



Florida Power

A Progress Energy Company

Crystal River Nuclear Plant
Docket No. 50-302
Operating License No. DPR-72

October 19, 2001
3F1001-10

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

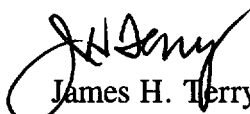
Subject: Crystal River Unit 3 - Cycle 13 Core Operating Limits Report

Dear Sir:

Florida Power Corporation (FPC) hereby submits the Cycle 13 Core Operating Limits Report (COLR) for Crystal River Unit 3 (CR-3). The COLR is required to be submitted to the NRC upon issuance for each reload cycle in accordance with CR-3 Improved Technical Specifications Section 5.6.2.18.

This letter establishes no new regulatory commitments. If you have any questions regarding this submittal, please contact Mr. Sid Powell, Supervisor, Licensing and Regulatory Programs at (352) 563-4883.

Sincerely,


James H. Terry
Engineering Manager

JHT/cju

Attachment

xc: NRR Project Manager
Regional Administrator, Region II
Senior Resident Inspector

A001

Rec'd
01/14/02

Florida Power Corporation
Crystal River Unit 3

Cycle 13
Core Operating Limits Report
Revision 0

Referencing
Improved Technical Specifications

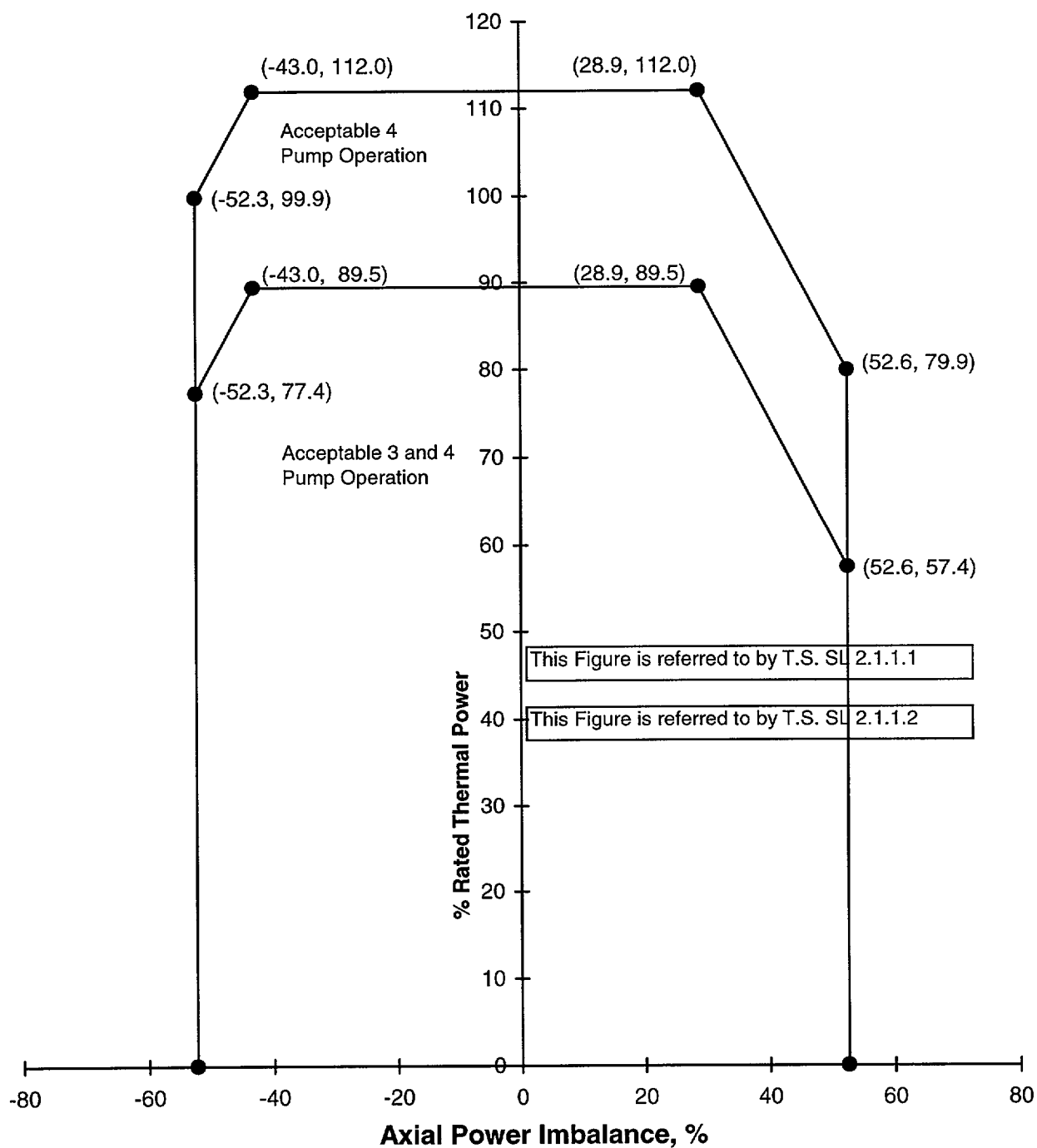
1.0 Core Operating Limits

This Core Operating Limits Report for CR3 Cycle 13 has been prepared in accordance with the requirements of Technical Specification Section 1.1 and 5.6.2.18. The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC. These methods are documented in BAW-10179PA, Rev. 3 "Safety Criteria and Methodology for Acceptable Cycle Reload Analyses". The Cycle 13 limits generated using this methodology above are documented in BAW-2391, "Crystal River Unit 3 Cycle 13 Reload Report", dated August 2001.

The following limits are included in this report.

- SL 2.1.1.1 AXIAL POWER IMBALANCE PROTECTIVE LIMITS
- SL 2.1.1.2 AXIAL POWER IMBALANCE PROTECTIVE LIMITS
- LCO 3.1.1 SHUTDOWN MARGIN
- LCO 3.1.3 MODERATOR TEMPERATURE COEFFICIENT
- SR 3.1.7.1 API/RPI POSITION INDICATION AGREEMENT
- LCO 3.2.1 REGULATING ROD INSERTION LIMITS
- LCO 3.2.2 AXIAL POWER SHAPING ROD INSERTION LIMITS
- LCO 3.2.3 AXIAL POWER IMBALANCE OPERATING LIMITS
- LCO 3.2.4 QUADRANT POWER TILT
- LCO 3.2.5 POWER PEAKING FACTORS
- LCO 3.3.1 REACTOR PROTECTION SYSTEM INSTRUMENTATION
- LCO 3.9.1 REFUELING BORON CONCENTRATION

Axial Power Imbalance Protective Limits



Shutdown Margin (SDM)

Normal operating procedures require RCS boration to 1.0% $\Delta k/k$ Subcritical at 73°F prior

to bypassing EFIC actuation on low steam generator pressure, or when high steam generator levels exist during secondary system chemistry control and steam generator cleaning in MODES 3, 4, and 5, therefore

Mode 3,4,5 $SDM \geq 1.0\% \Delta k/k$

These limits are referred to by Technical Specification LCO 3.1.1

Reference: Improved Technical Specification Bases B3.1.1.

Moderator Temperature Coefficient Limit

Lower Limit

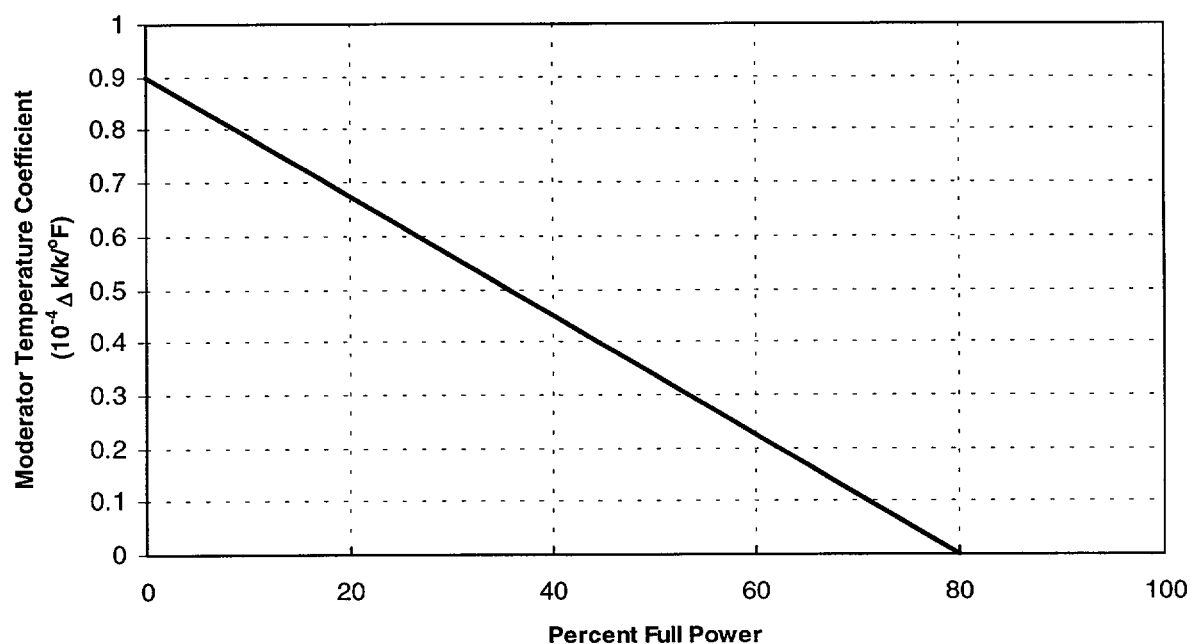
MTC at HFP > $-3.58 \times 10^{-4} \Delta k/k/^{\circ}F$

Upper Limit

MTC $\leq 0.9 \times 10^{-4} \Delta k/k/^{\circ}F$ when Thermal Power < 95% RTP

MTC ≤ 0.0 when Thermal Power $\geq 95\%$ RTP

The following Upper Limits may not be exceeded (Limits ensure the validity of the ECCS analysis is preserved) for operation in MODES 1 and 2:



These limits are
referred to by
Technical
Specification
LCO 3.1.3

Absolute Position Indicator / Relative Position Indicator Agreement Limits

2.7% when the comparison is performed using the plant computer, or

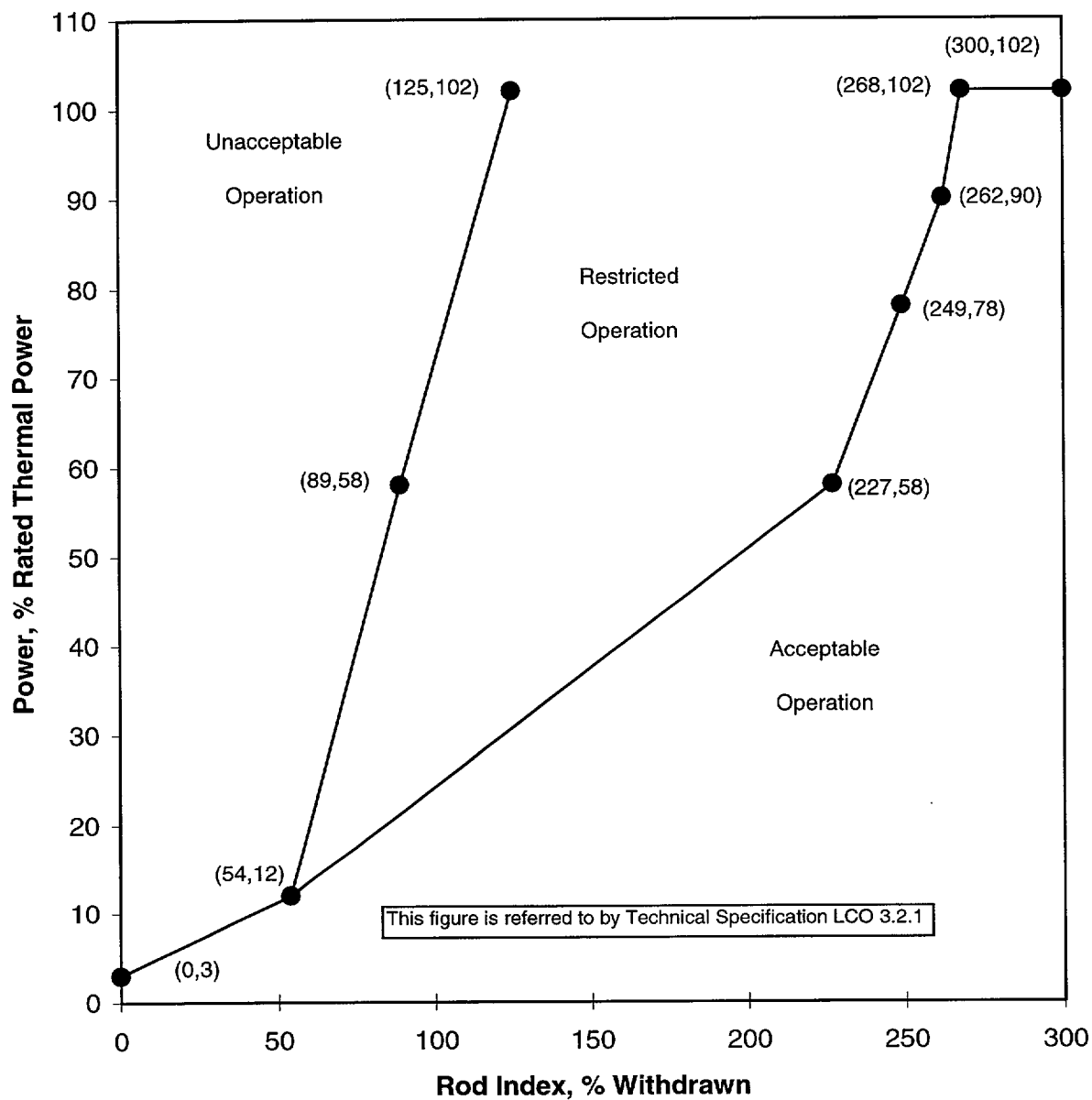
3.5% when the comparison is performed using the panel meters on the main control board.

These limits are referred to by Technical Specification SR 3.1.7.1

Reference: "Crystal River Unit 3 – Issuance of Amendment Re: Dual Channel Control Rod Position Indication (TAC No. M82990)", Licensing Amendment No. 144, Letter from H.S. Silver to P.M. Beard, June 25, 1992.

Regulating Rod Group Insertion Error Adjusted Limits

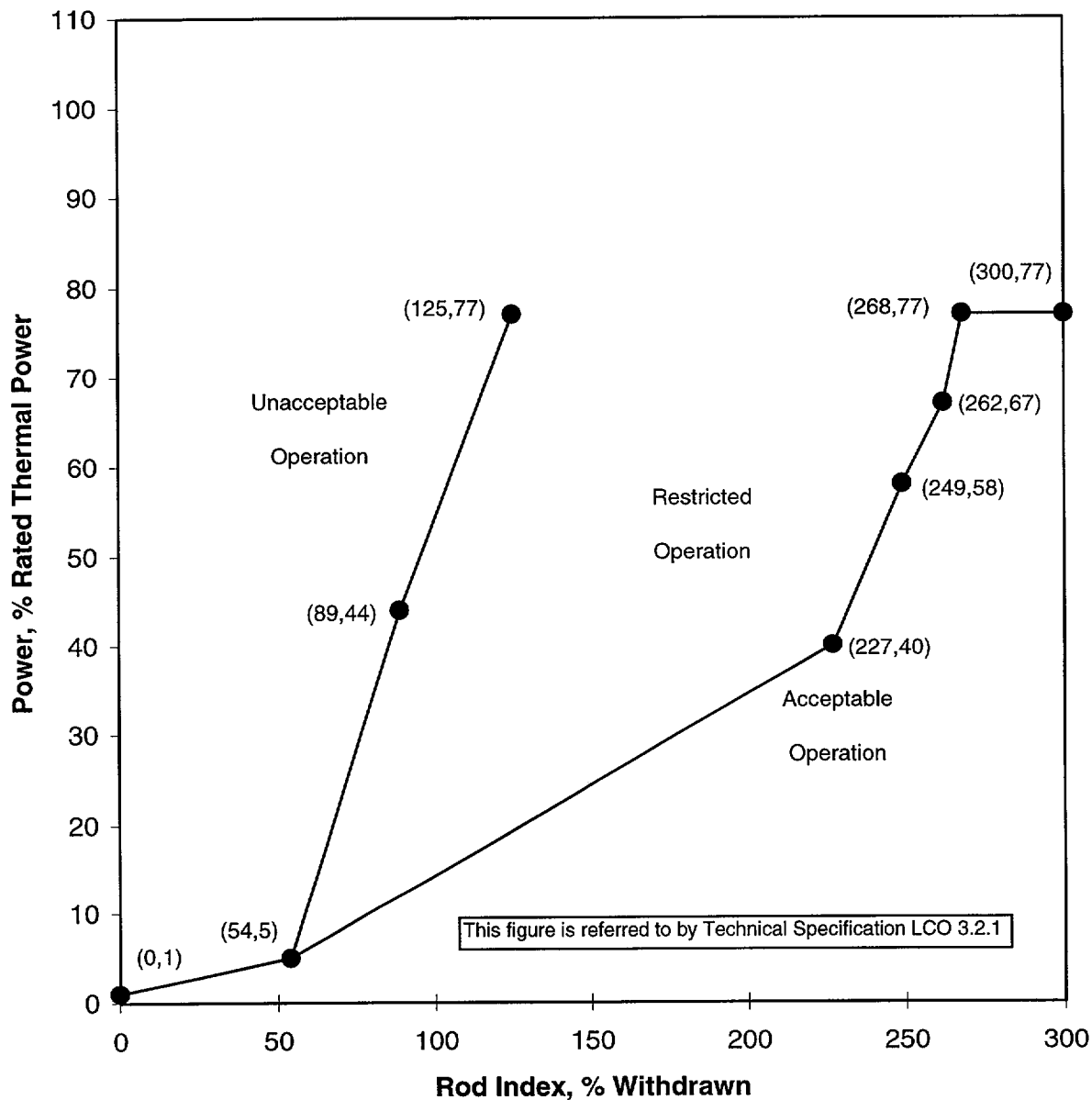
Four Pump Operation
0 EFPD to EOC



Note 1: A Rod group overlap of $25 \pm 5\%$ between sequential groups 5 and 6, and 6 and 7 shall be maintained
 Note 2: This figure shall be used up to, during, and after APSR withdrawal per LCO 3.2.2

Regulating Rod Group Insertion Error Adjusted Limits

Three Pump Operation
0 EFPD to EOC



Note 1: A Rod group overlap of $25 \pm 5\%$ between sequential groups 5 and 6, and 6 and 7 shall be maintained
Note 2: This figure shall be used up to, during, and after APSR withdrawal per LCO 3.2.2

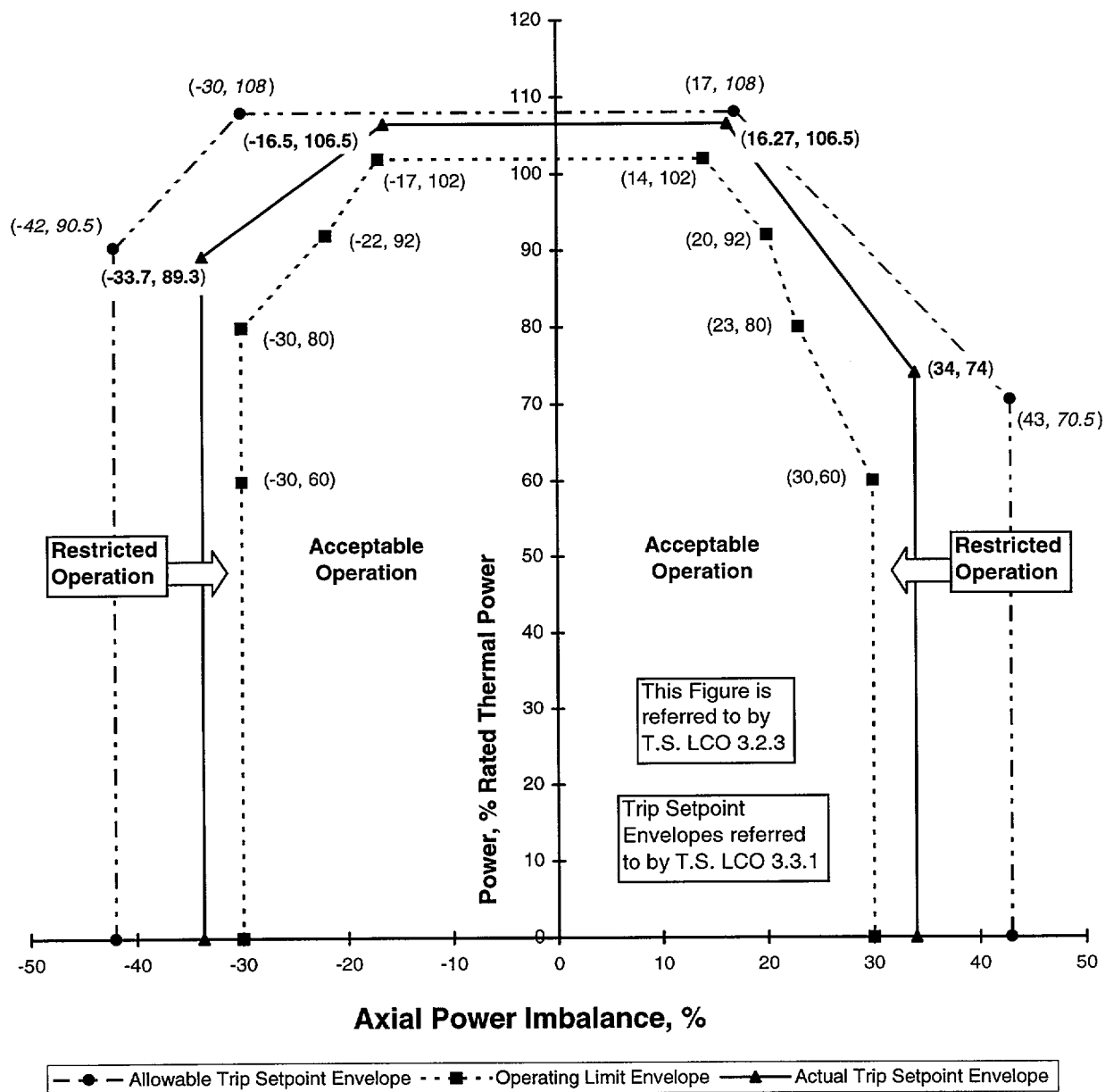
AXIAL POWER SHAPING ROD INSERTION LIMITS

Up to 630 EFPD the APSRs may be positioned as necessary. The APSRs shall be completely withdrawn (100%) by 650 EFPD. Between 630 and 650 EFPD, the APSRs may be withdrawn. However, once withdrawn during this period, the APSRs shall not be reinserted.

These limits are
referred to by
Technical
Specification
LCO 3.2.2

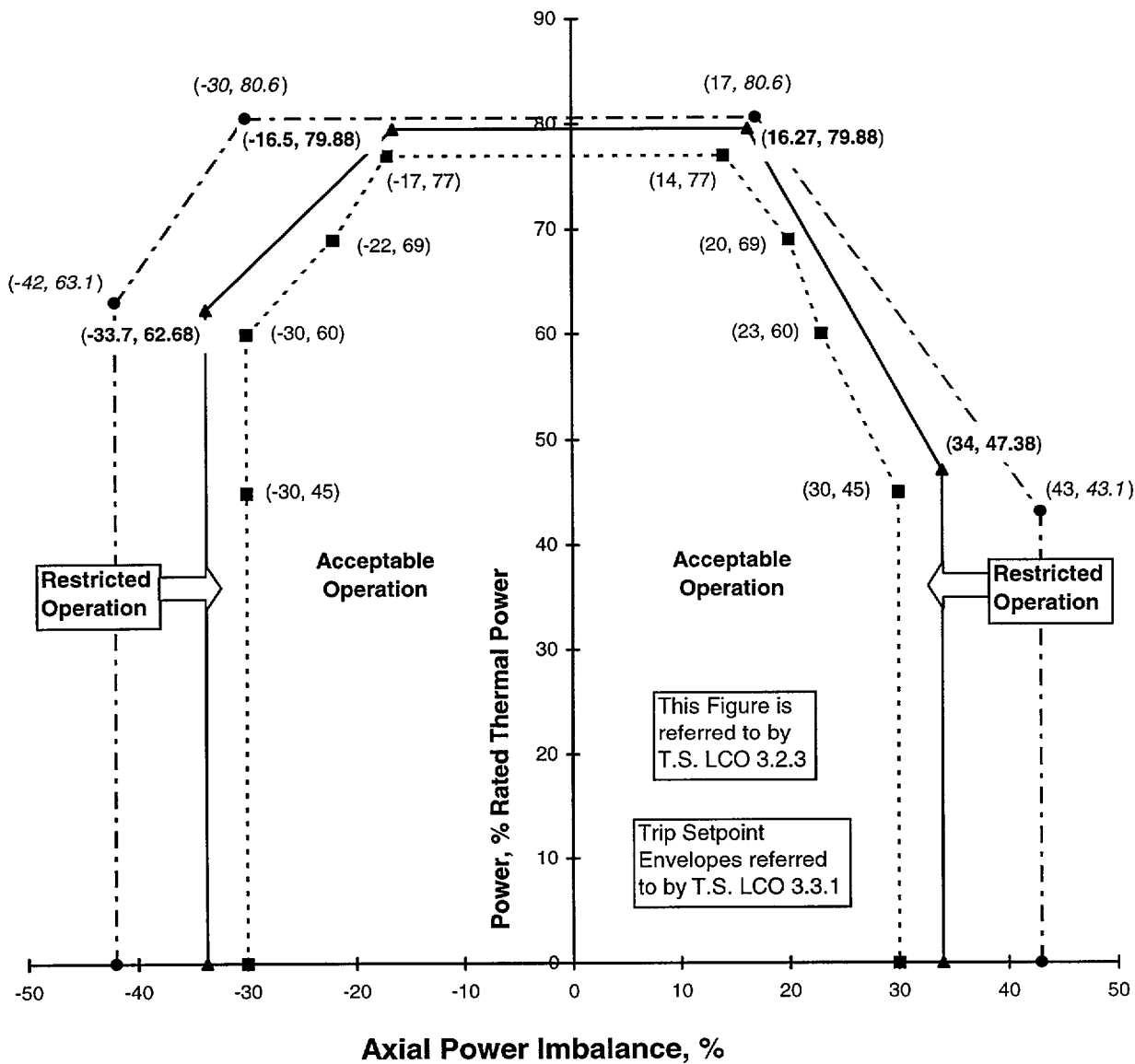
Axial Power Imbalance Error Adjusted Operating Limit and Trip Setpoint Envelopes

Four Pump Operation
0 EFPD to EOC



Axial Power Imbalance Error Adjusted Operating Limit and Trip Setpoint Envelopes

Three Pump Operation
0 EFPD to EOC



QUADRANT POWER TILT LIMITS FOR THERMAL POWER \leq 60%

For Operation from 0 EFPD to EOC-13

QUADRANT POWER TILT As Measured By:	STEADY-STATE <u>LIMIT(%)</u>	TRANSIENT <u>LIMIT(%)</u>	MAXIMUM <u>LIMIT(%)</u>
Symmetrical Incore Detector System	7.50	10.03	20.0
Power Range Channels	4.94	6.96	20.0
Minimum Incore Detector System	3.07	4.40	20.0
Measurement System Independent	8.58	11.07	20.0

QUADRANT POWER TILT LIMITS FOR THERMAL POWER $>$ 60%For Operation from 0 EFPD to 300 \pm 10 EFPD

QUADRANT POWER TILT As Measured By:	STEADY-STATE <u>LIMIT(%)</u>	TRANSIENT <u>LIMIT(%)</u>	MAXIMUM <u>LIMIT(%)</u>
Symmetrical Incore Detector System	4.34	10.03	20.0
Power Range Channels	1.96	6.96	20.0
Minimum Incore Detector System	1.90	4.40	20.0
Measurement System Independent	4.92	11.07	20.0

For Operation After 300 \pm 10 EFPD

QUADRANT POWER TILT As Measured By:	STEADY-STATE <u>LIMIT(%)</u>	TRANSIENT <u>LIMIT(%)</u>	MAXIMUM <u>LIMIT(%)</u>
Symmetrical Incore Detector System	4.16	10.03	20.0
Power Range Channels	1.96	6.96	20.0
Minimum Incore Detector System	1.90	4.40	20.0
Measurement System Independent	4.92	11.07	20.0

<p>These limits are referred to by Technical Specification LCO 3.2.4</p>

Power Peaking Factors

These Limits are referred to by Technical Specification LCO 3.2.5

Heat Flux Hot Channel Factor F_Q

F_Q shall be limited by the following relationships:

$$F_Q \leq LHR^{allow}(Bu) / [LHR^{avg} * P] \text{ (for } P \leq 1.0)$$

$LHR^{allow}(Bu)$ = See the following table

LHR^{avg} = 5.95 kW/ft for Mk-B10ZL fuel

LHR^{avg} = 5.95 kW/ft for Mk-B10I fuel

LHR^{avg} = 5.95 kW/ft for Mk-B10E fuel

P = ratio of THERMAL POWER / RATED THERMAL POWER

Bu = fuel burnup (MWd/mtU)

CR-3 Cycle 13 Reload Bounding LHR Limits
Batch 15 (Mark-B10I / Mark-B10E) LHR^{allow}
Allowable Peak LHR for Specified Burnup Range, kW/ft

NAS Level	0-690 EFPD 18690 – 40305 MWd/mtU
1	15.1
2	15.4
3	15.9
4	16.1
5	16.4
6	16.2
7	15.6
8	15.4

Crystal River Unit 3, Cycle 13

CR-3 Cycle 13 Reload Bounding LHR Limits
Batch 14B (Mark-B10E) LHR^{allow}
Allowable Peak LHR for Specified Burnup Range, kW/ft

NAS Level	0-526 EFPD 18690 – 35167 MWd/mtU	526-556 EFPD 35167 – 36107 MWd/mtU	556-600 EFPD 36107 – 37486 MWd/mtU	600-640 EFPD 37486 – 38739 MWd/mtU	640-690 EFPD 38739 – 40305 MWd/mtU
1	15.1	15.1	14.7	14.4	14.0
2	15.4	15.3	14.9	14.6	14.1
3	15.9	15.8	15.4	15.0	14.5
4	16.1	16.0	15.5	15.1	14.6
5	16.4	16.0	15.6	15.1	14.6
6	16.2	15.9	15.4	15.0	14.5
7	15.6	15.4	15.0	14.6	14.1
8	15.4	15.1	14.7	14.4	14.0

CR-3 Cycle 13 Reload Bounding LHR Limits
Batch 14 A,C,D,E (Mark-B10I) LHR^{allow}
Allowable Peak LHR for Specified Burnup Range, kW/ft

NAS Level	0-416 EFPD 18690 – 31722 MWd/mtU	416-475 EFPD 31722 – 33570 MWd/mtU	475-550 EFPD 33570 – 35920 MWd/mtU	550-625 EFPD 35920 – 38269 MWd/mtU	625-690 EFPD 38269 – 40305 MWd/mtU
1	15.1	14.8	14.2	13.5	12.9
2	15.4	15.0	14.3	13.6	13.0
3	15.9	15.5	14.7	13.9	13.2
4	16.1	15.7	14.8	14.0	13.3
5	16.4	15.7	14.8	14.0	13.3
6	16.2	15.5	14.7	13.9	13.2
7	15.6	15.1	14.3	13.6	13.0
8	15.4	14.8	14.2	13.5	12.9

These tables are referred to
by T.S. LCO 3.2.5

Crystal River Unit 3, Cycle 13

CR-3 Cycle 13 Reload Bounding LHR Limits
Batch 13A2,B,E2 (Mark-B10I) & Batch 13C (Mark-B10E) LHR^{allow}
Allowable Peak LHR for Specified Burnup Range, kW/ft

NAS Level	0-175 EFPD 18690 – 24172 MWd/mtU	175-375 EFPD 24172 – 30437 MWd/mtU	375-550 EFPD 30437 – 35920 MWd/mtU	550-625 EFPD 35920 – 38269 MWd/mtU	625-690 EFPD 38269 – 40305 MWd/mtU
1	13.0	12.8	12.5	12.2	11.9
2	13.1	12.8	12.6	12.2	11.9
3	13.3	13.0	12.7	12.3	11.9
4	13.3	13.0	12.7	12.3	11.9
5	13.3	13.0	12.8	12.3	11.9
6	13.3	13.0	12.7	12.3	11.9
7	13.1	12.8	12.6	12.2	11.9
8	13.0	12.8	12.5	12.2	11.9

CR-3 Cycle 13 Reload Bounding LHR Limits
Batch 12A3 (Mark-B10ZL) LHR^{allow}
Allowable Peak LHR for Specified Burnup Range, kW/ft

NAS Level	0-150 EFPD 18690 – 23389 MWd/mtU	150-350 EFPD 23389 – 29654 MWd/mtU	350-475 EFPD 29654 – 33570 MWd/mtU	475-575 EFPD 33570 – 36703 MWd/mtU	575-690 EFPD 36703 – 40305 MWd/mtU
1	14.3	14.0	13.3	12.7	12.0
2	14.4	14.2	13.4	12.8	12.0
3	14.8	14.5	13.7	12.9	12.1
4	14.9	14.6	13.7	13.0	12.1
5	15.0	14.6	13.7	13.0	12.1
6	14.8	14.5	13.7	12.9	12.1
7	14.4	14.2	13.4	12.8	12.0
8	14.3	14.0	13.3	12.7	12.0

These tables are referred to by Technical
Specification LCO 3.2.5

POWER PEAKING FACTORS

This Limit is referred to by Technical Specification LCO 3.2.5

Enthalpy Rise Hot Channel Factor $F_{\Delta H}^N$

$$F_{\Delta H}^N \leq \text{ARP} [1 + (1/\text{RH})(1 - P/P_m)]$$

ARP = Allowable Radial Peak, See the following table

P = ratio of THERMAL POWER / RATED THERMAL POWER and $P \leq 1.0$

$P_m = 1.0$ for 4-RCP operation

$P_m = 0.75$ for 3-RCP operation

RH = 3.34

Cycle 13 Allowable Radial Peaks (ARP)

Axial Peak	Axial Location* (X/L)	ARP
1.1	0.2	1.8899
1.1	0.4	1.8829
1.1	0.6	1.8708
1.1	0.8	1.8497
1.3	0.2	1.9684
1.3	0.4	1.9470
1.3	0.6	1.9103
1.3	0.8	1.8090
1.5	0.2	2.0287
1.5	0.4	1.9406
1.5	0.6	1.8193
1.5	0.8	1.6994
1.7	0.2	1.9271
1.7	0.4	1.8230
1.7	0.6	1.7060
1.7	0.8	1.5997
1.9	0.2	1.7999
1.9	0.4	1.6962
1.9	0.6	1.5944
1.9	0.8	1.5013

*Based on an active core height of 140.6 inches. Linear interpolation is acceptable; extrapolation above 112.48 inches and below 28.12 inches is acceptable.

Refueling Boron Concentration

The boron concentration must be greater than 2879 ppmb.

The value includes 1 % $\Delta k/k$ for uncertainties and is based on a 660 EF PD cycle 12. The refueling boron concentration must be increased by 2 ppm for each EFPD that the cycle 12 length is less than 660 EFPD, and 1.5 ppm/EFPD may be deducted for each EFPD that the cycle 12 length is more than 660 EFPD.

This limit is referred to by
T.S. LCO 3.9.1

Revision History

Revision 0 - Original Cycle 13 COLR