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

August 22, 1990

Docket No. 50-261

Mr. Lynn W. Eury
Executive Vice President
Power Supply
Carolina Power & Light Company
Post Office Box 1551
Raleigh, North Carolina 27602

Dear Mr. Eury:

SUBJECT: ISSUANCE OF AMENDMENT NO. 128 TO FACILITY OPERATING LICENSE NO. DPR-23 REGARDING POWER DISTRIBUTION CONTROL - H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2 (TAC NO. 74838)

The Nuclear Regulatory Commission has issued the enclosed Amendment No. 128 to Facility Operating License No. DPR-23 for the H. B. Robinson Steam Electric Plant, Unit No. 2. This amendment consists of changes to the Technical Specifications (TS) in response to your request dated August 24, 1989, as supplemented June 5, 1990.

The amendment changes TS Figures 3.10-4 and 3.10-5. These changes incorporate the results of analyses using a new three dimensional analytical technique that more explicitly models the plant-specific core power distributions.

In the staff's Safety Evaluation (SE), it is noted that for the revised TS Figures of this amendment to be valid, certain reactor core characteristics have to be within specific limits. From your August 24, 1989 submittal, we note that the reactor core characteristics in question in the staff's SE will remain within limits for the upcoming Cycle 14 operation.

By letter dated June 5, 1990, you stated that you will submit another license amendment request to implement the guidance of Generic Letter 88-16 and incorporate a Core Operating Limits Report (COLR) into the TS. In addition, you have committed to submit the COLR amendment request prior to the start of Cycle 14 operation. You also propose to incorporate the above mentioned reactor core characteristic limits in the bases of the COLR amendment request. The staff finds your COLR amendment submittal plan to be acceptable with respect to the maintainance of the reactor core characteristic limits for operations beyond Cycle 14.

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August 22, 1990

Mr. Lynn W. Eury -2-

DISTRIBUTION
See attached page

A copy of the related Safety Evaluation (SE) is enclosed. A Notice of Issuance will be included in the Commission's regular bi-weekly Federal Register notice.

Sincerely,

Orignal signed by:

Ronnie H. Lo, Senior Project Manager
Project Directorate II-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosures:
1. Amendment No. 128 to DPR-23
2. Safety Evaluation

cc w/enclosures:
See next page

OFC	:LA:PD21:DRPR	:PM:PD21:DRPR	:SRXB	:D:PD21:DRPR	:	:	:
NAME	: PAnderson	: RLo:sw	:HRichings	:EAdensam	:	:	:
DATE	:7/27/90	:7/27/90	:7/27/90	:8/22/90	:	:	:

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ROB AMEND 74838

AMENDMENT NO. 128 TO FACILITY OPERATING LICENSE NO. DPR-23 - ROBINSON, UNIT NO. 2

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Carolina Power & Light Company

H. B. Robinson Steam Electric
Plant, Unit No. 2

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

CAROLINA POWER & LIGHT COMPANY

DOCKET NO. 50-261

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 128
License No. DPR-23

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Carolina Power & Light Company (the licensee), dated August 24, 1989, as supplemented June 5, 1990, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications, as indicated in the attachment to this license amendment; and paragraph 3.B of Facility Operating License No. DPR-23 is hereby amended to read as follows:

(B) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 128 , are hereby incorporated in the license. Carolina Power & Light Company shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Orignal signed by:

Ronnie Lo for:
Elinor G. Adensam, Director
Project Directorate II-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: August 22, 1990

OFC	:LA:PD21:DRPR	:PM:PD21:DRPR	:OGC	:D:PD21:DRPR	:	:	:
NAME	:PAnderson	:RLo	:	:EAdensam	:	:	:
DATE	:7/10/90	:7/12/90	:8/6/90	:8/22/90	:	:	:

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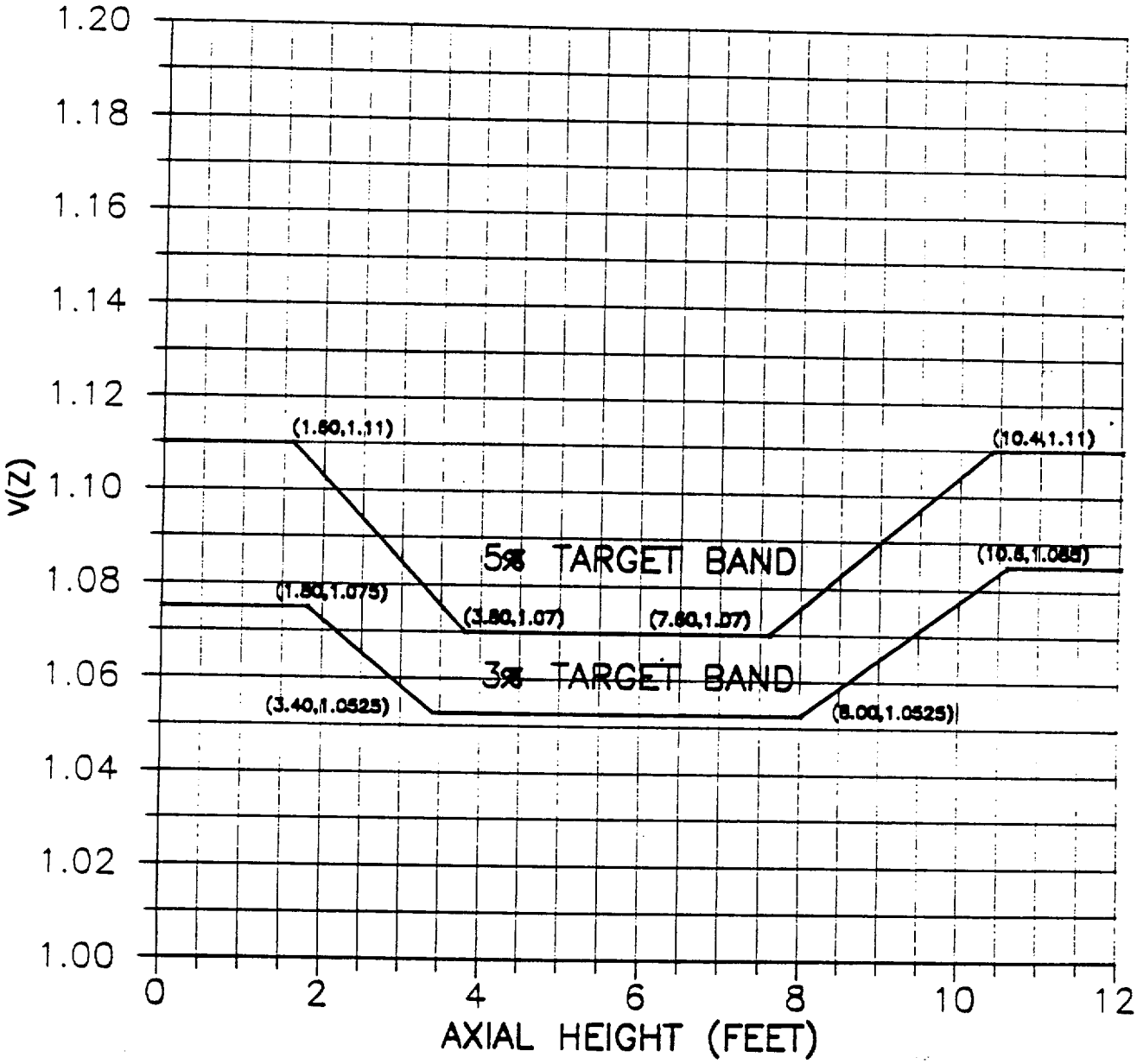
ATTACHMENT TO LICENSE AMENDMENT NO. 128

FACILITY OPERATING LICENSE NO. DPR-23

DOCKET NO. 50-261

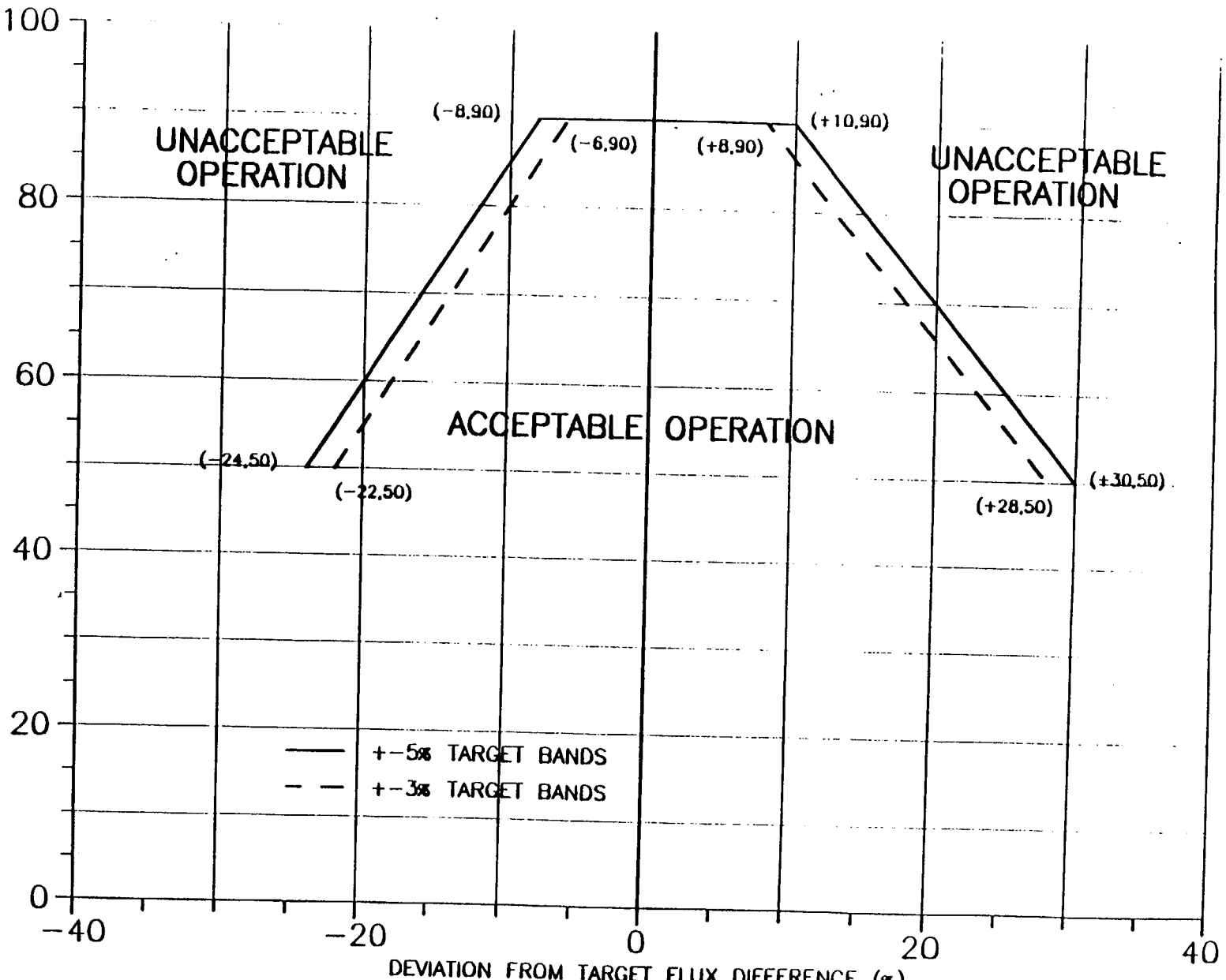
Replace the following pages of the Appendix A Technical Specifications with the enclosed pages. The revised areas are indicated by marginal lines.

Remove Pages	Insert Pages
3.10-23	3.10-23
3.10-24	3.10-24



V(Z) AS A FUNCTION OF CORE HEIGHT

Figure 3.10-4



ALLOWABLE DEVIATION FROM TARGET FLUX DIFFERENCE

Figure 3.10-5

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 128 TO FACILITY OPERATING LICENSE NO. DPR-23

CAROLINA POWER & LIGHT COMPANY

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

DOCKET NO. 50-261

1.0 INTRODUCTION

By letter dated August 24, 1989 (Reference 1), as supplemented by letter dated June 5, 1990 (Reference 2), Carolina Power & Light Company (CP&L) requested changes to the Technical Specifications (TS) for the H. B. Robinson Steam Electric Plant, Unit No. 2 (HBR2). The requested TS changes relate to power distribution control. The submittal from CP&L included a topical report, ANF-88-054, "PDC-3: Advanced Nuclear Fuels Corporation Power Distribution Control for Pressurized Water Reactors and Applications of PDC-3 to H. B. Robinson Unit 2." This report provides background and justification for the TS changes. It consists of: (1) a generic description and justification for the use of the Advanced Nuclear Fuels Corporation (ANF) PDC-3 power distribution control analysis methodology which replaces the previously used (and NRC staff approved) PDC-2 methodology, and (2) specific application of PDC-3 to HBR2, including the analysis leading to the changes to the TS. The June 5, 1990 submittal provided information that did not alter the proposed action or change the initial determination of no significant hazards consideration published in the Federal Register on November 1, 1989.

The proposed TS changes for HBR2 are to Figures 3.10-4 and 3.10-5 (referenced in TS 3.10.2). These figures provide some of the required parameters and limits associated with the ANF system of analytical and operational control of power distribution limits as used by HBR2 in the current and projected future operating cycles.

The primary characteristics of the ANF power distribution methodology relevant to the proposed TS changes and ANF-88-054 consists of: (1) operator controlled limits on axial power distribution (based on control of relative power in the top and bottom of the reactor, expressed as "axial offset" or "axial flux difference"), and (2) the analytically determined V(Z) distribution (the maximized ratio of the axially dependent, total peaking factor $F_Q(Z)$, during and following power maneuvers (simulated load follow), to the equilibrium $F_Q(Z)$ value at target offset conditions). These characteristics are a part of both current and future operations. The proposed changes do not affect operational procedures. The proposed changes only affect the axial offset limits related to allowed operation outside of the normal offset control band.

The TS changes result from changes to the ANF analysis methodology, i.e., a change from PDC-2 to PDC-3. The PDC-3 methodology for calculating V(Z) retains previous general characteristics, but has been changed in several details. The primary differences are:

(1) The core average radial and axial behavior analysis in steady state and power maneuvers is done with three-dimensional (3D) XTG (Reference 2), rather than using the PDC-2 methodology of one dimensional (1D) XTG and conservative radial peaking factors (F_{XY}).

(2) An expanded set (relative to PDC-2) of power maneuver transients has been used in the analyses to provide a more conservative set of transient values for $F_Q^T(Z)$ and the development of V(Z).

2.0 EVALUATION

PDC-2 uses a 1D axial analysis generated by collapsing a 3D XTG model. The suitability of the analysis has been verified by comparison to the experiment and has been previously reviewed and approved by the NRC and its consultants (Reference 3). ANF has now developed a "sample" 3D XTG model covering a representative operating cycle and has used it for 3D/1D comparisons in the development and justification of the generic PDC-3 methodology. The 1D model was developed from the 3D using the PDC-2 methodology. Using the previously approved standard load follow transients for the "sample" model and comparing the 3D and 1D axial power distributions, ANF determined that the agreement in axial behavior is very similar. The 3D and 1D XTG methods are equally acceptable for generating the axial component of V(Z). The results of 3D and 1D will differ between the two methods only in the treatment of the radial component of the power distribution, and in that aspect PDC-3 will be more realistic. The staff review of these analyses and comparisons indicate that the 3D methodology of PDC-3 is appropriate and acceptable.

For PDC-3, ANF has proposed an expanded set of load follow transient cases for the development of V(Z). From previous PDC-2 results the V(Z) limit could have been drawn less conservatively than it has been, particularly near the core center. However, a review of the PDC-2 methods (Reference 3) by NRC's consultant, Brookhaven National Laboratory (BNL), noted that the BNL independent (parallel) calculations produced slightly higher peaking factors near the core center-line (from alternate load follow strategies) than those of ANF. The final ANF V(Z) limits, however, were drawn as an extrapolated straight line in the core center region, well above the calculated results, including the BNL results. The NRC review indicated that this was acceptable, but that if a less conservative limit were to be proposed "a more definitive analysis of the differences would be required." To overcome the difference and enable the V(Z) limit to be drawn closer to the calculated values near the center, ANF has used additional load follow transients bounding all possible modes of (allowed) operation for PDC-3, including those indicated in the NRC review. Other aspects of the PDC-3 parameter selection process remain the same as for PDC-2.

The PDC-2 methodology uses three load follow strategies, each at beginning- and end-of-cycle (BOC and EOC) conditions. These display extremes of operator control in operations at the limits of allowed offset banks about the offset equilibrium target. For PDC-3, this set has been expanded to six (each at BOC and EOC). The additional strategies cover other extreme conditions (within allowed operations), including those suggested by the BNL calculations for PDC-2 and the effects of fuel with natural enrichment "axial blankets" as used in HBR2. The 12 cases combined cover all apparent extremes of relevant allowed operation and should provide bounding transient peaking factors. These additions allow ANF to draw the V(Z) limit closer to (above) the analysis data, particularly at the core center, rather than the straight line extension used in the generic PDC-2. The NRC staff review of these changes has concluded that a suitably bounding set of analyses have been provided via the expanded set of load follow cases in the PDC-3 methodology, and the resulting V(Z) curve drawn as proposed is acceptable. The review also concludes that the generic PDC-3 methodology, including the use of 3D XTG and the extended transient cases, has been suitably described and justified and is acceptable for use as described in ANF-88-054.

The full 3D XTG and expanded operating modes PDC-3 methodology has been applied to HBR2. For this analysis an HBR2 specific model was developed rather than using a generic model as had previously been done with the PDC-2 methodology for HBR2 TS development. The parameters of cycle 12 were used in the model. The results of the calculations are new values for V(Z) and for the limits for allowed operation outside of designated offset bands. These form the basis for the proposed changes to the current TS Figures 3.10-4 and 3.10-5. The changes are only to the calculation methodology. Operating procedures and other aspects of the power distribution TS are unchanged. The HBR2 cycle 12 characteristics differ from the generic PDC-3 "sample" plant in having: (1) a lower power density, (2) lower control bank (D) reactivity worth, and (3) natural uranium axial blankets. In keeping with the current TS, analyses were done for offset bands of both (plus and minus) 3 and 5 percent. The effect of control rod worth was examined by calculating V(Z) for normal, plus and minus 15 percent and plus 30 percent Bank D reactivity worths. A composite V(Z) was produced from the maxima of these results as a function of Z. A bounding, limiting V(Z) was drawn above the composite curve which becomes the proposed TS curve of Figure 3.10-4.

In the currently approved ANF power distribution operational methodology, during operation below 90 percent power, deviation of limited amounts outside of the allowed offset band is permitted for limited times. The offset limits are given in Figure 3.10-4. These limits have been reexamined using the HBR2 Cycle 12 model. Calculations were done for operations at various powers outside the band beginning from various extremes within the band. Allowed deviations were determined for both 3 and 5 percent band operation at powers from 90 to 50 percent. These differ slightly from current limits. The review has concluded that appropriate calculations have been done, the results are reasonable and both proposed TS changes are acceptable.

The HBR2 Cycle 12 model used in the analyses has certain significant characteristics which must be preserved in future HBR2 cycles for the revised TS figures to be valid. In a letter dated June 5, 1990, the licensee has committed to add a statement of these core characteristics to the Bases of T.S. 3.10.2 prior to startup from refueling outage 14 following the approval of the Core Operating Limits Report (COLR). We find the following proposed statement for the Bases to be acceptable:

> Current power distribution control methodology, as applied on a H. B. Robinson Unit 2 plant specific bases, places certain restrictions on core characteristics which affect the validity of the power distribution control curves as provided each cycle in the COLR. The restricted core characteristics are:
>
> a) Restrictions are placed on the maximum number of twice burned non-blanketed fuel assemblies which may be placed in the core and,
>
> b) The bank D control rod reactivity worth is restricted such that its value must be bounded by those values assumed in the most recent application of the power distribution control methodology to H. B. Robinson.
>
> The purpose of these restrictions is to make the power distribution curves plant specific but not core or reload specific, that is, if current core characteristics meet the restrictions on a) and b) above, the most recently developed power distribution control curves remain valid for the current reload. If at any time the noted restrictions cannot be met for a proposed core reload, the current power distribution control curves are not valid and re-analysis using the NRC-approved methodology is necessary to provide new curves.
>
> Specific numerical values for the number of twice burned non-blanketed assemblies allowed in the core and on the bounding bank D control rod reactivity worth are provided in Reference 2 of Technical Specification 6.9.3.3.b (NRC-approved power distribution control methodology) which details the most recent application(s) of the power distribution control methodology to H. B. Robinson.

3.0 SUMMARY

We have reviewed the reports submitted by CP&L proposing TS changes relating to power distribution limits as provided in TS Figures 3.10-4 and 3.10-5. This has included the ANF topical report ANF-88-054(P), providing

both a generic description and justification of the PDC-3 methodology and a HBR2 specific analysis using the PDC-3 methodology to calculate the revised TS. Based on this review, we have concluded that appropriate documentation was submitted and both the generic PDC-3 methodology and the proposed TS changes satisfy staff positions and requirements. The use of the PDC-3 methodology as described in ANF-88-054, including the use of 3D XTG and the expanded set of load follow simulations, has been reasonably justified and is acceptable, and ANF-88-054 and this review may be referenced for generic approval. The specific calculation for HBR2 and the proposed TS changes are also acceptable. The applicability of the revised TS is limited to the conditions of control rod worth and presence of axial blankets previously discussed. The licensee has committed to add a statement to include these core characteristics in the Bases of TS 3.10.2 prior to startup from refueling outage 14. The staff has reviewed the proposed statement and found this approach to be acceptable.

4.0 ENVIRONMENTAL CONSIDERATION

This 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 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 off site; and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that this amendment involves no significant hazards consideration, and there has been no public comment on such finding. Accordingly, this 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 this amendment.

5.0 CONCLUSION

The Commission made a proposed determination that this amendment involves no significant hazards consideration, which was published in the FEDERAL REGISTER (54 FR 46142) on November 1, 1989, and consulted with the State of North Carolina. No public comments or requests for hearing were received, and the State of North Carolina did not have any comments.

The Staff 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, and (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

6.0 REFERENCES

1. Letter from A. Cutter, CP&L, to NRC, dated August 24, 1989, "Request for License Amendment, Power Distribution Control."

2. Letter from A. Cutter, CP&L to NRC, dated June 5, 1990, "Basis Change Concerning PDC-3 Methodology."

3. R. B. Stout, "XTG: A Two-Group Three Dimensional Reactor Simulator Utilizing Coarse Mesh Spacing (PWR Version)," XN-CC-28, Exxon Nuclear Company, Richland, Washington 99352, January 1975.

4. M. Todosow, A. L. Aronson, D. J. Diamond, "Axial Power Distribution Control Strategies for PWRs," BNL-NUREG-28797, Brookhaven National Laboratory, Upton, New York 11973, June 1980.

Dated: August 22, 1990

Principal Contributors: H. Richings
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