H. Todd Grant
General Manager
Nuclear Engineering
Oconee Nuclear Station

Duke Energy
ON01VP | 7800 Rochester Hwy
Seneca, SC 29672

o. 864.873.6767
f: 864.873.5791
Todd.Grant@duke-energy.com

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U. S. Nuclear Regulatory Commission
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Duke Energy Carolinas, LLC
Oconee Nuclear Station (ONS) Unit 3
Docket Number 50-287
Renewed License Number DPR-55

Subject: Transmittal of Core Operating Limits Report (COLR) for Oconee Unit 3 Cycle 30 (Revision 1)

Pursuant to Oconee Technical Specification 5.6.5.d, attached is an information copy of the revised Core Operating Limits Reports (COLR) for Oconee Unit 3. This is a mid-cycle revision made to the COLR to increase the incore power tilt setpoints.

Any inquiries on this submittal should be directed to Sam Adams, Oconee Regulatory Affairs, at 864-873-3348.

Sincerely,

H. Todd Grant
General Manager
Nuclear Engineering
Oconee Nuclear Station

Attachment: Oconee Unit 3, Cycle 30, ONEI-0400-503, Revision 1.

A001
NRR

cc (w/attachment):

Ms. Catherine Haney, Administrator, Region II
U.S. Nuclear Regulatory Commission
Marquis One Tower
245 Peachtree Center Ave., NE, Suite 1200
Atlanta, GA 30303-1257

Ms. Audrey L. Klett, Project Manager
(by electronic mail only)
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Mail Stop O-08B1A
Rockville, MD 20852-2738

Mr. Eddy Crowe
NRC Senior Resident Inspector
Oconee Nuclear Station

DUKE ENERGY.

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Document Title :	OCONEE 3 CYCLE 30 CORE OPERATING LIMITS REPORT

Forster, Joy D	Originator	5/22/2018
Presnell, G Michael	Verifier	5/22/2018
Phelps, Timothy P	Cross Disciplinary Review	5/22/2018
Perrero, Steve J	Site Inspection	5/22/2018
Siphers, John T	APPROVER; for R R St Clair	5/22/2018

Notes :

Oconee 3 Cycle 30 Core Operating Limits Report

ONEI-0400-503
Revision 1

Reload 50.59 AR# 02190144

Prepared By:	J. D. Forster	All signatures were captured via Fusion E-signature. See the Fusion cover sheet for signature dates.
Design Verified By:	G. M. Presnell	
Cross-Disciplinary Review By:	T. P. Phelps (CDR of pages 4, 6 and 20 only)	
Site Inspection By:	S. J. Perrero, ONS RES	
Approved By:	J. T. Siphers	

Revision Summary

Revision	Pages Revised	Pages Added	Pages Deleted	Comments
0	--	1 - 22	--	Original issue.
1	1-22	--	--	Revised to increase incore tilt setpoints.

NOTES:

- Discard Attachment 1 (Design Verification Documents) of the EI.
- The O3C30 COLR will cease to be effective during NO MODE between cycles 30 and 31.

Oconee 3 Cycle 30

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3.1.4	Control Rod Group Alignment Limits	1, 3, 7, 8	Misaligned, Dropped, or Inoperable
3.1.5	Safety Rod Position Limits	1 ,3, 4, 5, 7, 8, 9, 10	Misaligned, Dropped, or Inoperable
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			3-pump No Inoperable Rod CR Position Setpoints
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SLC Number		NRC Approved Methodology Reference #	COLR Parameter
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Section 2.0 Core Operating Limits - Not Error Adjusted (NOT FOR PLANT USE)

TS Number	Technical Specification	NRC Approved Methodology Reference #	COLR Parameter
2.1.1	Safety Limits	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	Variable Low RCS Pressure Protective Limits
			Axial Power Imbalance Protective Limits
3.2.1	Regulating Rod Position Limits	1, 3, 4, 5, 7, 8, 9, 10	Rod Index Limits
3.2.3	Quadrant Power Tilt (QPT)	1, 3, 7, 9, 10	Quadrant Power Tilt Limits

Oconee 3 Cycle 30

1.0 Error Adjusted Core Operating Limits

The Core Operating Limits Report for O3C30 has been prepared in accordance with the requirements of TS 5.6.5. The core operating limits within this report have been developed using NRC approved methodology identified in References 1 through 11. The RPS protective limits and maximum allowable setpoints are documented in References 12 through 14. These limits are validated for use in O3C30 by References 15 and 16. The O3C30 analyses assume a design flow of 108.5% of 88,000 gpm per RCS pump, radial local peaking ($F\Delta h$) of 1.714, an axial peaking factor (Fz) of 1.5, and an EOC (< 100 ppmB) Tavg reduction for up to 10°F provided 4 RCPs are in operation and Tavg does not decrease below 569°F.

The error adjusted core operating limits included in Section 1 of the report incorporate all necessary uncertainties and margins required for operation of the O3C30 reload core.

1.1 References

1. DPC-NE-1006-PA, Oconee Nuclear Design Methodology Using CASMO-4 / SIMULATE-3, NRC SE issued August 2, 2011.
2. DPC-NE-1002-A, Oconee Nuclear Station Reload Design Methodology II, SE dated July 21, 2011.
3. NFS-1001-A, Oconee Nuclear Station Reload Design Methodology, SE dated July 21, 2011.
4. DPC-NE-2003-PA, ONS Core Thermal Hydraulic Methodology Using VIPRE-01, SE dated July 21, 2011.
5. DPC-NE-2005-PA, Thermal Hydraulic Statistical Core Design Methodology, SE dated March 2016.
6. DPC-NE-2008-PA, Fuel Mechanical Reload Analysis Methodology Using TACO3 and GDTACO, SE dated July 21, 2011.
7. DPC-NE-3005-PA, UFSAR Chapter 15 Transient Analysis Methodology, SE dated April 29, 2016.
8. DPC-NE-3000-PA, Thermal Hydraulic Transient Analysis Methodology, SE dated July 21, 2011.
9. BAW-10192P-A, Revision 0, BWNT LOCA - BWNT Loss of Coolant Accident Evaluation Model for Once-Through Steam Generator Plants, SER dated February 18, 1997.
10. BAW-10164P-A, Rev. 4 and 6, RELAP5/MOD2-B&W - An Advanced Computer Program for Light Water Reactor LOCA and Non-LOCA Transient Analysis, SERs dated April 9, 2002 and June 25, 2007, respectively.
11. BAW-10227P-A, Revision 1, Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel, June 2003 (SER to BAW-10186P-A dated June 18, 2003).
12. OSC-4048, Revision 6, RPS RCS Pressure & Temperature Trip Function Uncertainty Analyses and Variable Low Pressure Safety Limit.
13. OSC-5604, Revision 4, Power Imbalance Safety Limits and Tech Spec Setpoints Using Error Adjusted Flux-Flow Ratio of 1.094.
14. OSC-7265, Revision 1, ΔTc and EOC Reduced Tavg Operation.
15. OSC-11720, Revision 2, O3C30 Maneuvering Analysis.
16. OSC-11779, Revision 0, O3C30 Reload Safety Evaluation.

Oconee 3 Cycle 30

Miscellaneous Setpoints

BWST boron concentration shall be greater than **2500** ppm and less than **3000** ppm.
Referred to by TS 3.5.4.

Spent fuel pool boron concentration shall be greater than **2500** ppm.
Referred to by TS 3.7.12.

The equivalent of at least **1100** cubic feet of **11,000** ppm boron shall be maintained in the CBAST.
Referred to by TS SLC 16.5.13.

CFT boron concentration shall be greater than **2300** ppm. The average boron concentration in the CFT's shall be less than **4000** ppm. Referred to by TS 3.5.1.

RCS and Refueling canal boron concentration shall be greater than **2220** ppm and less than **3000** ppm.
Referred to by TS 3.9.1.

Shutdown Margin (SDM) shall be greater than **1%** $\Delta k/k$.
Referred to by TS 3.1.1.

Moderator Temperature Coefficient (MTC) shall be less than:
Linear interpolation is valid within the table provided.
Referred to by TS 3.1.3.

MTC x 10-4	
$\Delta\rho$ / °F	% FP
+0.70	0
+0.525	20
0.00	80
0.00	100
0.00	120

Departure from Nucleate Boiling (DNB) parameter for RCS loop pressure shall be
Referred to by TS 3.4.1.

4 RCP: measured hot leg pressure > 2125 psig
3 RCP: measured hot leg pressure > 2125 psig

DNB parameter for RCS loop average temperature shall be:
Referred to by TS 3.4.1.

The measured Tavg must be less than COLR limits minus instrument uncertainty. ΔTc is the setpoint value selected by the operators.

	Max Loop Tavg (Incl 2°F unc)	
ΔTc, °F	4 RCP Op	3 RCP Op
0	581.0	581.0 *
1	581.4	581.2
2	581.8	581.4
3	582.1	581.7
4	582.5	581.9
5	582.9	582.1

* This limit is applied to the loop with the lowest loop average temperature consistent with the NOTE in SR 3.4.1.2. All other temperature limits apply to the maximum loop Tavg.

DNB parameter for RCS loop total flow shall be:
Referred to by TS 3.4.1.

4 RCP: Measured ≥ **108.5** %df
3 RCP: Measured ≥ **74.7** % of 4 RCP min flow

Regulating rod groups shall be withdrawn in sequence starting with group 5, group 6, and finally group 7.
Referred to by TS 3.2.1.

Regulating rod group overlap shall be 25% ± 5% between two sequential groups.
Referred to by TS 3.2.1.

Misaligned, dropped, or inoperable rods may be excluded from control rod group average calculations when determining if overlap requirements are met as these situations are explicitly addressed by TS 3.1.4 (Control Rod Group Alignment Limits), TS 3.1.5 (Safety Rod Position Limits), and TS 3.2.3 (Quadrant Power Tilt).

Oconee 3 Cycle 30

Quadrant Power Tilt Setpoints

	Steady State		Transient		Maximum
Core Power Level, %FP	0 - 30	> 30	0 - 30	> 30	> 0
Full Incore	7.94	3.80	9.72	7.43	16.88
Out of Core	6.09	2.35	7.72	5.63	14.22
Backup Incore	3.87	2.25	4.81	3.63	10.07

Referred to by TS 3.2.3

Correlation Slope (CS)

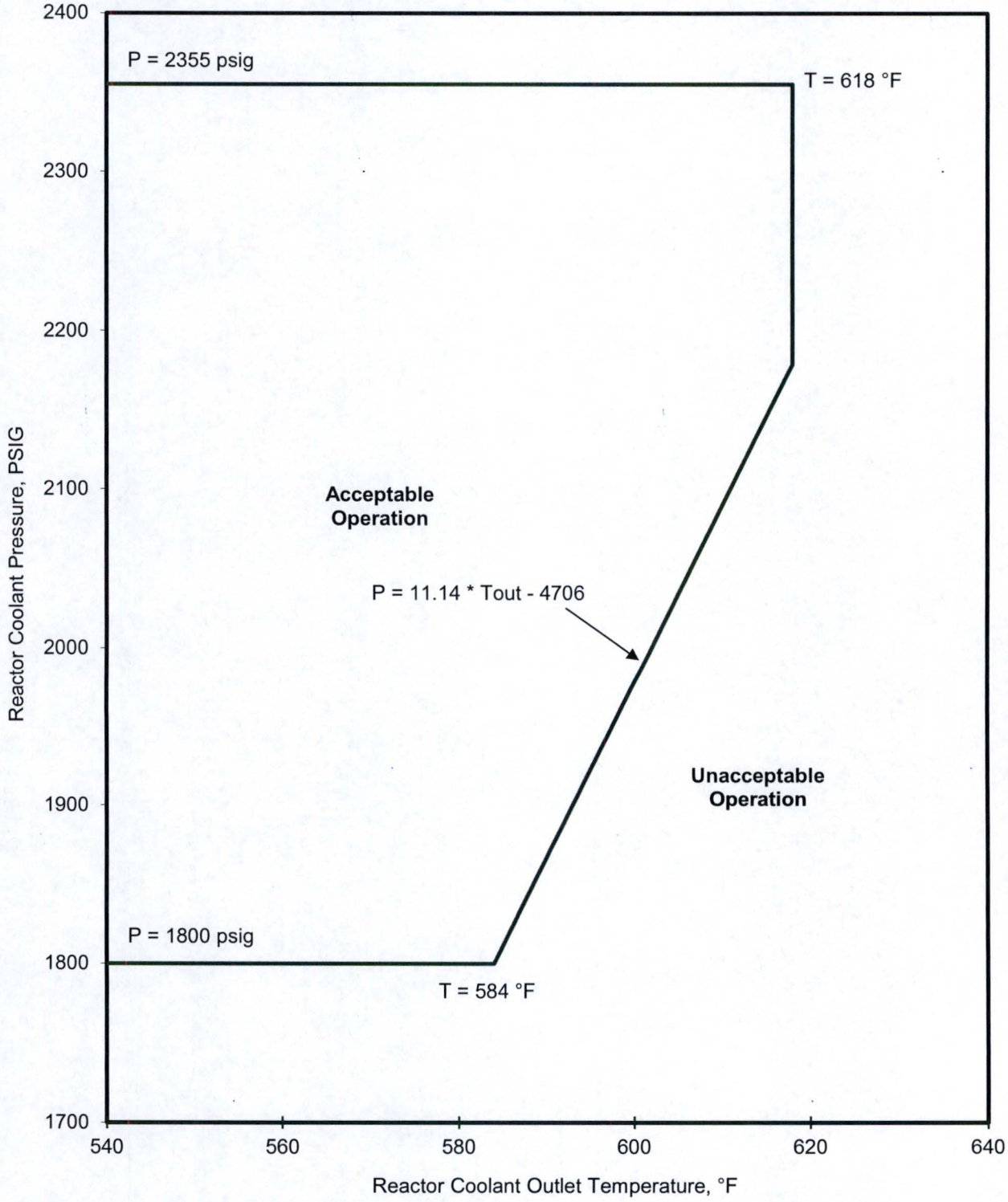
1.15

Referred to by TS 3.3.1 (SR 3.3.1.3).

Oconee 3 Cycle 30

Variable Low RCS Pressure RPS Setpoints

Referred to by TS 3.3.1



Oconee 3 Cycle 30

Referred to by TS 2.1.1 and TS Table 3.3.1-1

Maximum Allowable RPS Power Imbalance Limits

		% FP	% Imbalance
4 Pumps		0.0	-35.0
		90.0	-35.0
	Pmax =>	109.4	-14.4
	Pmax =>	109.4	14.4
		90.0	35.0
		0.0	35.0
3 Pumps		0.0	-35.0
		62.3	-35.0
	Pmax =>	81.7	-14.4
	Pmax =>	81.7	14.4
		62.3	35.0
		0.0	35.0

Oconee 3 Cycle 30

Operational Power Imbalance Setpoints

Referred to by TS 3.2.2

	%FP	Full Incore	Backup Incore	Out of Core
4 Pumps	0.0	-28.0	-25.5	-25.8
	80.0	-28.0	-25.5	-25.8
	90.0	-28.0	-20.9	-21.3
	100.0	-17.7	-14.8	-15.1
	102.0	-15.6	-13.6	-13.9
	102.0	15.6	11.8	12.1
	100.0	17.7	13.3	13.6
	90.0	28.0	20.7	21.1
	80.0	28.0	24.3	24.7
	0.0	28.0	24.3	24.7
3 Pumps	0.0	-28.0	-25.5	-25.8
	63.1	-28.0	-	-
	65.1	-	-	-25.8
	65.4	-	-25.5	-
	77.0	-13.2	-13.2	-13.2
	77.0	13.2	13.2	13.2
	66.5	-	24.3	-
	66.1	-	-	24.7
	63.1	28.0	-	-
	0.0	28.0	24.3	24.7

Referred to by TS 3.2.2

Oconee 3 Cycle 30

RPS / Operational Power Imbalance Setpoints

Operation with 4 RCS Pumps, BOC to EOC

Referred to by TS 3.2.2 and TS 3.3.1

% FP	RPS Trip		Full Incore Alarm		Out of Core Alarm	
107.9	-14.4	14.4				
106.0	-16.4	16.4				
105.0	-17.5	17.5				
104.0	-18.5	18.5				
103.0	-19.6	19.6				
102.0	-20.7	20.7	-15.6	15.6	-13.9	12.1
101.0	-21.7	21.7	-16.7	16.7	-14.5	12.9
100.0	-22.8	22.8	-17.7	17.7	-15.1	13.6
99.0	-23.9	23.9	-18.7	18.7	-15.7	14.4
98.0	-24.9	24.9	-19.8	19.8	-16.3	15.1
97.0	-26.0	26.0	-20.8	20.8	-17.0	15.9
96.0	-27.0	27.0	-21.8	21.8	-17.6	16.6
95.0	-28.1	28.1	-22.9	22.9	-18.2	17.4
94.0	-29.2	29.2	-23.9	23.9	-18.8	18.1
93.0	-30.2	30.2	-24.9	24.9	-19.4	18.9
92.0	-31.3	31.3	-25.9	25.9	-20.1	19.6
91.0	-32.3	32.3	-27.0	27.0	-20.7	20.4
90.4	-33.0	33.0	-27.6	27.6	-21.1	20.8
90.0	-33.0	33.0	-28.0	28.0	-21.3	21.1
89.0	-33.0	33.0	-28.0	28.0	-21.8	21.5
88.0	-33.0	33.0	-28.0	28.0	-22.2	21.8
87.0	-33.0	33.0	-28.0	28.0	-22.7	22.2
86.0	-33.0	33.0	-28.0	28.0	-23.1	22.5
85.0	-33.0	33.0	-28.0	28.0	-23.6	22.9
84.0	-33.0	33.0	-28.0	28.0	-24.0	23.3
83.0	-33.0	33.0	-28.0	28.0	-24.5	23.6
82.0	-33.0	33.0	-28.0	28.0	-24.9	24.0
81.0	-33.0	33.0	-28.0	28.0	-25.4	24.4
80.0	-33.0	33.0	-28.0	28.0	-25.8	24.7
0.0	-33.0	33.0	-28.0	28.0	-25.8	24.7
% FP	RPS Trip		Full Incore Alarm		Out of Core Alarm	

Oconee 3 Cycle 30

RPS / Operational Power Imbalance Setpoints

Operation with 3 RCS Pumps, BOC to EOC

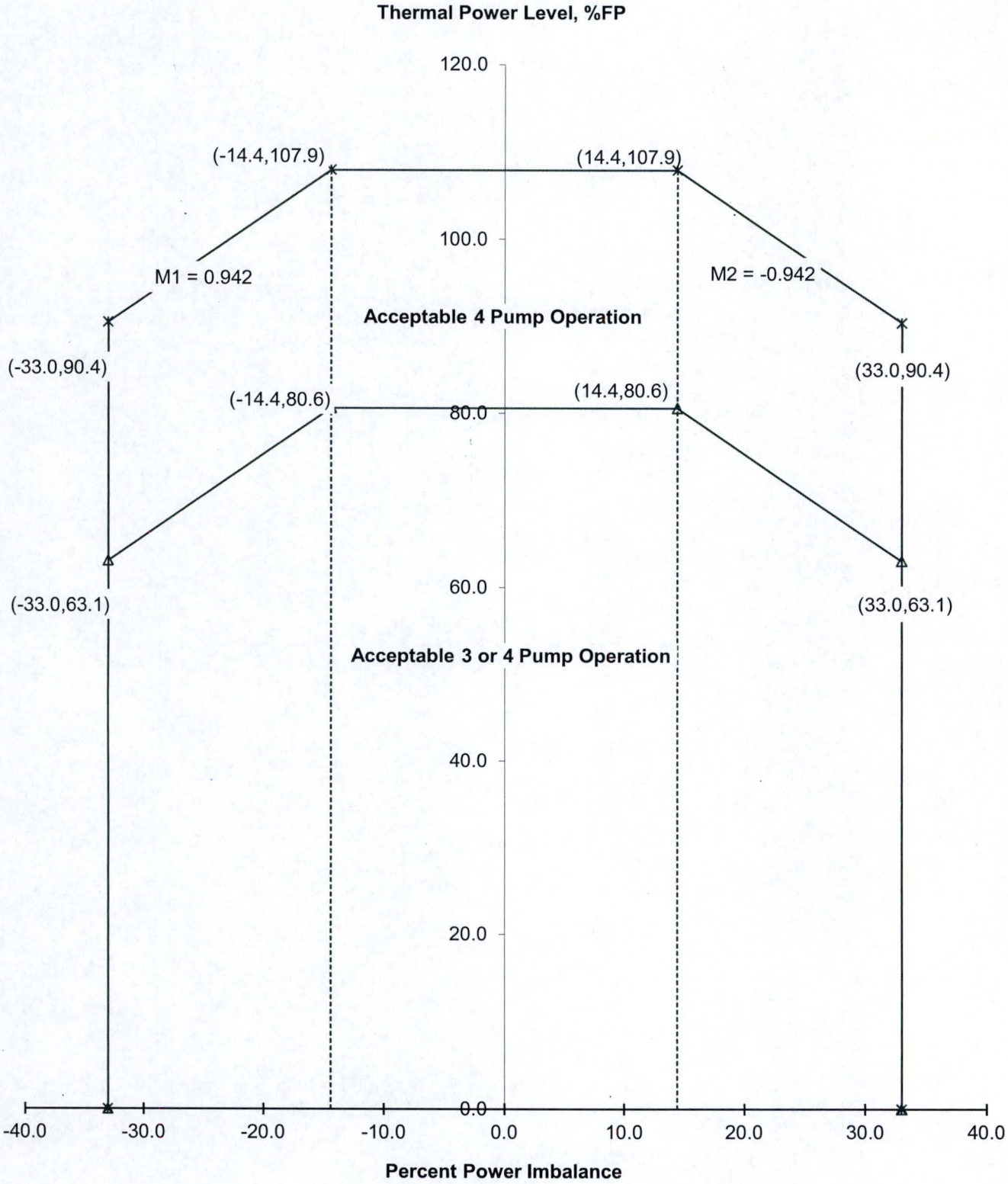
Referred to by TS 3.2.2 and TS 3.3.1

% FP	RPS Trip		Full Incore Alarm		Out of Core Alarm	
80.6	-14.4	14.4				
80.0	-15.0	15.0				
79.0	-16.1	16.1				
78.0	-17.1	17.1				
77.0	-18.2	18.2	-13.2	13.2	-13.2	13.2
76.0	-19.3	19.3	-14.3	14.3	-14.3	14.3
75.0	-20.3	20.3	-15.3	15.3	-15.3	15.3
74.0	-21.4	21.4	-16.4	16.4	-16.4	16.4
73.0	-22.5	22.5	-17.5	17.5	-17.4	17.4
72.0	-23.5	23.5	-18.5	18.5	-18.5	18.5
71.0	-24.6	24.6	-19.6	19.6	-19.6	19.5
70.0	-25.7	25.7	-20.7	20.7	-20.6	20.6
69.0	-26.7	26.7	-21.7	21.7	-21.7	21.7
68.0	-27.8	27.8	-22.8	22.8	-22.7	22.7
67.0	-28.8	28.8	-23.8	23.8	-23.8	23.8
66.1	-29.8	29.8	-24.8	24.8	-24.7	24.7
66.0	-29.9	29.9	-24.9	24.9	-24.8	24.7
65.1	-30.9	30.9	-25.9	25.9	-25.8	24.7
64.0	-32.0	32.0	-27.0	27.0	-25.8	24.7
63.1	-33.0	33.0	-28.0	28.0	-25.8	24.7
63.0	-33.0	33.0	-28.0	28.0	-25.8	24.7
62.0	-33.0	33.0	-28.0	28.0	-25.8	24.7
61.0	-33.0	33.0	-28.0	28.0	-25.8	24.7
60.0	-33.0	33.0	-28.0	28.0	-25.8	24.7
0.0	-33.0	33.0	-28.0	28.0	-25.8	24.7
% FP	RPS Trip		Full Incore Alarm		Out of Core Alarm	

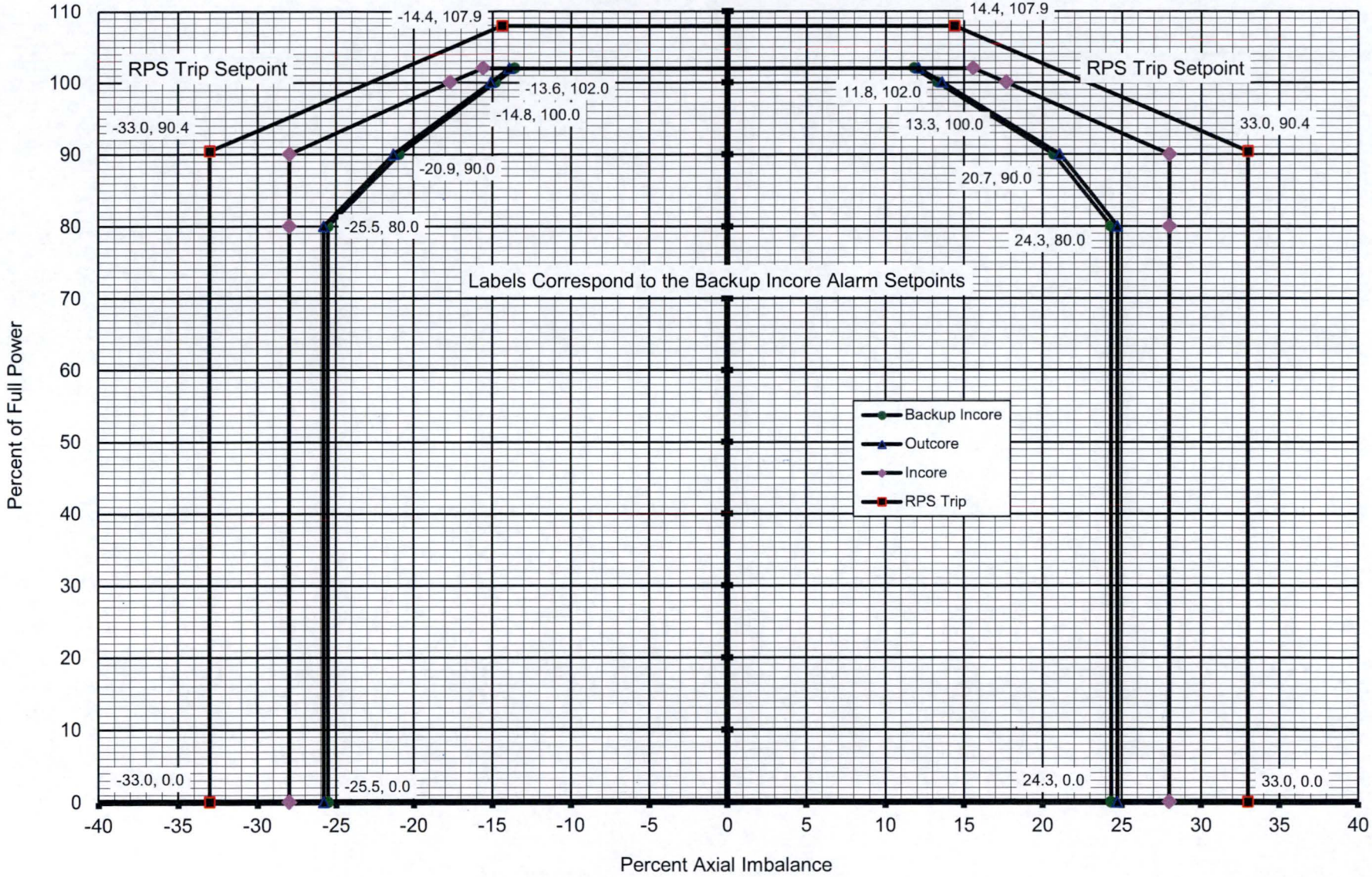
Oconee 3 Cycle 30

RPS Power Imbalance Setpoints

Referred to by TS 3.3.1 and TS Table 3.3.1-1



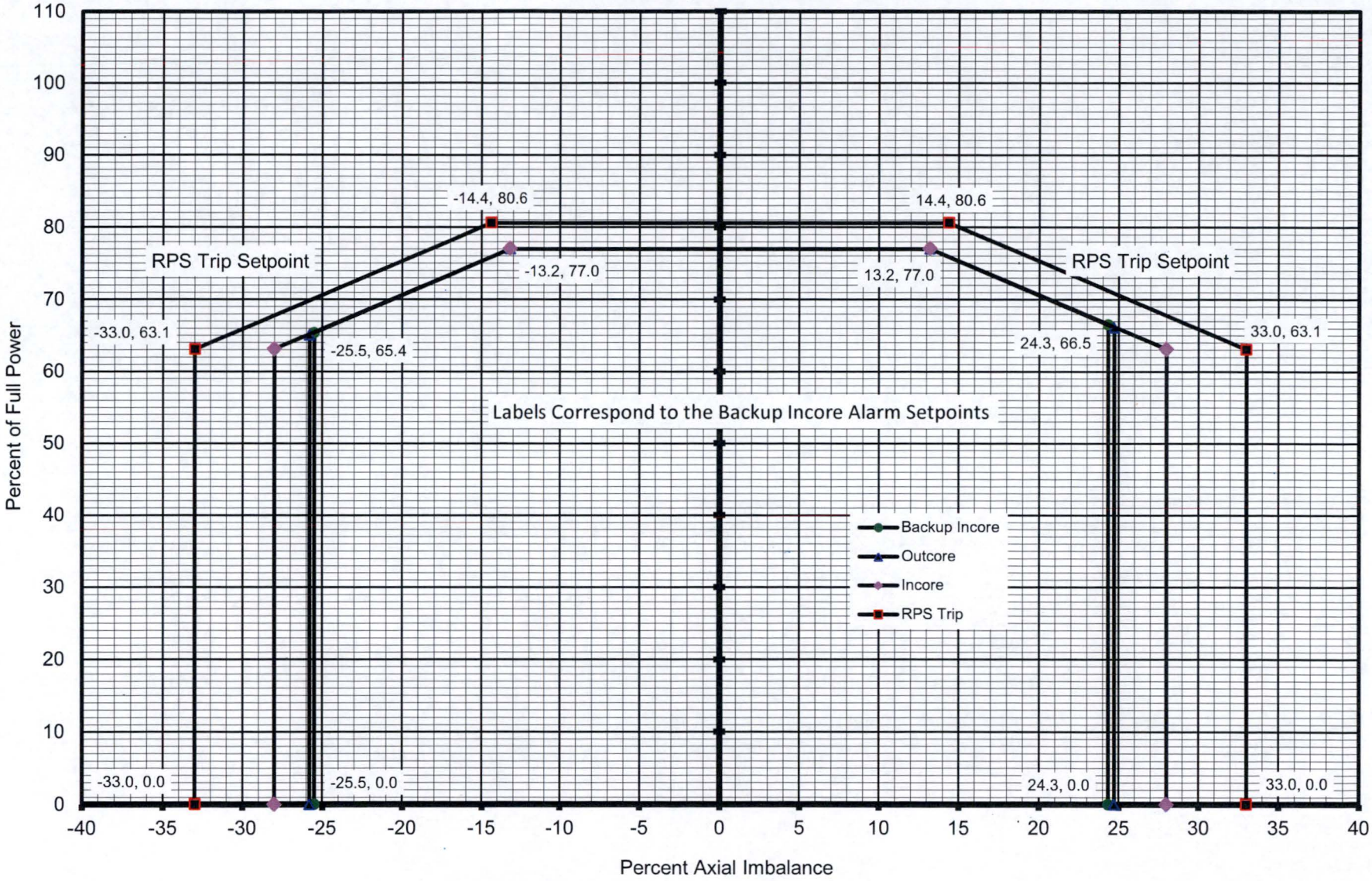
Oconee 3 Cycle 30
Imbalance Setpoints for 4 Pump Operation, BOC to EOC
Referred to by TS 3.2.2 and TS 3.3.1



Oconee 3 Cycle 30

Imbalance Setpoints for 3 Pump Operation, BOC to EOC

Referred to by TS 3.2.2 and TS 3.3.1



Oconee 3 Cycle 30

Operational Rod Index Setpoints

Referred to by TS 3.2.1

	%FP	RI Insertion Setpoint No Inop Rod	RI Insertion Setpoint 1 Inop Rod	RI Withdrawal Setpoint
4 Pumps	102.0	263.5	283.4	300
	100.0	261.5	281.5	300
	90.0	251.5	271.9	300
	80.0	241.5	262.3	300
	50.0	201.5	233.4	300
	48.0	195.2	231.5	300
	15.0	91.5	165.5	300
	13.0	76.5	161.5	300
	5.0	16.5	93.5	300
	3.0	1.5	76.5	300
	2.8	0.0	74.8	300
	0.0	0.0	51.0	300
3 Pumps	77.0	237.5	285.2	300
	75.0	234.8	281.5	300
	50.0	201.5	235.2	300
	48.0	195.2	231.5	300
	15.0	91.5	165.5	300
	13.0	76.5	161.5	300
	5.0	16.5	93.5	300
	3.0	1.5	76.5	300
	2.8	0.0	74.8	300
	0.0	0.0	51.0	300

Oconee 3 Cycle 30

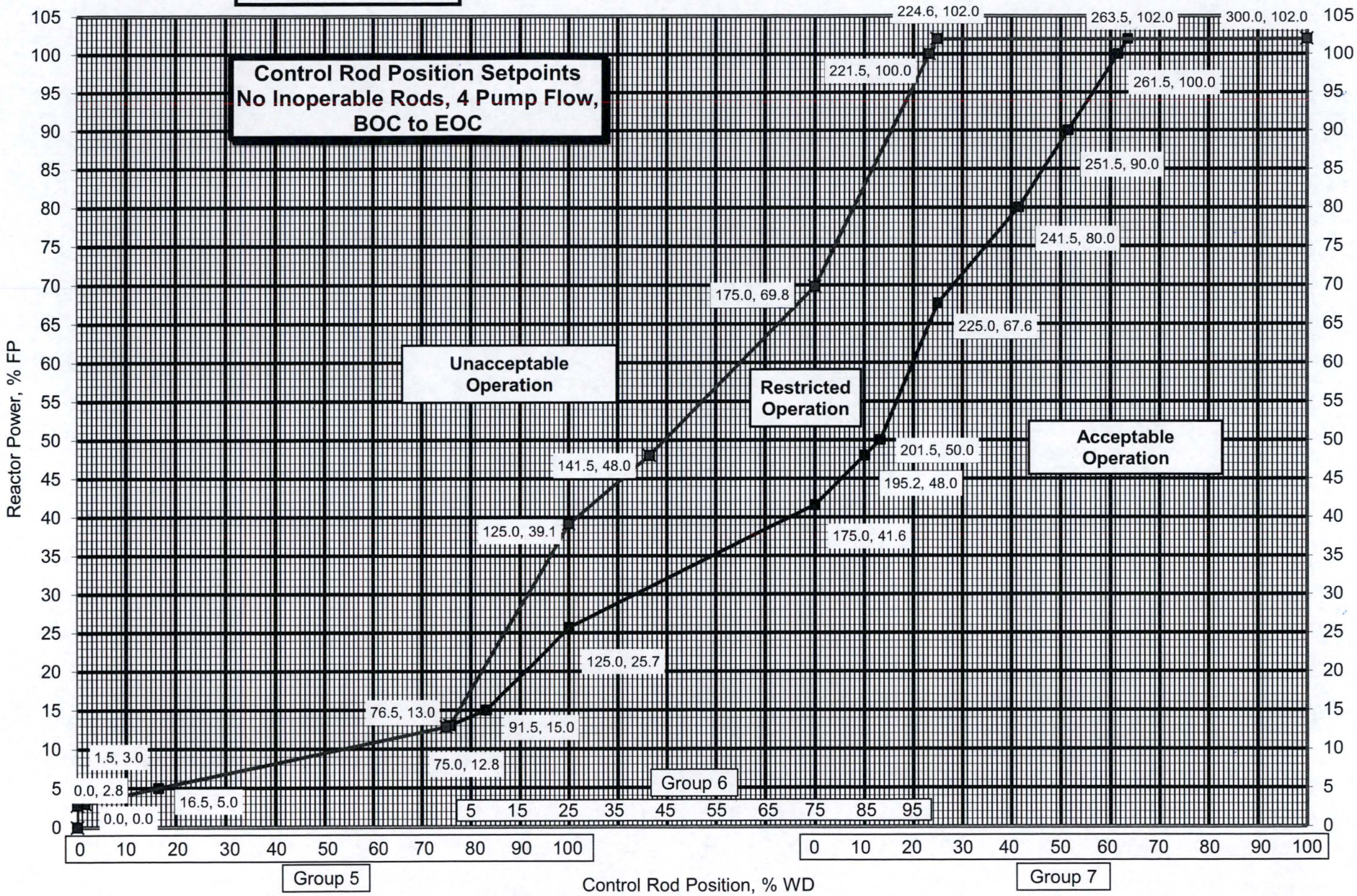
Shutdown Margin Rod Index Setpoints

Referred to by TS 3.2.1

	%FP	RI Insertion Setpoint No Inop Rod	RI Insertion Setpoint 1 Inop Rod	RI Withdrawal Setpoint
4 Pumps	102.0	224.6	283.4	300
	100.0	221.5	281.5	300
	48.0	141.5	231.5	300
	13.0	76.5	161.5	300
	3.0	1.5	76.5	300
	2.8	0.0	74.8	300
	0.0	0.0	51.0	300
3 Pumps	77.0	227.4	285.2	300
	75.0	221.5	281.5	300
	48.0	141.5	231.5	300
	13.0	76.5	161.5	300
	3.0	1.5	76.5	300
	2.8	0.0	74.8	300
	0.0	0.0	51.0	300

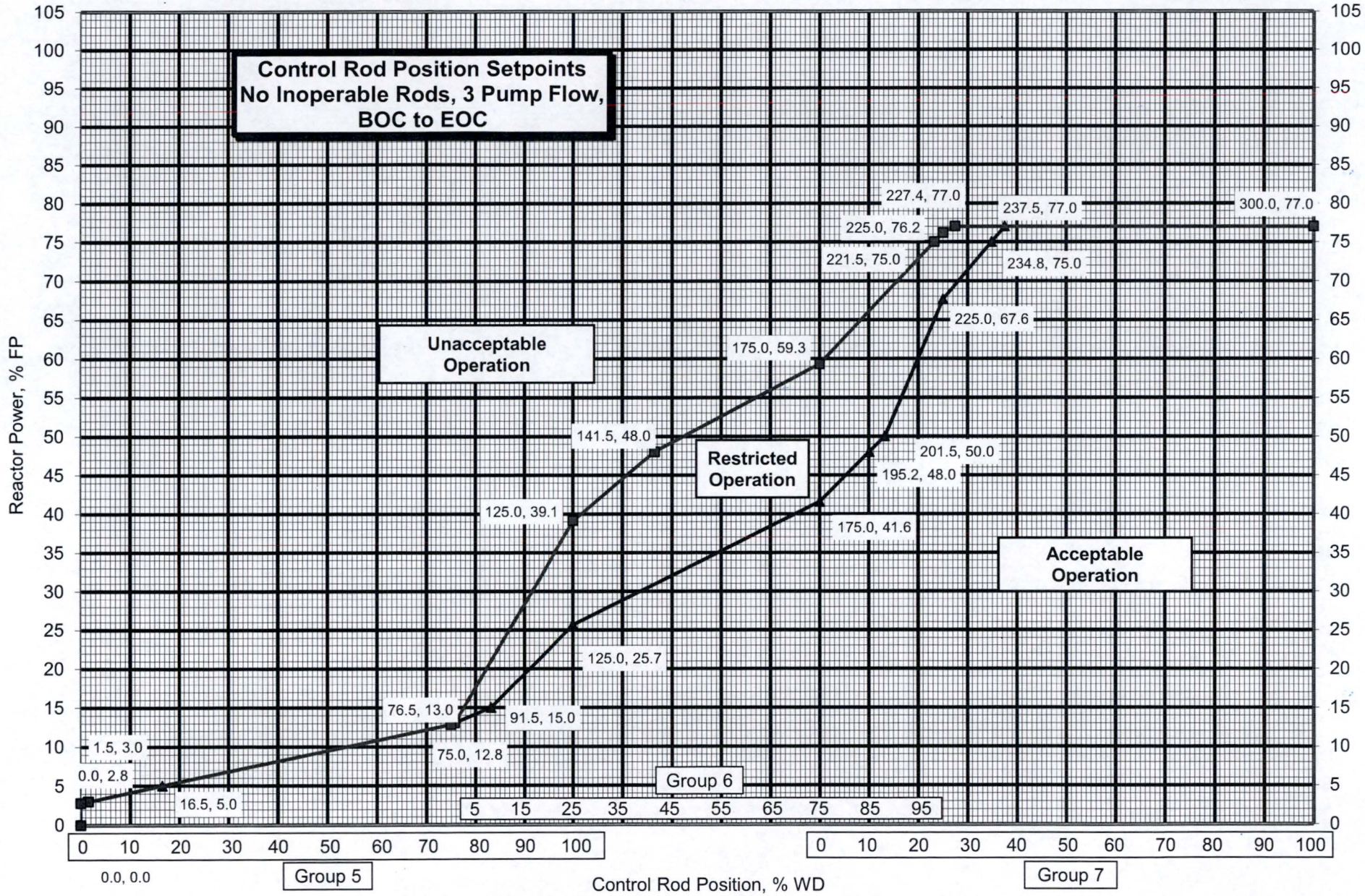
Oconee 3 Cycle 30

Referred to by TS 3.2.1

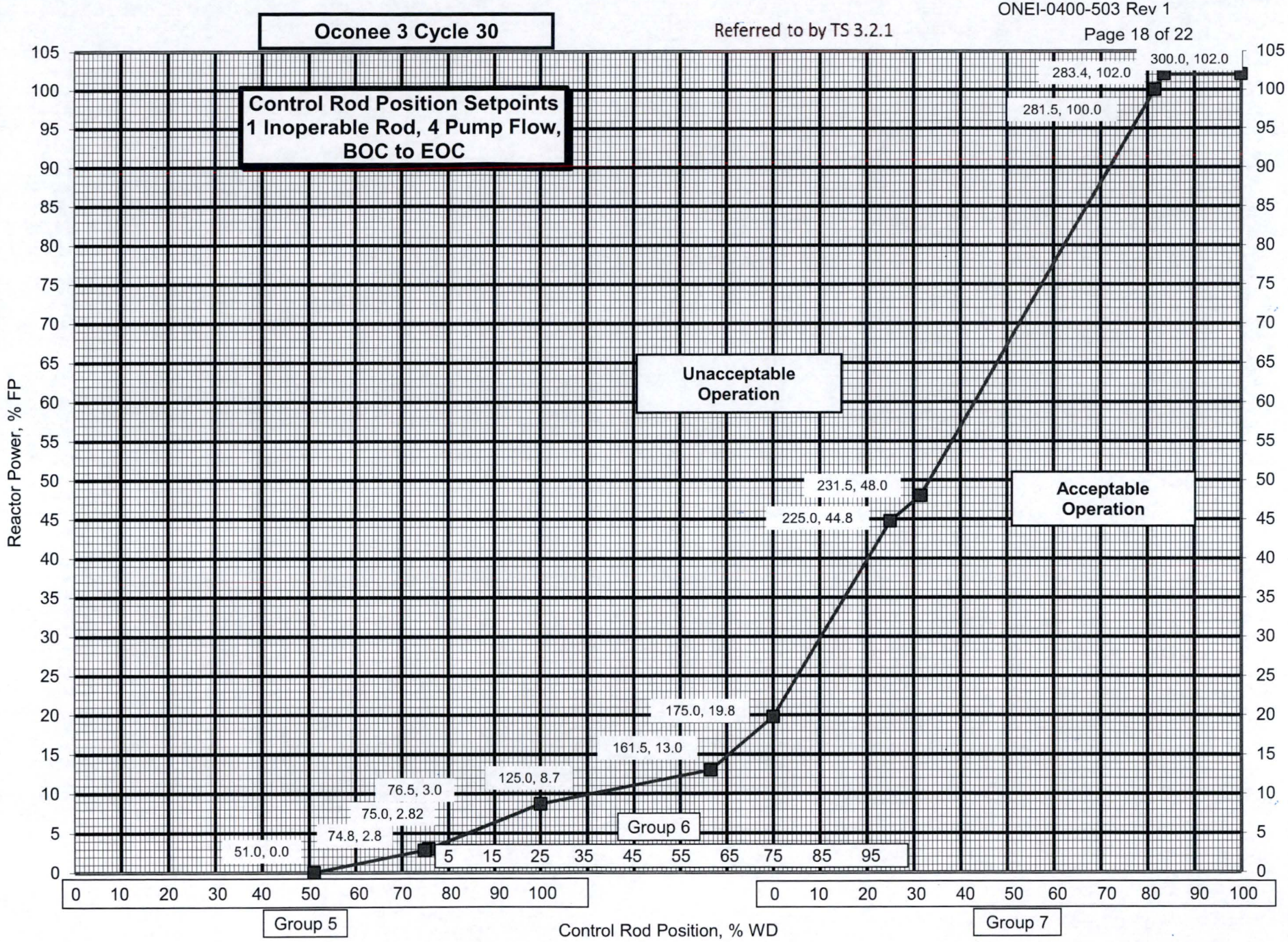


Oconee 3 Cycle 30

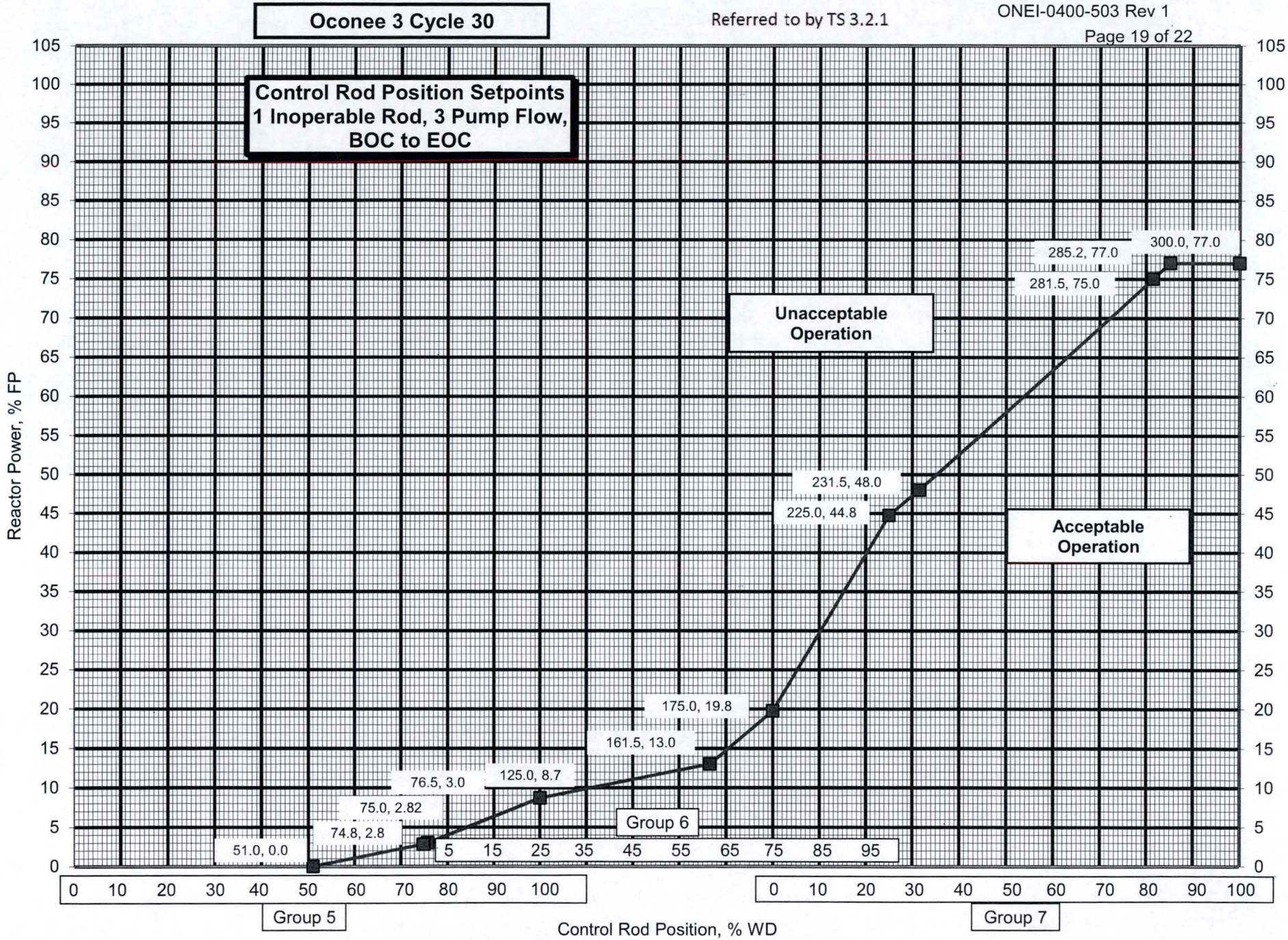
Referred to by TS 3.2.1



Referred to by TS 3.2.1



Referred to by TS 3.2.1



Oconee 3 Cycle 30

2.0 Core Operating Limits -- Not Error Adjusted

The data provided on the following pages satisfies a licensing commitment to identify specific parameters before instrumentation uncertainties are incorporated.

References provided in section 1 of this COLR identify the sources for the data which follows.

Information provided in this section should not be used in plant procedures.

Quadrant Power Tilt Limits

Referred to by TS 3.2.3

	Steady State		Transient		Maximum
Core Power Level, %FP	0 - 30	> 30	0 - 30	> 30	> 0
Quadrant Power Tilt, %	10.00	5.40	12.00	9.44	20.00

Variable Low RCS Pressure Protective Limits

Referred to by TS 2.1.1

Core Outlet Pressure psia	Reactor Coolant Outlet Temperature, °F 3 RCS Pumps	4 RCS Pumps
1800	581.0	578.3
1900	590.0	587.3
2000	598.9	596.3
2100	607.9	605.2
2200	616.9	614.2
2300	625.9	623.2

Oconee 3 Cycle 30

Axial Power Imbalance Protective Limits

Referred to by TS 2.1.1

Not for Plant Use

	%FP	RPS	Operational
4 Pumps	0.0	-35.0	-36.9
	80.0	-	-36.9
	90.0	-35.0	-32.0
	100.0	-	-25.2
	109.4	-14.4	-
	109.4	14.4	-
	100.0	-	23.4
	90.0	35.0	31.8
	80.0	-	35.5
	0.0	35.0	35.5
3 Pumps	0.0	-35.0	-36.9
	62.3	-35.0	-
	77.0	-	-36.9
	81.7	-14.4	-
	81.7	14.4	-
	77.0	-	35.5
	62.3	35.0	-
	0.0	35.0	35.5

Oconee 3 Cycle 30

Rod Index Limits

Referred to by TS 3.2.1

Not for Plant Use

	%FP	Operational RI Insertion Limit	Shutdown Margin RI Insertion Limit No Inop Rod	1 Inop Rod	RI Withdrawal Limit
4 Pumps	102	262	220	280	300
	100	260	-	-	300
	90	250	-	-	300
	80	240	-	-	300
	50	200	140	230	300
	15	90	75	160	300
	5	0	0	75	300
3 Pumps	77	236	220	280	300
	50	200	140	230	300
	15	90	75	160	300
	5	0	0	75	300

Record of Review

Document: ONEI-0400-503 **Revision:** 1

The signature of the Design Verification Reviewer confirms:

- The type of verification method performed
- Technical errors have been resolved and the records have been included, if applicable

☒ Reviewer or ☐ Concurrent Reviewer

Design Verification Review Method	
☒ Design Review ☐ Alternate Calculation ☐ Qualification Testing	Other Records: ☐ Attached

Note:
This Record of Review form may be used to document other reviews, but is only required for Design Verification Reviews.

G. M. Presnell / Signed Electronically	Nuclear	Dated Electronically
Reviewer(Print/Sign)	Discipline	Date

Item No.	Technical Error	Resolution
1	No technical errors were found.	N/A