

Attachment 1

Proposed Technical Specification Changes

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REACTIVITY CONTROL SYSTEMS

SHUTDOWN ROD INSERTION LIMIT

LIMITING CONDITION FOR OPERATION

3.1.3.5 All shutdown rods shall be ~~fully~~ withdrawn to at least 225 steps

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With a maximum of one shutdown rod ~~not fully~~ withdrawn, except for surveillance testing pursuant to specification 4.1.3.1.2, within 1 hour either:

- a. ~~fully~~ Withdraw the rod, or less than 225 steps
- 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4.1.3.5 Each shutdown rod shall be determined to be ~~fully~~ withdrawn to at least 225 steps

- a. Within 15 minutes prior to withdrawal of any rods in Control Bank A, B, C, or D during an approach to reactor criticality, and
- b. At least once per 12 hours thereafter.

*See Special Test Exceptions Specifications 3.10.2 and 3.10.3.

#With K_{eff} greater than or equal to 1.

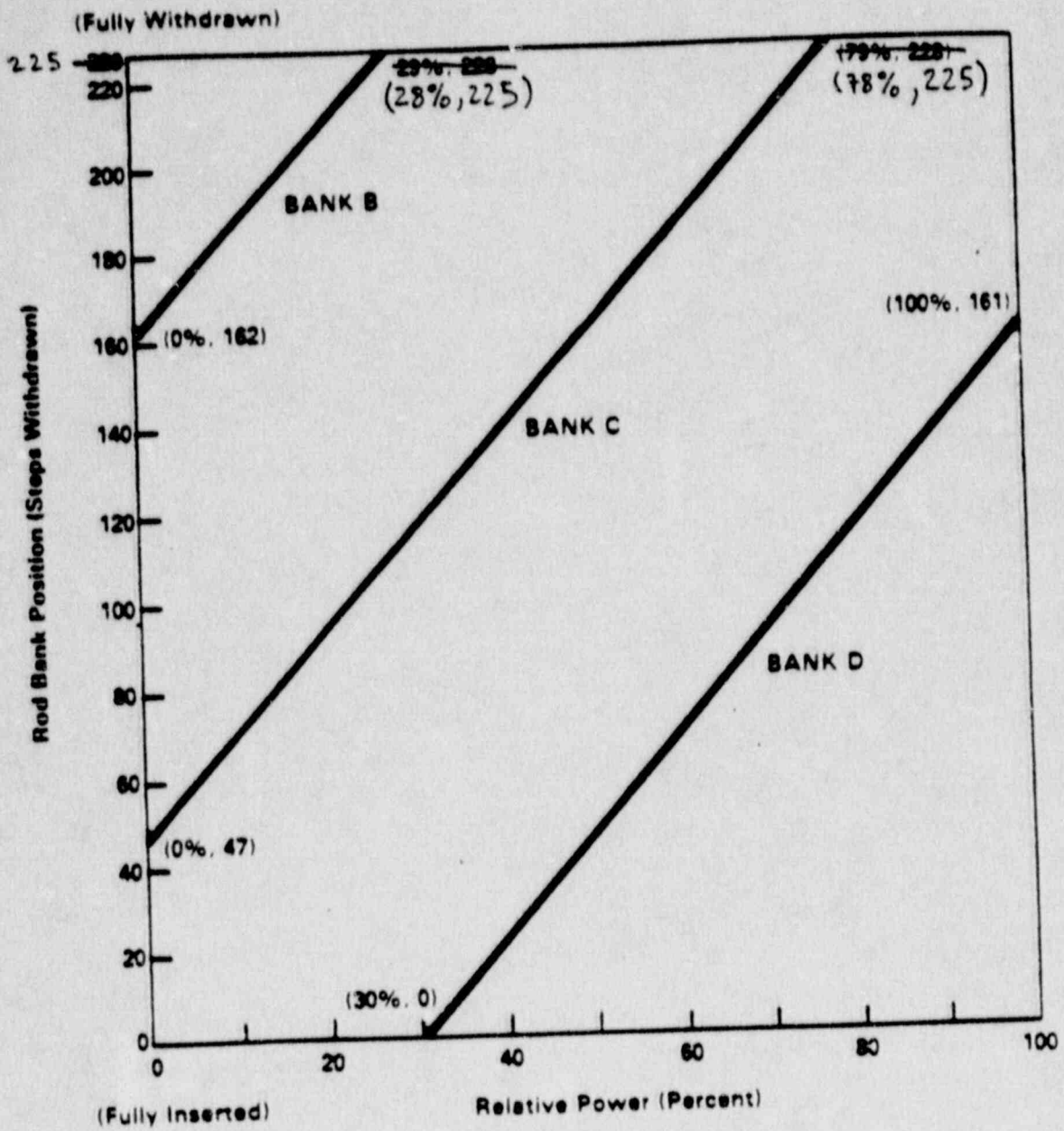


FIGURE 3.1-1

ROD BANK INSERTION LIMITS VERSUS THERMAL POWER
FOUR LOOP OPERATION

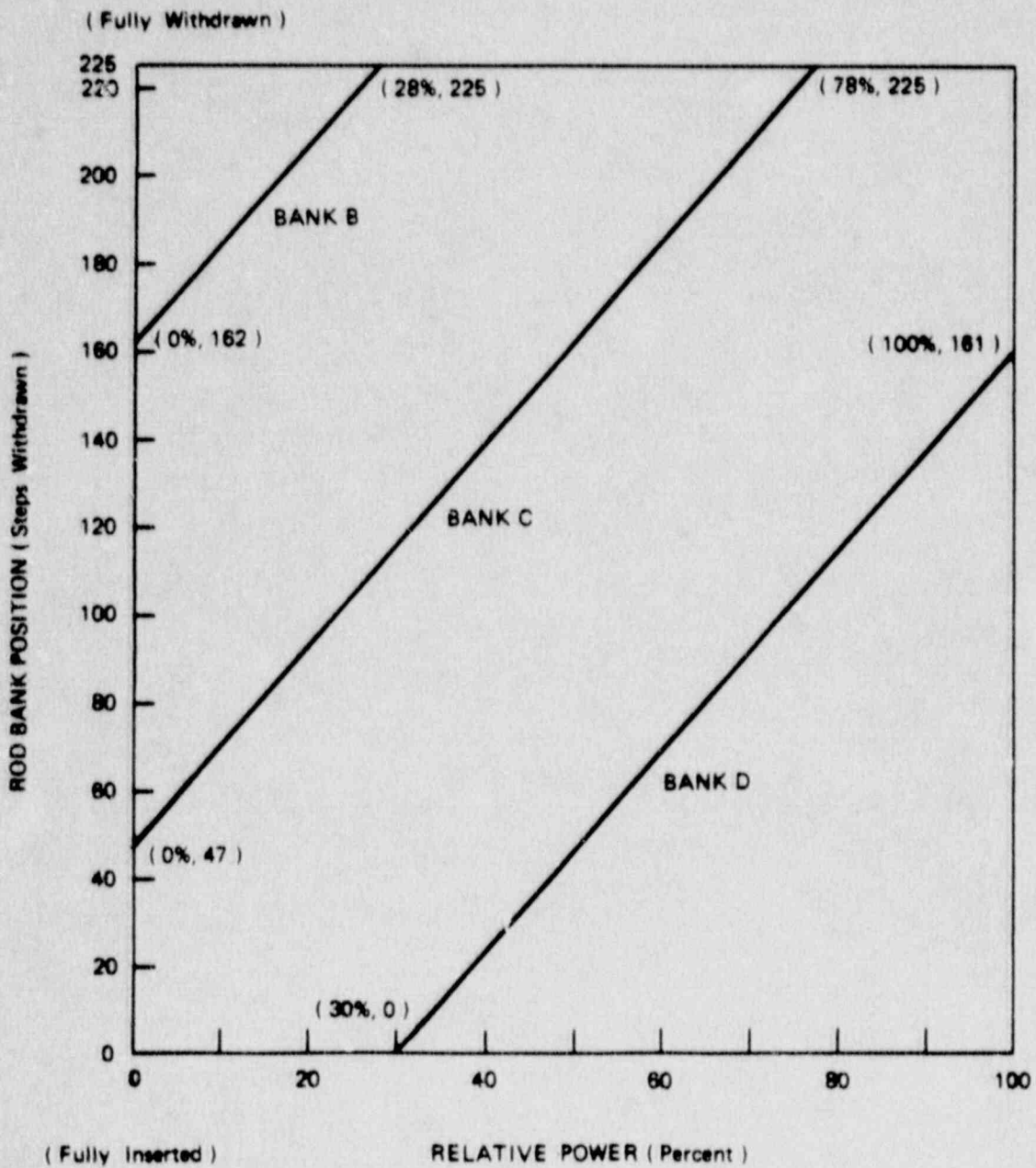


FIGURE 3.1-1
 ROD BANK INSERTION LIMITS VERSUS THERMAL POWER
 FOUR LOOP OPERATION

REACTIVITY CONTROL SYSTEMS

BASES

BORATION SYSTEMS (Continued)

MARGIN from expected operating conditions of 1.3% $\Delta k/k$ after xenon decay and cooldown to 200°F. The maximum expected boration capability requirement occurs at EOL from full power equilibrium xenon conditions and requires 16,321 gallons of 7000 ppm borated water from the boric acid storage tanks or 75,000 gallons of 2000 ppm borated water from the refueling water storage tank.

With the coolant temperature below 200°F, one Boron Injection System is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity changes in the event the single Boron Injection System becomes inoperable.

The limitation for a maximum of one centrifugal charging pump to be OPERABLE and the Surveillance Requirement to verify all charging pumps except the required OPERABLE pump to be inoperable below 285°F provides assurance that a mass addition pressure transient can be relieved by the operation of a single PORV.

The boron capability required below 200°F is sufficient to provide a SHUTDOWN MARGIN of 1% $\Delta k/k$ after xenon decay and cooldown from 200°F to 140°F. This condition requires either 906 gallons of 7000 ppm borated water from the boric acid storage tanks or 3170 gallons of 2000 ppm borated water from the refueling water storage tank.

The contained water volume limits include allowance for water not available because of discharge line location and other physical characteristics.

The limits on contained water volume and boron concentration of the refueling water storage tank also ensure a pH value of between 8.5 and 10.5 for the solution recirculated within containment after a LOCA. This pH band minimizes the evolution of iodine and minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components.

The OPERABILITY of one Boron Injection System during REFUELING ensures that this system is available for reactivity control while in MODE 6.

3/4.1.3 MOVABLE CONTROL ASSEMBLIES

The specifications of this section ensure that: (1) acceptable power distribution limits are maintained, (2) the minimum SHUTDOWN MARGIN is maintained, and (3) the potential effects of rod misalignment on associated accident analyses are limited. OPERABILITY of the control rod position indicators is required to determine control rod positions and thereby ensure compliance with the control rod alignment and insertion limits. Verification that the Digital Rod Position Indicator agrees with the demanded position within ± 12 steps at 24, 48, ~~120 and 226 steps withdrawn~~ for the Control Banks and 18, ~~110 and 228 steps withdrawn~~ for the Shutdown Banks provides assurances that the Digital Rod Position Indicator is operating correctly over the full range of indication. Since the Digital Rod Position System does not indicate the actual shutdown rod position between 18 steps and 210 steps, only points in the indicated ranges are picked for verification of agreement with demanded position.

and 120 steps and fully withdrawn (≥ 225 steps)

and 210 steps and fully withdrawn

Attachment 2

Discussion, No Significant Hazards Analysis and
Environmental Impact Statement

DISCUSSION, NO SIGNIFICANT HAZARDS ANALYSIS
AND ENVIRONMENTAL IMPACT STATEMENT

The proposed amendment changes the Technical Specification Limiting Condition for Operation (LCO) 3.1.3.5 and Figure 3.1-1 fully withdrawn shutdown rod bank position insertion limit from 228 steps withdrawn to 225 steps withdrawn or higher. The enclosed revision to Technical Specification Basis Section 3/4.1.3 reflects the insertion limit changes.

This amendment will allow operation of fully withdrawn Rod Control Cluster Assemblies (RCCAs) at or above 225 steps withdrawn.

Background

Control rod examinations performed at several foreign and domestic Westinghouse plants have identified significantly high wear rates on 17 x 17 RCCAs. Twelve 17 x 17 Hafnium RCCAs were determined to have thru-wall wear indications after 2 cycles at the Union Electric Callaway Plant, Unit 1. An Electricite de France (EdF) plant which operates 17 x 17 Hybrid B₄C RCCAs identified 22 RCCAs with thru-wall wear defects at the end-of-cycle 4 refueling outage. As a result of these industry observations, Duke Power Company performed several RCCA examinations at McGuire Nuclear Station Units 1 and 2 in 1988 and 1989, respectively. Based on these examinations, two 17 x 17 Hybrid B C RCCAs were replaced at McGuire Unit 2 during the end-of-cycle 4 refueling outage in July 1988. An additional three RCCAs were replaced during the end-of-cycle 5 refueling outage in August 1989 due to excessive wear. Also one 17 x 17 AgInCd RCCA was replaced at McGuire Unit 1 during the end-of-cycle 5 refueling outage in November 1988. The wear occurs as a result of flow induced vibratory contact between the RCCA rodlets and the upper internals guide cards when the RCCAs are operated in the fully withdrawn, parked position.

Westinghouse recommends axial repositioning of the fully withdrawn RCCAs in order to minimize the wear concerns and extend RCCA life. The advantage of RCCA repositioning is that the interfaces between the RCCA rodlets and the upper internals guide cards is shifted such that worn cladding surfaces are positioned away from the guide cards.

The operating elevation of the fully withdrawn RCCAs at both Catawba Units have been repositioned from 228 to 230 steps withdrawn. The fully withdrawn RCCAs in these Units are currently operating at 230 steps withdrawn without Technical Specification revisions. Based on a November 20, 1987 telephone conversation with the NRC staff, Catawba station personnel prepared a Technical Specification Interpretation to clarify that LCO 3.1.3.6 and Figure 3.1-1 allow operation of fully withdrawn RCCAs at or above 228 steps withdrawn. In addition, the interpretation outlined the intent of Figure 3.1-1 as defining rod insertion limits and not rod bank overlap. Therefore, small perturbations in rod bank overlap were found to be acceptable.

Repositioning to 230 steps withdrawn has been performed at both Catawba Units. However, additional RCCA repositioning is necessary to further extend the life of the RCCAs. Since 230 steps withdrawn represents the maximum operating elevation of fully withdrawn RCCAs based on the physical limitations of the control rod drives, any additional repositioning must be performed by

positioning the fully withdrawn RCCAs to elevations below 228 steps. RCCA repositioning to 225 steps withdrawn is beneficial with regard to shifting the RCCA/Upper Internals guide card interfaces because:

- 1) The guide cards are chamfered at the RCCA rodlet interface such that a 0.5 inch thick mating surface exists;
- 2) A change of one step withdrawn represents a 0.625 inch change in RCCA elevation; and
- 3) An accuracy of ± 1 step is assumed for the operating elevation of the fully withdrawn RCCAs.

RCCAs safety analysis are described in Catawba PSAR Sections 15.0 and 15.4.

Methods of Implementation

RCCA repositioning between 225 and 230 steps withdrawn will be performed as follows:

- 1) The bank overlap thumbwheel settings in the Control Rod Drive Mechanism (CRDM) logic cabinets will be adjusted during the Catawba Units 1 and 2 cycle startup to reflect the desired fully withdrawn position and overlap value for the control bank RCCAs. This would allow the automatic features of the Rod Control System to position the control bank RCCAs as necessary depending on demand reactor power.
- 2) The reactor operators will manually withdraw the shutdown bank RCCAs to the appropriate elevation.

Evaluation

RCCA Insertion Characteristics:

An important parameter in the accident analyses with respect to RCCA negative reactivity insertion following a reactor trip is the time to dashpot entry from the fully withdrawn position, which is 85 percent of the total rod travel. As indicated in Technical Specification 3.1.3.4, the RCCA insertion time to dashpot entry at full reactor core flow is taken to be 3.30 seconds with fully withdrawn RCCAs at 228 steps. RCCA repositioning to 225 steps withdrawn will result in a decrease in control rod drop times and are enveloped by existing analyses. RCCA repositioning to 230 steps withdrawn will result in a negligible increase in the control rod drop times and are also enveloped by existing analyses. The results of McGuire and Catawba Nuclear Stations rod drop time tests performed with RCCAs at 228 steps withdrawn at full flow hot conditions have indicated that the average insertion time to dashpot entry is less than 1.5 seconds. This provides greater than 1.8 seconds of margin between the actual value and that assumed in the accident analyses. Since a 2 step increase in the operating elevation of the fully withdrawn RCCAs translates into a 1.25 inch increase in rod travel from the full cut position to the dashpot entry, the effect on RCCA

drop times is negligible. The effect on RCCA drop times is covered by the 1.8 second margin. 1.25 inches represents a 1.0% increase in rod travel from the ARO position to the dashpot entry. An equivalent change in drop times can be approximated by assuming the relationship between rod position and drop time is linear. The corresponding increase in total drop time at 230 steps withdrawn is 0.018 seconds. In addition, rod drop time tests performed at McGuire Unit 1 during the Cycle 5 startup confirmed that the average RCCA drop times are below 3.3 seconds when released from an RCCA demand indication elevation of 235 steps withdrawn. Assuming that the RCCA withdrawal limit is less than 235 steps withdrawn, the RCCAs will be at the withdrawal limit when a demand indication greater than the withdrawal limit is selected. FSAR Figure 15.0.5-1 provides an illustration of the normalized time to dashpot versus rod position assumed in the analyses. RCCA repositioning at 225, 228, and 230 steps withdrawn has an insignificant impact on this figure.

Uncontrolled RCCA Bank Withdrawal From a Subcritical or Low Power Startup Condition:

The positive reactivity insertion rates assumed in this analysis are greater than those resulting from a simultaneous withdrawal of the two highest worth control banks moving at the maximum withdrawal speed and 100% bank overlap. Since the control bank overlaps are less than 100% for both methods of axial repositioning, the maximum positive reactivity insertion rate that can be obtained after repositioning is performed is less than that assumed in this analysis. Therefore, changes in the RCCA fully withdrawn step value which result in changes in the control bank overlap do not increase the probability or consequences of this accident provided that the overlaps remain less than 100%.

Uncontrolled RCCA Bank Withdrawal at Power:

The positive reactivity insertion rates assumed in this analysis are greater than those resulting from a simultaneous withdrawal of the two highest worth control banks moving at the maximum withdrawal speed and normal bank overlap. The control bank overlap assumed in this analysis is that which occurs when the RCCA fully withdrawn operating elevation is 228 steps withdrawn. This value (113 steps) is implied in Catawba Technical Specification 3.1.3.6 which defines the RCCA insertion limits required to maintain the adequate margins necessary for shutdown capability.

RCCA repositioning to either 230 or 225 steps withdrawn results in a one or two step difference in the initial withdrawal of each control bank relative to that of the previous sequential control bank. Therefore, the relative position of any two sequential control banks is shifted during the bank overlap phase of RCCA withdrawal such that the distance between the tips of the RCCAs in each bank is increased or decreased by a maximum of two steps. A two step difference in relative bank positions is calculated to have a minimal effect on the differential rod worths (less than one pcm/step change). Therefore, the change in differential rod worths that occurs as a result of a one or two step variation in the relative positions of two sequential control

banks during the overlap phase of RCCA withdrawal is expected to be negligible. In summary, the impact of a one or two step deviation in the relative positions of two sequential control banks from that assumed in the accident analyses at 228 steps withdrawn is negligible with respect to typical and transient differential rod worths, and the resulting reactivity insertion rates that are possible in these configurations do not create a situation in which the DNB limits are violated or any margins of safety are reduced.

RCCA Ejection Accidents:

The analysis for RCCA ejection accidents was performed - assuming the operating elevation of fully withdrawn RCCAs to be 228 with 113 steps of overlap between control bank RCCAs - to determine the consequences of a mechanical failure of a control rod mechanism pressure housing resulting in the ejection of an RCCA and its drive shaft.

The following cases are presented for both beginning and end of life, zero and full power conditions:

- 1) Beginning of Cycle, Full Power;
- 2) Beginning of Cycle, Zero Power;
- 3) End of Cycle, Full Power; and
- 4) End of Cycle, Zero Power.

The analyses performed at full power conditions assume control bank D to be inserted to its insertion limit with the remaining banks fully withdrawn. These analyses are not affected by changes in bank overlap because the ejection event occurs at a point in which overlap does not exist. The analyses performed at zero power conditions assume control bank D to be fully inserted with at least Bank C at its corresponding insertion limit. RCCA repositioning to 225 or 230 steps withdrawn results in an increase or decrease in the control bank overlaps such that the operation of Bank C at its insertion limit results in a one step deviation for Bank D relative to its insertion limit. The resulting impact of this deviation has been determined to have a negligible impact on the ejected rod worths. In addition, administrative limits in the form of Operator Aid Computer (OAC) rod alarm monitoring provide warning to the operators when any control bank is within 10 steps of its insertion limit. Therefore, the existing FSAR accident analyses for RCCA ejection accidents envelopes the operation of the fully withdrawn RCCAs at or above 225 steps and the probability or consequences of these accidents is not increased.

Shutdown Margin:

Catawba Technical Specification 3.1.3.6 defines the limiting conditions of RCCA operation such that adequate margin for shutdown capability is maintained at all times. Based on the revised figure 3.1-1, operation of the fully

withdrawn RCCAs at 228 or 230 steps results in an increase in the implied control bank overlap such that the operation of bank B or C at its insertion limit results in a three or four step deviation of the corresponding sequential bank below its insertion limit. The plant operators are alerted to possible violations of these limits through the warning indications provided by the OAC rod alarm monitoring system which contains a low level alarm for each control bank at 10 steps above their respective limits.

Based on core calculations of past and current cycles, a slight decrease in shutdown margin (approximately 30 pcm) results from operating Catawba fully withdrawn RCCAs at 225 steps. Adequate excess shutdown margin exists to cover the slight decrease. In addition, a shutdown margin calculation is performed prior to each Catawba start-up to verify that greater than the 1.3% Δp shutdown margin required by safety analysis exists.

Reactor Internals:

CRDM current trace tests performed at Catawba Unit 1 have indicated that the mechanical withdrawal limit of the 10 RCCAs which were tested is 230 steps at 150°F. These limits are expected to be consistent with Catawba Unit 2. Similar tests at McGuire at hot conditions indicated that the mechanical withdrawal limit of the RCCAs is 230 steps. Therefore, operation of the fully withdrawn RCCAs between 225 and 230 steps withdrawn has no mechanical affect on the ability of the rods to operate as required under all analyzed conditions and the probability of creating a stuck rod situation is not increased.

The amount of rodlet tip that operates in the fuel assembly guide tubes is reduced by 1.26 inches when the RCCAs are operated at 230 steps withdrawn, but the remaining 6.85 inches of rod tip insertion is adequate to provide proper alignment and uninhibited movement of the rodlets through the guide tubes. In addition, exercising the RCCAs at the established fully withdrawn step value has been determined to have no adverse effects on the operation of those rods relative to any upper internals structures and the ability of the stationary, movable, and lift coils to secure the CRDM drive shaft is not reduced. Since an increase in the operating elevation of the fully withdrawn RCCAs requires minimal changes that are within the mechanical abilities of the system, there is no possibility of creating an accident relative to the mechanical abilities of the CRDM which are different than any already evaluated. In addition, there is no increase in the probability of a stuck or dropped RCCA incident because the CRDM coil mechanisms are fully functional throughout the additional rod travel associated with the established withdrawal limits.

Following RCCA axial repositioning, the presence of 1) rodlet wear scars above or below guide card elevations and 2) multiple wear scars along the rodlet length do not increase the probability of a stuck rod or dropped rodlet provided the rodlet wear values do not exceed the Duke Power acceptance criterion. The Duke Power acceptance criterion is based on Westinghouse recommendations and applies to each individual wear scar. Control rod examinations are performed at both Catawba units to monitor RCCA clad wear. RCCAs which exceed the allowable wear limits are replaced.

Reactivity at 100% Power:

The utilization of control bank D RCCAs to control reactor power is not affected by changes in the operating elevation of fully withdrawn RCCAs between 225 and 230 steps withdrawn. The worst case absorber to fuel stack overlap is 0.7 inches when the fully withdrawn RCCAs are at 225 steps. Based on core calculations of past and present cycles, this negligible absorber to fuel stack overlap results in a negligible decrease in core reactivity of approximately 3 pcm.

Peaking Factors:

The Relaxed Axial Offset Control (RAOC) limits defined in the McGuire and Catawba Nuclear Stations Technical Specification 3/4.2.1 provide the limiting conditions of operation with respect to axial power distributions such that the Loss of Coolant Accident (LOCA) and the Loss of Flow Accident (LOFA) initial conditions assumed in the accident analyses remain satisfied. Based on core calculations and measured power distributions of past and present cycles, the axial flux difference is expected to be more negative by less than one percent, and increases in F_0 and $F_{\Delta H}$ are expected to be negligible (less than 1%) when fully withdrawn RCCAs are operated at 225 steps. Catawba has sufficient peaking factor margin to cover both of these effects. Therefore, the proposed modification in the operating elevation of the RCCAs is acceptable with respect to maintaining the axial power distributions within the established RAOC limits and the probability of violating any DNB limits is not increased.

Trip Reactivity Worth:

Based on core calculations of past and present cycles, a slight decrease in trip reactivity worth is expected as a result of operating fully withdrawn RCCAs at 225 steps. The resulting maximum decrease in trip reactivity worth is 50 pcm. A calculation, which assumes the fully withdrawn RCCAs are at 228 steps, is performed prior to each Catawba cycle startup to verify sufficient trip reactivity worth exists in the event a single RCCA from the highest worth bank is stuck. A 75 pcm penalty will be considered on all trip reactivity calculations performed for Catawba cycles with fully withdrawn RCCAs at 225 steps.

Loss of Flow:

Traditionally, transients involving the loss of reactor coolant flow have been the most limiting with respect to the consequences and probabilities of violating the DNB limits. As previously demonstrated, the drop times resulting from RCCA operation at 225 steps withdrawn are enveloped by the 1.8 second margin that exists between the actual drop time values measured at 228 and the value assumed in the accident analyses. Therefore, the probability and consequences of the accidents involving loss of flow when the RCCAs are operating between 225 and 230 steps withdrawn are enveloped by existing analyses.

Summary:

Modifying the Catawba Technical Specifications as identified in Attachment 1 to allow fully withdrawn RCCA operation between 225 and 230 does not increase the probability or consequences of the accidents or safety related equipment malfunctions that are evaluated in the PSAR. The possibility of an accident or equipment malfunction which is different than any previously evaluated in the PSAR is not created. Also, the margins of safety which are defined in the bases of the Technical Specifications are not reduced. RCCA repositioning between 225 and 230 steps withdrawn will reduce RCCA cladding wear, extend RCCA life, and ensure RCCA functional requirements are maintained.

10 CFR 50.92 states that a proposed amendment involves no significant hazards considerations if operation in accordance with the proposed amendment would not:

- 1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or
- 2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or
- 3) Involve a significant reduction in a margin of safety.

Based on the above discussion, Duke Power concludes that this proposed amendment does not involve any significant hazards considerations.

Environmental Impact

The proposed technical Specification change has been reviewed against the criteria of 10 CFR 51.22 for environmental considerations. As shown above, the proposed change does not involve a significant hazards consideration, nor increase individual or cumulative occupational radiation exposures. Based on this, the proposed Technical Specification change meets the criteria given in 10 CFR 51.22(c)(9) for a categorical exclusion from the requirement for an environmental Impact Statement.