Progress Energy

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

Ref: ITS 5.6.2.18(d)

October 8, 2003
3F1003-04

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

Subject: Crystal River Unit 3 – Core Operating Limits Report, Cycle 13, Revision 2

Dear Sir:

Progress Energy Florida, Inc. (PEF) hereby submits the Crystal River Unit 3 Core Operating Limits Report (COLR), Cycle 13, Revision 2, as required by Improved Technical Specifications (ITS) 5.6.2.18(d). This revision of the COLR increased the allowed cycle length from 690 to 693 effective full power days. The revision also adds the appropriate Mode 6 boron concentration for the Cycle 13 shutdown and offload.

No new regulatory commitments are made in this letter.

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/pei

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

A001

Progress Energy Florida, Inc.
Crystal River Nuclear Plant
15760 W. Powerline Street
Crystal River, FL 34428

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50 - 302 / LICENSE NUMBER DPR - 72

ATTACHMENT

Core Operating Limits Report (COLR)
Cycle 13, Revision 2

Florida Power Corporation
Crystal River Unit 3

Cycle 13
Core Operating Limits Report
Revision 2

Referencing
Improved Technical Specifications

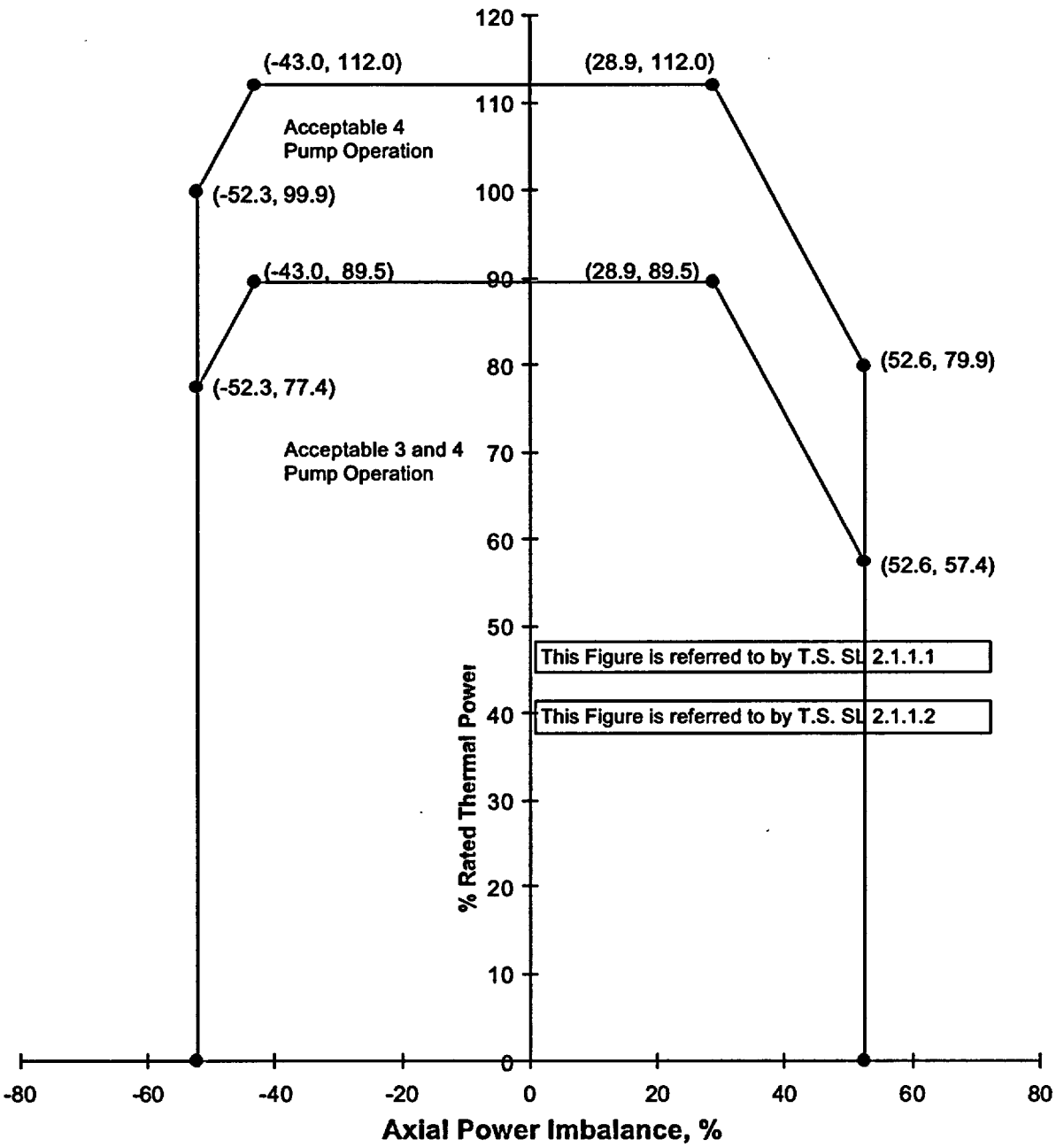
1.0 Core Operating Limits

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, Revision 1,"Crystal River Unit 3 Cycle 13 Reload Report", dated September 2001, except for the Mode 6 Boron Concentration for Cycle 13 shutdown and offload which is documented in BAW-2448, Revision 0, "Crystal River Unit 3 Cycle 14 Reload Report", dated August 2003. The methodology used to calculate this value is identical to that in BAW-10179PA, Rev 3. Evaluation of Cycle 13 operating cycle extension from 690 EFPD to 693 EFPD is documented in EC 54359, CR3 Cycle 13 Extension.

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
SR 3.4.1.1	RCS PRESSURE DNB LIMITS
SR 3.4.1.2	RCS TEMPERATURE DNB LIMITS
SR 3.4.1.3	RCS FLOW RATE DNB LIMITS
LCO 3.9.1	REFUELING BORON CONCENTRATION

Axial Power Imbalance Protective Limits



Shutdown Margin (SDM)

Normal operating procedures require RCS boration to 1.0%Δk/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% Δk/k

These limits are referred to by Technical Specification LCO 3.1.1

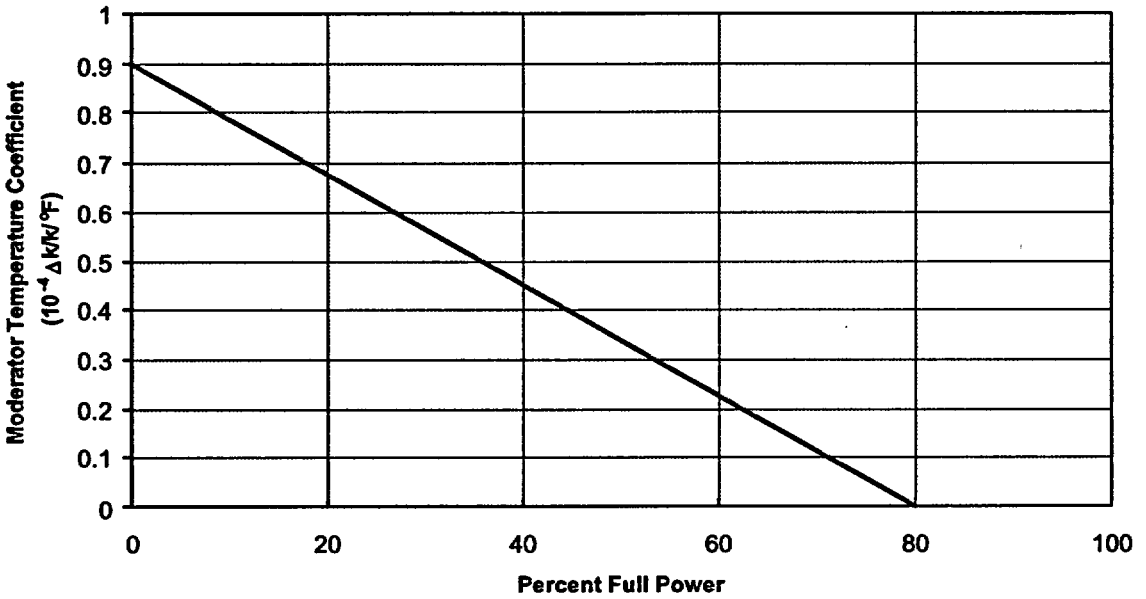
Reference: Improved Technical Specification Bases B3.1.1.

Moderator Temperature Coefficient Limit

Lower Limit
MTC at HFP > -3.58×10^{-4} Δ k/k/°F

Upper Limit
MTC ≤ 0.9×10^{-4} Δ k/k/°F when Thermal Power < 95% RTP
MTC ≤ 0.0 when Thermal Power ≥ 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

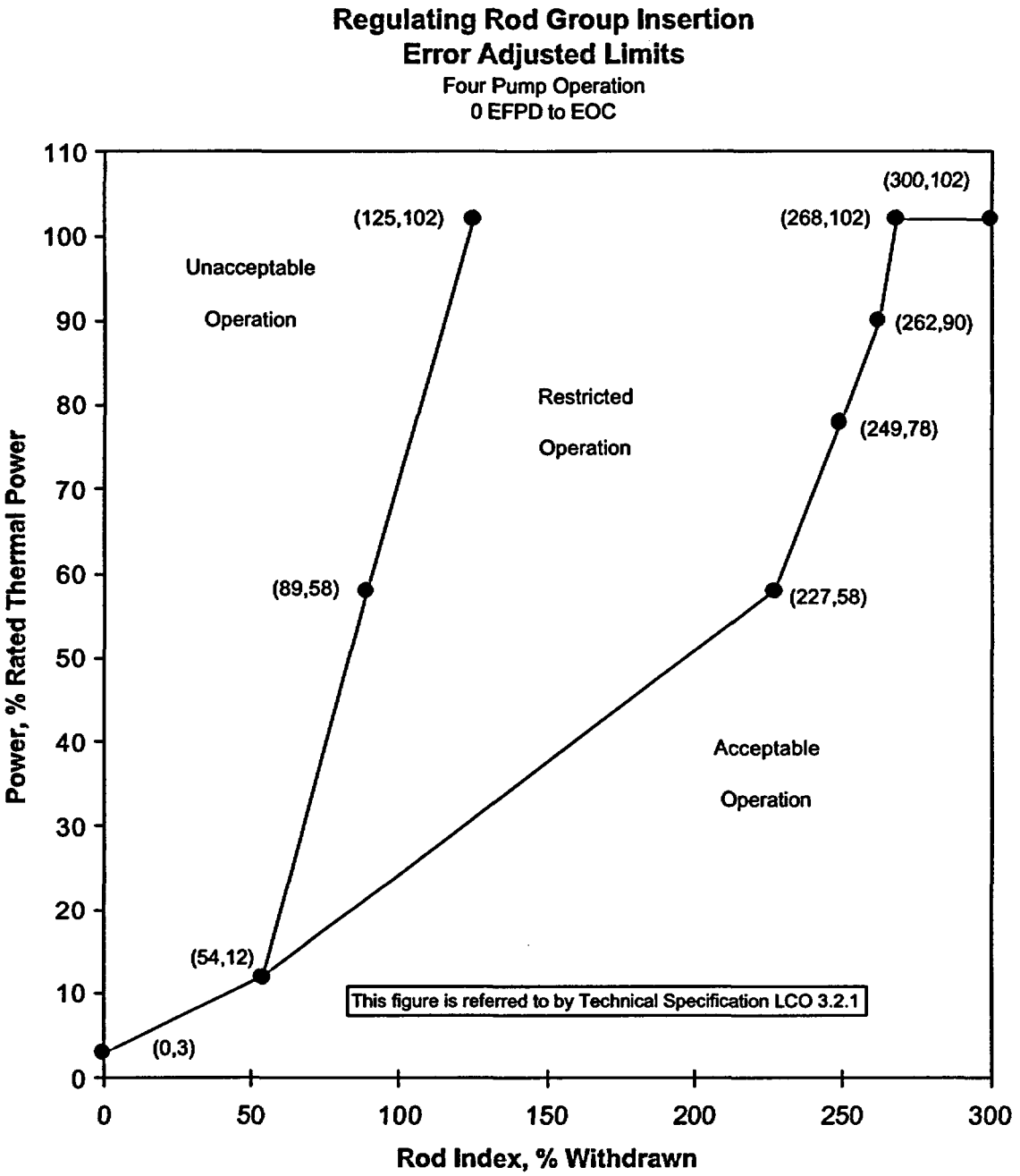
Absolute Position Indicator / Relative Position Indicator Agreement Limits

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

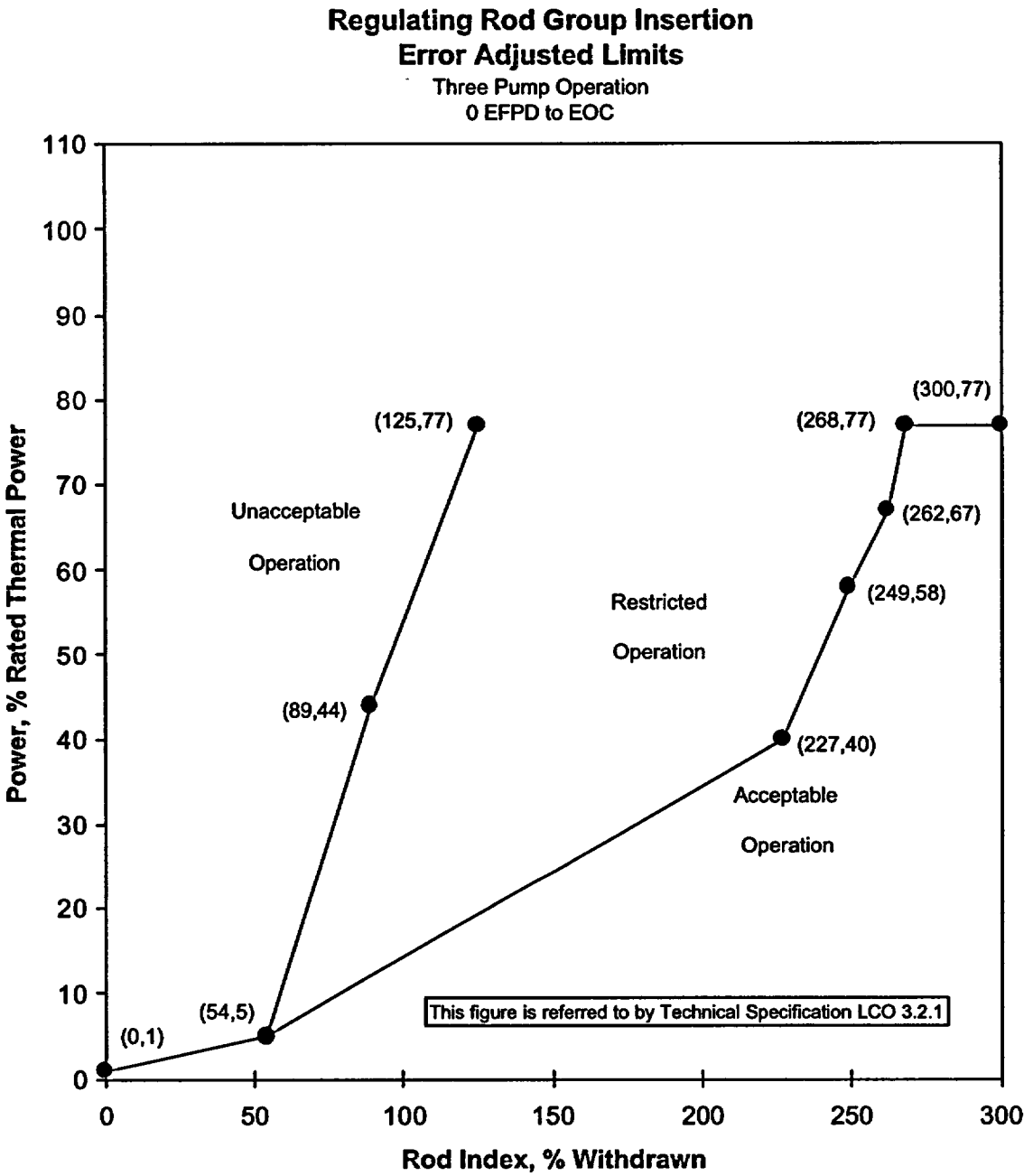
3.5% when the comparison is performed using the panel meters on the main control board.

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.



Note 1: A Rod group overlap of 25 +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



Note 1: A Rod group overlap of 25 ±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

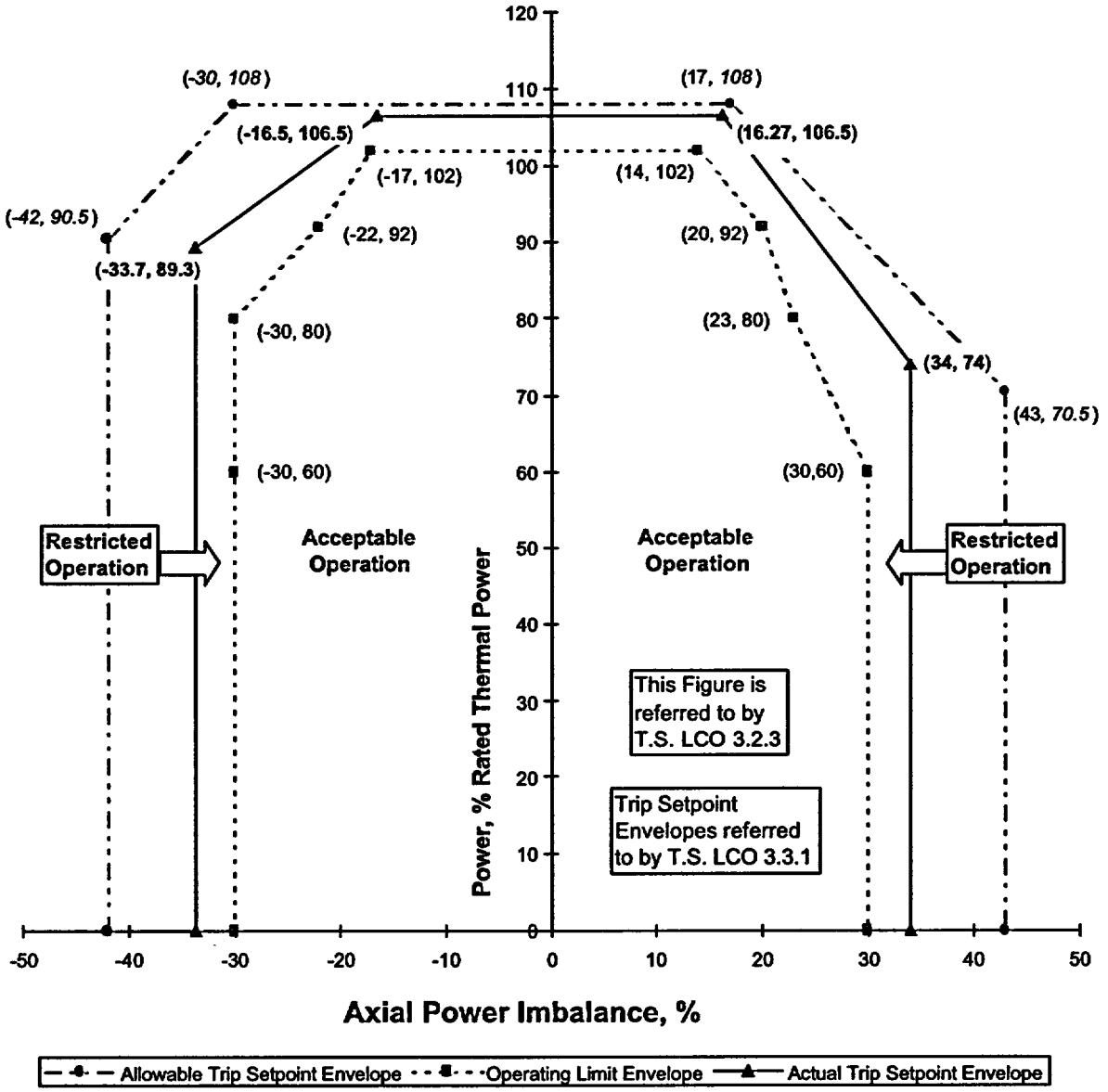
AXIAL POWER SHAPING ROD INSERTION LIMITS

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.

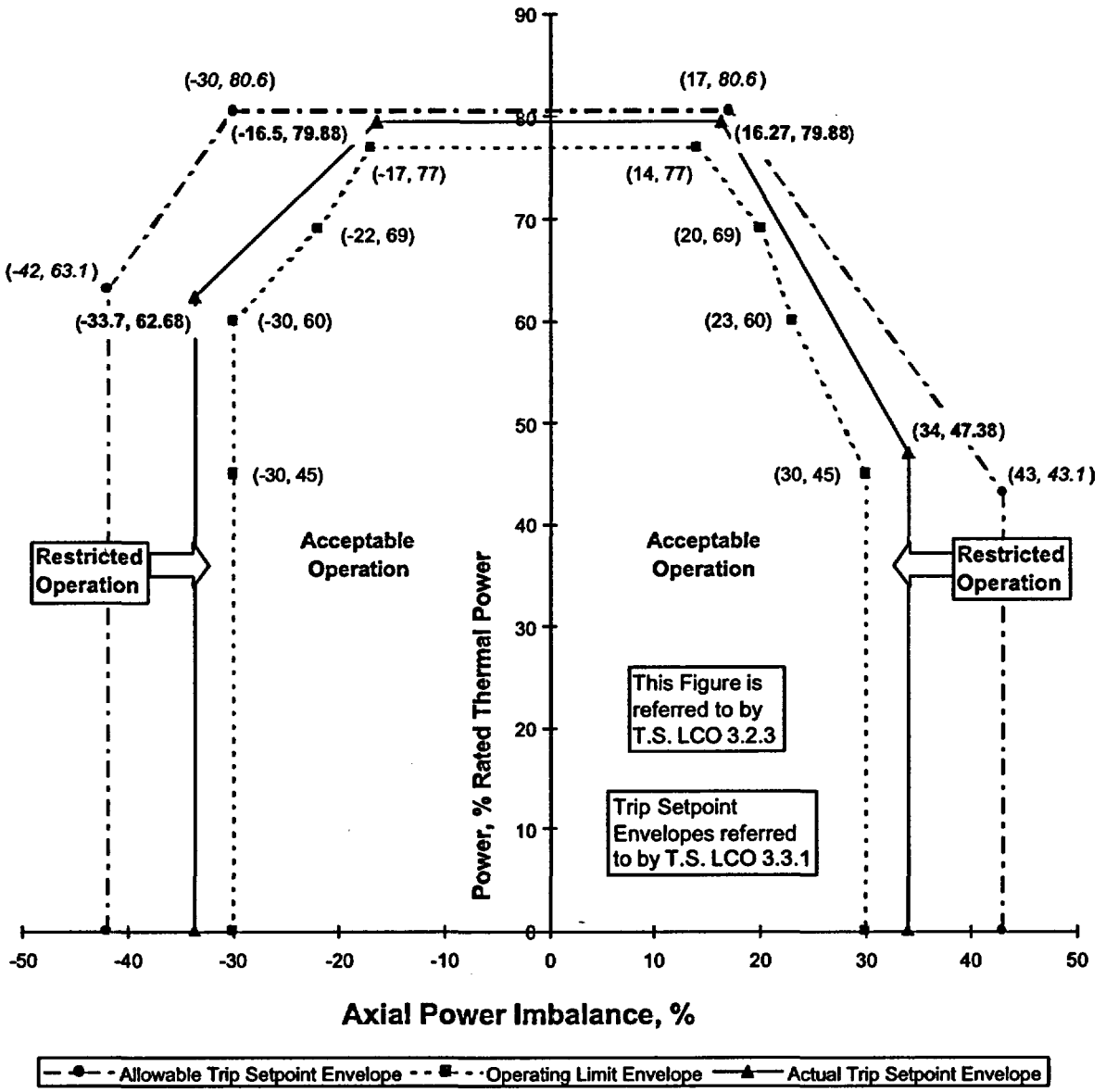
These limits are referred to by Technical Specification LCO 3.2.2

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 LIMIT(%)	TRANSIENT LIMIT(%)	MAXIMUM LIMIT(%)
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 LIMIT(%)	TRANSIENT LIMIT(%)	MAXIMUM LIMIT(%)
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 LIMIT(%)	TRANSIENT LIMIT(%)	MAXIMUM LIMIT(%)
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

These limits are referred to by Technical Specification LCO 3.2.4

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:

$F_Q \leq LHR^{allow}(Bu) / [LHR^{avg} * P]$ (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	0-693 EFPD 18690 - 40399 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

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	625-693 EFPD 38269 - 40399 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	575-693 EFPD 36703 - 40399 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 $F^N_{\Delta H}$

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

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.

RCS Variable Low Pressure Setpoint Equation

$P_{Trip} \geq (11.59 * T_{HOT} - 5037.8)$ psig

These limits are referred to by ITS Table 3.3.1-1, Item 5

RCS DNB Pressure Limits

RCS loop pressure ≥ 2064 psig

(Assumes 20% OTSG tube plugging and bounds either four or three RCPs operating).

These limits are referred to by SR 3.4.1.1

RCS DNB Temperature Limit

RCS Hot Leg Temperature ≤ 604.6°F (Cycle 13 limit).

To accommodate up to 20% equivalent OTSG tube plugging, RCS Hot Leg Temperature shall be ≤ 605.8°F (ITS limit).

These limits are referred to by SR 3.4.1.2

RCS DNB Flow Rate Limits

For Cycle 13, RCS total flow rate ≥ 139.7 E6 lb/hr with four RCPs operating, or ≥ 104.4 E6 lb/hr with three RCPs operating.

To accommodate up to 20% equivalent OTSG tube plugging, RCS total flowrate shall be ≥ 133.5 E6 lb/hr with four RCPs operating, or ≥ 99.7 E6 lb/hr, with three RCPs operating (ITS limit).

These limits are referred to by SR 3.4.1.3

Refueling Boron Concentration

The boron concentration must be greater than 2879 ppmb.

The value includes 1 %Δk/k for uncertainties and is based on a 660 EFPD 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.

The Mode 6 Boron Concentration for Cycle 13 shutdown and offload must be greater than 1384 ppmb.

The value includes 1 %Δk/k for uncertainties and is based on a 675 EFPD cycle 13.

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

Revision History

Revision 0 - September 2001; Original Cycle 13 COLR.

Revision 1 - August 2002; Incorporation of ITS Amendment 204 (LAR #263), "Relocation of Reactor Coolant System Parameters to the Core Operating Limits Report and 20% Steam Generator Tube Plugging."

Revision 1 adds the RCS Variable Low Pressure Setpoint Equation for use in Table 3.3.1-1, Item5, the RCS Pressure DNB Limits for use in SR 3.4.1.1, the RCS Temperature DNB Limits for use in SR 3.4.1.2, and the RCS Flow Rate DNB Limits for use in SR 3.4.1.3. The revision of BAW-2391, the Crystal River Unit 3 Cycle 13 Reload Report, referenced in Section 1.0 is also updated.

Revision 1 is produced under EGR-NGGC-0017 whereas Revision 0 was produced under NEP-213.

Revision 1 modifies the header and removes the footer.

Revision 2 - September 2003; Changes implementing Cycle 13 cycle operating window from 690 EFPD to 693 EFPD per EC 54359. Addition of Mode 6 Boron Concentration for Cycle 13 shutdown and offload.