



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
RELATED TO AMENDMENT NO. 197 TO FACILITY OPERATING LICENSE NO. DPR-64  
POWER AUTHORITY OF THE STATE OF NEW YORK  
INDIAN POINT NUCLEAR GENERATING UNIT NO. 3  
DOCKET NO. 50-286

1.0 INTRODUCTION

By letter dated January 29, 1999, as supplemented by letter dated August 2, 1999, the Power Authority of the State of New York (PASNY or the licensee) submitted amendments to modify Indian Point Unit 3 (IP3) Technical Specifications (TSs) 3.10.5, "Rod Misalignment Limitations" and 3.10.6, "Inoperable Rod Position Indicator Channels" and their associated BASES. The proposed amendments would allow  $\pm 24$  steps misalignment (currently it is  $\pm 18$  steps), at or below 85% of Rated Thermal Power (RTP). Above 85% of RTP, the indicated misalignment between the group step counter demand position and the analog rod position indicator shall remain less than or equal to  $\pm 12$  steps. The proposed change is based on an evaluation performed by Westinghouse (WCAP-14668).

The licensee's experience with the Analog Rod Position Indication (ARPI) System shows that indicated misalignment is often greater than  $\pm 12$  steps. The root cause of this phenomenon is the analog rod position indication variation with temperature, most often after a recent power level change.

IP3 has modified TS 3.10.5.1 to allow up to 1 hour after control rod motion to verify control rod position. The 1 hour time period is consistent with the NRC approved time extensions at other plants.

Westinghouse performed the evaluations of the effects of increasing the allowed control rod indicated misalignment from  $\pm 12$  steps to an indicated misalignment of up to  $\pm 24$  steps when the core power is less than or equal to 85% of RTP and  $\pm 12$  steps above 85% of RTP. Changing the TS to allow  $\pm 24$  steps misalignment will reduce the use of the flux mapping system. Frequent use of the flux mapping system may lead to more maintenance work required on the system, and an "As Low as is Reasonably Achievable" (ALARA) concern. The results of the analyses were documented in WCAP-14668, and submitted to the staff by PASNY letter IPN-97-024 dated February 26, 1997. A review of the results is presented below.

2.0 SAFETY EVALUATION

The ARPI system is designed to an accuracy of 12 steps. Therefore, in order to guarantee a rod misalignment of less than  $\pm 24$  steps (12 steps misalignment + 12 steps ARPI uncertainty), the individual ARPI readings must be no larger than 12 steps. In order to justify changing the misalignment to  $\pm 24$  steps, the licensee did evaluations for misalignments of up to 36 steps

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(12 steps indicated and 24 steps uncertainty). The TS limits on peaking factors  $F_q$  and  $F_{\Delta H}$  increase as the power level lowers. The increase in the limit for  $F_q$  and  $F_{\Delta H}$  was used to accommodate the larger than  $\pm 12$  steps misalignment at the reduced power levels.

The Westinghouse Advanced Nodal Computer Code (ANC) (WCAP-10965-P-A, September 1986) in the three dimensional mode was used for the analysis. Full core and quarter core models were used in the analyses. The calculations were performed by Westinghouse and documented in Topical Report WCAP-14668, as part of the submittal.

## 2.1 Core Models Used and Misalignment Cases Analyzed

To perform the analysis of the possible rod misalignments, Westinghouse used two different ANC models of the IP3 core. The first model is the currently operating Cycle 9, and represents the current IP3 licensing basis for fuel products and peaking factor limits. The second model used is intended to represent a "Bounding" future cycle; it uses higher enrichments, longer cycle length, higher peaking factors, and more burnable absorbers which may be present in future cycles.

The number and type of rod misalignments were limited to those permitted by the failure mode and effects analysis performed by Westinghouse and presented in WCAP-14668, for the rod control system. The evaluation was limited to single failures, because multiple failures are not considered reasonable precursors of rod misalignment since there is frequent surveillance of rod position.

## 2.2 Misalignment Calculations

### 2.2.1 Analysis Results for Power $\leq 85\%$

To maximize effect, the licensee assumed misalignment from the power dependent insertion limit (PDIL) in order to determine the power level at which the peaking factor increase due to misalignment would be acceptable. The licensee analyzed misalignment of groups of rod cluster control assemblies (RCCAs) in the control bank since it is more probable that the RCCAs in one group would mis-step rather than different RCCAs from different groups would mis-step. Single RCCA misalignment calculations were also performed.

The licensee's evaluation of operation at or below 85% RTP, indicated that rod misalignments for up to  $\pm 24$  steps between the group step counter demand position and the analog rod position indicator (ARPI), may be allowed because of the additional peaking factor margin that is introduced by the reduction in the power level. The analysis showed that the margin requirements for  $F_{\Delta H}$  and  $F_q(Z)$  are 3.5% and 6.3%, respectively, for a misalignment of  $\pm 24$  steps indicated. The increased limits for  $F_{\Delta H}$  and  $F_q$  exceed these values prior to operation at or below 85% of RTP. The licensee concluded, therefore, that the increase in allowed indicated misalignment is acceptable. The staff concurs with this conclusion and finds that an indicated misalignment of up to 24 steps is acceptable under 85% RTP. Above 85% RTP, the number of misaligned steps remains the same, that is,  $\pm 12$  steps.



### 2.3 Safety Analyses Parameters.

The safety analyses parameters that are expected to be affected by the increase in the rod misalignment are the rod insertion allowance (RIA), the ejected rod  $F_q(Z)$  and the ejected rod worth ( $\Delta \rho_{EJ}$ ). The licensee's analyses (conducted throughout the power range), show that the maximum effect on the RIA will occur upon the misalignment of all the rods at the rod insertion limit (RIL) in the inserted direction. Analysis of the results showed that the RIA increased as a result of the misalignment, consequently, the RIA for the reload safety evaluation was increased to 160 pcm to conservatively bound this effect.

Rod ejection was also analyzed subject to misalignment of individual rods, groups and entire banks of rods. The subsequent effects on  $F_q(z)$  and  $\Delta \rho_{EJ}$  were determined. Results of the analysis indicated that an increase of 1.5% in  $F_q(z)$  and 3.0% in  $\Delta \rho_{EJ}$  must be included in the safety analyses to bound the projected effects when a cycle specific analysis is not performed. The staff finds this acceptable.

RCCA misalignments up to 36 steps (24 steps indicated + 12 steps ARPI) have been evaluated for impact on peaking factors and reactivity worth. The results of the analysis showed that the incremental increases in the peaking factors were only a small fraction of the increase in the peaking factor limits for powers less than 85%. The change in reactivity worth was also shown to be well within the excess margin available. Thus it has been shown that the increase in peaking factors will be accommodated at or below 85% of RTP and the change to the technical specification to allow misalignment of up to 24 steps is acceptable.

### 3.0 STATE CONSULTATION

In accordance with the Commission's regulations, the New York State official was notified of the proposed issuance of the amendment. The State official had no comments.

### 4.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (64 FR 29713). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

### 5.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the

Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

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Date: October 14, 1999