Attachment 1

Duke Power Company
Oconee Nuclear Station

Proposed Technical Specification Revision

Oconee 3, Cycle 7

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can be related to DNB through the use of the BAW-2 correlation (1). The BAW-2 correlation has been developed to predict DNB and the location of DNB for axially uniform and non-uniform heat flux distributions. The local DNB ratio (DNBR), defined as the ratio of the heat flux that would cause DNB at a particular core location to the actual heat flux, is indicative of the margin to DNB. The minimum value of the DNBR, during steady-state operation, normal operational transients, and anticipated transients is limited to 1.30. A DNBR of 1.30 corresponds to a 95 percent probability at a 95 percent confidence level that DNB will not occur; this is considered a conservative margin to DNB for all operating conditions. The difference between the actual core outlet pressure and the indicated reactor coolant system pressure has been considered in determining the core protection safety limits. The difference in these two pressures is nominally 45 psi; however, only a 30 psi drop was assumed in reducing the pressure trip setpoints to correspond to the elevated location where the pressure is actually measured.

The curve presented in Figure 2.1-1A represents the conditions at which a minimum DNBR of 1.30 is predicted for the maximum possible thermal power (112 percent) when four reactor coolant pumps are operating (minimum reactor coolant flow is 106.5 percent of 131.3 x 10^6 lbs/hr). This curve is based on the combination of nuclear power peaking factors, with potential effects of fuel densification and rod bowing, which result in a more conservative DNBR than any other shape that exists during normal operation.

The curves of Figure 2.1-2A are based on the more restrictive of two thermal limits and include the effects of potential fuel densification and rod bowing:

1. The 1.30 DNBR limit produced by the combination of the radial peak, axial peak and position of the axial peak that yields no less than a 1.30 DNBR.

2. The combination of radial and axial peak that causes central fuel melting at the hot spot. The limit is 20.05 kw/ft for Unit 1.

Power peaking is not a directly observable quantity and therefore limits have been established on the bases of the reactor power imbalance produced by the power peaking.

The specified flow rates of Figure 2.1-3A correspond to the expected minimum flow rates with four pumps, three pumps, and one pump in each loop, respectively.

The curve of Figure 2.1-1A is the most restrictive of all possible reactor coolant pump-maximum thermal power combinations shown in Figure 2.1-3A.

The magnitude of the rod bow penalty applied to each fuel cycle is equal to or greater than the necessary burnup dependent DNBR rod bow penalty for the applicable cycle minus a credit of 1% for the flow area reduction factor used in the hot channel analysis. All plant operating limits are based on a minimum DNBR criteria of 1.30 plus the amount necessary to offset the reduction in DNBR due to fuel rod bow.

1. The 1.30 DNBR limit produced by the combination of the radial peak, axial peak and position of the axial peak that yields no less than a 1.30 DNBR.

2. The combination of radial and axial peak that causes central fuel melting at the hot spot. The limit is 20.15 kw/ft for Unit 2.

Power peaking is not a directly observable quantity, and, therefore, limits have been established on the bases of the reactor power imbalance produced by the power peaking.

The specified flow rates 2.1-3B correspond to the expected minimum flow rates with four pumps, three pumps, and one pump in each loop, respectively.

The curve of Figure 2.1-1B is the most restrictive of all possible reactor coolant pump-maximum thermal power combinations shown in Figure 2.1-3B.

The magnitude of the rod bow penalty applied to each fuel cycle is equal to or greater than the necessary burnup dependent DNBR rod bow penalty for the applicable cycle minus a credit of 1% for the flow area reduction factor used in the hot channel analysis. All plant operating limits are based on a minimum DNBR criteria of 1.30 plus the amount necessary to offset the reduction in DNBR due to fuel rod bow. (3)

The maximum thermal power for three-pump operation is 90.606 percent due to a power level trip produced by the flux-flow ratio 74.7 percent flow x 1.08 = 80.68 percent power plus the maximum calibration and instrument error. The maximum thermal power for other coolant pump conditions are produced in a similar manner.

For each curve of Figure 2.1-3B, a pressure-temperature point above and to the left of the curve would result in a DNBR greater than 1.30 or a local quality at the point of minimum DNBR less than 22 percent for that particular reactor coolant pump situation. The curve of Figure 2.1-1B is the most restrictive of all possible reactor coolant pump-maximum thermal power combinations shown in Figure 2.1-3B.

References

(1) Correlation of Critical Heat Flux in a Bundle Cooled by Pressurizer Water, BAW-10000, March 1970.

(2) Oconee 2, Cycle 4 - Reload Report, BAW-1491, August 1978.

(3) Oconee 2, Cycle 6 - Reload Report, BAW-1691, August 1981.

2. The combination of radial and axial peak that causes central fuel melting at the hot spot. The limits for Unit 3 are 20.5 kw/ft for fuel rod burnup less than or equal to 10,000 MWD/MTU and 21.5 kw/ft - after 10,000 MWD/MTU.

Power peaking is not a directly observable quantity, and, therefore, limits have been established on the bases of the reactor power imbalance produced by the power peaking.

The specified flow rates of Figure 2.1-3C correspond to the expected minimum flow rates with four pumps, three pumps, and one pump in each loop, respectively.

The magnitude of the rod bow penalty applied to each fuel cycle is equal to or greater than the necessary burnup dependent DNBR rod bow penalty for the applicable cycle minus a credit of 1% for the flow area reduction factor used in the hot channel analysis. All plant operating limits are based on a minimum DNBR criteria of 1.30 plus the amount necessary to offset the reduction in DNBR due to fuel rod bow. (4)

The maximum thermal power for three-pump operation is 90.65 percent due to a power level trip produced by the flux-flow ration 74.7 percent flow x 1.08 = 80.7 percent power plus the maximum calibration and instrument error (Reference 4). The maximum thermal power for other coolant pump conditions are produced in a similar manner.

For each curve of Figure 2.1-3C a pressure-temperature point above and to the left of the curve would result in a DNBR greater than 1.30 or a local quality at the point of minimum DNBR less than 22 percent for that particular reactor coolant pump situation. The curve of Figure 2.1-1C is the most restrictive of all possible reactor coolant pump-maximum thermal power combinations shown in Figure 2.1-3C.

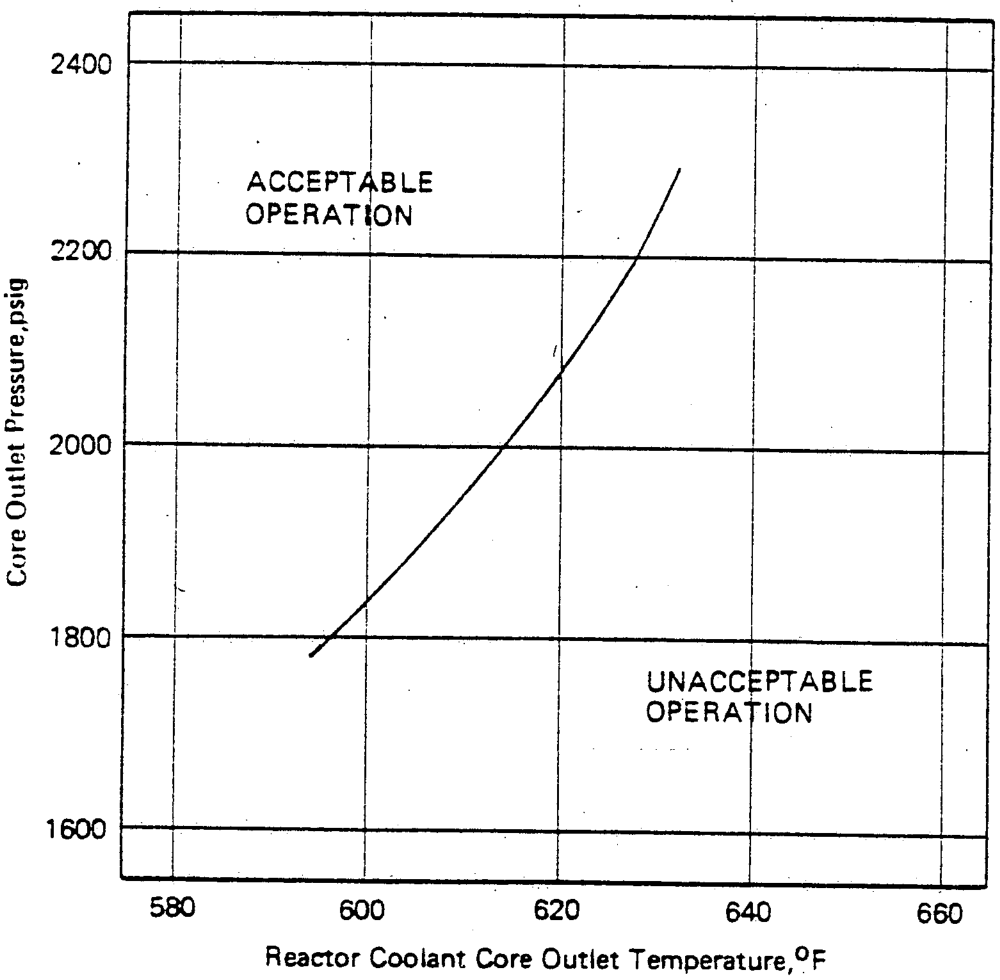
References

(1) Correlation of Critical Heat Flux in a Bundle Cooled by Pressurized Water, BAW-10000, March 1970.

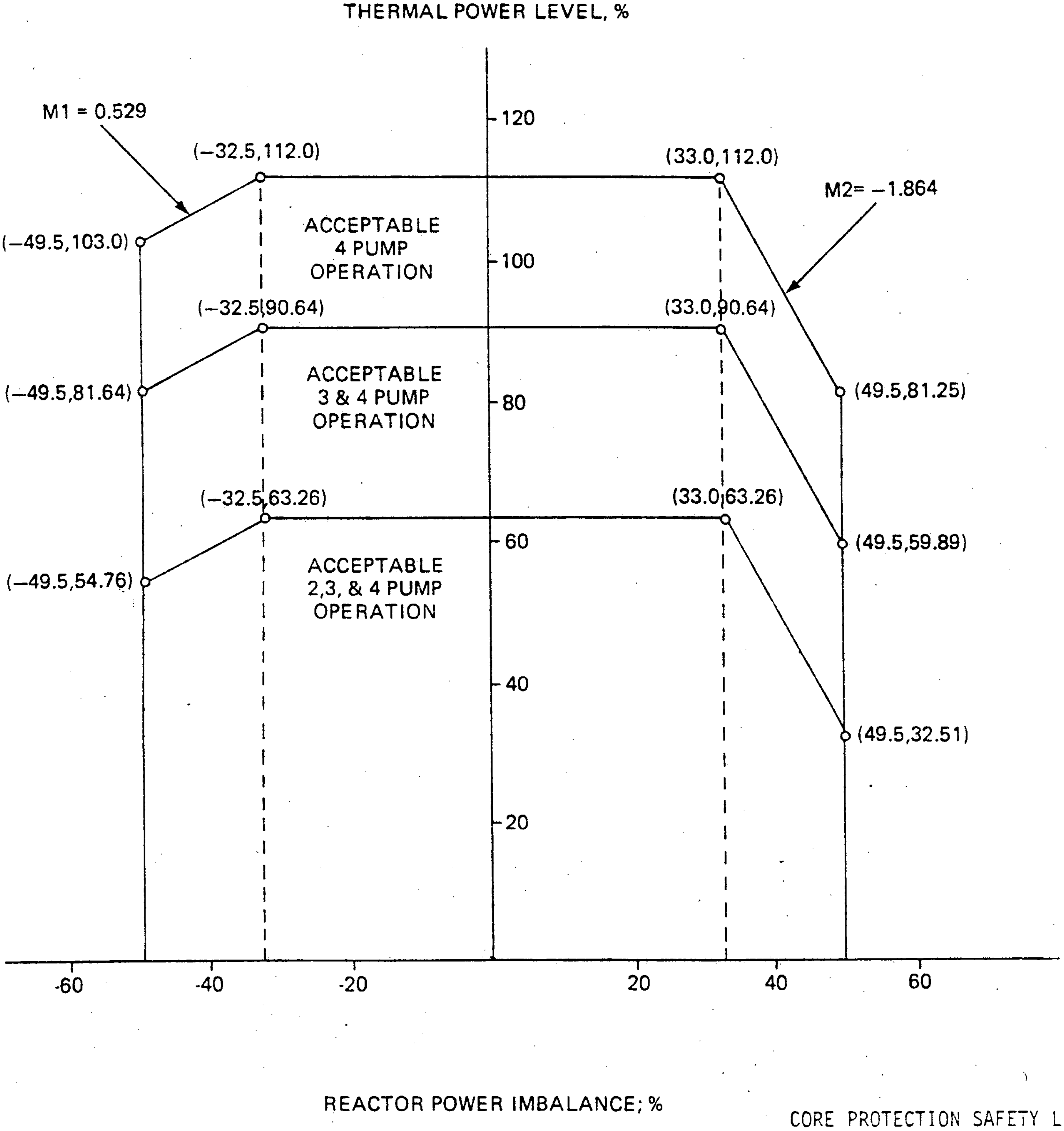
(2) Oconee 3, Cycle 3 - Reload Report - BAW-1453, August 1977.

(3) Amendment 1 - Oconee 3, Cycle 4 - Reload Report - BAW-1486, June 12, 1978.

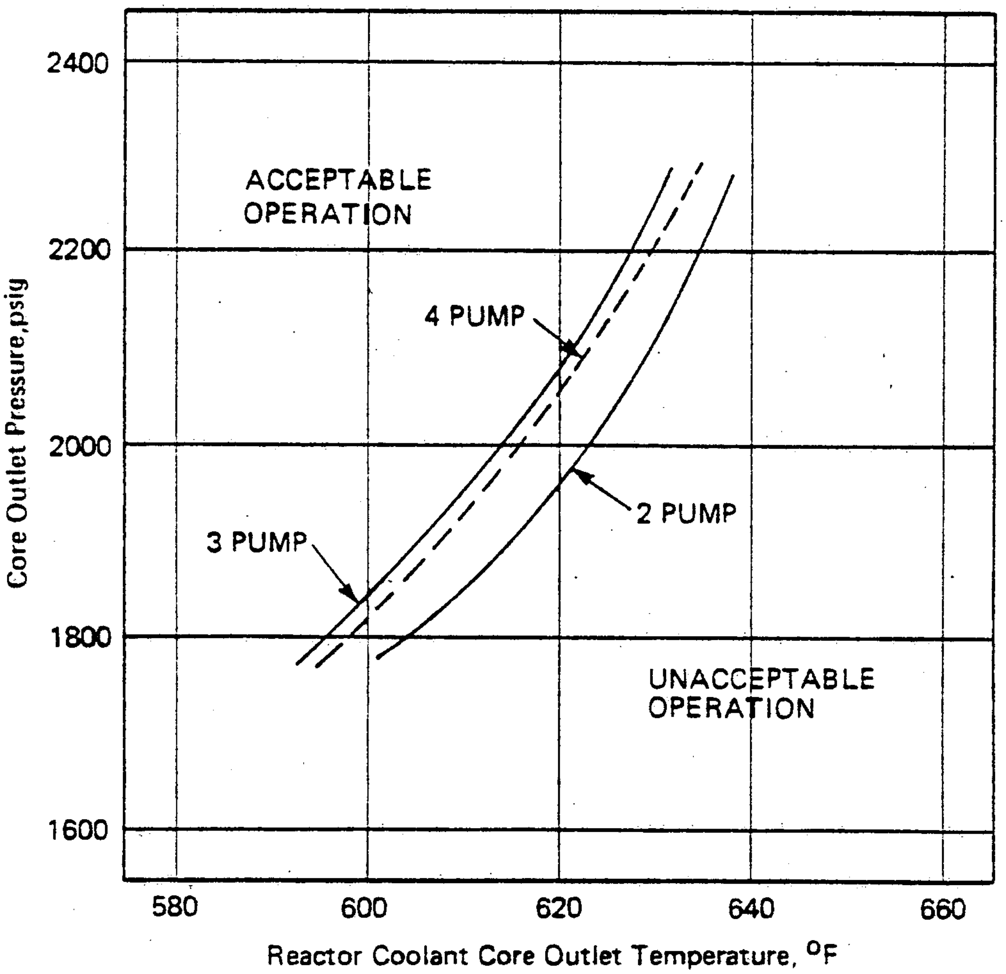
(4) Oconee 3, Cycle 7 - Reload Report - DPC-RD-2001, Revision 1, July 1982.



CORE PROTECTION SAFETY LIMITS
UNIT 3
OCONEE NUCLEAR STATION
Figure 2.1-1C

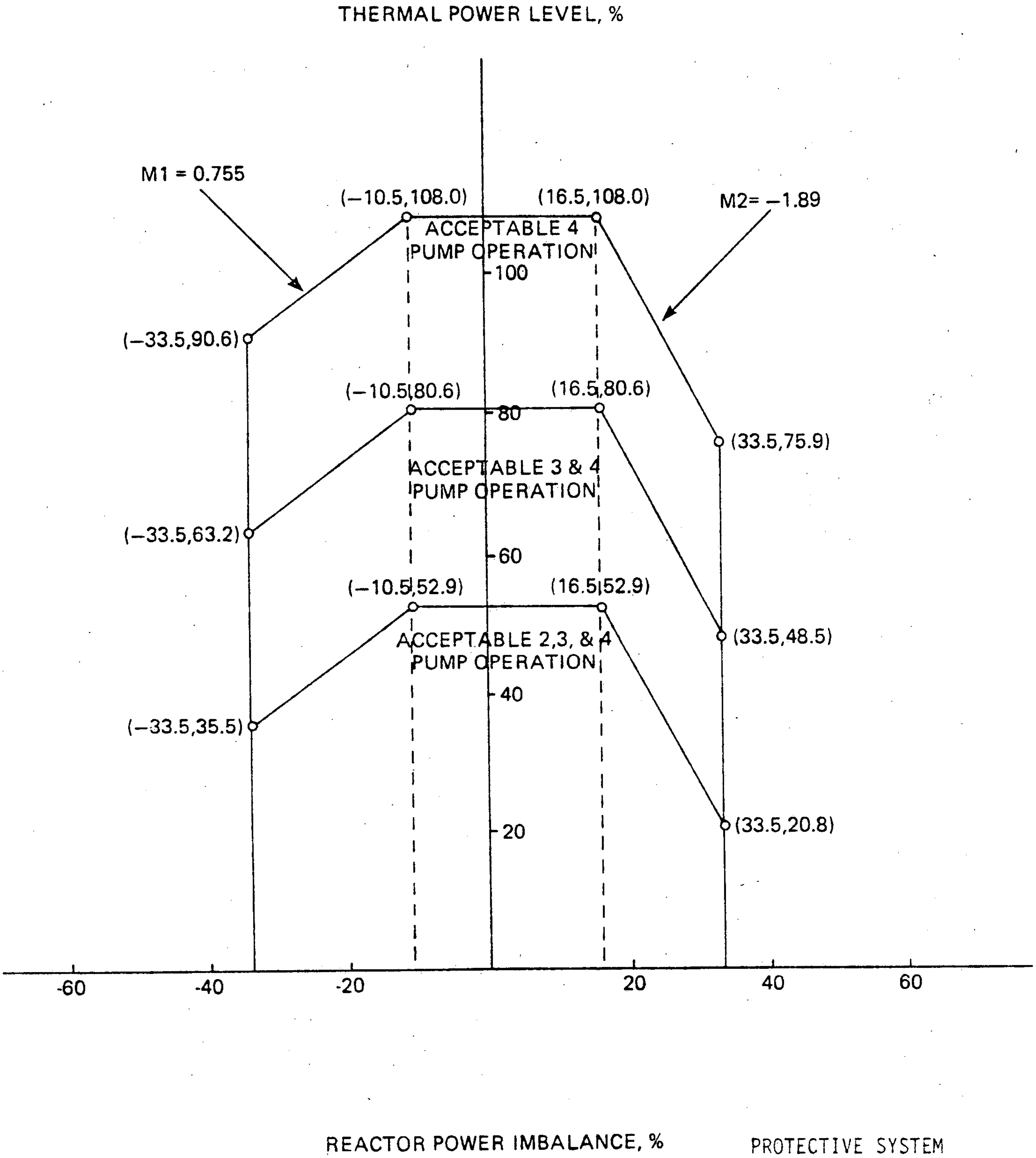


CORE PROTECTION SAFETY LIMITS
UNIT 3
OCONEE NUCLEAR STATION
Figure 2.1-2C



PUMPS OPERATING	COOLANT FLOW (GPM)	POWER (% FP)	TYPE OF LIMIT
4	374,880(100%)	112.0	DNBR
3	280,035(74.7%)	90.7	DNBR
2	183,690(49.0%)	63.63	DNBR/QUALITY

CORE PROTECTION SAFETY LIMITS
UNIT 3
OCONEE NUCLEAR STATION
Figure 2.1-3C



PROTECTIVE SYSTEM
MAXIMUM ALLOWABLE SETPOINTS
UNIT 3
OCONEE NUCLEAR STATION
Figure 2.3-2C

Bases

The high pressure injection system and chemical addition system provide control of the reactor coolant system boron concentration.(1) This is normally accomplished by using any of the three high pressure injection pumps in series with a boric acid pump associated with either the boric acid mix tank or the concentrated boric acid storage tank. An alternate method of boration will be the use of the high pressure injection pumps taking suction directly from the borated water storage tank.(2)

The quantity of boric acid in storage in the concentrated boric acid storage tank or the borated water storage tank is sufficient to borate the reactor coolant system to a 1% $\Delta k/k$ subcritical margin at cold conditions (70°F) with the maximum worth stuck rod and no credit for xenon at the worst time in core life. The current cycles for each unit were analyzed with the most limiting case selected as the basis for all three units. Since only the present cycles were analyzed, the specifications will be re-evaluated with each reload. A minimum of 1020 ft^3 of 8,700 ppm boric acid in the concentrated boric acid storage tank, or a minimum of 350,000 gallons of 1835 ppm boric acid in the borated water storage tank (3) will satisfy the requirements. The volume requirements include a 10% margin and, in addition, allow for a deviation of 10 EFPD in the cycle length. The specification assures that two supplies are available whenever the reactor is critical so that a single failure will not prevent boration to a cold condition. The required amount of boric acid can be added in several ways. Using only one 10 gpm boric acid pump taking suction from the concentrated boric acid storage tank would require approximately 12.7 hours to inject the required boron. An alternate method of addition is to inject boric acid from the borated water storage tank using the makeup pumps. The required boric acid can be injected in less than six hours using only one of the makeup pumps.

The concentration of boron in the concentrated boric acid storage tank may be higher than the concentration which would crystallize at ambient conditions. For this reason, and to assure a flow of boric acid is available when needed, these tanks and their associated piping will be kept at least 10°F above the crystallization temperature for the concentration present. The boric acid concentration of 8,700 ppm in the concentrated boric acid storage tank corresponds to a crystallization temperature of 77°F and therefore a temperature requirement of 87°F. Once in the high pressure injection system, the concentrate is sufficiently well mixed and diluted so that normal system temperatures assure boric acid solubility.

REFERENCES

(1) FSAR, Section 9.1; 9.2
(2) FSAR, Figure 6.2
(3) Technical Specification 3.3

f. If the maximum positive quadrant power tilt exceeds the Maximum Limit of Table 3.5-1, the reactor shall be shut down within 4 hours. Subsequent reactor operation is permitted for the purpose of measurement, testing, and corrective action provided the thermal power and the Nuclear Overpower Trip Setpoints allowable for the reactor coolant pump combination are restricted by a reduction of 2% of thermal power for each 1% tilt for the maximum tilt observed prior to shutdown.

g. Quadrant power tilt shall be monitored on a minimum frequency of once every 2 hours during power operation above 15% full power.

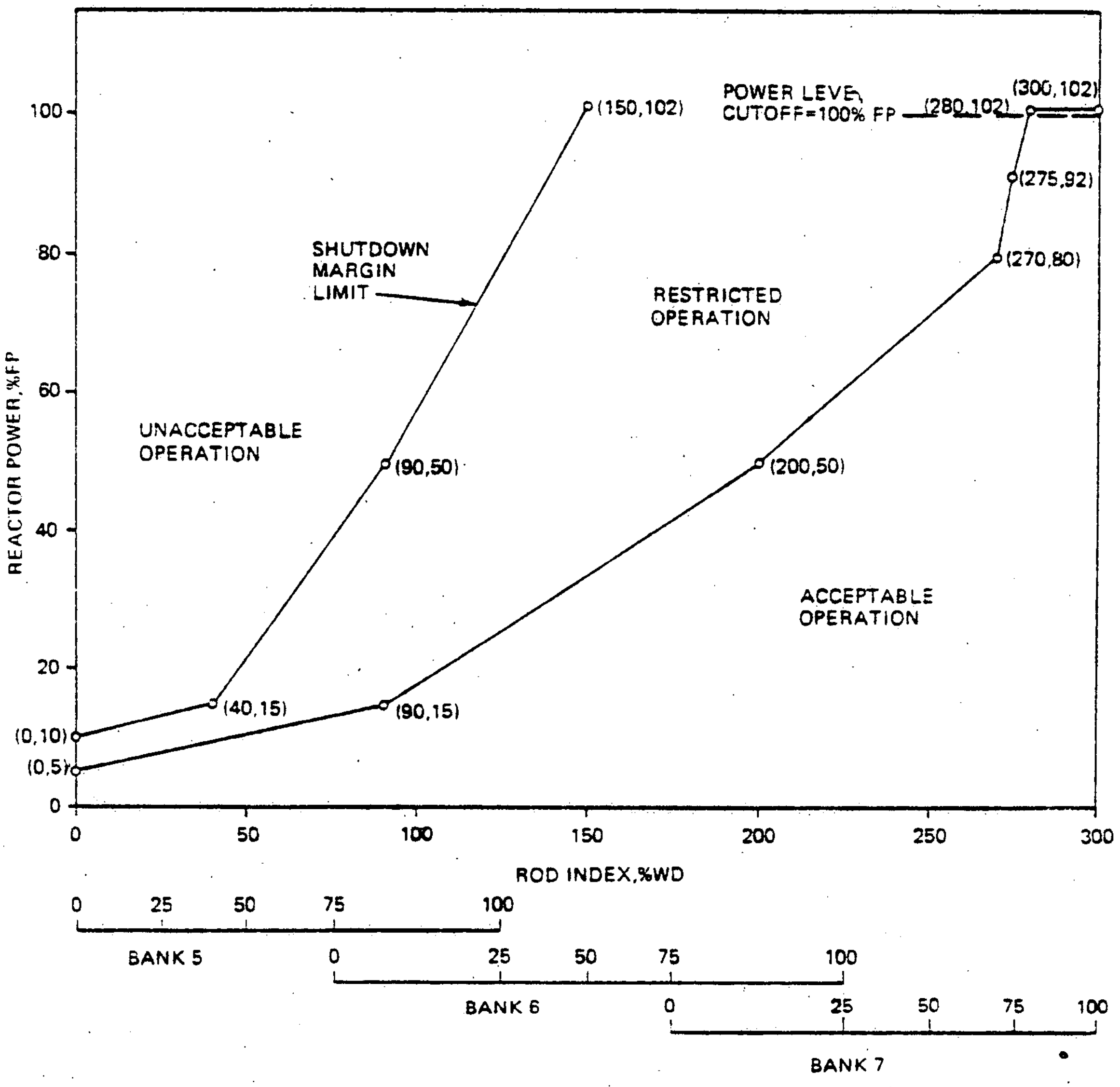
3.5.2.5 Control Rod Positions

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, 3.5.2-1A2, and 3.5.2-1A3 (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, on figures 3.5.2-2A1, 3.5.2-2A2, and 3.5.2-2A3 (Unit 1); 3.5.2-2B1, 3.5.2-2B2, and 3.5.2-2B3 (Unit 2); figures 3.5.2-2C1, 3.5.2-2C2, and 3.5.2-2C3 (Unit 3) for three pump operation, and on figures 3.5.2-2A4, 3.5.2-2A5, and 3.5.2-2A6 (Unit 1); 3.5.2-2B4, 3.5.2-2B5, and 3.5.2-2B6 (Unit 2); figures 3.5.2-2C4, 3.5.2-2C5, and 3.5.2-2C6 (Unit 3) for two 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, 3.5.2-4A2, and 3.5.2-4A3 (Unit 1); 3.5.2-4B1, 3.5.2-4B2, and 3.5.2-4B3 (Unit 2); 3.5.2-4C1, 3.5.2-4C2, and 3.5.2-4C3 (Unit 3).

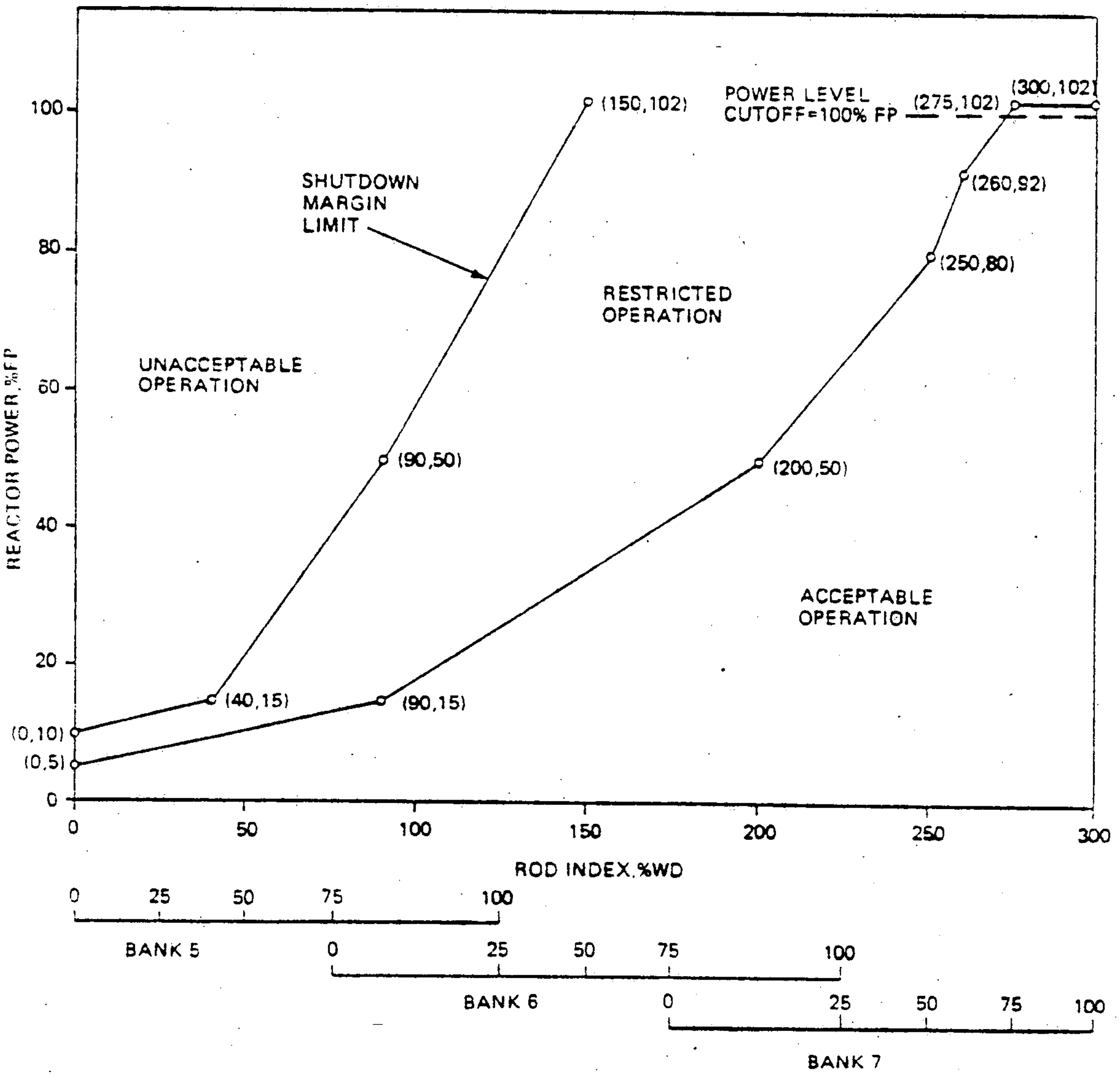
If the control rod position limits are exceeded, corrective measures shall be taken immediately to achieve an acceptable control rod position. An acceptable control rod position shall then be attained within two hours. The minimum shutdown margin required by Specification 3.5.2.1 shall be maintained at all times.



ROD POSITION LIMITS
FOR FOUR-PUMP OPERATION
FROM 0 TO 50 (+10, -0) EFPD
UNIT 3

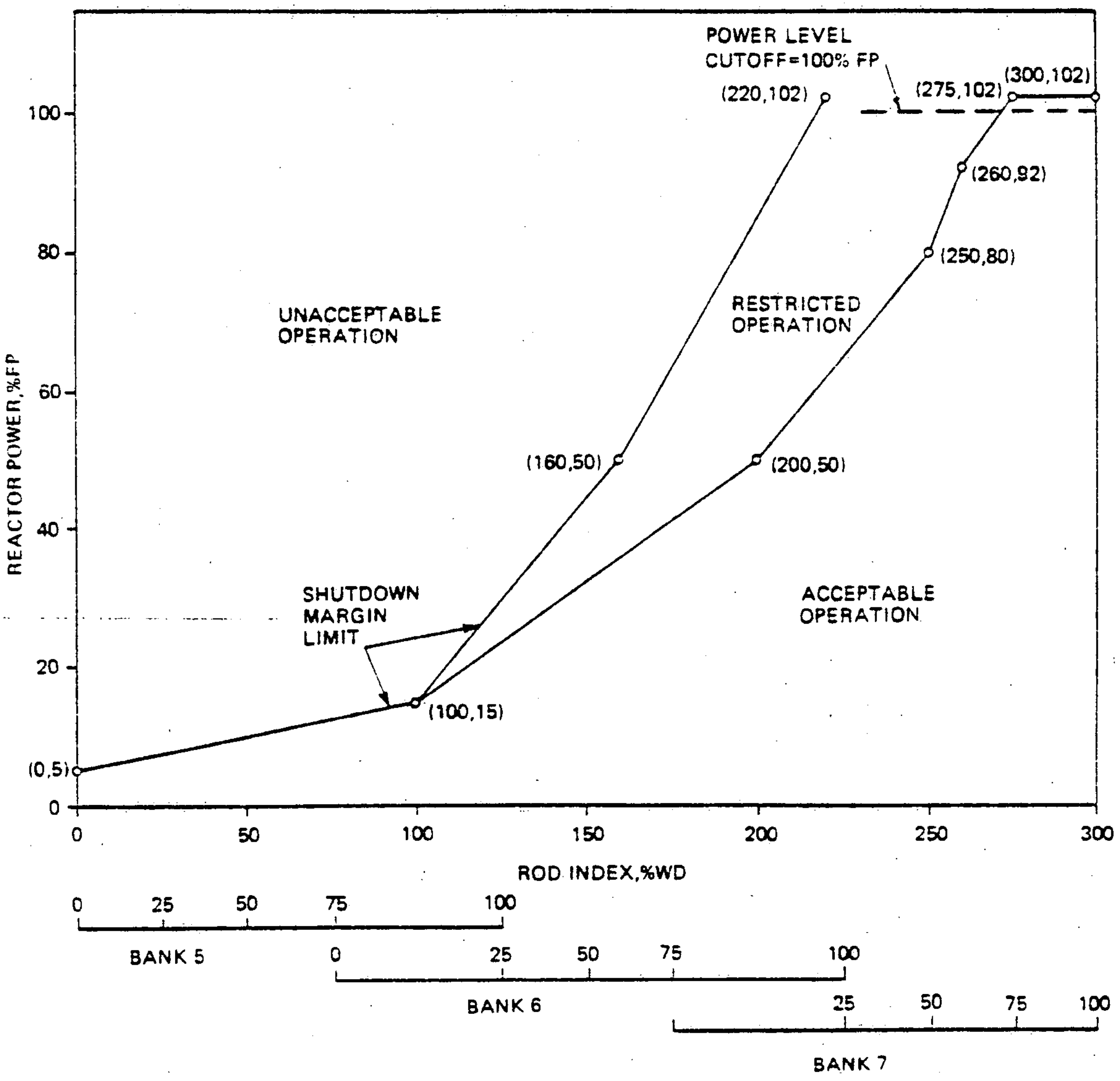
OCONEE NUCLEAR STATION

Figure 3.5.2-1C1

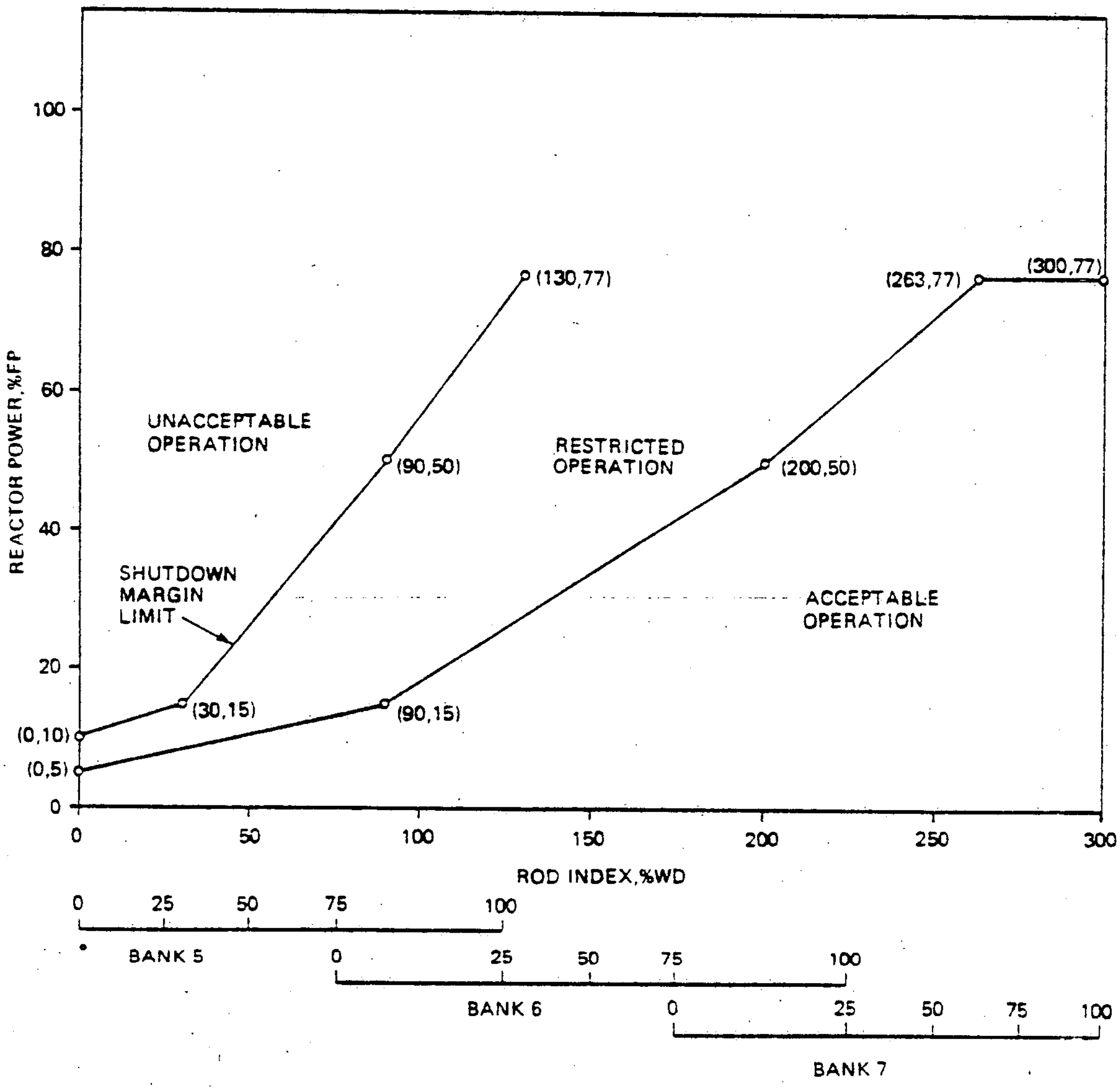


ROD POSITION LIMITS FOR
FOUR-PUMP OPERATION FROM
50 (+10, -0) TO 200 (±10) EFPD
UNIT 3

OCONEE NUCLEAR STATION
Figure 3.5.2-1C2

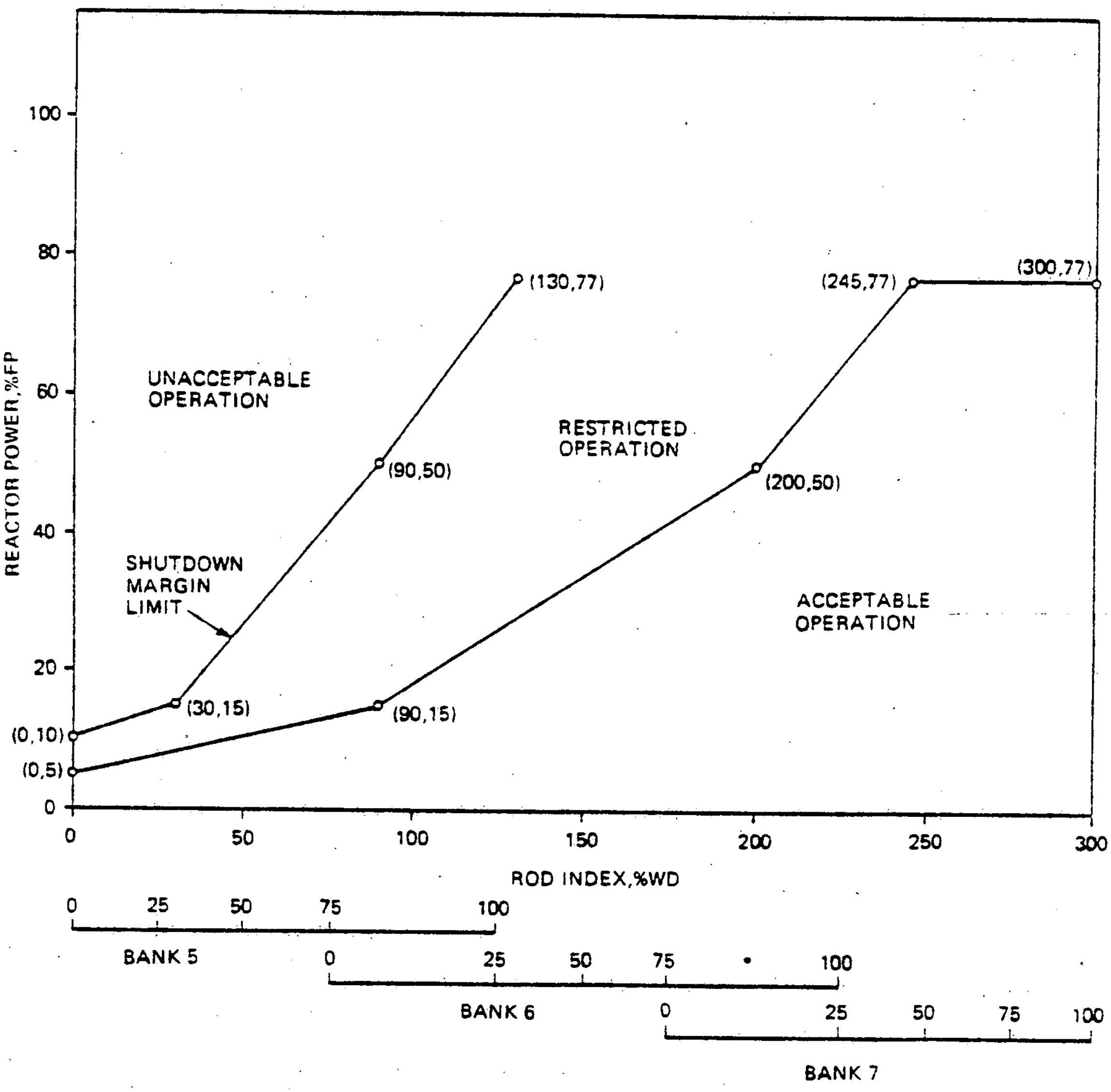


ROD POSITION LIMITS
FOR FOUR-PUMP OPERATION
AFTER 200 (±10) EFPD
UNIT 3
OCONEE NUCLEAR STATION
Figure 3.5.2-1C3



ROD POSITION LIMITS
FOR THREE-PUMP OPERATION
FROM 0 TO 50 (+10, -0) EFPD
UNIT 3
OCONEE NUCLEAR STATION

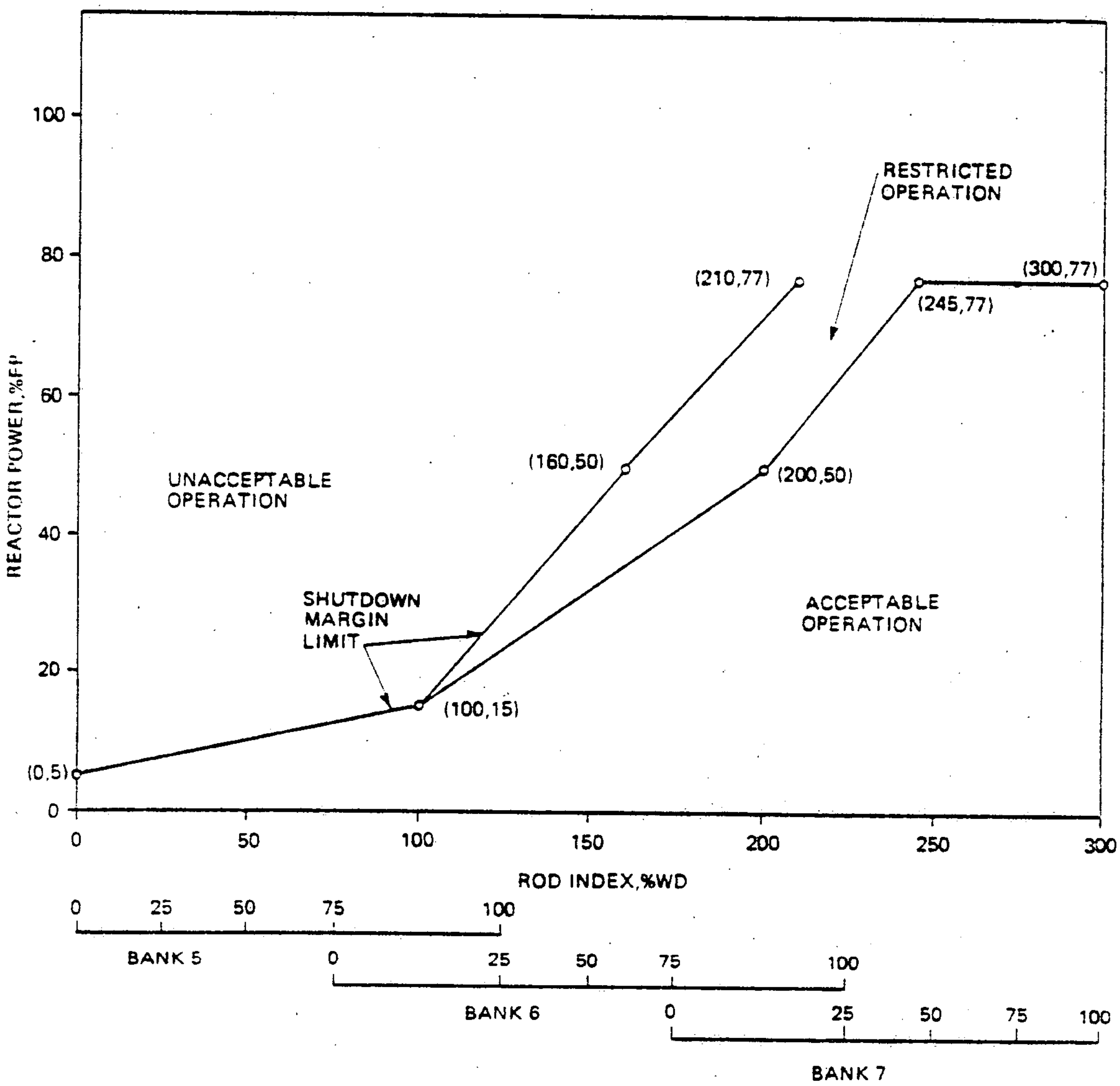
Figure 3.5.2-2C1



ROD POSITION LIMITS FOR
THREE-PUMP OPERATION FROM
50 (+10, -0) TO 200 ±10 EFPD
UNIT 3

OCONEE NUCLEAR STATION

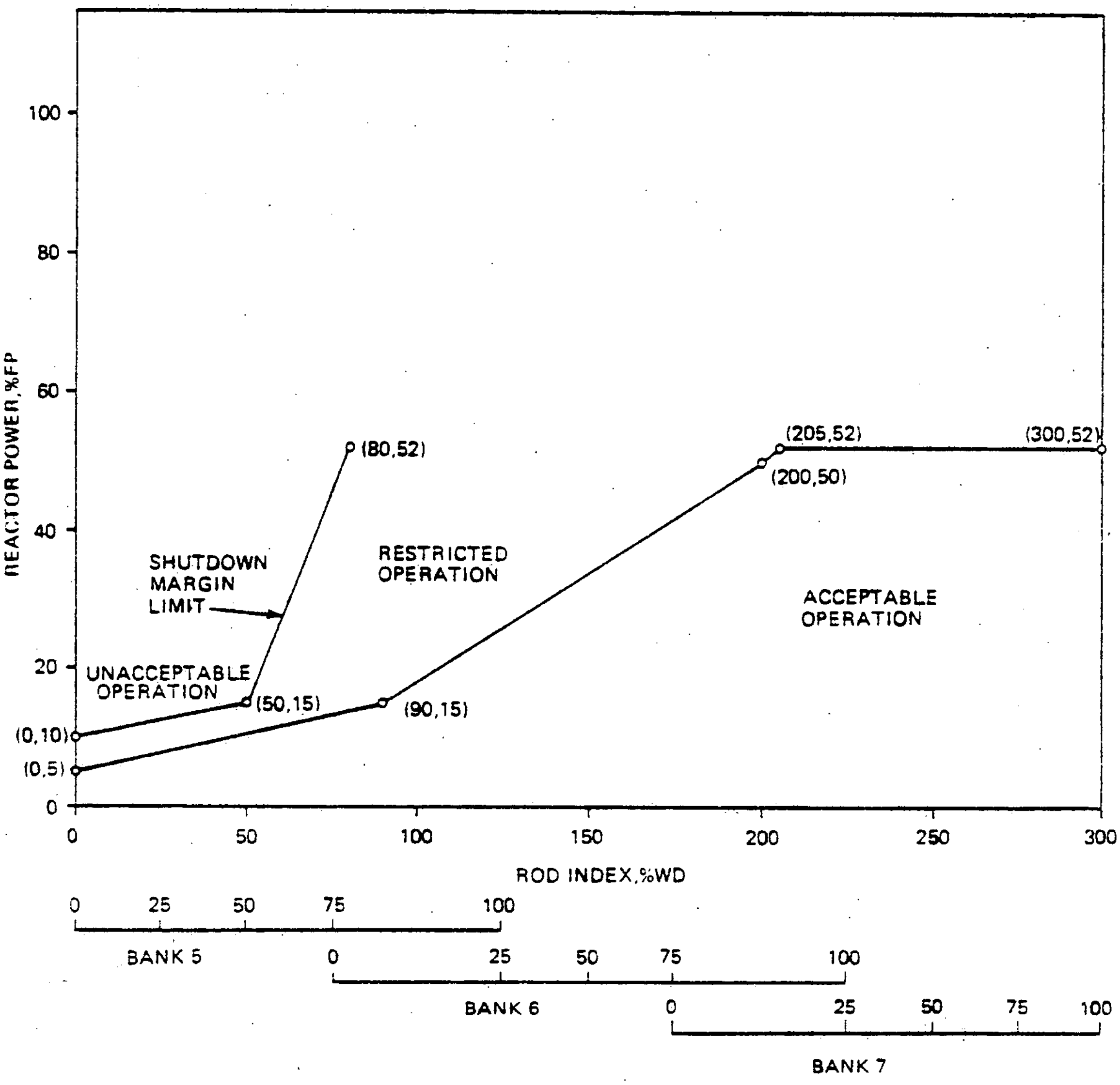
Figure 3.5.2-2C2



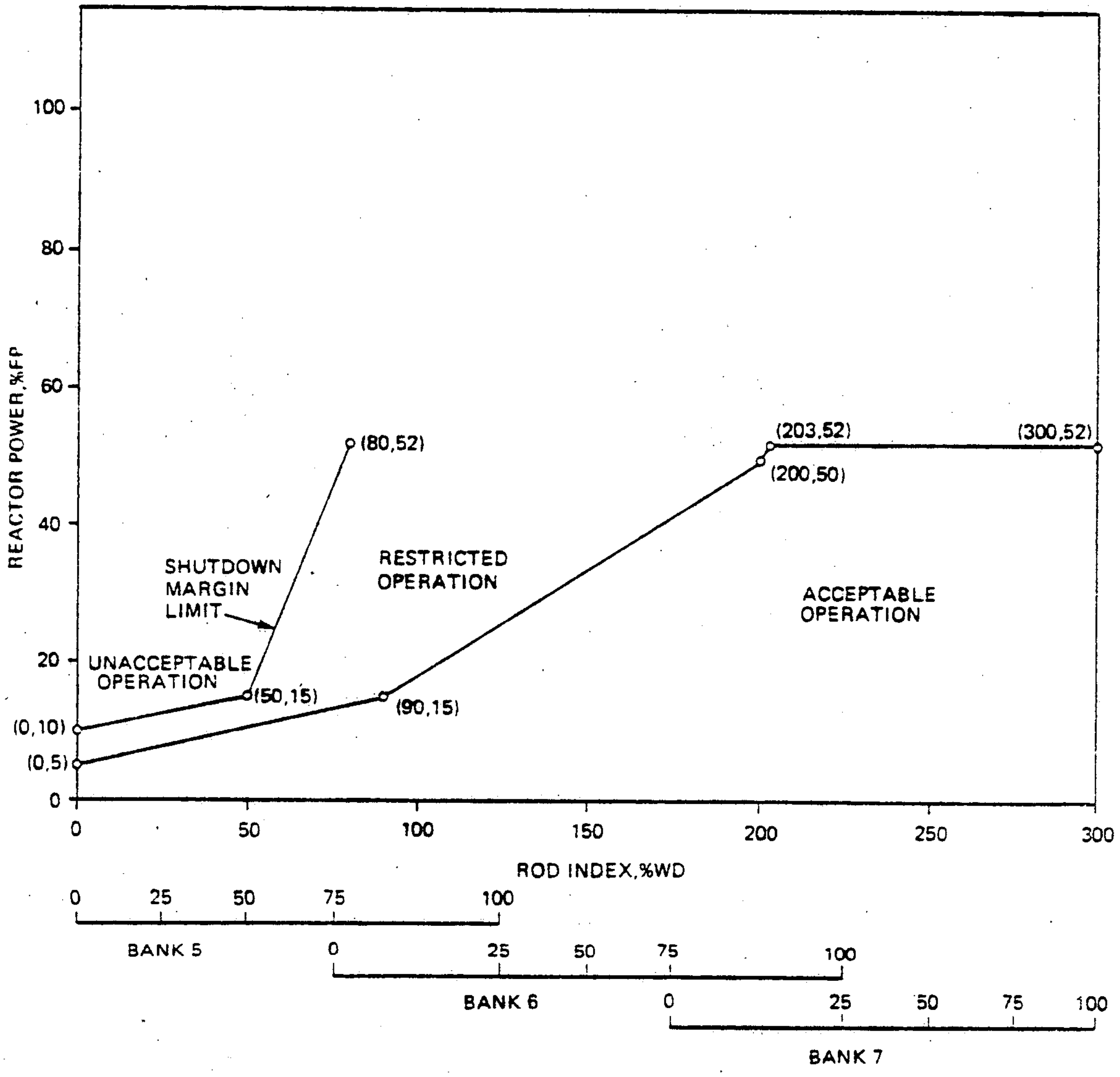
ROD POSITION LIMITS
FOR THREE-PUMP OPERATION
AFTER 200 ±10 EFPD
UNIT 3

OCONEE NUCLEAR STATION

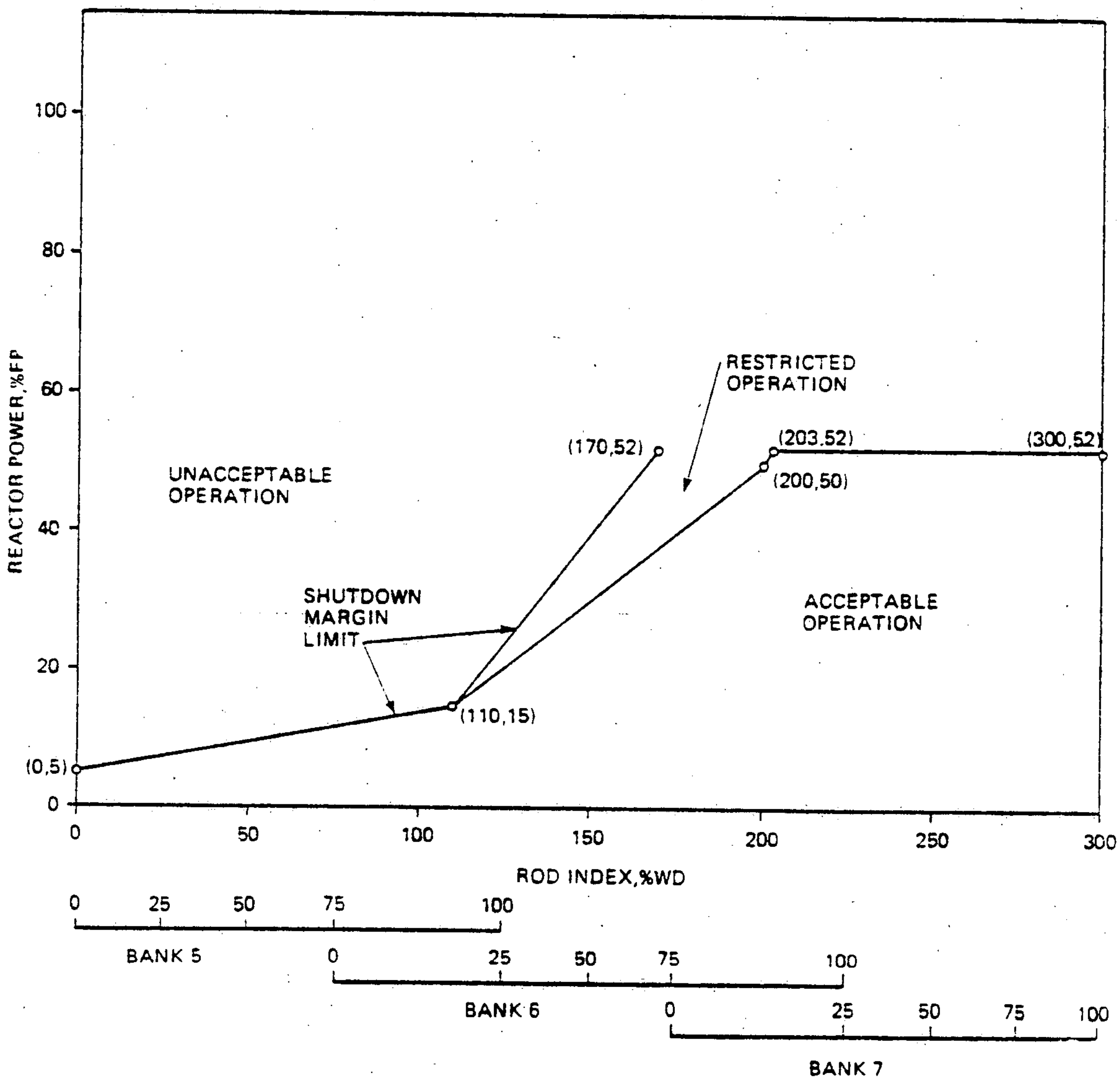
Figure 3.5.2-2C3



ROD POSITION LIMITS
FOR TWO-PUMP OPERATION
FROM 0 TO 50 (+10, -0) EFPD
UNIT 3
OCONEE NUCLEAR STATION
Figure 3.5.2-2C4

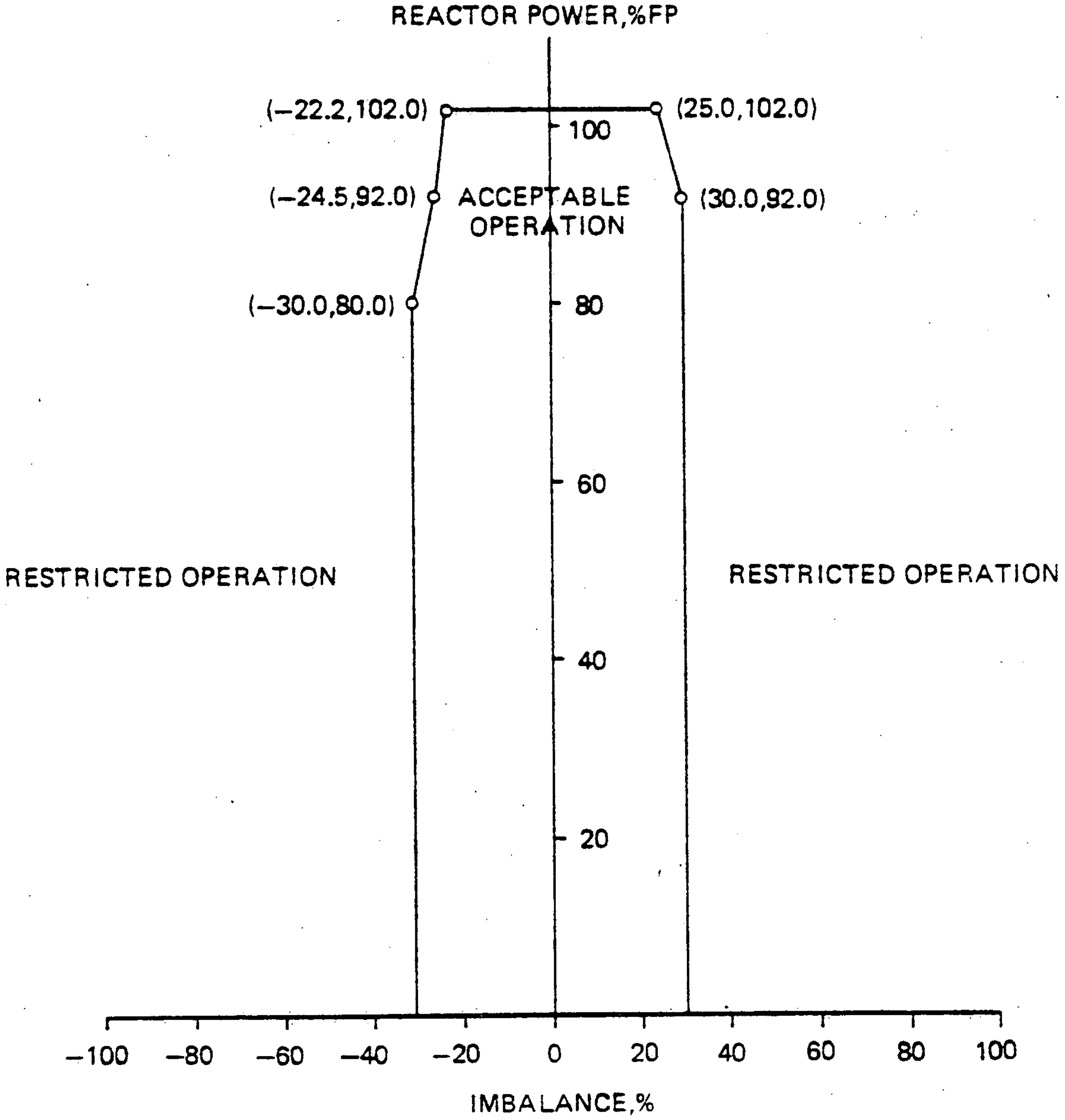


ROD POSITION LIMITS
FOR TWO-PUMP OPERATION FROM
50 (+10, -0) TO 200 ±10 EFPD
UNIT 3
OCONEE NUCLEAR STATION
Figure 3.5.2-2C5

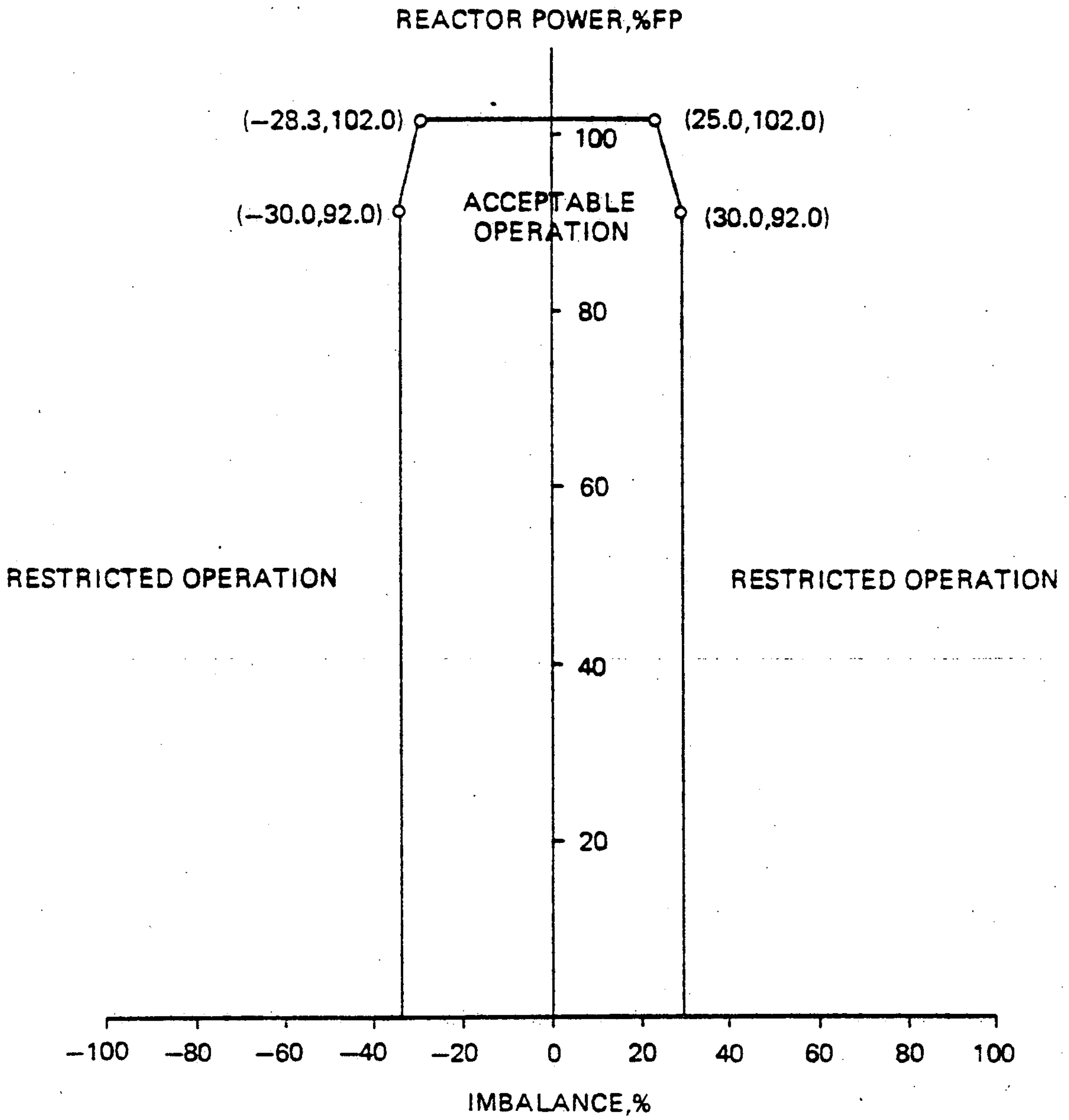


ROD POSITION LIMITS FOR
TWO-PUMP OPERATION
AFTER 200 ±10 EFPD
UNIT 3
OCONEE NUCLEAR STATION

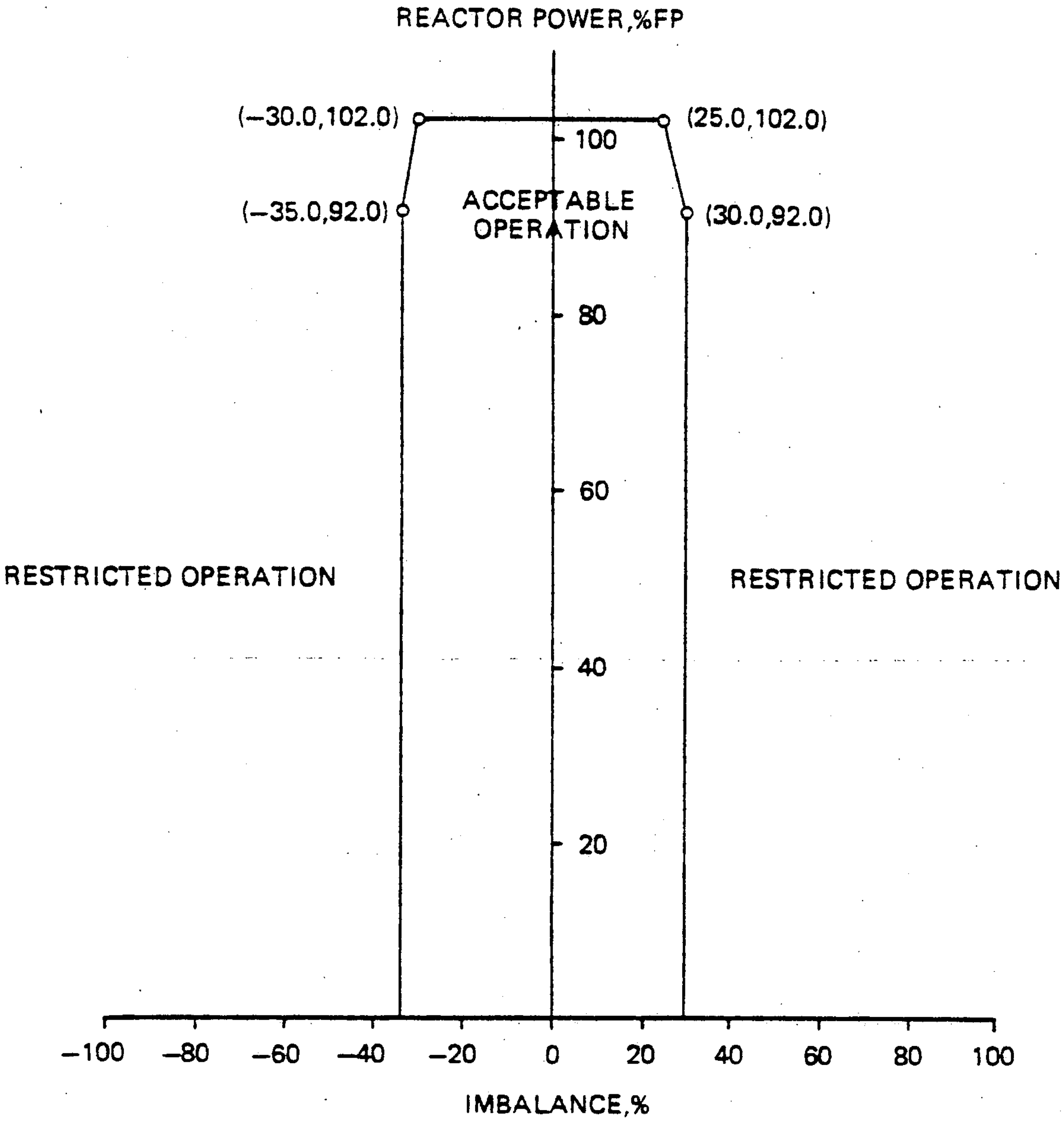
Figure 3.5.2-2C6



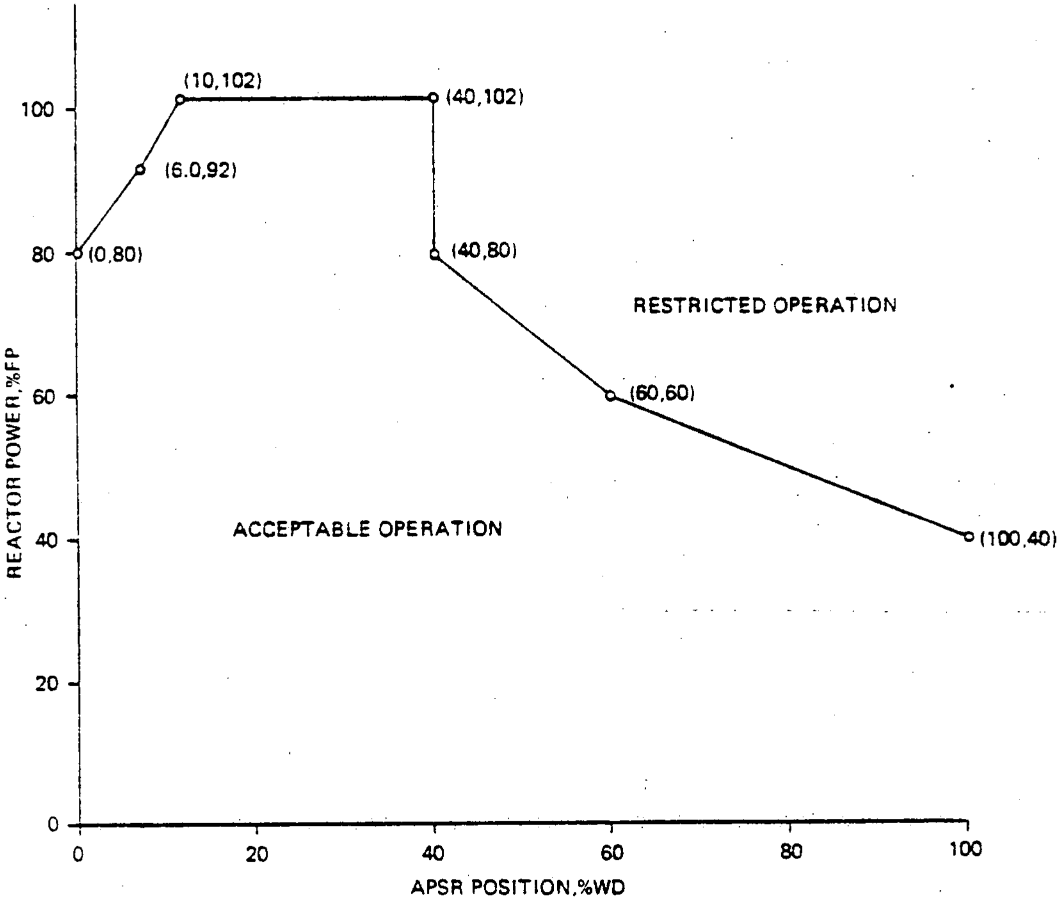
OPERATIONAL POWER
IMBALANCE ENVELOPE FROM
0 TO 50 (+10, -0) EFPD
UNIT 3
OCONEE NUCLEAR STATION
Figure 3.5.2-3C1



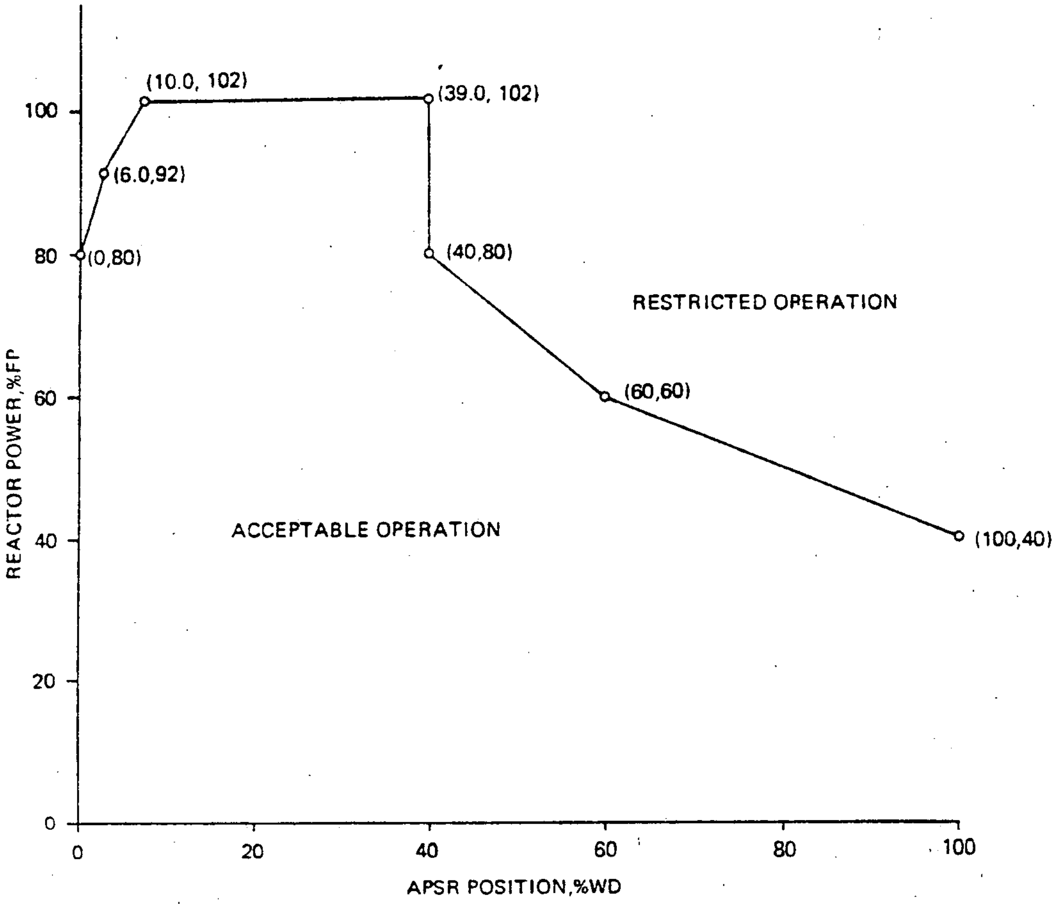
OPERATIONAL POWER
IMBALANCE ENVELOPE FROM
50 (+10, −0) TO 200 ±10 EFPD
UNIT 3
OCONEE NUCLEAR STATION
Figure 3.5.2-3C2



OPERATIONAL POWER
IMBALANCE ENVELOPE
AFTER 200 ±10 EFPD
UNIT 3
OCONEE NUCLEAR STATION
Figure 3.5.2-3C3



APSR POSITION LIMITS
FOR OPERATION
FROM 0 TO 200 ±10 EFPD
UNIT 3
OCONEE NUCLEAR STATION
Figure 3.5.2-4C1



APSR POSITION LIMITS
FOR OPERATION
AFTER 200 ±10 EFPD
UNIT 3
OCONEE NUCLEAR STATION
Figure 3.5.2-4C2

Figure 3.5.2-4C3

Deleted during Oconee Unit 3, Cycle 7 Operation