODES 1** and 2**.

ACTION:

- a. With one or more rods inoperable due to being immovable as a result of excessive friction or mechanical interference or known to be untrippable, determine within one hour that the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is satisfied and be in HOT STANDBY within 6 hours.
- b. With more than one rod inoperable due to causes other than those addressed by ACTION "a" above or misaligned from the group step counter demand position by more than the above alignment requirements, determine within one hour that the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is satisfied and be in HOT STANDBY within 6 hours.
- c. With a maximum of one rod inoperable due to causes other than those addressed by ACTION "a" above or misaligned from the group step counter demand position by more than the above alignment requirements, POWER OPERATION may continue provided that within one hour, either:
 1. The rod is restored to OPERABLE status within the above alignment requirements, or
 2. The rod is declared inoperable and the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is satisfied. POWER OPERATION may then continue provided that:
 - a) A reevaluation of each accident analysis of Table 3.1-1 is performed within 5 days. This reevaluation shall confirm that the previous analyzed results of these accidents remain valid for the duration of operation under these conditions, and

* For power levels below 50% of RATED THERMAL POWER, the position of each rod as determined by its individual rod position indicator may be more than ± 12 steps from its group step counter demand position for a maximum one hour in every 24. During this hour, the indicated position of each rod may be no more than ± 24 steps from its demand position. The ± 24 step/hour limit is not applicable when control rod position is known to be greater than 12 steps from the rod group step counter demand position indication.

** See Special Test Exceptions 3.10.2 and 3.10.3

REACTIVITY CONTROL SYSTEMS

GROUP HEIGHT

LIMITING CONDITION FOR OPERATION (Continued)

- b) The SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is determined at least once per 12 hours, and
- c) A power distribution map is obtained from the movable incore detectors and $F_Q(Z)$ and $F_{\Delta H}^N$ are verified to be within their limits within 72 hours, or

Either the THERMAL POWER level is reduced to $\leq 75\%$ of RATED THERMAL POWER within one hour and within the next 4 hours the high neutron flux trip setpoint is reduced to $\leq 85\%$ of RATED THERMAL POWER, or

The remainder of the rods in the group with the inoperable rod are aligned to within ± 12 steps of the inoperable rod within the hour while maintaining the thermal power, rod sequence, and insertion limits of Specification 3.1.3.6 during subsequent operation.

SURVEILLANCE REQUIREMENTS

4.1.3.1.1 The position of each rod shall be determined to be within the group demand limit by verifying the individual rod positions at least once per 12 hours except during time intervals when the Rod Position Deviation Monitor is inoperable, then verify the group positions at least once per 4 hours.

4.1.3.1.2 Each rod not fully inserted in the core shall be determined to be OPERABLE by movement of at least 10 steps in any one direction at least once per 31 days.

REACTIVITY CONTROL SYSTEMS

POSITION INDICATOR CHANNELS - OPERATING

LIMITING CONDITION FOR OPERATION

3.1.3.2 The shutdown and control rod position indicating system shall be OPERABLE with:

- a. Each individual rod position indicator channel, 1 per rod, accurate to within ± 12 steps* of actual rod position, and
- b. Each demand position indicator, 1 per group, accurate to within ± 2 steps of demand position, and
- c. The Automatic Rod Position Deviation Monitor with the alarm setpoint < 12 steps.

APPLICABILITY: MODES 1 and 2

ACTION:

- a. With a maximum of one individual rod position indicator channel per group inoperable, either:
 1. Determine the position of the non-indicating rod indirectly by the movable incore detectors at least once per 8 hours and immediately after any motion of the non-indicating rod which exceeds 24 steps in one direction since the last determination of the rod's position as well as verify that the rod position requirements of Specification 3.1.3.1 are satisfied, or
 2. Reduce THERMAL POWER to $< 50\%$ of RATED THERMAL POWER within 8 hours and verify that the requirements of Specification 3.1.3.1 are satisfied.
- b. With a maximum of one demand position indicator per bank inoperable, either:
 1. Verify that all individual rod position indicators for the affected bank are OPERABLE and that the most withdrawn rod and the least withdrawn rod of the bank are within a maximum of 12 steps of each other at least once per 8 hours, or
 2. Reduce THERMAL POWER to $< 50\%$ of RATED THERMAL POWER within 8 hour and verify that the requirements of Specification 3.1.3.1 are satisfied.
- c. With the Automatic Rod Position Deviation Monitor inoperable, compare the demand position indicators and the individual rod position indicator channels at least once per 4 hours to ensure that rod position indication is within the above tolerance requirements. The provisions of Specification 3.0.4 are not applicable.

* Below 50% power each individual rod position indicator may be more than ± 12 steps from its group step counter demand position for a maximum of one hour in every 24. During this hour, each individual rod position indicator may be no more than ± 24 steps from its demand position. If either the one hour period or the ± 24 step limit is exceeded, immediately declare the individual rod position indicator channel inoperable.

REACTIVITY CONTROL SYSTEMS

POSITION INDICATOR CHANNELS - OPERATING

SURVEILLANCE REQUIREMENTS

4.1.3.2.1 Each individual rod position indicator shall be determined to be OPERABLE by:

- a. Performing a CHANNEL CHECK* by intercomparison of each individual rod position indicator and its corresponding demand position indicator at least once per 12 hours, and
- b. Performing a CHANNEL FUNCTIONAL TEST and CHANNEL CALIBRATION at least once per 18 months.

4.1.3.2.2 Each demand position indicator shall be determined to be OPERABLE by:

- a. Performing a CHANNEL CHECK of the demand position indicators within a bank at least once per 7 days, and
- b. Performing a CHANNEL CHECK by an intercomparison of the control bank benchboard demand position indicators and the rod control system logic cabinet bank overlap indicator or the rod position indicator cabinet P/A indicators, and determining their agreement within ± 2 steps, at least once per 92 days.

4.1.3.2.3 The Automatic Rod Position Deviation Monitor shall be determined to be OPERABLE by performing a functional test of the process computer alarm to demonstrate the process computer remains capable of recognizing a deviation of 12 steps or more at least once per 7 days.

* Below 50% power each individual rod position indicator may be more than ± 12 steps from its group step counter demand position for a maximum of one hour in every 24. During this hour, each individual rod position indicator may be no more than ± 24 steps from its demand position. If either the one hour period or the ± 24 step limit is exceeded, immediately declare the individual rod position indicator channel inoperable. A scan frequency of approximately once per minute, by either the plant computer or a data acquisition system, is acceptable for determining the total time that a rod position indicator has deviated more than ± 12 steps but no more than ± 24 . A rod position indicator which is found to be so deviated is assumed to have been deviated for the entire scanning period. When the scanner is unavailable to sum deviated time, the tolerance reverts to ± 12 steps.

REACTIVITY CONTROL SYSTEMS

POSITION INDICATOR CHANNELS - SHUTDOWN

LIMITING CONDITION FOR OPERATION

3.1.3.3 The rod group step counter demand position indicator shall be OPERABLE and accurate to within ± 2 steps of the demand position from the logic cabinet for each shutdown or control rod group not fully inserted.

APPLICABILITY: MODES 3*, 4* and 5*.

ACTION:

With less than the above required demand position indicators OPERABLE, open the reactor trip system breakers within 15 minutes

SURVEILLANCE REQUIREMENTS

4.1.3.3 Each of the above required demand position indicators shall be determined to be OPERABLE by:

- a. Performing a CHANNEL CHECK of the demand position indicators within a bank at least once per 7 days, and
- b. Performing a CHANNEL CHECK by an intercomparison of the control bank benchboard demand position indicators and the rod control system logic cabinet bank overlap indicator or the rod position indicator cabinet P/A indicators, and determining their agreement within ± 2 steps, at least once per 92 days.
- c. The provisions of Specification 4.0.4 are not applicable.

* With the reactor trip system breakers in the closed position.

REACTIVITY CONTROL SYSTEMS

SHUTDOWN ROD INSERTION LIMIT

LIMITING CONDITION FOR OPERATION

3.1.3.5 All shutdown rods shall be fully withdrawn.

APPLICABILITY: MODES 1* and 2*#.

ACTION:

With a maximum of one shutdown rod not fully withdrawn, except for surveillance testing pursuant to Specification 4.1.3.1.2, within one hour either:

- a. Fully withdraw the rod, or
- b. Declare the rod to be inoperable and apply Specification 3.1.3.1.

SURVEILLANCE REQUIREMENTS

4.1.3.5 Each shutdown rod shall be determined to be fully withdrawn:

- a. Within 15 minutes prior to initial control rod bank withdrawal during an approach to reactor criticality, and
- b. At least once per 12 hours thereafter.

* See Special Test Exceptions 3.10.2 and 3.10.3.

With $K_{eff} \geq 1.0$

REACTIVITY CONTROL SYSTEMS

CONTROL ROD INSERTION LIMITS

LIMITING CONDITION FOR OPERATION

3.1.3.6 The control banks shall be limited in physical insertion as shown in Figures 3.1-1 and 3.1-2.

APPLICABILITY: MODES 1* and 2*#.

ACTION:

With the control banks inserted beyond the above insertion limits, except for surveillance testing pursuant to Specification 4.1.3.1.2, either:

- a. Restore the control banks to within the insertion limits within two hours, or
- b. Reduce THERMAL POWER within two hours to less than or equal to that fraction of RATED THERMAL POWER which is allowed by the rod group step position counter demand using the above figures, or
- c. Be in HOT STANDBY within 6 hours.

SURVEILLANCE REQUIREMENTS

4.1.3.6 The position of each control bank shall be determined to be within the insertion limits at least once per 12 hours except during time intervals when the Rod Insertion Limit Monitor is inoperable, then verify either the individual rod positions (indicated positions) or the group step counter demand position of each rod group to be within the insertion limits at least once per 4 hours.

* See Special Test Exceptions 3.10.2 and 3.10.3.

With $K_{eff} \geq 1.0$

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REACTIVITY CONTROL SYSTEMS

BASES

3/4.1.2 BORATION SYSTEMS (Continued)

The contained water volume limits include allowance for water not available because of discharge line location and other physical characteristics. The OPERABILITY of one boron injection system during REFUELING insures that this system is available for reactivity control while in MODE 6.

The limits on contained water volume and boron concentration of the RWST also ensure a pH value of between 8.5 and 11.0 for the solution recirculated within the containment after a LOCA. This pH minimizes the evolution of iodine and minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components.

At least one charging pump must remain operable at all times when the opposite unit is in MODE 1, 2, 3, or 4. This is required to maintain the charging pump cross-connect system operational.

3/4.1.3 MOVABLE CONTROL ASSEMBLIES

The specifications of this section (1) ensure that acceptable power distribution limits are maintained, (2) ensure that the minimum SHUTDOWN MARGIN is maintained, and (3) limit the potential effects of rod misalignment on associated accident analyses. OPERABILITY of the movable control assemblies is established by observing rod motion and determining that rods are positioned within ± 12 steps (indicated position) of the respective demand step counter position. The OPERABILITY of the individual rod position indication system is established by appropriate periodic CHANNEL CHECKS, CHANNEL FUNCTIONAL TESTS, and CHANNEL CALIBRATIONS. OPERABILITY of the individual rod position indicators is required to determine control rod position and thereby ensure compliance with the control rod alignment and insertion limits. The OPERABLE condition for the individual rod position indicators is defined as being capable of indicating rod position within ± 12 steps of the associated demand position indicator. For power levels below 50 percent of RATED THERMAL POWER, the specifications of this section permit a maximum one hour stabilization in every 24 period (thermal "soak time") to allow stabilization of known thermal drift in the individual rod position indicator channels during which time the indicated rod position may vary from demand position indication by no more than ± 24 steps. This "1 in 24" feature is an upper limit on the frequency of thermal soak allowances and is available both for a continuous one hour period or one consisting of several discrete intervals. During this stabilization period, greater reliance is placed upon the demand position indicators to determine rod position. In addition, the ± 24 step/hour limit is not applicable when the control rod position is known to be greater than 12 steps from the rod group step counter demand position indication. Above 50 percent of RATED THERMAL POWER, rod motion is not expected to induce thermal transients of sufficient magnitude to exceed the individual rod position indicator instrument accuracy of ± 12 steps. Comparison of the demand position indicators to the bank insertion limits with verification of rod position by the individual rod position indicators (after thermal soak following rod motion below 50 percent of RATED THERMAL POWER) is sufficient verification that the control rods are above the insertion limits.

REACTIVITY CONTROL SYSTEMS

BASES (Continued)

The ACTION statements which permit limited variations from the basic requirements are accompanied by additional restrictions which ensure that the original design criteria are met. Misalignment of a rod requires measurement of peaking factors or a restriction in THERMAL POWER; either of these restrictions provides assurance of fuel rod integrity during continued operation. In addition, those accident analyses affected by a misaligned rod are reevaluated to confirm that the results remain valid during future operation.

Continuous monitoring of rod position with respect to insertion limits and rod deviation is provided by the rod insertion limit monitor and rod position deviation monitor, respectively. OPERABILITY of the rod position deviation monitor is verified by a functional test at least once per 7 days and by comparison of the indicated positions versus the respective demand position indicators at least once per 12 hours. If the rod position deviation monitor or the rod insertion limit monitor is inoperable, the frequency of manual comparison of indicated rod (or bank) position is increased to an interval of at least once per 4 hours.

The maximum rod drop time restriction is consistent with the assumed rod drop time used in the accident analyses. Measurement with $T_{avg} \geq 500^{\circ}\text{F}$ and with all reactor coolant pumps operating ensures that the measured drop times will be representative of insertion times experienced during a reactor trip at operating conditions.

3/4.10 SPECIAL TEST EXCEPTIONS

BASES

3/4.10.1 SHUTDOWN MARGINS

This special test exception provides that a minimum amount of control rod worth is immediately available for reactivity control when tests are performed for control rod worth measurement. This special test exception is required to permit the periodic verification of the actual versus predicted core reactivity condition occurring as a result of fuel burnup or fuel cycling operations.

3/4.10.2 GROUP HEIGHT, INSERTION, AND POWER DISTRIBUTION LIMITS

This special test exception permits individual control rods to be positioned outside of their normal group heights and insertion limits during the performance of such PHYSICS TESTS as those required to 1) measure control rod worth and 2) determine the reactor stability index and damping factor under xenon oscillation conditions.

3/4.10.3 PHYSICS TESTS

This special test exception permits PHYSICS TESTS to be performed at less than or equal to 5% of RATED THERMAL POWER and is required to verify the fundamental nuclear characteristics of the reactor core and related instrumentation.

3/4.10.4 REACTOR COOLANT LOOPS

This special test exception permits reactor criticality under no flow conditions and is required to perform certain startup and PHYSICS TESTS while at low THERMAL POWER levels.

Attachment 3

Discussion of Proposed Change

North Anna Units 1 and 2

Virginia Electric and Power Company

Background and Introduction

Several Westinghouse designed plants have experienced difficulties with calibration and accuracy of the Individual Rod Position Indication (IRPI) system. The system consists of a set of linear variable transformers formed from primary and secondary coils alternately stacked on cylindrical stainless steel tubes. An extension shaft from the rod drive mechanism extends up into the tube and serves as a variable core for the transformer. Thus, with a constant a.c. source applied to the primary side, movement of the rod drive extension shaft changes the primary to secondary coupling of the transformer and produces a secondary voltage that is directly related to rod position.

There are two basic problems relating to the calibration of these instruments. First, the instrumentation readout design is based on the assumption that secondary output voltage is a linear function of rod position. In fact, the steady-state calibration curve is an arc-shaped or even an S-shaped curve. For many rods, at a given steady-state condition, the Zero and Span adjustments can be used to fit the calibration curve to within the specified 12 step tolerance, but this is not true for all rods for all plants.

The second problem is that the instrument response is highly temperature sensitive, and there is a transient (nonequilibrium) temperature response associated not only with RCS temperature changes but also with rod motion. On most plants the RPI for each individual rod is calibrated at hot-operating temperatures at beginning of cycle. As the reactor is cooled down to enter modes 3, 4, and 5 (hot, intermediate, and cold shutdown), the hot calibration curve becomes inaccurate and may be off by as much as 60 steps (over one-quarter of the core height).

The transient thermal response problem has been characterized as an "overshoot" for most plants. In other words, if a rod is withdrawn, the IRPI channel will show greater withdrawal than actual for a period of time, then as the system returns to thermal equilibrium, the indication will settle back to the "true" calibrated value. Similarly, if the rod is inserted, the IRPI channel will initially indicate a greater insertion than actual. Reference 2 indicates that the transient indication error is as high as 25 steps for some plants and tends to be worse in the top half of the core (i.e., near the fully withdrawn position). The thermal "soak time," or the time for the IRPI channel to reach equilibrium following rod motion is reported to range between 20 and 45 minutes.

North Anna is one of the Westinghouse designed plants which have experienced difficulties with calibration and accuracy of the IRPI system. As a result of these difficulties, Virginia Electric and Power Company is proposing a set of changes to the Technical Specifications for North Anna Units 1 and 2 which shift the emphasis from the IRPI system to the demand position indication system (step counters) for providing detailed rod position information during the shutdown modes (modes 3-5) and during startup and shutdown operations. For situations where it is important to have independent verification that control and shutdown rods are moving upon demand, the IRPI system will still be available to provide this function.

General Discussion of the Proposed Changes

During plant shutdown modes where the reactor trip system breakers are closed, the IRPI operability requirements have been replaced with operability requirements for a group step counter demand position indicator for each rod group not fully inserted in the core.

While the IRPI system was originally not intended to be used in the shutdown modes, many plants have a specification requiring IRPI indication during these modes as an intended means of providing added confidence to the shutdown reactivity margin calculations. The reality of the situation is that, due to the calibration problems, it is not possible to use the system accurately in these modes and therefore the use of the IRPI system may create more problems than it solves. The Technical Specifications require a minimum of 1.77% shutdown reactivity margin in modes 3-5, 1% of which must always be inserted in the core (i.e., $k_{eff} < 0.99$). Station administrative procedures for determining the required shutdown boron concentrations in these modes include conservative allowances for calculation and measurement uncertainties. In addition, the demand position indicators have been highly reliable, not only at North Anna but throughout the industry, and are demonstrably the most accurate means of determining bank position.

This high level of reliability combined with the requirement that $k_{eff} < 0.99$ in modes 3, 4, and 5 provides adequate protection against inadvertent criticality in these modes. As a result, the IRPI system is not needed to guarantee subcriticality and/or shutdown margin in these modes, and use of the system could in fact be counterproductive to this end. Therefore, consistent with the NRC Staff's SER of Reference 1, we propose the elimination of IRPI operability requirements for modes 3, 4, and 5.

The second proposed change, applicable in modes 1 and 2, is the incorporation of a one-hour "soak time" below 50% rated thermal power. For one hour in every twenty-four below 50% rated thermal power, the IRPI channel tolerance widens from ± 12 steps to ± 24 steps. During this hour, the demand position indicator will be considered the primary indicator of rod position, with the IRPI channel displaying general information regarding rod motion (i.e., the IRPI channel will be used to verify that rods are moving in or out on demand, but will not be relied on for precise position indication). We believe this proposal is sound from a safety standpoint based on the following considerations:

- a. A potentially misaligned rod that goes undetected for as much as an hour does not pose an unacceptable risk. We analyze the impact of statically misaligned rods on the core power distribution throughout core life for each reload core and demonstrate that the Condition II DNB limits are met for power levels up to and including hot full power. The proposed one-hour relaxation is limited and would only apply at low power (below 50% full power). The probability of experiencing a limiting Condition II event (i.e., uncontrolled rod withdrawal) during the one-hour interval is insignificant (of the order of 10^{-6}).
- b. As discussed previously, the control rod drive system and the demand position indication system have been historically demonstrated to be highly reliable. In

view of the history of performance problems associated with the IRPI system, the step counters are in fact demonstrably the most reliable means of determining rod position, particularly, during the first hour following rod motion.

- c. There are adequate methods available for periodic testing of the reliability of the step counters as indicators of actual rod bank position. Details of the proposed surveillance program are discussed later in this evaluation.

Detailed Discussion of the Proposed Changes

This section presents a detailed discussion and evaluation of the proposed Technical Specification changes presented in Attachments 1 and 2. Unless otherwise specified, these changes are applicable to both the Unit 1 and the Unit 2 Technical Specifications.

3.1.3.1 Group Height: Limiting Condition for Operation

In the Unit 1 Technical Specifications, remove the term "full length" from the rod description because all shutdown and control rods are full length rods; i.e., part-length rods are no longer used in the core designs. The term has already been removed from the Unit 2 Specifications. Also, the phrase "which are inserted in the core" has been removed from both Unit 1 and 2 Technical Specifications because the phrase referred to the use of "part-length" rods. Elimination of these phrases is an editorial change which removes unnecessary ambiguity from the specification.

The parenthetical term "(indicated position)" following the rod position alignment tolerance in the LCO is removed thereby redirecting the emphasis of this specification toward actual rod position. In addition, the action statements have been reworded to emphasize actual rod position rather than the indications provided by the IRPI system.

The phrase "by more than ± 12 steps" has been removed from the action statements and replaced by the phrase "by more than the above alignment requirement." This is an editorial change that adds clarity to the action statement by not repeating the specified tolerance.

In general, the action statements have been reworded and rearranged to provide clarification as to the Technical Specification action statements intent and to provide viable resolutions for circumstances of rod misalignment greater than the ± 12 steps limit for continued power operation.

A footnote has been added to the section which allows a maximum one-hour "thermal soak" time below 50% power during which the "indicated position" tolerance requirements for rod misalignment are relaxed. During that hour, the IRPI tolerance widens from ± 12 steps to ± 24 steps. This IRPI tolerance may not be applied prior to entering the action statements associated with a misaligned rod. Therefore, wording was added to the footnote that states the ± 24 step/hour limit is not applicable when control rod position is known to be greater than 12 steps from the rod group step counter demand position indication. The thermal soak time is defined in the bases as

a maximum one-hour period to permit stabilization of known thermal drift in the analog rod position indicator channels. This "1 in 24" feature is an upper limit on the frequency of thermal soak allowances and is available both for a continuous 1 hour period or one consisting of several discrete intervals for a total of no more than 1 hour in 24. This change reflects the shift in emphasis from the IRPI system to the demand position indication system for providing detailed rod position information during startup and shutdown operations.

4.1.3.1 Group Height: Surveillance Requirements

In the Unit 1 Technical Specifications, remove the term "full length" from the rod description because all shutdown and control rods are full length rods; i.e., part-length rods are no longer used in the core designs. Removing the term is an editorial change and removes ambiguity from the specification.

3.1.3.2 Position Indicator Channels - Operating: Limiting Condition For Operation

Specification 3.1.3.2 has been changed to depict the Automatic Rod Position Deviation monitors as part of the rod position indication system. The requirement to increase the frequency of comparison between the analog position indicators (IRPIs) and demand position indicators from once per 12 hours to once per 4 hours whenever the Rod Position Deviation Monitor is inoperable has been retained, but it has been moved from the surveillance requirements to a separate action statement which is referenced to an inoperable rod deviation monitor.

A footnote has also been added which allows a maximum one-hour "thermal soak" time below 50% power during which the analog channel tolerance requirements are relaxed. During that hour, the IRPI tolerance widens from ± 12 steps to ± 24 steps. This thermal soak time is defined in the bases as a one-hour period to permit stabilization of known thermal drift in the analog rod position indicator channels.

Paragraph (c) has been added to the action statements associated with Specification 3.1.3.2 to provide a response for an inoperable Rod Position Deviation Monitor, as discussed above. Paragraphs (a) and (b) which address inoperable analog and demand position indicators remain essentially the same.

4.1.3.2 Position Indicator Channels - Operating: Surveillance Requirements

This section has been expanded to reflect the shift from the IRPIs to reliance on the demand position indicating system as the primary indicator of rod position, especially during the first hour following rod motion below 50% power and during Mode 2 startup and shutdown. This shift in emphasis is reflected in the addition of channel checks for the demand position indicators.

Two types of channel checks are specified for the demand counters. The first consists of an intercomparison of the two counters within each bank at least once per 7 days. The second involves comparing the benchboard demand position indicators with the

digital readout in the logic cabinets every three months. These actions provide assurance that problems resulting from mechanical or other malfunctions of the step counters will be detected promptly.

Surveillance of the analog rod position indicating channels has been broken into two parts. Part (a) requires performance of a channel check by intercomparison with the step counter once per 12 hours, as is currently required. The one-hour thermal soak allowance below 50% power is provided for by the addition of the footnote. Part (b) involves performance of a channel functional test and channel calibration every 18 months. This requirement has been moved from Specification 4.1.3.3 (Surveillance Requirements for the shutdown condition) for clarity and continuity.

The method of surveillance to determine cumulative time during which each rod is misaligned by more than ± 12 steps, but not more than ± 24 , is specified by the footnote which has been added to the Surveillance Requirement. Because continuous monitoring is not possible with the currently available hardware, a scan frequency of approximately once per minute will be employed. Rods found to be so misaligned will be assumed to have been misaligned for the entire scanning period. Should the required surveillance not be possible, the misalignment tolerance will revert to ± 12 steps.

Specification 4.1.3.2.3 has been added which requires weekly functional testing of the computer-generated rod deviation alarm by injecting a test signal either on the demand side or on the analog instrumentation side to demonstrate that the plant computer remains capable of recognizing a deviation of 12 steps or more.

3/4.1.3.3 - Position Indicator Channels - Shutdown

This section has been modeled after the generic section evaluated by the NRC Staff in Reference 1. The requirement for operable analog rod position indication channels has been replaced with a requirement for operable group demand position indicators. Determination of operability is by performance of channel checks consistent with those in Specification 4.1.3.2.2. When a demand position indicator is inoperable, the trip breakers must be opened within 15 minutes; an acceptable allowance when there is no imminent danger to the plant.

The reference to the special test exception regarding operability of the IRPI system during shutdown has been removed because the requirement for operable analog rod position indication channels has been replaced.

4.1.3.5 - Shutdown Rod Insertion Limit: Surveillance Requirements

This section has been revised to require the shutdown rods be verified fully withdrawn within 15 minutes prior to initial control rod withdrawal thereby eliminating the unnecessary requirement to verify the shutdown rods fully withdrawn within 15 minutes prior to withdrawal of each of the other banks of control rods. The requirement to verify the shutdown rods to be fully withdrawn at least once per 12 hours remains.

By shifting the emphasis from the IRPI system to the demand position indication system in Specifications 3.1.3.1 and 3.1.3.2, the "thermal soak" time allowance below 50% power is thereby applied to shutdown rod position requirements of this specification. Indication of appropriate shutdown rod position is adequately maintained by the step counters and IRPI channels throughout power operation.

The purpose of this specification is to maintain radial peaking factors within analyzed limits and to ensure adequate shutdown margin. The intent and effect of the specification is maintained by requiring verification of shutdown rod position by both the step counters and IRPI channels within 15 minutes prior to initiation of control bank motion and at least once per 12 hours thereafter.

3.1.3.6 - Control Rod Insertion Limits: Limiting Condition For Operation

Revise the term "group position" in Action 'b' to read "rod group step counter demand position" to agree with the terms in Figure 3.1-1. Revising the term is strictly an editorial change to remove ambiguity from the specification.

4.1.3.6 - Control Rod Insertion Limits: Surveillance Requirements

This section has been revised to allow verification of the control rod insertion limits, whenever the rod insertion limit monitor is inoperable, by either 1) manual check of the individual rod position indicators (current allowable verification method), or 2) manual check of the group demand position indicators. This change is based on the recognition that there are different types of failures which could lead to an inoperable insertion limit monitor, some of which lead to concurrent inoperability of the group demand position indicators, and others which do not. For the case where reliance on the individual rod position indicators is necessary, reference to "indicated position" via the IRPIs provides for the one-hour "thermal soak" time below 50% power.

3/4.10.5 - Special Test Exception: Position Indicator Channels - Shutdown

This special test exception permits the position indicator channels to be inoperable during rod drop time measurements. This exception was made since the data necessary to determine the rod drop time are derived from the voltage induced in the position indicator coils as the rod is dropped. This induced voltage is small compared to the normal operating voltage of the coils and therefore cannot be observed if the position indicator channel remains operable. Since under the proposed changes position indicator channels are not required to be operable in modes 3, 4, and 5, this special test exception is no longer required and has therefore been deleted.

Bases Section 3/4.1.3 - Movable Control Assemblies

This section has been rewritten to reflect the shift in emphasis from the IRPI system to the demand position indicators as the primary indicators of exact control rod position. The basis of the one-hour "thermal soak" time is thoroughly discussed, and the discussion of the surveillance requirements for the rod position indication system has been expanded.

Bases Section 3/4.10.5 - Position Indicator Channels - Shutdown

This section has also been deleted.

Summary and Conclusions

Virginia Electric and Power Company has developed a proposed set of Technical Specifications changes for North Anna Units 1 and 2 which are intended to improve operational flexibility by accounting for known inaccuracies in the Individual Rod Position Indication (IRPI) system.

The basic thrust of the proposed changes is to shift the emphasis from the IRPI system to the demand position indicators as the primary source of rod position indication during zero and (for a limited fraction of time) low power operation. The IRPI system remains available to confirm rod movement direction at this time as a backup system. The surveillance requirements have been adjusted to reflect this shift in emphasis.

References

1. NRC Safety Evaluation Report (SER), "Westinghouse Analog Rod Position Indication for Shutdown Modes," transmitted by letter from S. A. Varga (NRC) to C. W. Giesler (Wisconsin Public Service Corporation), March 24, 1983. See also the letter from Mr. Varga to R. E. Uhrig, "Requirements for Analog Position Instruments In Shutdown Modes - Turkey Point Units 3 and 4," March 15, 1983.
2. NRC Safety Evaluation, "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment No. 51 to Facility Operating License No. DPR-66, Duquesne Light Company / Ohio Edison Company / Pennsylvania Power Company, Beaver Valley Power Station, Unit No. 1, Docket No. 50-334," transmitted by Letter from P. S. Tam (USNRC) to J. J. Carey (Duquesne Light), June 14, 1982.

Attachment 4

**10 CFR 50.92 Evaluation
North Anna Units 1 and 2**

Virginia Electric and Power Company

10 CFR 50.92 Significant Hazards Considerations Analysis

It has also been determined that the proposed changes do not involve a significant hazards consideration as defined in 10 CFR 50.92. This determination was based on the following points.

1. **Accident Probability or Consequence Increase.** The proposed changes have no adverse impact upon potential accident probability or consequence. No new or unique accident precursors are introduced by these changes to the Technical Specification requirements.

Likewise, the consequences of the accidents will not increase. Peaking factors which occur as a consequence of severely misaligned or dropped rods are verified on a reload basis as not violating any safety limit. Assumed misalignments in accident analyses easily bound any which can occur under the proposed Technical Specifications so that these changes cannot result in an accident consequence increase.

2. **Accident Probability Creation.** Since the implementation of the proposed surveillance requirements will require no hardware modifications (i.e., alterations to plant configuration), operation with these proposed Technical Specifications does not create probability for any accident which has not already been evaluated in the Updated Final Safety Analysis Report (UFSAR).
3. **Safety Margin Reduction.** Misalignments and their subsequent peaking factors assumed in the UFSAR accident analyses bound potential misalignments under the proposed Technical Specifications therefore, no safety margin reduction accompanies these changes.

Attachment 5

**MERITS Proposed Changes
North Anna Units 1 and 2**

Virginia Electric and Power Company

3.1 REACTOR

3.1.4 Rod Group Alignment Limits

LCO 3.1.4

All shutdown and control rods shall be OPERABLE and all indicated rod positions shall be within 12 steps of their group demand position.

NOTE

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more rods inoperable due to being immovable, as a result of excessive friction or mechanical interference, or known to be untrippable.	A.1.1 Verify SHUTDOWN MARGIN $\geq 1.77\% \Delta k/k$ by performing SR 3.1.1.2.	1 hour
	OR	
	A.1.2.1 Initiate boration at ≥ 10 gpm of a solution containing ≥ 12950 ppm boron, or equivalent to establish SHUTDOWN MARGIN	1 hour
	AND	
	A.1.2.2 Continue action as required in A.1.2.1.	Until required SHUTDOWN MARGIN restored
	AND	
	A.2 Be in MODE 3.	6 hours

(continued)

* For power levels below 50% of RATED THERMAL POWER, the position of each rod as determined by its individual rod position indicator may be more than ± 12 steps from its group step counter demand position for up to one hour in every 24. During this hour, the indicated position of each rod may be no more than ± 24 steps from its demand position.

BASES

ACTIONS
(continued)

B.3.3, B.3.4, B.3.5, B.3.6, B.3.7, and B.3.8

Reduction of power to 75% of RATED THERMAL POWER (RTP) ensures that local linear heat rate increases due to a misaligned RCCA will not cause the core design criteria to be exceeded. The Completion Time of 2 hours gives the operator sufficient time to accomplish an orderly power reduction without challenging the reactor protection system.

Reduction of the Power Range Neutron Flux--High trip setpoints to 85% of RTP after power has been reduced to 75% of RTP maintains both core protection and an operability margin at reduced power similar to that at full power. The Completion Time of 6 hours (4 hours after power has been reduced) allows sufficient time to plan, schedule, and complete the adjustments of the overpower trip setpoint.

When a rod, or group of rods, is known to be inoperable or misaligned, there is a potential to impact the SHUTDOWN MARGIN. Since the core conditions can change with time, periodic verification of SHUTDOWN MARGIN is required. A surveillance frequency of 12 hours is sufficient to ensure this requirement continues to be met.

Verifying that Heat Flux Hot Channel Factor - $F_Q(Z)$ and Nuclear Enthalpy Hot Channel Factor - $F_{\Delta H}^N$ are within the required limits ensures that current operation at 75% of RTP with a rod misaligned is not resulting in power distributions which could cause fuel damage if the reactor were at full power. The Completion Time of 72 hours allows sufficient time to obtain flux maps of the core power distribution using the incore flux mapping system and for calculation of $F_Q(Z)$ and $F_{\Delta H}^N$.

Once current conditions have been verified acceptable, time is available to perform evaluations of accident analysis to determine that core limits will not be exceeded during a design basis event for the duration of operation under these conditions. A Completion Time of 5 days is sufficient time to obtain the required input data and to perform the analysis.

(continued)

BASES

ACTIONS
(continued)

C.1

In most cases, when more than one rod is found to be trippable and aligned but inoperable, the malfunction can be traced to the Rod Control System. Since the majority of Rod Control System malfunctions can be repaired without reactor shutdown and since the unit conditions are not outside any accident analysis assumptions, there is time available to locate the malfunction and restore the rods to an OPERABLE status. Maintaining the sequence, insertion, and power limits of LCO 3.1.5 and LCO 3.1.6 ensures that core design limits are not exceeded. A Completion Time of 72 hours provides adequate time for location of the malfunction as well as obtaining parts and performing the repairs.

D.1

When Required Actions B and C cannot be completed within their Completion Time, the unit must be placed in MODE 3 within 6 hours. This LCO is not applicable in MODE 3; placing the unit in MODE 3 obviates concerns about the development of undesirable xenon or power distributions. The Completion Time of 6 hours is reasonable, based upon operating experience, to reach MODE 3 without challenging the safety systems.

E.1

If more than one rod is found to be misaligned or becomes misaligned because of bank movement, the unit conditions fall outside of the accident analysis assumptions. Since automatic bank sequencing would continue to cause misalignment, the unit must be shutdown and the rods restored to an operable status. The Completion Time of 6 hours allows sufficient time to shutdown the unit in a controlled manner.

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.1.4.1

Verification that individual rod positions are within the alignment limits at a frequency of 12 hours provides a history that allows the operator to detect a rod beginning to deviate from its expected position. If the Rod Position Deviation Monitor is inoperable, a frequency of 4 hours accomplishes the same goal.

SR 3.1.4.2

Exercising control rod groups at a frequency of 31 days allows the operator to determine that all rods continue to be OPERABLE, even if they are not regularly moved.

SR 3.1.4.3

Individual rods whose drop times are greater than safety analysis assumptions are not OPERABLE. Verification of rod drop times allows the operator to determine that the maximum rod drop time permitted is consistent with the assumed rod drop time used in the safety analysis. Measuring rod drop times prior to reactor criticality after reactor vessel head removal assures that the reactor internals and rod drive mechanism will not interfere with rod motion or rod drop time. During normal operation, performing the tests at a frequency of 18 months assures no degradation in these systems has occurred that would adversely affect control rod motion or drop time.

REFERENCES

1. Title 10 Code of Federal Regulations (10CFR), Part 50, Appendix A, General Design Criteria for Nuclear Power Plants, 1988.
 2. 52FR3788, "Interim Policy Statement on Technical Specification Improvements for Nuclear Power Reactors," United States Nuclear Regulatory Commission, February 6, 1987.
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ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>^{or more} B. One rod trippable, but inoperable due to causes other than addressed by Condition A.</p> <p><u>OR</u></p> <p>One rod outside alignment limit.</p>	B.1 Restore rod to OPERABLE status within alignment limit.	1 hour
	<u>OR</u>	
	B.2.1 Declare rod inoperable.	1 hour
	AND	
	B.2.2 -----NOTE----- Maintain bank sequence and insertion limits of LCO 3.1.5 and LCO 3.1.6, with changes to rod position or THERMAL POWER level, during subsequent operation. ----- Realign remainder of rods in the group with the inoperable rod to within alignment limit.	1 hour
	<u>OR</u>	
	B.3.1 Declare rod inoperable.	1 hour
	AND	
	B.3.2.1 Verify SHUTDOWN MARGIN $\geq 1.77\% \Delta k/k$. by performing SR 3.1.1.2 <u>OR</u>	1 hour
	(continued)	

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.3.2.2.1 Initiate boration at ≥ 10 gpm of a solution containing ≥ 12950 ppm boron or equivalent.	1 hour
	<u>AND</u>	
	B.3.2.2.2 Continue action as required in B.3.2.2.1.	Until required SHUTDOWN MARGIN restored
	<u>AND</u>	
	B.3.3 Reduce THERMAL POWER to $\leq 75\%$ of RATED THERMAL POWER (RTP).	2 hours
	<u>AND</u>	
	B.3.4 Reduce Power Range Neutron Flux--High trip setpoints to $\leq 85\%$ of RTP.	6 hours
	<u>AND</u>	
	B.3.5 Verify SHUTDOWN MARGIN $\geq 1.77\% \Delta k/k$. <i>By performing SR 3.1.1.2</i>	Once per 12 hours
	<u>AND</u>	
	B.3.6 Perform $F_0^C(Z)$ verification as per SR 3.1.7.1.	72 hours
	<u>AND</u>	
	B.3.7 Perform $F_0^N(Z)$ verification as per SR 3.1.8.1.	72 hours
	<u>AND</u>	
	(continued)	

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.3.8 Reevaluate each safety analysis in Table 3.1.4-1 and confirm analysis results remain valid for duration of operation under these conditions.	5 days
C. More than one rod inoperable, due to causes other than addressed by Condition A, but aligned and trippable. <i>is immovable or inoperable due to a control urgent failure alarm or obvious electrical problem in the Rod Control System.</i>	C.1 -----NOTE----- Maintain bank sequence and insertions limits of LCO 3.1.5 and LCO 3.1.6, with changes to bank position or THERMAL POWER, during subsequent operation. ----- Restore rods to OPERABLE status.	72 hours
D. Required Actions for Conditions B or C not met within required Completion Times.	D.1 D.2 Be in MODE 3. <i>Reduce Thermal Power to of Rated THERMAL POWER (RTP)</i>	6 hours
E. More than one rod outside alignment limit.	E.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.4.1	Verify individual rod positions within alignment limit as follows: a. With the rod position deviation monitor inoperable.	4 hours
	<u>OR</u> b. With the rod position deviation monitor OPERABLE.	12 hours
SR 3.1.4.2	Move each rod not fully inserted in the core at least 10 steps in either direction.	31 days
SR 3.1.4.3	Verify rod drop time of each rod, from the fully withdrawn position, is ≤ 2.2 seconds from the beginning of decay of stationary gripper coil voltage to dashpot entry, with:	Prior to reactor criticality after removal of the reactor head
	a. $T_{avg} \geq 500^{\circ}F$, and b. All reactor coolant pumps operating.	<u>AND</u> 18 months

CROSS-REFERENCES

TITLE	NUMBER
Shutdown Bank Insertion Limit	3.1.5
Control Bank Insertion Limits	3.1.6
MODE 1 Physics Tests Exceptions	3.1.12
MODE 2 Physics Tests Exceptions	3.1.13

Table 3.1.4-1 (Page 1 of 1)
Safety Analyses Requiring Reevaluation
in the Event of an Inoperable Rod

SAFETY ANALYSES	
1.	Rod Cluster Control Assembly Insertion Characteristics
2.	Rod Cluster Control Assembly Misalignment
3.	Loss of Reactor Coolant from Small Ruptured Pipes or from Cracks in Large Pipes Which Actuate the Emergency Core Cooling System
4.	Single Rod Cluster Control Assembly Withdrawal at Full Power
5.	Major Reactor Coolant System Pipe Ruptures (Loss-of-Coolant Accident)
6.	Major Secondary Coolant System Pipe Rupture
7.	Rupture of a Control Rod Drive Mechanism Housing (Rod Cluster Control Assembly Ejection)

B 3.1 REACTOR

B 3.1.4 Rod Group Alignment Limits

*The BASES will be updated
at a later date after the Spec.
is finalized for North Anna.*

BASES

BACKGROUND

Rod Cluster Control Assemblies (RCCAs), or rods, are moved out of the core (up/withdrawn) or into the core (down/inserted) by their Control Rod Drive Mechanisms (CRDMs). Each CRDM moves its RCCA one step (approximately 5/8 inches) at a time but at varying rates (steps per minute) depending on the signal output from the Rod Control System.

The RCCAs are divided among control banks and shutdown banks. North Anna has four control banks and two shutdown banks. Each bank is further subdivided into two groups to provide for precise reactivity control. A group consists of four RCCAs that are electrically paralleled to step simultaneously. The two groups in each bank are moved in a staggered fashion, but always within one step of each other.

The shutdown banks are maintained either in the fully inserted or fully withdrawn position. The control banks are moved in an overlap pattern using the following withdrawal sequence: When Control Bank A reaches a predetermined height in the core, Control Bank B begins to move out with Control Bank A. Control Bank A stops at the position of maximum withdrawal and Control Bank B continues to move out. When Control Bank B reaches a predetermined height, Control Bank C begins to move out with Control Bank B. This sequence continues until Control Banks A, B, and C are at the fully withdrawn position and Control Bank D is approximately halfway withdrawn. The insertion sequence is the opposite of the withdrawal sequence. The control rods are arranged in a radially symmetric pattern so that control bank motion does not introduce radial asymmetries in the core power distributions.

The axial position of shutdown rods and control rods is indicated by two separate and independent systems, which are the Group Demand Position Indication system (commonly called group step counters), and the Individual Rod Position Indication (IRPI) system.

(continued)

BASES

BACKGROUND (continued)

The Group Demand Position Indication system counts the pulses from the rod control system that move the rods. There is one step counter for each group of rods. Individual rods in a group all receive the same signal to move and should, therefore, all be at the same position indicated by the group step counter for that group. The Group Demand Position Indication system is considered highly accurate (± 1 step or $\pm 5/8$ inch). If a rod does not move one step for each demand pulse, the step counter will still count the pulse and incorrectly reflect the position of the rod.

The IRPI system is an analog system which utilizes a linear transformer as the primary detector. The detector consists of alternately stacked primary and secondary coil windings and the control rod drive shaft which acts as the armatur of the transformer. The vertical position of the top of the control drive shaft determines the amount of coupling between the primary and the secondary windings. The resulting output voltage from the secondary windings is an a.c. signal whose amplitude is proportional to the actual position of the rod. The a.c. signal is fed to a signal conditioning module which rectifies the a.c. signal. The d.c. signal varies between 0 and 3.45 volts as the rods move from fully in to fully out position. When each rod position indication channel is calibrated at the hot reactor shutdown conditions, the overall accuracy is $\pm 5\%$ of full rod travel (full in to full out). This includes inaccuracies arising from the system power supply extremes (regulation and wave form distortion) and the normal range of plant coolant temperature variation from HOT SHUTDOWN to full power operation.

The applicable General Design Criteria for the movable control assemblies and their position indication systems are GDC 26 and GDC 28 (Ref. 1).

APPLICABLE SAFETY ANALYSES

The operability of the shutdown and control rods are initial assumptions in all safety analyses which assume rod insertion upon reactor trip. Maximum rod misalignment directly affects core power distributions and assumptions of available SHUTDOWN MARGIN.

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

Analysis of RCCA misalignment includes:

- a. One or more dropped RCCAs within the same group
- b. A dropped RCCA bank
- c. A statically misaligned RCCA

One or more dropped RCCAs within the same group or a dropped RCCA bank will in most cases lead to plant trip. For those cases which do not result in reactor trip, the Departure from Nucleate Boiling Ratio (DNBR) remains greater than the limit value and, therefore, the DNB design basis is met. One of the most severe misalignment situations, with respect to DNBR at significant power levels, arises from a case such as Control Bank D fully inserted with one RCCA fully withdrawn. However, also in this case, the analysis confirms that the DNBR will not fall below the limit value.

Another type of misalignment analysis confirms that the required SHUTDOWN MARGIN is met, after reactor trip, with one RCCA stuck fully withdrawn. This condition is assumed in the evaluation to determine that the required SHUTDOWN MARGIN is met within the maximum worth RCCA fully withdrawn.

Shutdown and control rod operability and alignment are directly related to power distributions and SHUTDOWN MARGIN, which are initial conditions assumed in safety analyses. Therefore they may be considered process variables that satisfy the requirements of Selection Criterion 2 of the NRC Interim Policy Statement (Ref. 2).

LCOs

The limits on shutdown or control rod alignments assure that the assumptions in the safety analysis will remain valid. The requirements on OPERABILITY assure that upon reactor trip, the assumed reactivity will be available and will be inserted. The operability requirements also assure that the RCCAs and banks will move correctly upon command, to maintain the correct power distribution and rod alignment.

The requirement to maintain the rod alignment to within ± 12 steps is conservative. The minimum misalignment assumed in safety analysis is 24 steps (15 inches), and in some cases a total misalignment from fully withdrawn to fully inserted is assumed.

(continued)

BASES

LCOs
(continued) Failure to meet the requirements of this LCO may produce power distributions with unacceptable peaking factors and linear heating rates, or unacceptable SHUTDOWN MARGIN, all of which may constitute initial conditions inconsistent with the initial conditions assumed in the safety analysis.

APPLICABILITY The requirements on RCCA OPERABILITY and alignment are applicable in MODES 1 and 2 because these are the only modes in which power is generated, and the OPERABILITY and alignment of rods has the potential to affect the safety of the unit. In the shutdown modes, the OPERABILITY of the shutdown and control rods has the potential to affect the required SHUTDOWN MARGIN, but this effect can be compensated for by an increase in the boron concentration of the reactor coolant system.

ACTIONS A.1.1, A.1.2.1, and A.1.2.2

When one or more rods are inoperable to the extent that they are immovable and untrippable, there is a high probability that the required SHUTDOWN MARGIN may be adversely affected. Under these conditions it is important to determine the SHUTDOWN MARGIN, and if it is less than the required value, initiate boration until the required SHUTDOWN MARGIN is recovered. The Completion Time of 1 hour is adequate to determine SHUTDOWN MARGIN and ~~if necessary, to initiate emergency boration and restore SHUTDOWN MARGIN.~~

A.2

In addition to the actions required in A.1.1 and A.1.2, the unit must be put in MODE 3 since the accident analysis assumption of only one stuck rod is no longer valid. The Completion Time of 6 hours allows the operator sufficient time to perform an orderly shutdown of the reactor.

(continued)

BASES

ACTIONS
(continued)

B.1

When a rod becomes misaligned, it can usually be moved and is still trippable. If the rod can be realigned within the Completion Time of 1 hour, local xenon redistribution during this short interval will not be significant and operation may proceed without further restriction.

B.2.1 and B.2.2

An alternative to realigning a single misaligned RCCA to the group average position is aligning the remainder of the group to the position of the misaligned or inoperable RCCA. However, this must be done without violating the bank sequence, overlap, and insertion limits specified in LCO 3.1.5, Shutdown Bank Insertion Limit, and LCO 3.1.6, Control Bank Insertion Limits. The Completion Time of 1 hour gives the operator sufficient time to adjust the rod positions in an orderly manner.

B.3.1, B.3.2.1, B.3.2.2.1, and B.3.2.2.2

In many cases, realigning the remainder of the group to the misaligned rod may not be desirable. For example, realigning Control Bank B to a rod that is misaligned fifteen steps from the top of the core would require a reactor shutdown.

Power operation may continue with one RCCA trippable but inoperable or misaligned provided that SHUTDOWN MARGIN is verified within 1 hour or boration is initiated within 1 hour to establish the required SHUTDOWN MARGIN. The Completion Time of 1 hour represents the time necessary to determine the actual unit SHUTDOWN MARGIN and, if necessary align and start the necessary systems and components to initiate boration.

(continued)
