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U.S. NUCLEAR REGULATORY COMMISSION

DOCKET NUMBER 50-269

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NRC DISTRIBUTION FOR PART 50 DOCKET MATERIAL

TO: Mr. Edson G. Case

FROM: Duke Power Co.
Charlotte, N. C. 28242
William O. Parker, Jr.

DATE OF DOCUMENT 11/09/77

DATE RECEIVED 12/07/77

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DESCRIPTION Notorized 11/09/77...Trans The Following:

2p

ENCLOSURE Consists of Oconne 1, Cycle 4 Justification For Full Power Operation In An Un-Rodded Mode and Revision request for Amendment to the Oconne Tech Specs which will permit operation of Oconne 1, Cycle 4 in the unrodded mode...

6p +14p

PLANT NAME: OCONNE UNIT # 1
jcm 12/07/77

10 ENCL.

FOR ACTION/INFORMATION

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DUKE POWER COMPANY
POWER BUILDING
422 SOUTH CHURCH STREET, CHARLOTTE, N. C. 28242

WILLIAM O. PARKER, JR.
VICE PRESIDENT
STEAM PRODUCTION

TELEPHONE: AREA 704
373-4083

November 9, 1977

Mr. Edson G. Case, Acting Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

RE: Oconee Unit 1
Docket No. 50-269

Dear Sir:

My letter dated October 4, 1977 advised you of the results of the Oconee 1, Cycle 4 startup physics testing program. A core tilt in excess of the Technical Specification limits for normal operation was observed at reactor power levels of 40 percent full power. Power escalation to the 75 percent plateau was planned to enable further physics testing to investigate the presence of the core tilt. An amendment was requested to the Oconee Technical Specifications to permit continued operation with a core tilt in excess of the Technical Specifications limits at 75 percent full power with certain conservative limits applied. By letter dated October 31, 1977, these amendments were approved by the NRC.

The reactor has operated at 75 percent full power and the core tilt has decreased to near the original Technical Specification limit of 3.41%. The cause of the core tilt has not yet been identified although investigations are continuing. Analyses have been performed, however, which demonstrate the capability for safe operation of the Oconee 1, Cycle 4 core at full power for 100 EFPD in an unrodded mode assuming a real core tilt of 6%. Analyses for operation beyond 100 EFPD will be performed at a later date. A summary of these considerations is provided in Attachment 1.

Pursuant to the provisions of 10CFR50.90, an amendment is requested to the Oconee Technical Specifications which will permit operation of Oconee 1, Cycle 4 in the unrodded mode. The requested revision is indicated in Attachment 2. Although operation is currently permitted under the original Technical Specifications if the core tilt returns to less than 3.41% and power ascention testing is accomplished in the rodded mode, it is considered desirable and prudent to provide for continued operation in an unrodded mode. Therefore, it is requested that these amendments be approved on a prompt basis.

Very truly yours,

William O. Parker, Jr.

MST:ge
Attachments

773410112

WILLIAM O. PARKER, JR., being duly sworn, states that he is Vice President of Duke Power Company; that he is authorized on the part of said Company to sign and file with the Nuclear Regulatory Commission this request for amendment of the Oconee Nuclear Station Facility Operating Licenses DPR-38, DPR-47, and DPR-55; and that all statements and matters set forth therein are true and correct to the best of his knowledge.

William O. Parker, Jr.

William O. Parker, Jr., Vice President

Subscribed and sworn to before me this 9th day of November, 1977.

Vivian B. Rehkins

Notary Public

My Commission Expires:

Feb. 15, 1982

ATTACHMENT 1

OCONEE 1, CYCLE 4

JUSTIFICATION FOR FULL POWER OPERATION IN AN UNRODDED MODE

OCONEE 1, CYCLE 4
JUSTIFICATION FOR OPERATION
IN AN UNRODDED MODE

Power Peaking Conservatisms

The power peaking analysis for Oconee 1 Cycle 4 operation from 0 to 100 EFPD in the unrodded mode was performed assuming the existence of a 6% real quadrant tilt at all power levels. This tilt was determined to cause a 9% increase in local peaking, based on two factors:

a) this represents the relationship between peaking and tilt established by many full-core PDQ calculations with induced tilts, and

b) the comparison of calculated and measured power distribution shown in Figures 1 and 2 at 40 and 75% of full power show that a factor of 1.09, in conjunction with the standard total and radial nuclear uncertainty factors would be conservative.

All other peaking penalties normally included in the generation of Technical Specification operating limits were included in this analysis. The present cycle 4 Reactor Protective System limits, Figure 2.1-2A, were shown to be valid under the above conditions.

Table 1 provides a comparison of the total peaks calculated during each time step of the fuel cycle through 100 EFPD. Operation in the unrodded mode was found to provide reduced total peaks during the fuel cycle at all times after the 4 EFPD time step compared to rodded operation. Since the base peaking is lower for the unrodded cores the perturbed peaking is also lower. This is especially true when bank 7 is confined to the range of 295% WD to 274% WD at full power, as restricted by the proposed Figure 3.5.2-1A1.

Operating in the unrodded mode provides a means to restrict power peaking to nominal values. This protection is gained at the expense of operational flexibility. With this mode of operation the plant has a greatly reduced maneuvering capability. However, as stated above, the usual peaking factors due to xenon changes induced by normal maneuvering were included in the analysis, providing additional conservatism.

Ejected Rod Limits

The ejected rod worth insertion limits were determined based on using the hot, zero power measured values to correct for the quadrant tilt effects. The resulting maximum ejected rod worth correction factor was over 50%. This factor was used to adjust calculated ejected rod worths for the existence of the quadrant tilt. The net result of this procedure is the decrease in the amount that the operating banks may be inserted to satisfy the criteria during a postulated ejected rod accident. The resulting rod insertion limits were less limiting than shutdown margin criteria at all power levels above

zero power. Thus only the zero power limit (30% withdrawn) is based on ejected rod criteria.

Shutdown Rod Insertion Limits

The shutdown rod insertion limits were determined using standard techniques based on symmetric conditions and adjusting these calculations to account for the tilt. The calculated stuck rod worths are increased over 50%. The measured values of banks, 5, 6 and 7 at HZP were also used to determine the shutdown margin rod insertion limits. As an added conservatism the BOC calculated total rod worth was used at 100 EFPD to determine the limits at this time. The result of this procedure is the conservative shutdown rod insertion limits shown in Figures 3.5.2-1A1 and 3.5.2-2A1.

Discussion

The net effect of all these conservatisms is that the core is restricted in operating flexibility but allowed to operate at full power in a safe manner. The current APSR position limits (Figure 3.5.2-5A1) and imbalance limits Figure 3.5.2-3A1) for 0 to 100 EFPD are more restrictive than necessary for the proposed mode of rods-out-operations. This represents another conservatism in the analysis. The rod position limits were determined based on the super-position of the most conservative calculated and measured data. The limits are clearly conservative.

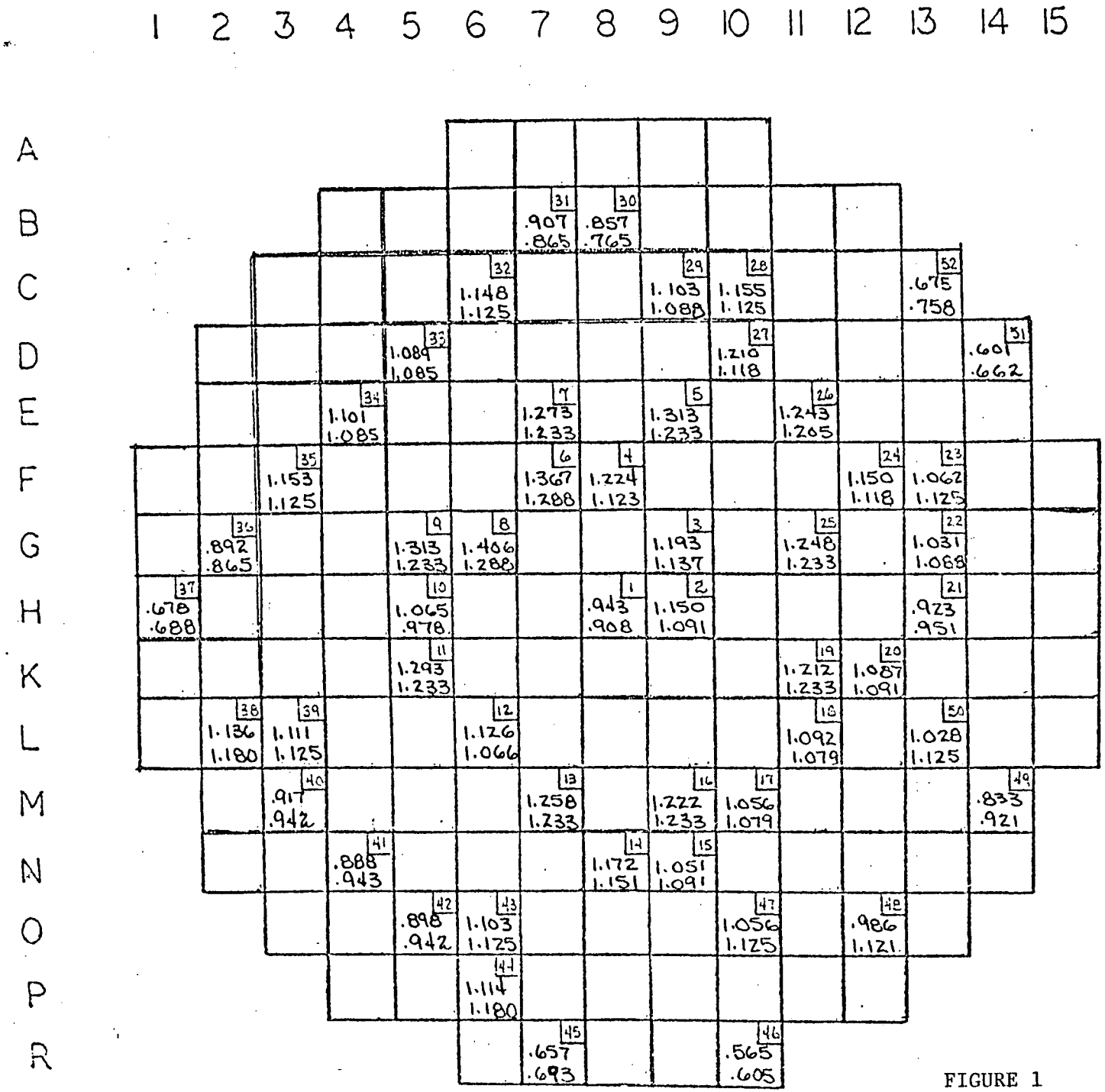
TABLE 1

FLAME Calculated Total Peaks For Unrodded And Rodded Operation

Time EFPD	Unrodded Max. Calc. Total Peak	Rodded Max. Cal. Total Peak	% Difference
0	1.647	1.581	(4.17)
4	1.572	1.524	(3.15)
25	1.476	1.521	2.96
50	1.424	1.481	3.85
100	1.393	1.455	4.26

OCONEE 1 CYCLE 4

BOC MEASURED VERSUS PREDICTED POWER DISTRIBUTIONS: 40% FULL POWER



MAXIMUM RADIAL PEAK	MAXIMUM TOTAL PEAK
MEASURED 1.406 AT G6	MEASURED 1.812 AT G6 LEVEL 4
CALCULATED 1.288 AT G6	CALCULATED 1.537 AT G6 LEVEL 3
% DIFFERENCE	
8.393	15.177

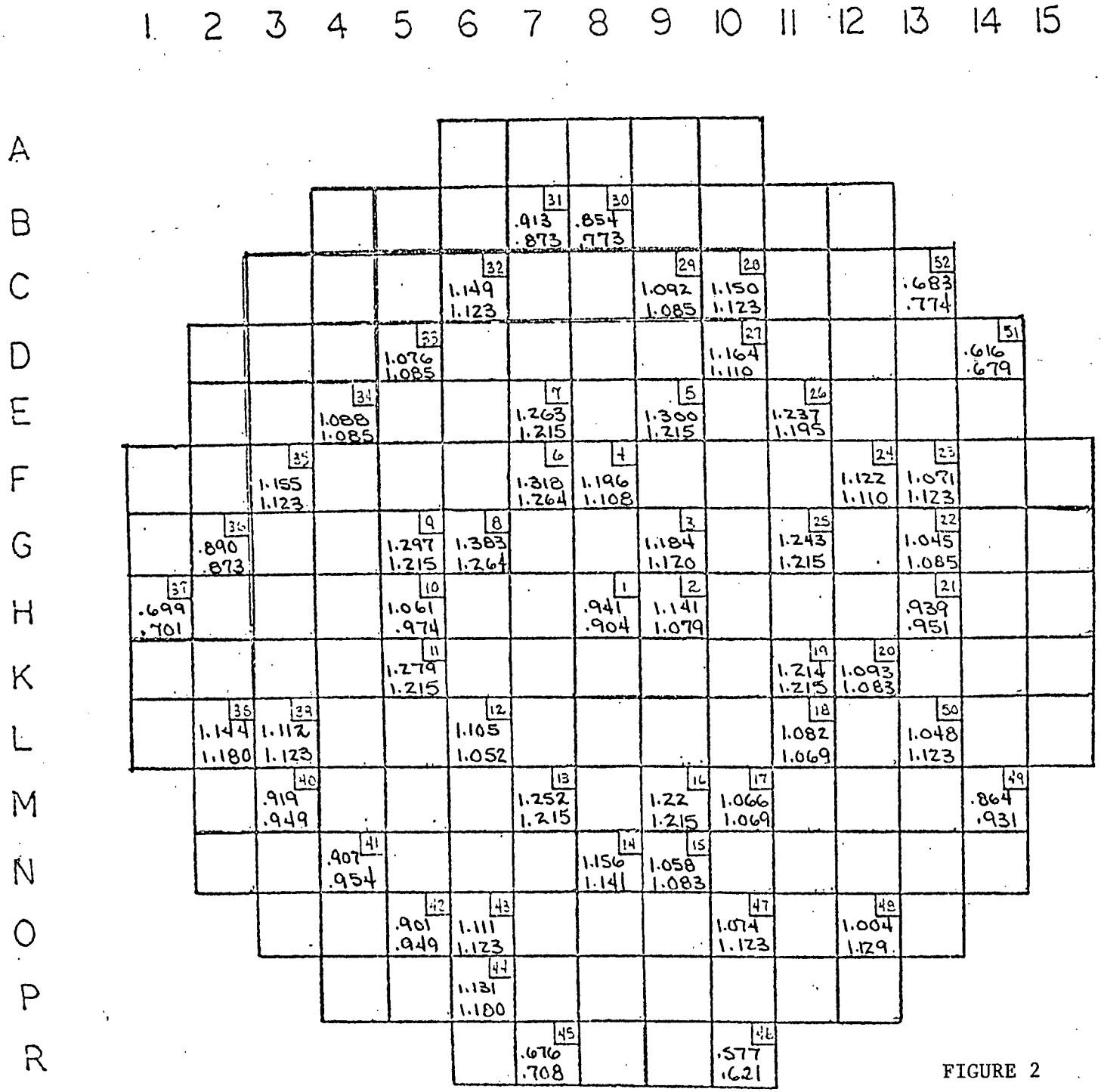
% Difference = $\frac{\text{Measured} - \text{Calculated}}{\text{Measured}} \times 100$

N INSTRUMENT No.
X MEASURED RELATIVE POWER
Y PREDICTED FOR SYMMETRIC CORE

FIGURE 1

OCONEE 1 CYCLE 4

BOC MEASURED VERSUS PREDICTED POWER DISTRIBUTIONS: 75% FULL POWER



MAXIMUM RADIAL PEAK	MAXIMUM TOTAL PEAK
MEASURED 1.383 AT G6	MEASURED 1.672 AT G6 LEVEL 3
CALCULATED 1.264 AT G6	CALCULATED 1.497 AT G6 LEVEL 4&5
% DIFFERENCE	
8.60%	10.46%

% Difference = $\frac{\text{MEASURED} - \text{CALCULATED}}{\text{MEASURED}} \times 1$

X [N] Y — INSTRUMENT NO. MEASURED RELATIVE ASSEMBLY POWER PREDICTED FOR SYMMETRIC CORE

FIGURE 2

ATTACHMENT 2

OCONEE 1, CYCLE 4

PROPOSED TECHNICAL SPECIFICATION
CHANGES

g. If within one (1) hour of determination of an inoperable rod, it is not determined that a 1%Δk/k hot shutdown margin exists combining the worth of the inoperable rod with each of the other rods, the reactor shall be brought to the hot standby condition until this margin is established.

h. Following the determination of an inoperable rod, all rods shall be exercised within 24 hours and exercised weekly until the rod problem is solved.

i. If a control rod in the regulating or safety rod groups is declared inoperable, power shall be reduced to 60 percent of the thermal power allowable for the reactor coolant pump combination.

j. If a control rod in the regulating or axial power shaping groups is declared inoperable, operation above 60 percent of rated power may continue provided the rods in the group are positioned such that the rod that was declared inoperable is maintained within allowable group average position limits of Specification 3.5.2.2.a and the withdrawal limits of Specification 3.5.2.5.c.

3.5.2.3 The worths of single inserted control rods during criticality are limited by the restrictions of Specification 3.1.3.5 and the control rod position limits defined in Specification 3.5.2.5.

3.5.2.4 Quadrant Power Tilt

a. Except for physics tests, if the maximum positive quadrant power tilt exceeds 6.03% Unit 1, 3.41% Unit 2, 3.41% Unit 3 be reduced to less than 6.03% Unit 1, 3.41% Unit 2, 3.41% Unit 3 within two hours or the following actions shall be taken:

(1) If four reactor coolant pumps are in operation, the allowable thermal power shall be reduced below the power level cutoff (as identified in specification 3.5.2.5) and further reduced by 2% of full power for each 1% tilt in excess of 6.03% Unit 1, 3.41% Unit 2, 3.41% Unit 3.

(2) If less than four reactor coolant pumps are in operation, the allowable thermal power for the reactor coolant pump combination shall be reduced by 2% of full power for each 1% tilt.

(3) Except as provided in specification 3.5.2.4.b, the reactor shall be brought to the hot shutdown condition within four hours if the quadrant power tilt is not reduced to less than
6.03% Unit 1 within 24 hours.
3.41% Unit 2
3.41% Unit 3

b. If the quadrant tilt exceeds 6.03% Unit 1 and there is simultaneous
3.41% Unit 2
3.41% Unit 3
indication of a misaligned control rod per Specification 3.5.2.2, reactor operation may continue provided power is reduced to 60% of the thermal power allowable for the reactor coolant pump combination.

c. Except for physics test, if quadrant tilt exceeds 9.44% Unit 1,
9.44% Unit 2
9.44% Unit 3
a controlled shutdown shall be initiated immediately, and the reactor shall be brought to the hot shutdown condition within four hours.

d. Whenever the reactor is brought to hot shutdown pursuant to 3.5.2.4.a(3) or 3.5.2.4.c above, subsequent reactor operation is permitted for the purpose of measurement, testing, and corrective action provided the thermal power and the power range high flux setpoint allowable for the reactor coolant pump combination are restricted by a reduction of 2 percent of full power for each 1 percent tilt for the maximum tilt observed prior to shutdown.

e. Quadrant power tilt shall be monitored on a minimum frequency of once every two hours during power operation above 15 percent of rated power.

3.5.2.5 Control Rod Positions

a. Technical Specification 3.1.3.5 does not prohibit the exercising of individual safety rods as required by Table 4.1-2 or apply to inoperable safety rod limits in Technical Specification 3.5.2.2.

b. Except for physics tests, operating rod group overlap shall be 25% ± 5% between two sequential groups. If this limit is exceeded, corrective measures shall be taken immediately to achieve an acceptable overlap. Acceptable overlap shall be attained within two hours or the reactor shall be placed in a hot shutdown condition within an additional 12 hours.

c. Position limits are specified for regulating and axial power shaping control rods. Except for physics tests or exercising control rods, the regulating control rod insertion/withdrawal limits are specified on figures 3.5.2-1A1, (Unit 1); 3.5.2-1B1, 3.5.2-1B2 and 3.5.2-1B3 (Unit 2); 3.5.2-1C1, 3.5.2-1C2 and 3.5.2-1C3 (Unit 3) for four pump operation, and on figures 3.5.2-2A1, (Unit 1); 3.5.2-2B1, 3.5.2-2B2 and 3.5.2-2B3 (Unit 2); 3.5.2-2C1, 3.5.2-2C2 and 3.5.2-2C3 (Unit 3) for two or three

pump operation. Also, excepting physics tests or exercising control rods, the axial power shaping control rod insertion/withdrawal limits are specified on figures 3.5.2-4A1, (Unit 1); 3.5.2-4B1, 3.5.2-4B2, and 3.5.2-4B3 (Unit 2). If the control rod position limits are exceeded, corrective measures shall be taken immediately to achieve an acceptable control rod position. An acceptable control rod position shall then be attained within two hours. The minimum shutdown margin required by Specification 3.5.2.1 shall be maintained at all times.

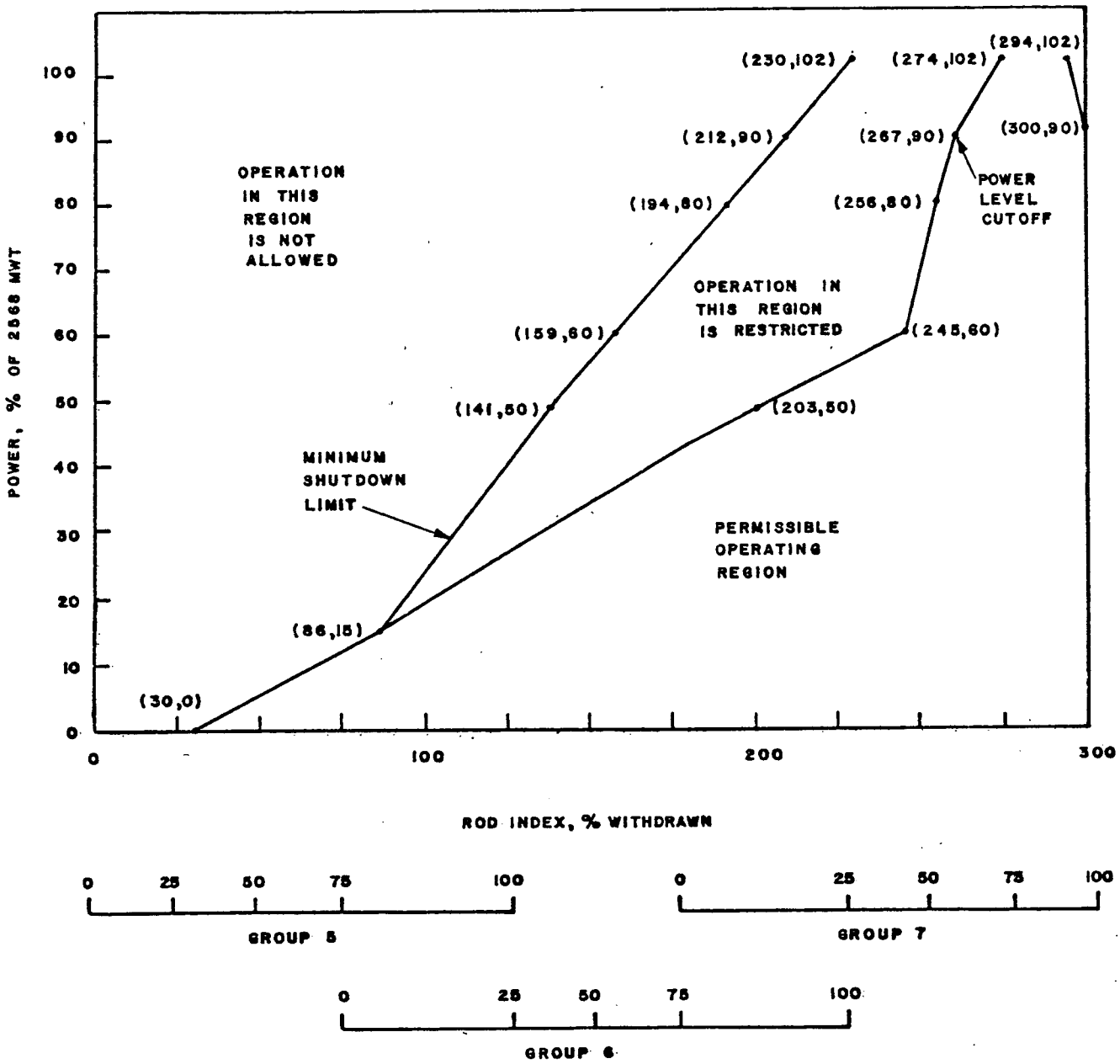
d. Except for physics tests, power shall not be increased above the power level cutoff as shown on Figures 3.5.2-1A1, (Unit 1), 3.5.2-1B1, 3.5.2-1B2, and 3.5.2-1B3 (Unit 2), and 3.5.2-1C1, 3.5.2-1C2, 3.5.2-1C3 (Unit 3), unless the following requirements are met.

(1) The xenon reactivity shall be within 10 percent of the value for operation at steady-state rated power.

(2) The xenon reactivity worth has passed its final maximum or minimum peak during its approach to its equilibrium valve for operation at the power level cutoff.

3.5.2.6 Reactor power imbalance shall be monitored on a frequency not to exceed two hours during power operation above 40 percent rated power. Except for physics tests, imbalance shall be maintained within the envelope defined by Figures 3.5.2-3A1, 3.5.3-3B1, 3.5.2-3B2, 3.5.2-3B3, 3.5.2-3C1, 3.5.2-3C2, and 3.5.2-3C3. If the imbalance is not within the envelope defined by these figures, corrective measures shall be taken to achieve an acceptable imbalance. If an acceptable imbalance is not achieved within two hours, reactor power shall be reduced until imbalance limits are met.

3.5.2.7 The control rod drive patch panels shall be locked at all times with limited access to be authorized by the manager or his designated alternate.



ROD INDEX IS THE PERCENTAGE SUM OF THE WITHDRAWAL OF GROUPS 5, 6 AND 7

OCONEE 1 CYCLE 4 ROD POSITION LIMITS FOR FOUR PUMP OPERATION FROM 0 TO 100 (±10) EFPD

OCONEE NUCLEAR STATION

Figure 3.5.2-1A1

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(These figures will be provided after analyses for operation of Oconee Unit 1 beyond 100 EFPD is performed.)

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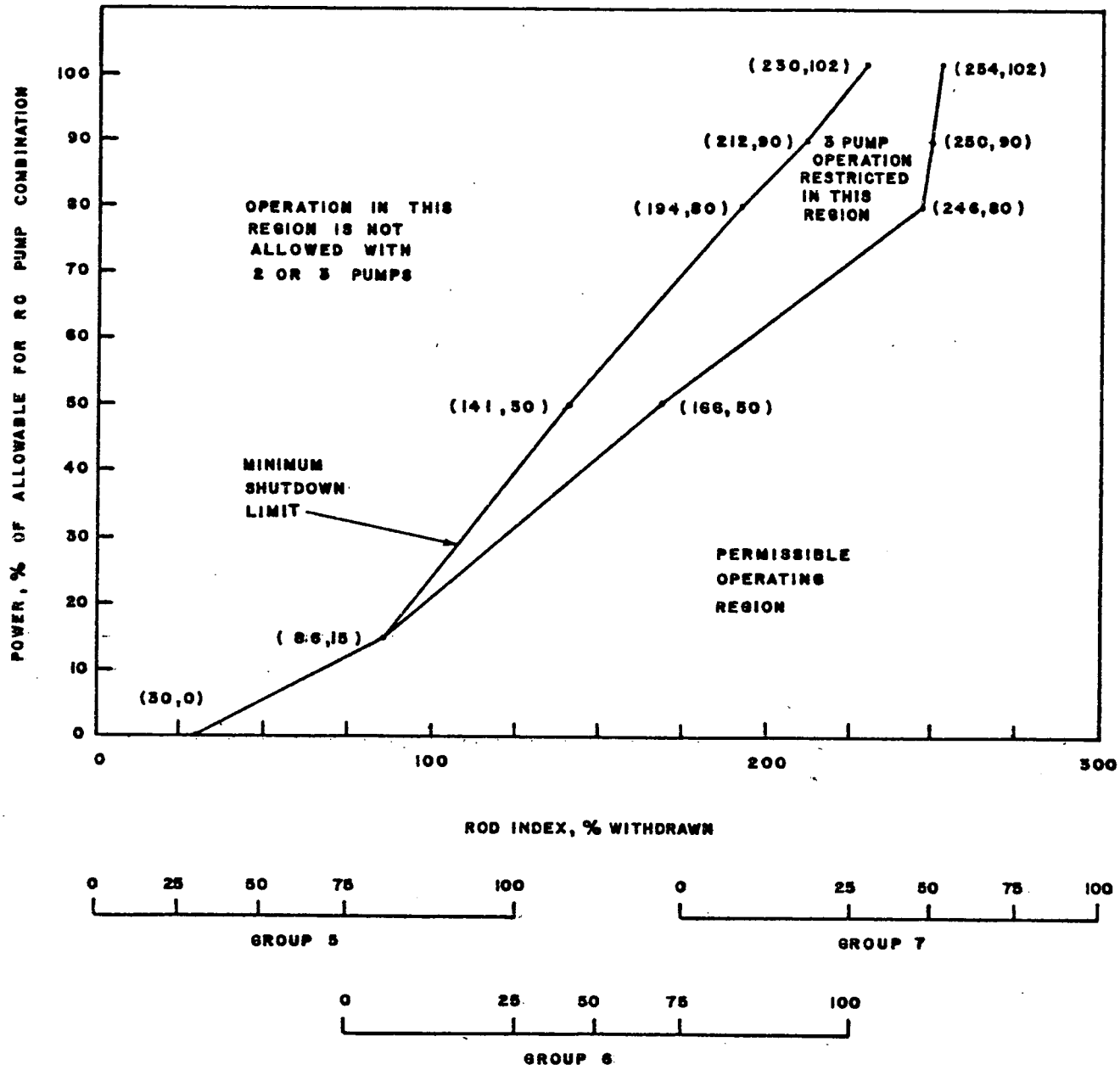
(These figures will be provided after analyses for operation of Oconee Unit 1 beyond 100 EFPD is performed.)



ROD INDEX IS THE PERCENTAGE SUM OF THE WITHDRAWAL OF GROUPS 5, 6 AND 7

OCONEE 1 CYCLE 4 ROD POSITION LIMITS FOR TWO AND THREE PUMP OPERATION FROM 0 TO 100 (±10) EFPD

OCONEE NUCLEAR STATION

Figure 3.5.2-2A1

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