LIST OF TABLES

Amendment No. 116,

LIST OF FIGURES

3.10.5 Rod Misalignment Limitations

3.10.5.1 At least once per shift (allowing one hour for thermal soak after rod motion) the position of each control or shutdown rod shall be determined:

a. For operation less than or equal to 85% of rated thermal power, the indicated misalignment between the group step counter demand position and the analog rod position indicator shall be less than or equal to 24 steps. A control or shutdown rod indicating a misalignment greater than 24 steps shall be realigned within one hour or the core peaking factors shall be determined within two hours and the requirements of Specification 3.10.2 applied.

b. For operation greater than 85% of rated thermal power, the indicated misalignment between the group step counter demand position and the analog rod position indicator for each control or shutdown rod shall be within the limits of Figure 3.10-1. This allowable deviation may be increased by up to an additional six steps (indicated on Table 3.10-1) as a function of peaking factor margin $F_Q(Z)$ and $F_{\Delta H}^N$. A control or shutdown rod indicating a misalignment greater than that allowed by this specification shall be realigned within one hour or the core peaking factors shall be determined within two hours and the requirements of Specification 3.10.2 applied.

3.10.5.2 If the requirements of Specification 3.10.3 are determined not to apply and the core peaking factors have not been determined within two hours and the rod remains misaligned, the high reactor flux setpoint shall be reduced to less than or equal to 85% of its rated value.

3.10.5.3 If the misaligned control rod is not realigned within 8 hours, the rod shall be declared inoperable.

3.10.6 Inoperable Rod Position Indicator Channels

3.10.6.1 If a rod position indicator channel is out of service, then:

a. For operation between 50 percent and 100 percent of

rating, the position of the control rod shall be checked indirectly by core instrumentation (excore detectors and/or movable incore detectors) once per 8 hours, or subsequent to rod motion exceeding 24 steps, whichever occurs first.

b. During operation below 50 percent of rating, no special monitoring is required.

3.10.6.2 Not more than one rod position indicator channel per group nor two rod position indicator channels per bank shall be permitted to be inoperable at any time.

3.10.6.3 If a control rod having a rod position indicator channel out of service, is found to be misaligned from 3.10.6.1a above, then Specification 3.10.5 will be applied.

3.10.7 Inoperable Rod Limitations

3.10.7.1 An inoperable rod is a rod which does not trip or which is declared inoperable under Specification 3.10.5 or fails to meet the requirements of 3.10.8.

3.10.7.2 Not more than one inoperable control rod shall be allowed any time the reactor is critical except during physics tests requiring intentional rod misalignment. Otherwise, the plant shall be brought to the hot shutdown condition.

3.10.7.3 If any rod has been declared inoperable, then the potential ejected rod worth, associated transient power distribution peaking factors and the accidents listed in Table 3.10-2 shall be analyzed within 5 days, or the reactor brought to the hot shutdown condition using normal operating procedures. The analysis shall include due allowance for non-uniform fuel depletion in the neighborhood of the inoperable rod. If the analysis results in a more limiting hypothetical transient than the cases reported in the safety analysis, the plant power level shall be reduced to an analytically determined part power level which is consistent with the safety analysis.

3.10.8 Rod Drop Time

At operating temperature and full flow, the drop time to each control rod shall be no greater than 1.8 seconds from loss of stationary gripper coil voltage to dashpot entry.

(e.g. rod misalignment) affect $F_{\Delta H}^N$, in most cases without necessarily affecting F_Q, (b) the operator has a direct influence on F_Q through movement of rods, and can limit it to the desired value, he has no direct control over $F_{\Delta H}^N$ and (c) an error in the predictions for radial power shape, which may be detected during startup physics tests, can be compensated for in F_Q by tighter axial control, but compensation for $F_{\Delta H}^N$ is less readily available. When a measurement of $F_{\Delta H}^N$ is taken, no additional allowances are necessary prior to comparison with the limit of section 3.10.2. A measurement uncertainty of 4% has been allowed for in determination of the design DNBR value.

Measurements of the hot channel factors are required as part of startup physics tests, at least each effective full power month of operation, and whenever abnormal power distribution conditions require a reduction of core power to a level based on measured hot channel factors. The incore map taken following initial loading provides confirmation of the basic nuclear design basis including proper fuel loading patterns. The periodic monthly incore mapping provides additional assurance that the nuclear design bases remain inviolate and identify operational anomalies which would, otherwise, affect these bases.

For normal operation, it is not necessary to measure these quantities. Instead it has been determined that, provided certain conditions are observed, the hot channel factor limits will be met; these conditions are as follows:

1. Control rods in a single bank move together with no individual rod insertion differing by more than 15 inches from the group step counter demand position (operating at greater than 85% of rated thermal power with no accounting for peaking factor margin), 18.75 inches (operating at greater than 85% of rated thermal power with accounting for peaking factor margin) or 22.5 inches (operating at less than or equal to 85 % of rated thermal power). An indicated misalignment limit of 12 steps precludes a rod misalignment of greater than 15 inches with consideration of instrumentation error, 18 steps indicated misalignment corresponds to 18.75 inches with instrumentation error and 24 steps indicated misalignment corresponds to 22.5 inches with instrumentation error. Additional misalignment is allowed near the fully withdrawn position, since the top of the active core (approximately 225 steps) is less than the fully withdrawn position.

2. Control Rod banks are sequenced with overlapping banks as described in Technical Specification 3.10.4.

3. The control rod bank insertion limits are not violated.

Amendment No. 20, 86, 103, 175, 176, 180,

The intent of the test to measure control rod worth and shutdown margin (Specification 3.10.4) is to measure the worth of all rods less the worth of the worst case for an assumed stuck rod, that is, the most reactive rod. The measurement would be anticipated as part of the initial startup program and infrequency over the life of the plant, to be associated primarily with determinations of special interest such as end of life cooldown, or startup of fuel cycles which deviate from normal equilibrium conditions in terms of fuel loading patterns and anticipated control bank worth. These measurements will augment the normal fuel cycle design calculations and place the knowledge of shutdown capability on a firm experimental as well as analytical basis.

The specifications of Section 3.10.5 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 position and thereby ensure compliance with the control rod alignment and insertion limits.
Control rod misalignments are evaluated "as indicated by the analog rod position indicators within one hour after control rod motion." During plant startup and power escalation, the control rods are moved regularly, but not necessarily in a continuous manner. Therefore, control rod motion shall be considered to have been stopped if control rods have not been moved in the same direction as the previous control rod motion within an hour since the last control rod movement. At the end of the hour, if control rods have not been moved, then the hour hold time for evaluating control rod misalignmnet shall also be considered to have been met.
Permitted control rod misalignments (as indicated by the analog rod position indicators within one hour after control rod motion) fall into two separate categories, which are:

a) ±24 steps of the group step counter demand position (if the power level is less than or equal to 85% of rated thermal power);

b) to within the varying allowable deviations shown in Figure 3.10-1 for power level greater than 85% of rated thermal power. This may be extended up to an additional 6 steps in either direction if sufficient peaking factor margin exists;

Amendment No. 34, 61, 103, 112, 160, 175, 176, 180,

The allowable deviation shown in Figure 3.10-1 varies as a function of bank demand position allowing for the top of active fuel ending at a control rod position of approximately 225 steps. Also above 85% of rated thermal power, if sufficient peaking factor margin is demonstrated by satisfying the requirements of Table 3.10-1, the acceptable deviation is increased by up to an additional 6 steps depending upon peaking factor margin, (e.g., for an allowable increase of 6 additional steps from indicated misalignment, the peak measured $F_Q(Z)$ from the most recent, current cycle, full power (i.e. $\geq$ 98% Rated Thermal Power) incore flux map must be at least 3.0% less than the limit AND the peak measured $F_{\Delta H}^N$ from the most recent, current cycle, full power incore flux map must be at least 2.0% less than the limiting value).

For group step counter demand positions greater than 212 steps withdrawn, it is acceptable for the analog rod position indicator to indicate misalignment greater than +12 steps (as indicated on Figure 3.10-1) without accounting for peaking factor margin. This is due to the top of active fuel stack being at approximately 225 steps withdrawn. Indicated misalignment in the more withdrawn direction should result in the actual rod position being no lower than 201 steps withdrawn (which is within the analyzed limits). Actual control rod positions above the top of active fuel will not result in increased peaking factors for increased misalignments. Similarly, allowable negative deviation limits may increase by 1 step for every step of group step counter demand position over the top of active fuel.

For power levels less than or equal to 85% of rated thermal power the peaking factor margin does not have to be verified on an explicit basis. This is due to the rate of peaking factor margin increase (as the power level decreases) being greater than the peaking factor margin loss (due to the increased control rod misalignment). This effect is described in WCAP-14668. These limits are applicable to all control rods (of all banks) over the range of 0 to 231 steps withdrawn inclusive.

The comparison of group step counter demand position and analog rod position indicator may take place at any time up to one hour after rod motion. This allows up to one hour of thermal soak time to allow the control rod drive shaft to reach a thermal equilibrium and thus present a consistent position indication. A similar time period (up to one hour after rod motion) is allowed for comparison of the bank insertion limits and the analog rod position indicators. This comparison is sufficient to verify that the control rods are above the insertion limits and thus assures the presence

of sufficient shutdown margin to satisfy the assumptions of the safety analyses. Rod position can also be confirmed via a digital voltage meter applied to the rod position control racks, in which case the operators will continue to monitor the rod position indicators on the main control board (and on the plant computer, if available and in agreement with the digital voltage meter reading) to check for deviation.

The action statements which permit limited variation from the basic requirements are accompanied by additional restrictions which ensure that the original criteria are met. Misalignment of a rod requires measurement of peaking factors (to confirm acceptability) or a restriction in thermal power; either of these restrictions provides assurance of fuel rod integrity during continued operation.

The reactivity worth of a misaligned rod is limited for the remainder of the fuel cycle to prevent exceeding the assumption used in the accident analysis.

One inoperable control rod is acceptable provided that the power distribution limits are met, trip shutdown capability is available, and provided the potential hypothetical ejection of the inoperable rod is not worse than the cases analyzed in the safety analysis report. The rod ejection accident for an isolated fully inserted rod will be worse if the residence time of the rod is long enough to cause significant non-uniform fuel depletion. The 5 day period is short compared with the time interval required to achieve a significant, non-uniform fuel depletion.

The assumed control rod drop time in the safety analysis is 2.7 seconds, consisting of 1.80 seconds for normal rod drop time plus additional margin which includes a seismic allowance. The required control rod drop time in Section 3.10.8 is therefore consistent with that assumed in the safety analysis.

REFERENCE

1. WCAP-8576, "Augmented Startup and Cycle 1 Physics Program," August 1975
2. FSAR Appendix 14C
3. Letter from J.P. Bayne to S.A. Varga dated April 23, 1985, entitled "Proposed Technical Specifications Regarding the Cycle 4/5 Refueling."
4. WCAP-14668, "Conditional Extension of the Rod Misalignment Technical Specification for Indian Point Unit 3," October 1996 (Proprietary).

TABLE 3.10-1

ACCEPTABLE INDICATED CONTROL ROD MISALIGNMENT
AS A FUNCTION OF MEASURED PEAKING FACTOR MARGIN ($F_Q(z)$, $F_{\Delta H}^N$)
AT POWER LEVELS)85% Of RATED THERMAL POWER

Margins To be Determined From The Most Recent, Current Cycle Full-Power (≥98% Rated Thermal Power)Flux Maps.

Note: The tabulated margins shown below represent the minimum margins that must Both be satisfied in order to increase the allowable misalignment by the corresponding number of steps shown in the first column.

Increase In Allowable Indicated Position Misalignment*	Required Margin to $F_Q(z)$ Limit	Required Margin to $F_{\Delta H}^N$ Limit
0	0%	0%
1	0.5%	0.33%
2	1.0%	0.67%
3	1.5%	1.0%
4	2.0%	1.33%
5	2.5%	1.67%
6	3.0%	2.0%

Increase in allowable indicated position misalignment is above and beyond the allowable deviations of Figure 3.10-1 in both positive and negative directions (Reference 4).

* Between the group step counter demand position and the analog rod position indicator.

TABLE 3.10-2

ACCIDENT ANALYSES REQUIRING REEVALUATION
IN THE EVENT OF AN INOPERABLE FULL
LENGTH ROD

Rod Cluster Control Assembly Insertion Characteristics

Rod Cluster Control Assembly Misalignment

Loss of Reactor Coolant From Small Ruptured Pipes Or From Cracks In Large Pipes Which Actuates The Emergency Core Cooling System

Single Rod Cluster Control Assembly Withdrawal At Full Power

Major Reactor Coolant System Pipe Ruptures (Loss of Coolant Accident)

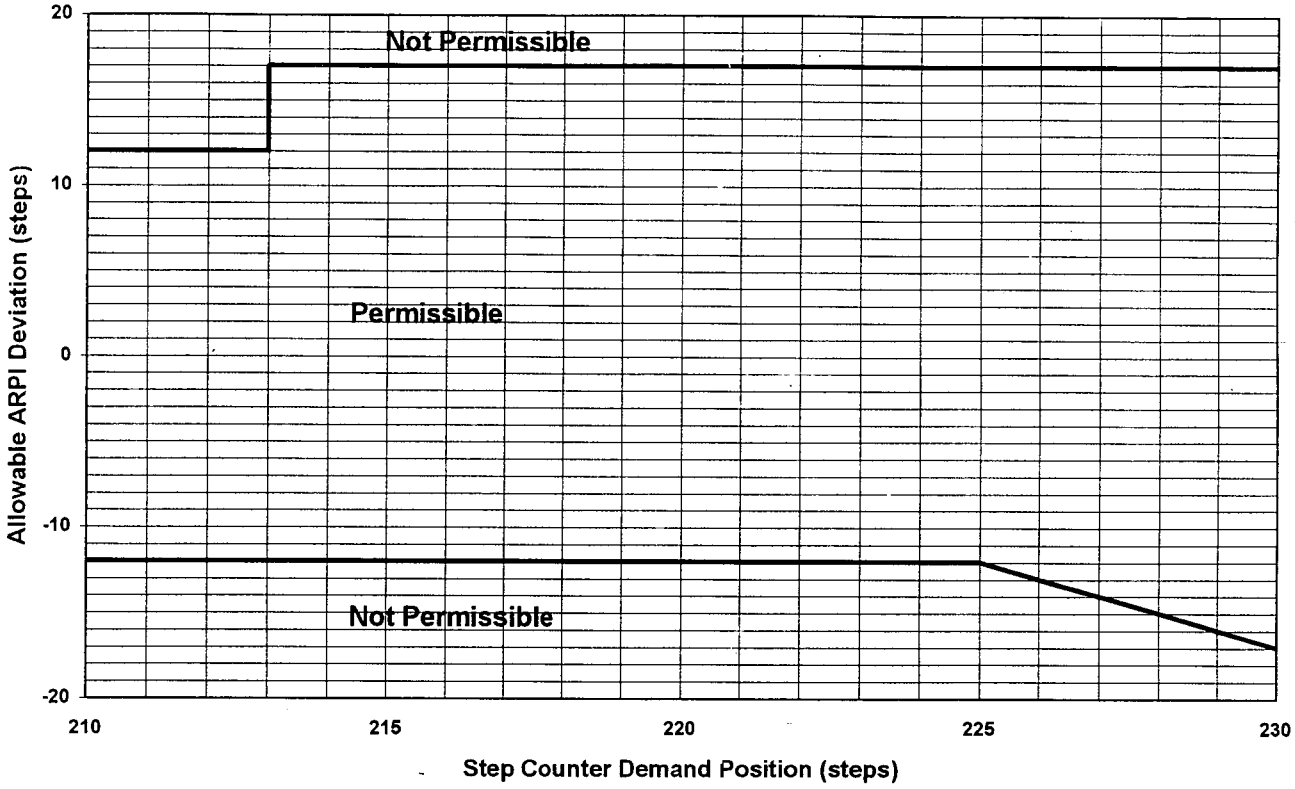
Major Secondary System Pipe Rupture

Rupture of a Control Rod Drive Mechanism Housing (Rod Cluster Control Assembly Ejection)

Figure 3.10-1

Permissible Rod Misalignment vs. Step Counter Demand Position, > 85% of Rated Thermal Power

Note: In this Figure, ARPI Deviation is defined as: (Indicated ARPI Position) - (Step Counter Demand Position)



Step Counter Demand Position	Maximum Deviation (ARPIs Reading ABOVE Step Counter Demand Pos)	Maximum Deviation (ARPIs Reading BELOW Step Counter Demand Pos)
≤ 212	12	-12
213	17	-12
214 - 225	17	-12
226	17	-13
227	17	-14
228	17	-15
229	17	-16
≥230	17	-17

Note: The permissible rod misalignment shown on this figure may be increased by up to 6 steps in either direction based upon peaking factor margins shown in Table 3.10-1.

ATTACHMENT II TO IPN-99-015

SAFETY EVALUATION FOR

PROPOSED TECHNICAL SPECIFICATION CHANGES

REGARDING CONTROL ROD MISALIGNMENT

AND ROD POSITION INDICATION

NEW YORK POWER AUTHORITY
INDIAN POINT 3 NUCLEAR POWER PLANT
DOCKET NO. 50-286
DPR-64

SAFETY EVALUATION OF TECHNICAL SPECIFICATION CHANGES REGARDING CONTROL ROD MISALIGNMENT AND ROD POSITION INDICATION

This application for amendment to the Indian Point 3 Technical Specifications proposes to amend Sections 3.10.5 and 3.10.7, and the Bases of Appendix A of the Operating License. The proposed amendment would permit increasing the indicated control rod misalignment from the current limits to an indicated misalignment of ±24 steps when the core power is less than or equal to 85% of rated thermal power (RTP) and ±12 steps above 85% of RTP with the following considerations: when the group step counter (GSC) demand position exceeds the top of active fuel (TAF) at about 225 steps, the acceptable deviation on the negative side (i.e. when analog rod position indicator is below GSC demand position) may increase by 1 step for every additional step of GSC demand position; when the GSC demand position is below the TAF by no more than 12 steps, the acceptable deviation on the positive side may extend to the all-rods-out (ARO) position; the acceptable deviation may be further increased by up to 6 steps as a function of measured peaking factor margin. The proposed change is based on an evaluation performed by Westinghouse in WCAP-14668. The proprietary and non-proprietary versions of WCAP-14668 were submitted to the NRC by the Authortiy via letter dated February 26, 1997(IPN-97-024).

SECTION I- Description Of Change

The proposed changes are:

Revise "List of Tables" page vii to add Table No. 3.10-1 and change current Table No. 3.10-1 to 3.10-2. Revise "List of Figures" page viii to add Figure No. 3.10-1.

Revise Section 3.10.5.1 to read as follows:

3.10.5.1

a. For operation less than or equal to 85% of rated thermal power, the indicated misalignment between the group step counter demand position and the analog rod position indicator shall be less than or equal to 24 steps. A control or shutdown rod indicating a misalignment greater than 24 steps shall be realigned within one hour or the core peaking factors shall be determined within two hours and the requirements of Specification 3.10.2 applied.

b. For operation greater than 85% of rated thermal power, the indicated misalignment between the group step counter demand position and the analog rod position indicator for each control or shutdown rod shall be within the limits of Figure 3.10-1. This allowable deviation may be increased by up to an additional six steps (indicated on Table 3.10-1) as a function of peaking factor margin $F_Q(Z)$ and $F_{\Delta H}^N$. A control or shutdown rod indicating a misalignment greater than that allowed by this specification shall be realigned within one hour or the core peaking factors shall be determined within two hours and the requirements of Specification 3.10.2 applied.

3.10.5.2 Change "reduced to 85% of its rated value", to read, "reduced to less than or equal to 85% of its rated value."

3.10.7.3 In Specification 3.10.7.3, change number on Table 3.10-1 to read Table 3.10-2 and correct a typographical error.

In the Bases Section, revise the following items to read:

Page 3.10-10 1. Control rods in a single bank move together with no individual rod insertion differing by more than 15 inches from the group step counter demand position (operating at greater than 85% of rated thermal power with no accounting for peaking factor margin), 18.75 inches (operating at greater than 85% of rated thermal power with accounting for peaking factor margin) or 22.5 inches (operating at less than or equal to 85% of rated thermal power). An indicated misalignment limit of 12 steps precludes a rod misalignment greater than 15 inches with consideration of instrumentation error, 18 steps indicated misalignment corresponds to 18.75 inches with instrumentation error and 24 steps indicated misalignment corresponds to 22.5 inches with instrumentation error. Additional misalignment is allowed near the fully withdrawn position, since the top of the active core (approximately 225 steps) is less than the fully withdrawn position.

Pages 3.10-16, 17 & 18 The specifications of Section 3.10.5 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 position and thereby ensure compliance with the control rod alignment and insertion limits. Control rod misalignments are evaluated "as indicated by the analog rod position indicators within one hour after control rod motion." During plant startup and power escalation, the control rods are moved

regularly, but not necessarily in a continuous manner. Therefore, control rod motion shall be considered to have been stopped if control rods have not been moved in the same direction as the previous control rod motion within an hour since the last control rod movement. At the end of the hour, if control rods have not been moved, then the hour hold time for evaluating control rod misalignment shall also be considered to have been met. Permitted control rod misalignments (as indicated by the analog rod position indicators within one hour after control rod motion) fall into two separate categories, which are:

a) ±24 steps of the group step counter demand position (if the power level is less than or equal to 85% of rated thermal power);

b) to within the varying allowable deviations shown in Figure 3.10-1 for power level greater than 85% of rated thermal power. This may be extended up to an additional six steps in either direction if sufficient peaking factor margin exists;

The allowable deviation shown in Figure 3.10-1 varies as a function of bank demand position allowing for the top of active fuel ending at a control rod position of approximately 225 steps. Also above 85% of rated thermal power, if sufficient peaking factor margin is demonstrated by satisfying the requirements of Table 3.10-1, the acceptable deviation is increased by up to an additional 6 steps depending upon peaking factor margin,(e.g.for an allowable increase of 6 additional steps from indicated misalignment, the peak measured $F_Q(Z)$ from the most recent, current cycle, full power (i.e. ≥ 98% Rated Thermal Power) incore flux map must be at least 3.0% less than the limit AND the peak measured $F_{\Delta H}^N$ from the most recent, current cycle, full power incore flux map must be at least 2.0% less than the limiting value).

For group step counter demand positions greater than 212 steps withdrawn, it is acceptable for the analog rod position indicator to indicate misalignment greater than +12 steps (as indicated on Figure 3.10-1) without accounting for peaking factor margin. This is due to the top of active fuel stack being at approximately 225 steps withdrawn. Indicated misalignment in the more withdrawn direction should result in the actual rod position being no lower than 201 steps withdrawn (which is within the analyzed limits). Actual control rod positions above the top of active fuel will not result in increased peaking factors for increased misalignments.

Similarly, allowable negative deviation limits may increase by 1 step for every step of group step counter demand position over the top of active fuel.

For power levels less than or equal to 85% of rated thermal power the peaking factor margin does not have to be verified on an explicit basis. This is due to the rate of peaking factor margin increase (as the power level decreases) being greater than the peaking factor margin loss (due to the increased control rod misalignment). This effect is described in WCAP-14668. These limits are applicable to all control rods (of all banks) over the range of 0 to 231 steps withdrawn inclusive.

The comparison of group step counter demand position and analog rod position indicator may take place at any time up to one hour after rod

motion. This allows up to one hour of thermal soak time to allow the control rod drive shaft to reach a thermal equilibrium and thus present a consistent position indication. A similar time period (up to one hour after rod motion) is allowed for comparison of the bank insertion limits and the analog rod position indicators. This comparison is sufficient to verify that the control rods are above the insertion limits and thus assures the presence of sufficient shutdown margin to satisfy the assumptions of the safety analyses. Rod position can also be confirmed via a digital voltage meter applied to the rod position control racks, in which case the operators will continue to monitor the rod position indicators on the main control board (and on the plant computer, if available and in agreement with the digital voltage meter reading) to check for deviation.

The action statements which permit limited variation from the basic requirements are accompanied by additional restrictions which ensure that the original criteria are met. Misalignment of a rod requires measurement of peaking factors (to confirm acceptability) or a restriction in thermal power; either of these restrictions provides assurance of fuel rod integrity during continued operation. The reactivity worth of a misaligned rod is limited for the remainder of the fuel cycle to prevent exceeding the assumption used in the accident analysis.

Add Page 3.10-19, Table 3.10-1, Acceptable Indicated Control Rod Misalignment as a Function of Measured Peaking Factor Margin ($F_Q(z)$, $F_{\Delta H}^N$) at Power Levels 〉85% of Rated Thermal Power.

Add Page 3.10-20, and change Table 3.10-1 to Table 3.10-2.

Add Figure 3.10-1, Permissible Rod Misalignment vs. Step Counter Demand Position,)85% Of Rated Thermal Power

SECTION II- Evaluation of Changes

Westinghouse performed an evaluation of the effects of increasing the allowed control rod indicated misalignment from ±12 steps to an indicated misalignment of ±24 steps when the core power is less than or equal to 85% of RTP and ±12 steps above 85% of RTP with the following considerations:

- when the group step counter demand position exceeds the top of active fuel (TAF), the acceptable deviation on the negative side may increase by 1 step for every additional step of group step counter demand position;

- when the group step counter demand position is below the TAF by no more than 12 steps, the acceptable deviation on the positive side may extend to the all-rods-out (ARO) position; the acceptable deviation may be further increased by up to 6 steps as a function of measured peaking factor margin.

The results of this evaluation are reported in Westinghouse document WCAP-14668 and are summarized here. WCAP-14668 was previously submitted to the NRC by NYPA letter IPN-97-024 dated February 26, 1997. The number and type of rod misalignments were limited by the performance of an evaluation of the Failure Mode and Effects Analysis performed for the rod control system (Reference 1 of WCAP-14668). The evaluation was limited to single failures within the rod control system logic cabinets, power cabinets and the control rod drive mechanisms themselves. Multiple failures were not considered as reasonable precursors of rod misalignment since there is frequent surveillance of rod position to limit such occurrences. The evaluation concluded that there were six categories of failure mechanisms that warranted investigation. These categories are described in Section 2.0 of WCAP-14668. As a result of these failure mode categories, eight different cases of misalignment were analyzed. These cases involved single and multiple rod misalignments in a single group in either the insertion or withdrawal directions. These misalignments can be asymmetric. Other cases involved all rods in a group misaligned from the group step counter demand position. While this type of misalignment did not result in a rod to rod deviation, either the group did not move in the correct direction or the correct group did not move which for the purpose of this evaluation was considered a misalignment from the demand position. This type of misalignment is symmetric. The eight cases are described in detail in Section 3.3 of WCAP-14668.

The evaluation concluded that below 85% of RTP, indicated rod misalignments of up to ± 24 steps between the group step counter demand position and analog rod position indicator (ARPI) may be allowed based on the magnitude of peaking factor margin that is introduced by the reduction in the power level.

The margin increases are provided by the equations of Specification 3.10.2.1, noted below for clarity:

$$F_Q(Z) \leq \frac{[F_Q^{RTP}][K(Z)]}{P} \text{ for } P > 0.5$$

$$F_Q(Z) \leq \frac{[F_Q^{RTP}][K(Z)]}{0.5} \text{ for } P \leq 0.5$$

$$F_{\Delta H}^N \leq [F_{\Delta H}^{RTP}] [1.0+(PF_{\Delta H})(1-P)]$$

The margin requirements are 3.5% in $F_{\Delta H}$ and 6.3% in $F_Q(Z)$ for a maximum control rod misalignment of 24 steps indicated. The increases in the limits for F_Q and $F_{\Delta H}$ exceed these values prior to operation at or below 85% of RTP (for P = 85%, the quantity [1.0 + 0.3(1-P)] equals 1.045 or an increase of 4.5% in $F_{\Delta H}$ and 1/P equals 1.176 or an increase of 17.6% in F_Q). Therefore, the increase in allowed indicated misalignment is considered reasonable and acceptable.

For operation at power levels above 85% of RTP, the evaluation concludes that the degree of indicated misalignment is a function of the peaking factor margin present. The margin is determined by comparing the measured F_Q (Z)and $F_{\Delta H}^N$ from the most recent, current cycle, full power incore flux map with their corresponding limits. The degree of margin required for an indicated misalignment greater than that allowed by Figure 3.10-1 is defined in Table 3.10-1.

For group step counter demand positions greater than 212 steps withdrawn, it is acceptable for the ARPI to indicate misalignment greater than +12 steps (as indicated on Figure 3.10-1) without accounting for peaking factor margin. This is due to the TAF stack being at approximately 225 steps withdrawn. Actual control rod positions above the TAF will not result in increased peaking factors for increased misalignments. Similarly, allowable negative deviation limits may increase by 1 step for every step of group step counter demand position over the TAF.

WCAP-14668 Section 3 identifies the effects of indicated rod misalignments greater than ±12 steps on the normal operation peaking factors. Section 4 of WCAP-14668 identifies the effects on the safety analyses. In summary, the increase in rod misalignment does not significantly affect the following: moderator or Doppler reactivity coefficients or defects, reactor kinetics data, boron worth or data generated for evaluation of boron dilution or boron system duty. Condition II transients, (rod out of position, dropped rod and single rod withdrawal) assume either all rods out (ARO) or rods at the insertion limit (RIL) as initial conditions. Since the precondition operation with the increased rod misalignment results in an $F_{\Delta H}$ increase of less than 2.0%, the transient $F_{\Delta H}$ increase due to the misalignment is

expected to be bounded by the same magnitude.

Safety analyses parameters that are expected to be affected by the increased rod misalignment are the rod insertion allowance (RIA), the ejected rod $F_Q(Z)$ and the ejected rod worth ($\Delta\rho_{EJ}$). As noted in Section 4 of WCAP-14668, the maximum effect on the RIA will occur upon misalignment of all rods at the RIL in the inserted direction. Evaluation of this misalignment was performed at full power, zero power and part-power conditions for both of the cycles evaluated for Indian Point 3. The evaluation concluded that the RIA increased as a result of the misalignment and that the calculated RIA for the reload safety evaluation should be increased to 160 pcm to conservatively bound this effect. To determine the ejected rod effects, preconditioning with the maximum allowed misalignment was assumed for single rod, a group of rods and entire banks. The subsequent effects on $F_Q(Z)$ and $\Delta\rho_{EJ}$ for the two cycles were determined. It was noted that increases of 1.5% $F_Q(Z)$ and 3.0% $\Delta\rho_{EJ}$ must be included in the safety analyses to bound the projected effects when a cycle specific analysis is not performed.

Section III - No Significant Hazards Evaluation

Consistent with the criteria of 10 CFR 50.92, the enclosed application is judged to involve no significant hazards based on the following information:

(1) Does the proposed license amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

Response:

No. Based on the Westinghouse evaluation in WCAP-14668, the Authority has determined that all pertinent licensing basis acceptance criteria have been met, and the margin of safety as defined in the TS Bases is not reduced in any of the IP3 licensing basis accident analysis. Increasing the magnitude of allowed control rod indicated misalignment (in Section 3.10.5) is not a contributor to the mechanistic cause of an accident evaluated in the FSAR. Neither the rod control system nor the rod position indicator function is being altered. Therefore, the probability of an accident previously evaluated has not significantly increased. Because design limitations continue to be met, and the integrity of the reactor coolant system pressure boundary is not challenged, the assumptions employed in the calculation of the offsite radiological doses remain valid. Therefore, the consequences of an accident previously evaluated will not be significantly increased.

(2) Does the proposed license amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

Response:

No. Based on the Westinghouse evaluation in WCAP-14668, the Authority has determined that all pertinent licensing basis acceptance criteria have been met, and the margin of safety as defined in the TS Bases is not reduced in any of the IP3 licensing basis accident analysis. Increasing the magnitude of allowed control rod indicated misalignment is not a contributor to the mechanistic cause of any accident. Neither the rod control system nor the rod position indicator function is being altered. Therefore, an accident which is new or different than any previously evaluated will not be created.

3) Does the proposed amendment involve a significant reduction in a margin of safety?

Response:

No. Based on the Westinghouse evaluation in WCAP-14668, the Authority has determined that all pertinent licensing basis acceptance criteria have been met, and the margin of safety as defined in the TS Bases is not reduced in any of the IP3 licensing basis accident analysis based on the changes to safety analyses input parameter values as discussed in WCAP-14668. Since the evaluations in Section 3.0 of WCAP-14668 demonstrate that all applicable acceptance criteria continue to be met, the proposed change will not involve a significant reduction in margin of safety.

Section IV - Impact of Changes

These changes will not adversely affect the following:
ALARA Program
Security and Fire Protection Programs
Emergency Plan
FSAR or SER Conclusions
Overall Plant Operations and the Environment

Section V - Conclusions

The incorporation of this change: a) will not significantly increase the probability nor the consequences of an accident or malfunction of equipment important to safety as previously evaluated in the Safety Analysis Report; b) will not create the possibility of a new or different kind of accident than any evaluated previously in the Safety Analysis Report; c) will not significantly reduce the margin of safety as defined in the bases for any technical specification; and d) involves no significant hazards considerations as defined in 10 CFR 50.92.

Section VI - References

a) IP3 FSAR
b) IP3 SER
c) WCAP-14668,. "Conditional Extension of the Rod Misalignment Technical Specification for Indian Point Unit 3," October 1996 (Proprietary)(Submitted by NYPA letter dated February 26, 1997 (IPN-97-024)).

ATTACHMENT III TO IPN-99-015

Marked-Up Pages of the TS (For Information Only)

NEW YORK POWER AUTHORITY
INDIAN POINT 3 NUCLEAR POWER PLANT
DOCKET NO. 50-286
DPR-64

LIST OF TABLES

LIST OF FIGURES

Amendment No. 101, 103, 116, 143, 173, 179,

3.10.5 Rod Misalignment Limitations

3.10.5.1 At least once per shift (allowing one hour for thermal soak after rod motion) the position of each control or shutdown rod shall be determined:

a. For operation less than or equal to 85% of rated thermal power, the indicated misalignment between the group step counter demand position and the analog rod position indicator shall be less than or equal to ~~24~~ 24 steps. A control or shutdown rod indicting a misalignment greater than ~~24~~ 24 steps shall be realigned within one hour or the core peaking factors shall be determined within two hours and the requirements of Specification 3.10.2 applied.

b. For operation greater than 85% of rated thermal power, the indicated misalignment between the group step counter demand position and the analog rod position indicator ~~shall be ±12 steps for less than or equal to 212 steps and +17, -12 steps for greater than 212 steps. A control or shutdown rod indicating a misalignment greater than the above mentioned steps shall be realigned within one hour or the core peaking factors shall be determined within two hours and the requirements of Specification 3.10.2 applied~~.

See Insert 'A'

3.10.5.2 If the requirements of Specification 3.10.3 are determined not to apply and the core peaking factors have not been determined within two hours and the rod remains misaligned, the high reactor flux setpoint shall be reduced to less than or equal to 85% of its rated value.

3.10.5.3 If the misaligned control rod is not realigned within 8 hours, the rod shall be declared inoperable.

3.10.6 Inoperable Rod Position Indicator Channels

3.10.6.1 If a rod position indicator channel is out of service, then:

a. For operation between 50 percent and 100 percent of rating, the position of the control rod shall be checked indirectly by core instrumentation (excore detectors and/or movable incore detectors) once per 8 hours, or subsequent to rod motion exceeding 24 steps, whichever occurs first.

b. During operation below 50 percent of rating, no special monitoring is required.

3.10.6.2 Not more than one rod position indicator channel per group nor two rod position indicator channels per bank shall be permitted to be inoperable at any time.

3.10.6.3 If a control rod having a rod position indicator channel out of service, is found to be misaligned from 3.10.6.1a above, then Specification 3.10.5 will be applied.

Insert 'A'

for each control or shutdown rod shall be within the limits of Figure 3.10-1. This allowable deviation may be increased by up to an additional six steps (indicated on Table 3.10-1) as a function of peaking factor margin $F_Q(Z)$ and $F_{\Delta H}^N$. A control or shutdown rod indicating a misalignment greater than that allowed by this specification shall be realigned within one hour or the core peaking factors shall be determined within two hours and the requirements of Specification 3.10.2 applied.

3.10.7 Inoperable Rod Limitations

3.10.7.1 An inoperable rod is a rod which does not trip or which is declared inoperable under Specification 3.10.5 or fails to meet the requirements of 3.10.8.

3.10.7.2 Not more than one inoperable control rod shall be allowed any time the reactor is critical except during physics tests requiring intentional rod misalignment. Otherwise, the plant shall be brought to the hot shutdown condition.

3.10.7.3 If any rod has been declared inoperable, then the potential ejected rod worth, associated transient power distribution peaking factors and the accident listed in Table 3.10-~~1~~ 2 shall be analyzed within 5 days, or the reactor brought to the hot shutdown condition using normal operating procedures. The analysis shall include due allowance for non-uniform fuel depletion in the neighborhood of the inoperable rod. If the analysis results in a more limiting hypothetical transient than the cases reported in the safety analysis, the plant power level shall be reduced to an analytically determined part power level which is consistent with the safety analysis.

3.10.8 Rod Drop Time

At operating temperature and full flow, the drop time to each control rod shall be no greater than 1.8 seconds from loss of stationary gripper coil voltage to dashpot entry.

(e.g. rod misalignment) affect $F_{\Delta H}^N$, in most cases without necessarily affecting F_Q, (b) the operator has a direct influence on F_Q through movement of rods, and can limit it to the desired value, he has no direct control over $F_{\Delta H}^N$ and (c) an error in the predictions for radial power shape, which may be detected during startup physics tests, can be compensated for in F_Q by tighter axial control, but compensation for $F_{\Delta H}^N$ is less readily available. When a measurement of $F_{\Delta H}^N$ is taken, no additional allowances are necessary prior to comparison with the limit of section 3.10.2. A measurement uncertainty of 4% has been allowed for in determination of the design DNBR value.

Measurements of the hot channel factors are required as part of startup physics tests, at least each effective full power month of operation, and whenever abnormal power distribution conditions require a reduction of core power to a level based on measured hot channel factors. The incore map taken following initial loading provides confirmation of the basic nuclear design basis including proper fuel loading patterns. The periodic monthly incore mapping provides additional assurance that the nuclear design bases remain inviolate and identify operational anomalies which would, otherwise, affect these bases.

For normal operation, it is not necessary to measure these quantities. Instead it has been determined that, provided certain conditions are observed, the hot channel factor limits will be met; these conditions are as follows:

1. Control rods in a single bank move together with no individual rod insertion differing by more than 15 inches from the group step counter demand position (operating at greater than 85% of rated thermal power with no accounting for peaking factor margin), ~~or 18.75 inches (operating at less than or equal to 85% of rated thermal power). An indicated misalignment limit of 12 steps precludes a rod misalignment greater than 15 inches with consideration of instrumentation error and 18 steps indicated misalignment corresponds to 18.75 inches with instrumentation error~~.

See Insert 'B'

2. Control Rod banks are sequenced with overlapping banks as described in Technical Specification 3.10.4.

3. The control rod bank insertion limits are not violated.

Insert 'B'

18.75 inches (operating at greater than 85% of rated thermal power with accounting for peaking factor margin) or 22.5 inches (operating at less than or equal to 85% of rated thermal power). An indicated misalignment limit of 12 steps precludes a rod misalignment greater than 15 inches with consideration of instrumentation error, 18 steps indicated misalignment corresponds to 18.75 inches with instrumentation error and 24 steps indicated misalignment corresponds to 22.5 inches with instrumentation error. Additional misalignment is allowed near the fully withdrawn position, since the top of the active core (approximately 225 steps) is less than the fully withdrawn position.

The intent of the test to measure control rod worth and shutdown margin (Specification 3.10.4) is to measure the worth of all rods less the worth of the worst case for an assumed stuck rod, that is, the most reactive rod. The measurement would be anticipated as part of the initial startup program and infrequency over the life of the plant, to be associated primarily with determinations of special interest such as end of life cooldown, or startup of fuel cycles which deviate from normal equilibrium conditions in terms of fuel loading patterns and anticipated control bank worth. These measurements will augment the normal fuel cycle design calculations and place the knowledge of shutdown capability on a firm experimental as well as analytical basis.

~~The rod position indicator channel is sufficiently accurate to detect a rod ±7 inches away from its demand position. An indicated misalignment less than 12 steps does not exceed the power peaking factor limits. If the rod position indicator channel is not operable, the operator will be fully aware of the inoperability of the channel, and special surveillance of core power tilt indications, using established procedures and relying on excore nuclear detectors, and/or moveable incore detectors, will be used to verify power distribution symmetry. These indirect measurements do not have the same resolution if the bank is near either end of the core, because a 12 step misalignment would have no effect on power distribution. Therefore, it is necessary to apply the indirect checks following significant rod motion.~~

See Insert 'C'

One inoperable control rod is acceptable provided that the power distribution limits are met, trip shutdown capability is available, and provided the potential hypothetical ejection of the inoperable rod is not worse than the cases analyzed in the safety analysis report. The rod ejection accident for an isolated fully inserted rod will be worse if the residence time of the rod is long enough to cause significant non-uniform fuel depletion. The 5 day period is short compared with the time interval required to achieve a significant, non-uniform fuel depletion.

The assumed control rod drop time in the safety analysis is 2.7 seconds, consisting of 1.80 seconds for normal rod drop time plus additional margin which includes a seismic allowance. The required control rod drop time in Section 3.10.8 is therefore consistent with that assumed in the safety analysis.

REFERENCE

1. WCAP-8576, "Augmented Startup and Cycle 1 Physics Program," August 1975
2. FSAR Appendix 14C
3. Letter from J.P. Bayne to S.A. Varga dated April 23, 1985, entitled "Proposed Technical Specifications Regarding the Cycle 4/5 Refueling."
4. WCAP-14668, "Conditional Extension of the Rod Misalignment Technical Specification for Indian Point Unit 3," October 1996 (Proprietary).

Insert 'C'

The specifications of Section 3.10.5 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 position and thereby ensure compliance with the control rod alignment and insertion limits. Control rod misalignments are evaluated "as indicated by the analog rod position indicators within one hour after control rod motion." During plant startup and power escalation, the control rods are moved regularly, but not necessarily in a continuous manner. Therefore, control rod motion shall be considered to have been stopped if control rods have not been moved in the same direction as the previous control rod motion within an hour since the last control rod movement. At the end of the hour, if control rods have not been moved, then the hour hold time for evaluating control rod misalignment shall also be considered to have been met. Permitted control rod misalignments (as indicated by the analog rod position indicators within one hour after control rod motion) fall into two separate categories, which are:

a) ±24 steps of the group step counter demand position (if the power level is less than or equal to 85% of rated thermal power);

b) to within the varying allowable deviations shown in Figure 3.10-1 for power level greater than 85% of rated thermal power. This may be extended up to an additional six steps in either direction if sufficient peaking factor margin exists;

The allowable deviation shown in Figure 3.10-1 varies as a function of bank demand position allowing for the top of active fuel ending at a control rod position of approximately 225 steps. Also above 85% of rated thermal power, if sufficient peaking factor margin is demonstrated by satisfying the requirements of Table 3.10-1, the acceptable deviation is increased by up to an additional 6 steps depending upon peaking factor margin,(e.g.for an allowable increase of 6 additional steps from indicated misalignment, the peak measured $F_Q(Z)$ from the most recent, current cycle, full power (i.e. ≥ 98% Rated Thermal Power) incore flux map must be at least 3.0% less than the limit AND the peak measured $F_{\Delta H}^N$ from the most recent, current cycle, full power incore flux map must be at least 2.0% less than the limiting value).

For group step counter demand positions greater than 212 steps withdrawn, it is acceptable for the analog rod position indicator to indicate misalignment greater than +12 steps (as indicated on Figure 3.10-1) without accounting for peaking factor margin. This is due to the top of active fuel stack being at approximately 225 steps withdrawn. Indicated misalignment in the more withdrawn direction should result in the actual rod position being no lower than 201 steps withdrawn (which is within the analyzed limits). Actual control rod positions above the top of active fuel will not result in increased peaking factors for increased misalignments. Similarly, allowable negative deviation limits may increase by 1 step for every step of group step counter demand position over the top of active fuel.

For power levels less than or equal to 85% of rated thermal power the peaking factor margin does not have to be verified on an explicit basis. This is due to the rate of peaking factor margin increase (as the power level decreases) being greater than the peaking factor margin loss (due to the increased control rod misalignment). This effect is described in

Insert 'C' Continued

WCAP-14668. These limits are applicable to all control rods (of all banks) over the range of 0 to 231 steps withdrawn inclusive.

The comparison of group step counter demand position and analog rod position indicator may take place at any time up to one hour after rod motion. This allows up to one hour of thermal soak time to allow the control rod drive shaft to reach a thermal equilibrium and thus present a consistent position indication. A similar time period (up to one hour after rod motion) is allowed for comparison of the bank insertion limits and the analog rod position indicators. This comparison is sufficient to verify that the control rods are above the insertion limits and thus assures the presence of sufficient shutdown margin to satisfy the assumptions of the safety analyses. Rod position can also be confirmed via a digital voltage meter applied to the rod position control racks, in which case the operators will continue to monitor the rod position indicators on the main control board (and on the plant computer, if available and in agreement with the digital voltage meter reading) to check for deviation.

The action statements which permit limited variation from the basic requirements are accompanied by additional restrictions which ensure that the original criteria are met. Misalignment of a rod requires measurement of peaking factors (to confirm acceptability) or a restriction in thermal power; either of these restrictions provides assurance of fuel rod integrity during continued operation. The reactivity worth of a misaligned rod is limited for the remainder of the fuel cycle to prevent exceeding the assumption used in the accident analysis.

TABLE 3.10-~~1~~ 2

ACCIDENT ANALYSES REQUIRING REEVALUATION
IN THE EVENT OF AN INOPERABLE FULL
LENGTH ROD

Rod Cluster Control Assembly Insertion Characteristics

Rod Cluster Control Assembly Misalignment

Loss of Reactor Coolant From Small Ruptured Pipes Or From Cracks In Large Pipes Which Actuates The Emergency Core Cooling System

Single Rod Cluster Control Assembly Withdrawal At Full Power

Major Reactor Coolant System Pipe Ruptures (Loss of Coolant Accident)

Major Secondary System Pipe Rupture

Rupture of a Control Rod Drive Mechanism Housing (Rod Cluster Control Assembly Ejection)

~~FIGURE 3.10-1~~

~~HAS BEEN~~

~~DELETED~~

See New Figure 3.10-1