Progress Energy

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

Ref: ITS 5.6.2.18(d)

October 23, 2007
3F1007-14

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

Subject: Crystal River Unit 3 – Core Operating Limits Report, Cycle 15, Revision 2

Reference: Crystal River Unit 3 to NRC letter dated December 1, 2005, "Crystal River Unit 3 – Core Operating Limits Report, Cycle 15, Revision 0 and Revision 1"

Dear Sir:

Florida Power Corporation, doing business as Progress Energy Florida, Inc., hereby submits the Crystal River - Unit 3 (CR-3) Core Operating Limits Report (COLR), Cycle 15, Revision 2, as required by Improved Technical Specifications (ITS) 5.6.2.18(d).

Revision 2 adds the end of Cycle 15 Refueling Boron Concentration to the COLR to support the upcoming Refueling Outage 15 at CR-3.

No new regulatory commitments are made in this letter.

If you have any questions regarding this submittal, please contact Mr. Dennis Herrin, Acting Supervisor, Licensing and Regulatory Programs at (352) 563-4633.

Sincerely,

Stephen J. Cahill
Engineering Manager

SJC/dar

Attachment: Core Operating Limits Report, Cycle 15, Revision 2

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

A001

NRR

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, Cycle 15, Revision 2

Progress Energy - Florida
Crystal River Unit 3

Cycle 15
Core Operating Limits Report
Revision 2

Referencing
Improved Technical Specifications

1.0 Core Operating Limits

The analytical methods used to determine the core protective and operating limits shall be those previously reviewed and approved by the NRC. These methods are documented in the following topical reports and Technical Specification Amendments:

Safety Criteria and Methodology for Acceptable Cycle Reload Analyses, BAW-10179P-A, Rev. 5, Framatome-ANP, Lynchburg, Virginia, December 2004.

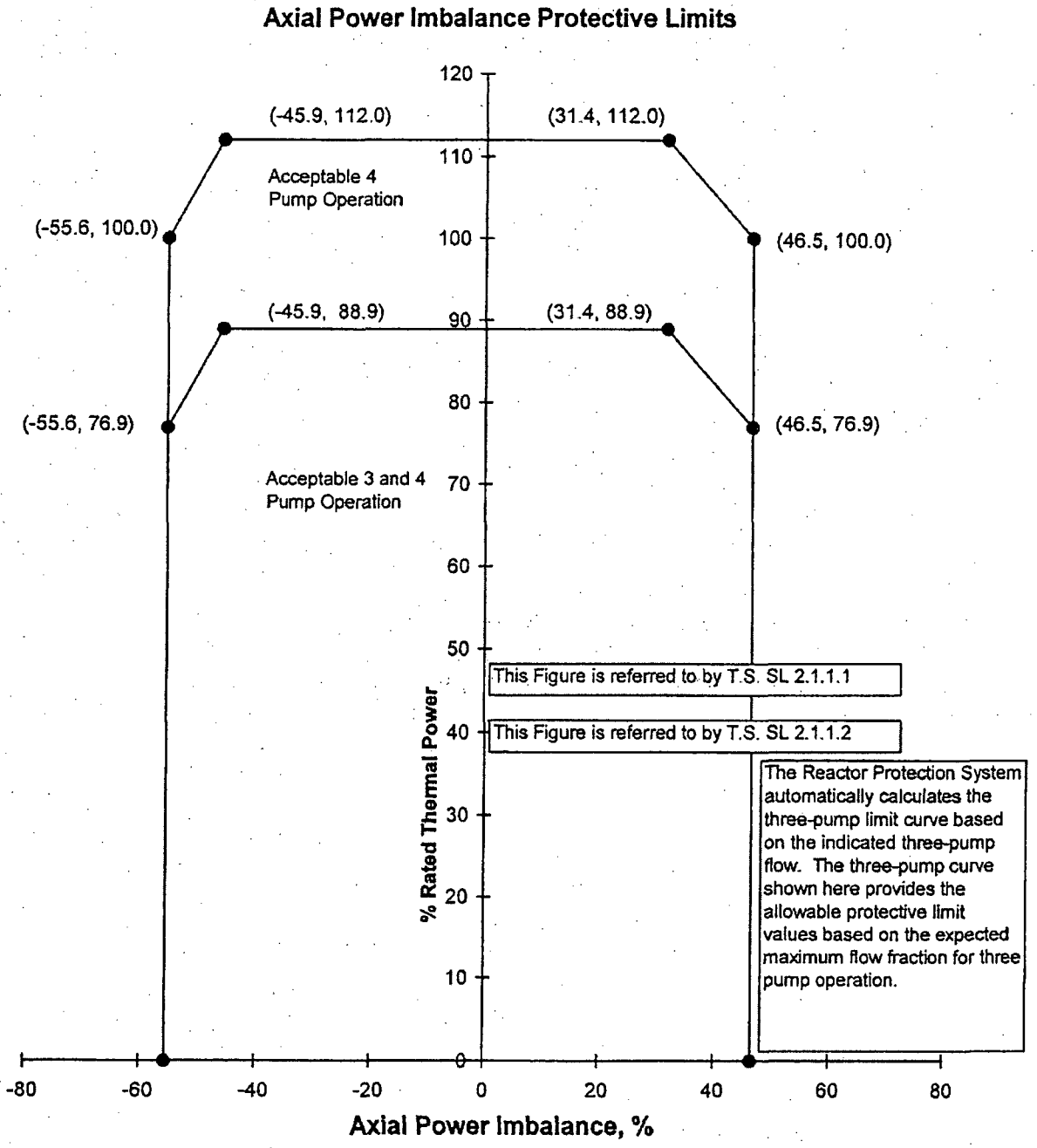
"Crystal River Unit 3 - Issuance of Amendment Re Dual Channel Control Rod Position Indication (TAC No M82990)," Licensing Amendment No 144, letter from H Silver to P M Beard, June 25, 1992.

The Cycle 15 limits generated using the methodologies above are documented in BAW-2492 Rev. 1, "Crystal River Unit 3 Cycle 15 Reload Report", dated November 2005.

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 (MTC)
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 (APSR) 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 (RPS) Instrumentation
SR 3.4.1.1	Reactor Coolant System Pressure DNB Limits
SR 3.4.1.2	Reactor Coolant System Temperature DNB Limits
SR 3.4.1.3	Reactor Coolant System Flow DNB Limits
LCO 3.9.1	Boron Concentration

AXIAL POWER IMBALANCE Protective Limits



SHUTDOWN MARGIN

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

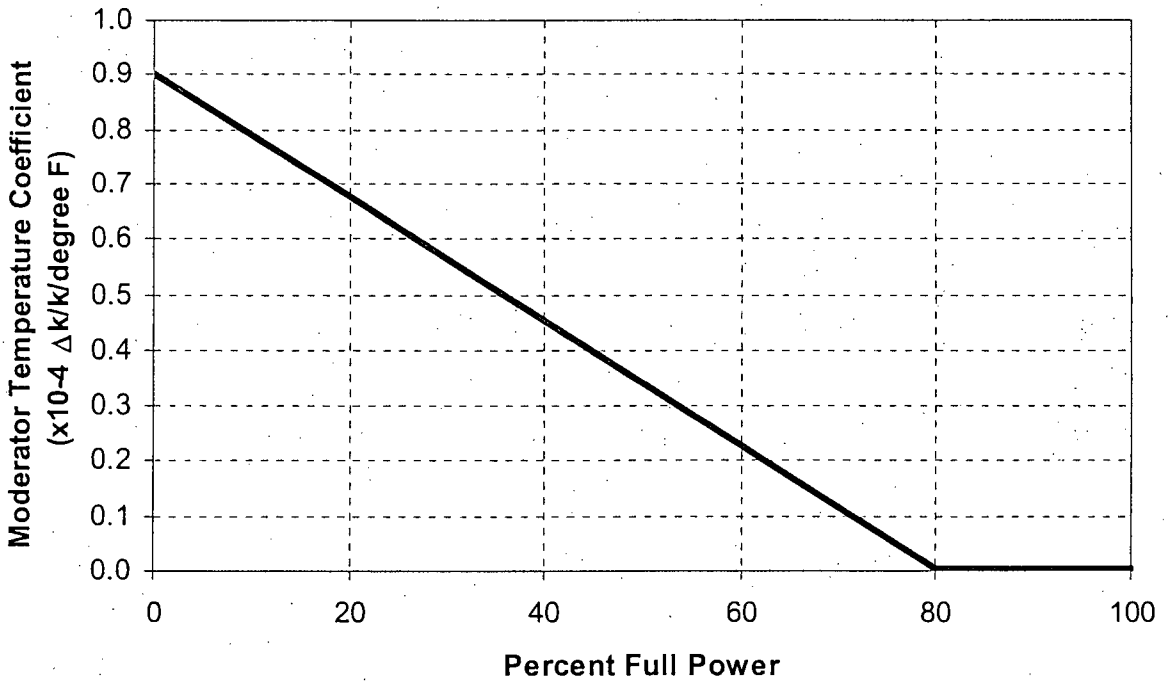
Reference: Improved Technical Specification Bases B3.1.1.

Moderator Temperature Coefficient Limit (MTC)

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

Upper Limit
MTC $\leq$ The curve below:

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 (API)/ Relative Position Indicator (RPI) Agreement Limits

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

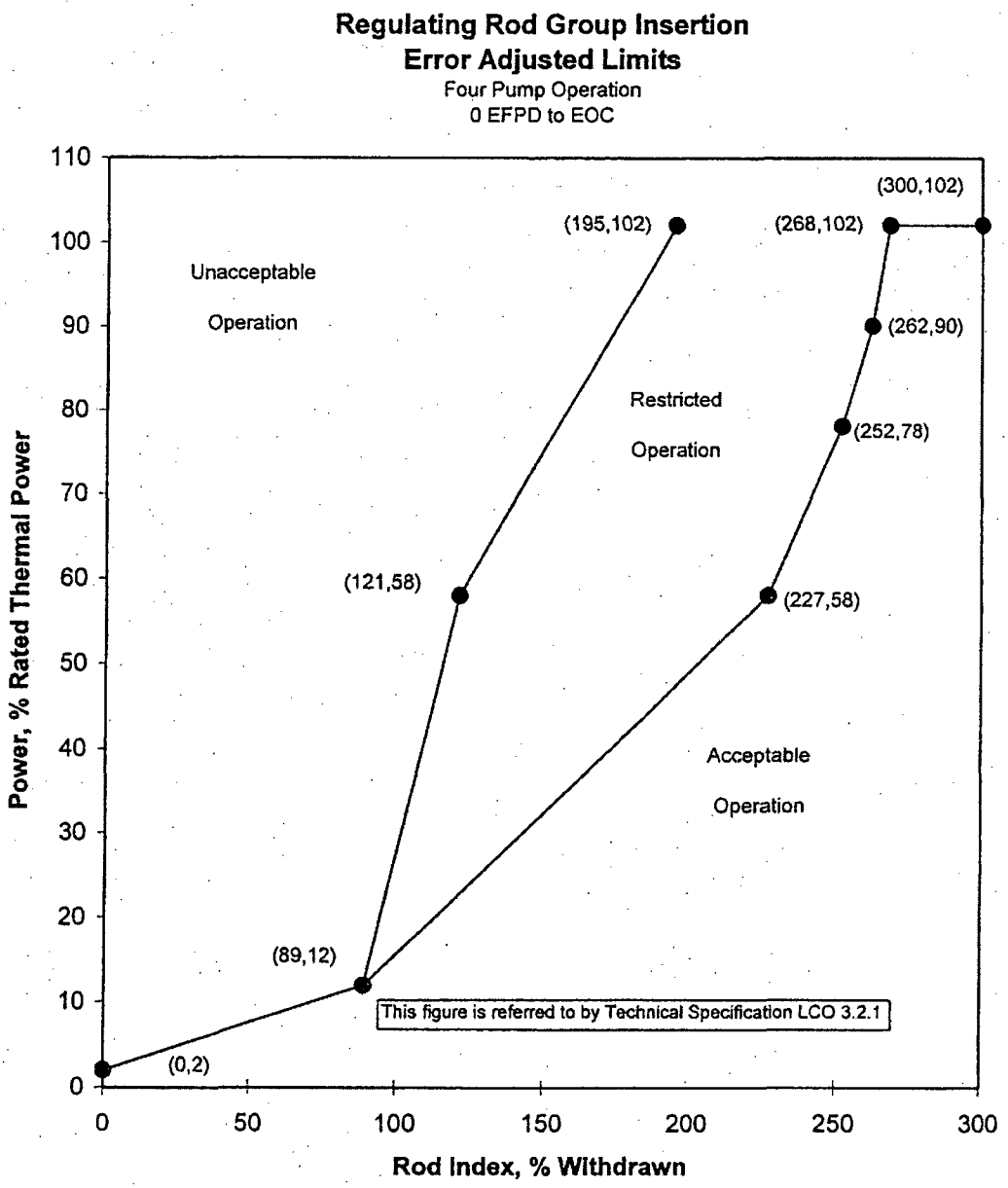
3.5% when the comparison is performed using the panel meters on the main control board.

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.

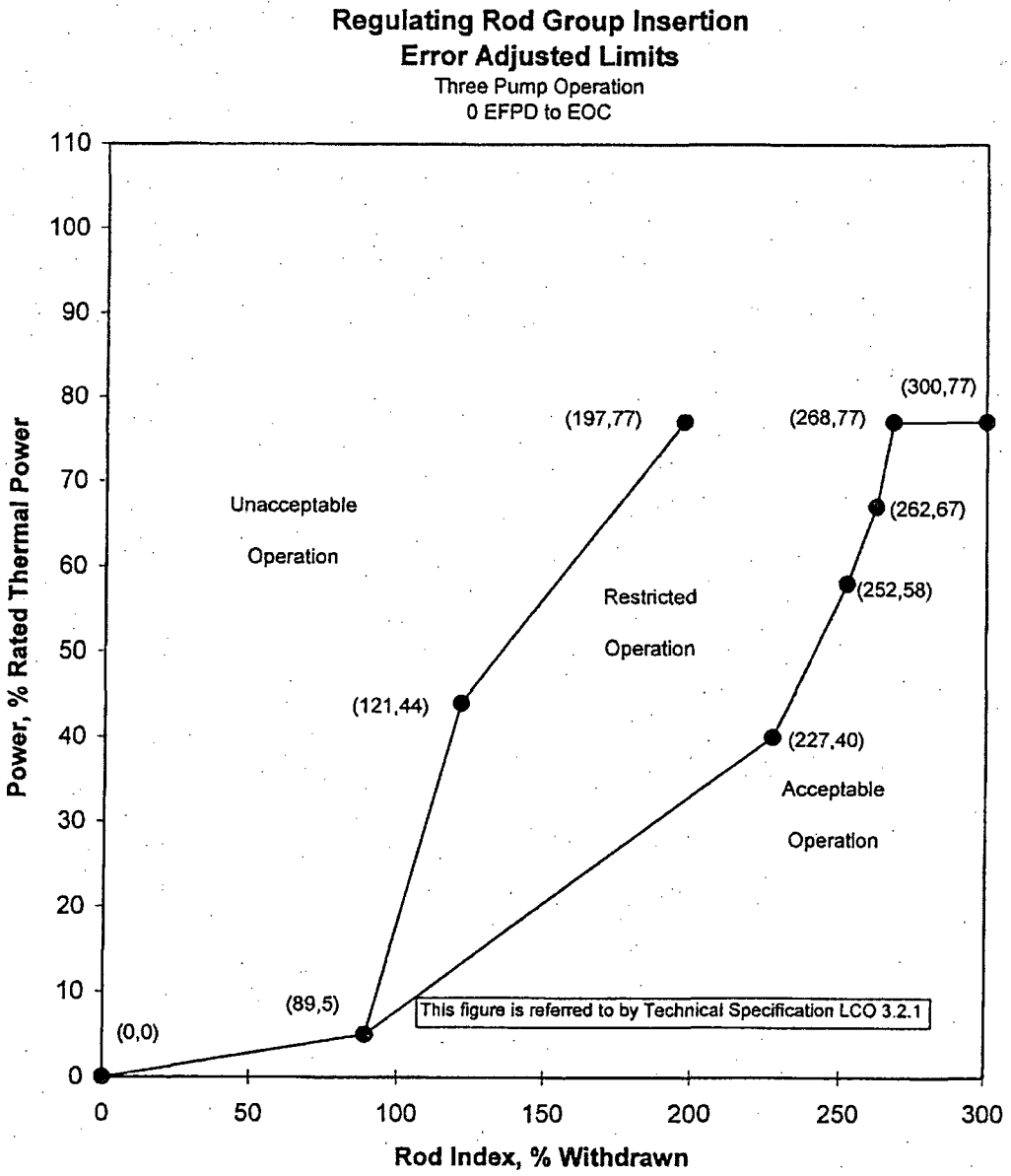
Note 1 If the plant computer is not available, then the following meter models are approved for use: Keithley 2001, Keithley 197, Keithley 197A (Ref. EC 61264).

Regulating Rod Insertion Limits



Note 1: A Rod group overlap of 25 ±5% between sequential groups 5 and 6, and 6 and 7 shall be maintained

Regulating Rod Insertion Limits (Continued)



Note 1: A Rod group overlap of 25 ±5% between sequential groups 5 and 6, and 6 and 7 shall be maintained

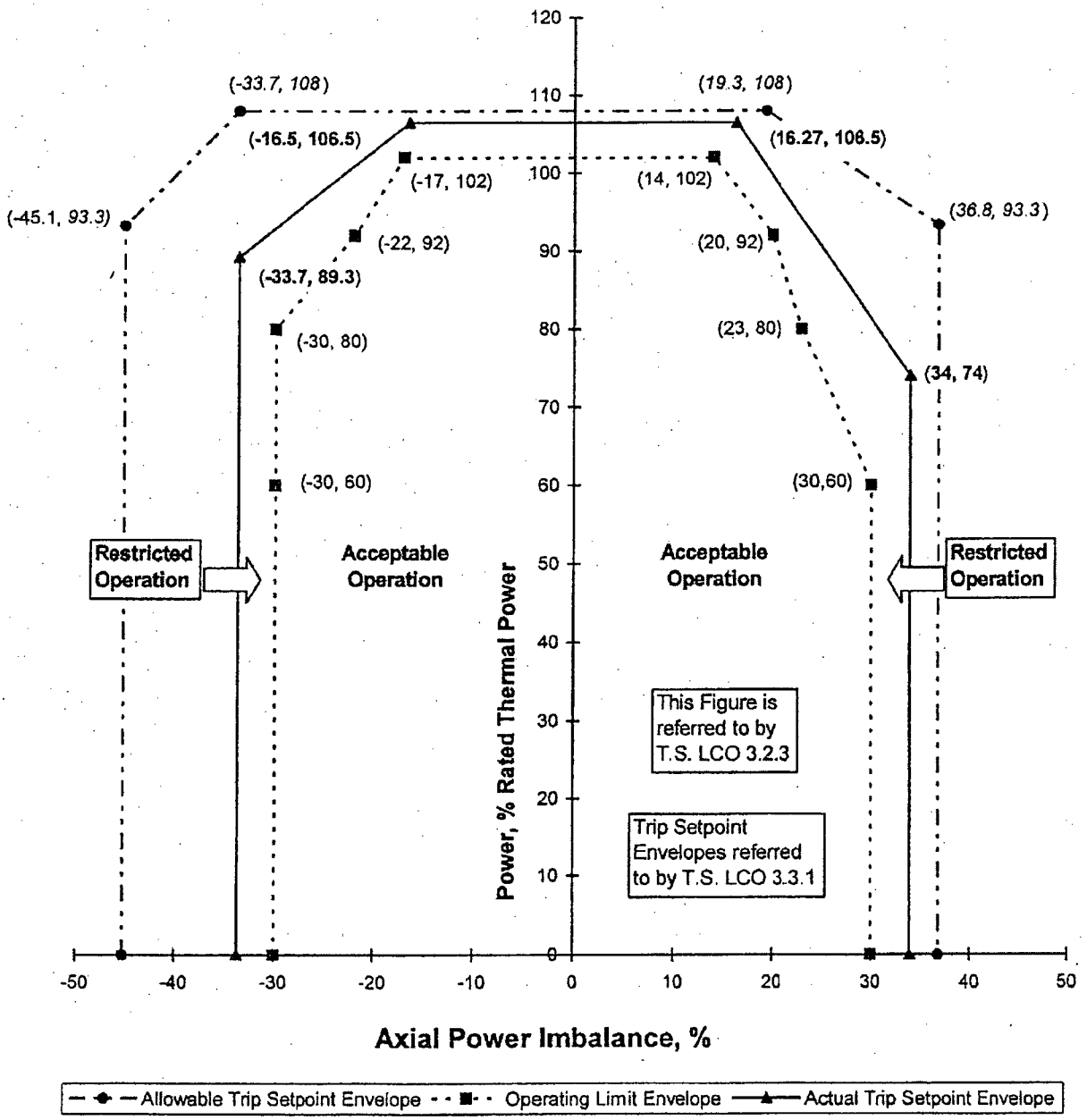
AXIAL POWER SHAPING ROD (APSR) Insertion Limits

The Axial Power Shaping Rods (APSRs) shall be inserted at the initial startup following fuel reload and may be positioned as necessary during the Power Imbalance Detector Correlation (PIDC) test. The APSRs shall be fully withdrawn from the core before exceeding 4 EFPD and prior to thermal power escalation above 80% RTP. Once the APSR pull maneuver has been completed, the APSRs shall not be inserted for the remainder of the fuel cycle during normal operation.

These limits are referred to by Technical Specification LCO 3.2.2

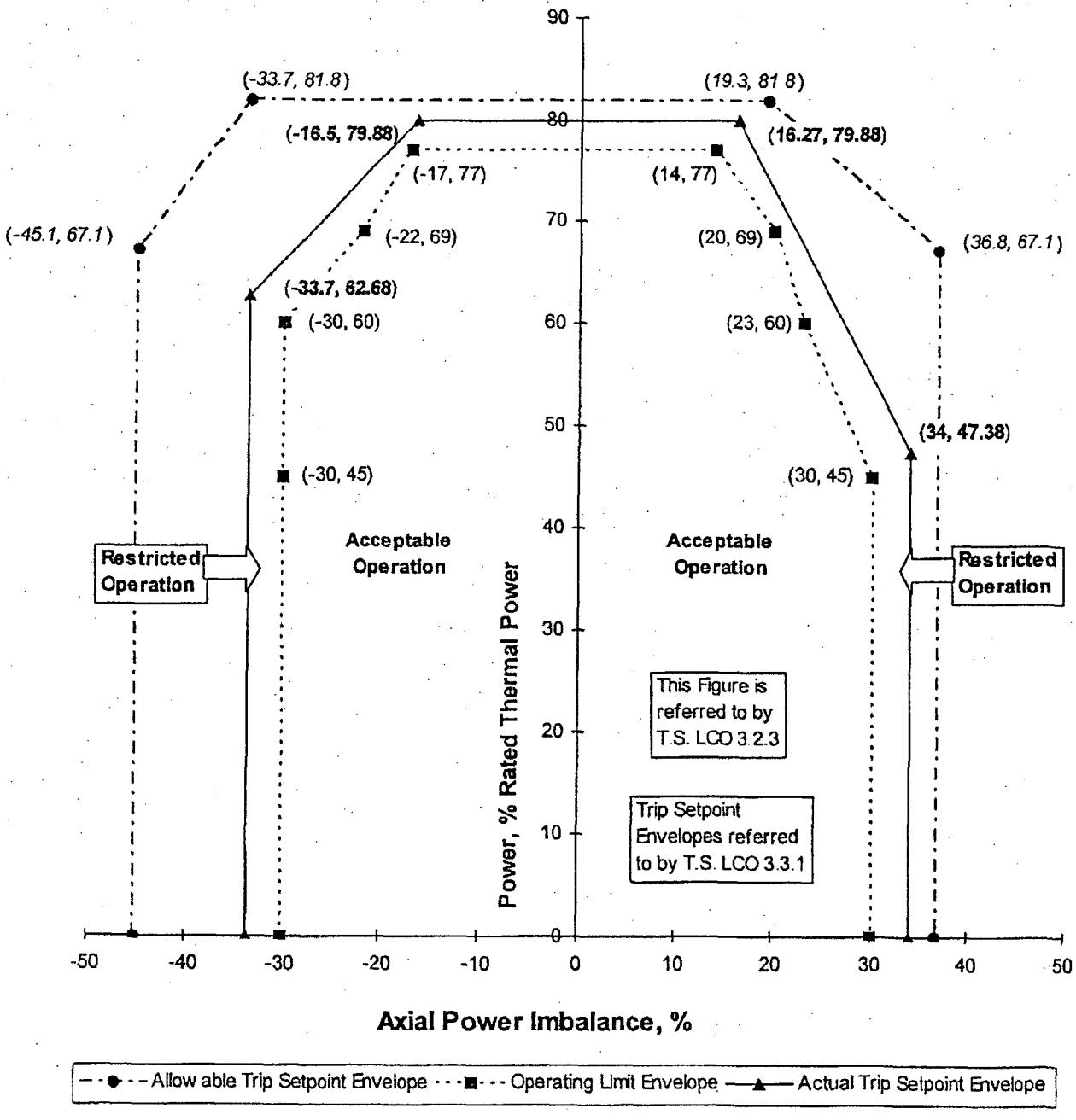
AXIAL POWER IMBALANCE Operating Limits

Axial Power Imbalance Error Adjusted
Operating Limit and Trip Setpoint Envelopes
Four Pump Operation
0 EFPD to EOC



AXIAL POWER IMBALANCE Operating Limits (Continued)

Axial Power Imbalance Error Adjusted
Operating Limit and Trip Setpoint Envelopes
Three Pump Operation
0 EFPD to EOC



QUADRANT POWER TILT

QUADRANT POWER TILT Limits For Thermal Power ≤ 60%

For Operation from 0 EFPD to EOC

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 EOC

QUADRANT POWER TILT As Measured By:	STEADY-STATE LIMIT(%)	TRANSIENT LIMIT(%)	MAXIMUM LIMIT(%)
Symmetrical Incore Detector System	4.44	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 (for NAS)

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} = 5.9476 kW/ft for Batches 14D2 and 15E2 Mark-B10I fuel

LHR^{avg} = 5.8533 kW/ft for Batch 16 Mark-B-HTP fuel

LHR^{avg} = 5.8636 kW/ft for Batch 17 Mark-B-HTP fuel

P = ratio of THERMAL POWER / RATED THERMAL POWER

Bu = fuel burnup (MWd/mtU)

CR-3 Cycle 15 Reload Allowable LHR Limits
Batch 17F (Mark-B-HTP) LHR^{allow}
Allowable Peak LHR for Specified Burnup, kW/ft

NAS Level	0-725 EFPD 13396 – 35028 MWd/mtU
1	15.3
2	15.6
3	16.2
4	16.4
5	16.8
6	16.5
7	15.9
8	15.6

This table is referred to by Technical Specification LCO 3.2.5

Power Peaking Factors (Continued)

CR-3 Cycle 15 Reload Allowable LHR Limits
Batch 17A, B, C, D, & E (Mark-B-HTP) LHR^{allow}
Allowable Peak LHR for Specified Burnup, kW/ft

NAS Level	0-725 EFPD 13396 – 35028 MWd/mtU
1	15.4
2	15.7
3	16.3
4	16.5
5	17.1
6	16.8
7	16.2
8	15.9

CR-3 Cycle 15 Reload Allowable LHR Limits
Batch 16B, C, D, E, & F (Mark-B-HTP) LHR^{allow}
Allowable Peak LHR for Specified Burnup Range, kW/ft

NAS Level	0-423 EFPD 13396 – 26016 MWd/mtU	423-500 EFPD 26016 – 28314 MWd/mtU	500-600 EFPD 28314 – 31298 MWd/mtU	600-650 EFPD 31298 – 32790 MWd/mtU	650-725 EFPD 32790 – 35028 MWd/mtU
1	15.6	15.4	15.1	15.0	14.8
2	15.9	15.6	15.3	15.1	14.9
3	16.5	16.1	15.7	15.5	15.2
4	16.7	16.4	15.9	15.7	15.3
5	17.1	16.6	16.1	15.8	15.4
6	16.8	16.4	15.9	15.7	15.3
7	16.2	15.8	15.5	15.3	15.0
8	15.9	15.6	15.3	15.1	14.9

These tables are referred to by Technical Specification. LCO 3.2.5

Power Peaking Factors (Continued)

CR-3 Cycle 15 Reload Allowable LHR Limits
Batch 16A (Mark-B-HTP) LHR^{allow}
Allowable Peak LHR for Specified Burnup, kW/ft

NAS Level	0-725 EFPD 13396 – 35028 MWd/mtU
1	15.3
2	15.6
3	16.2
4	16.4
5	16.8
6	16.5
7	15.9
8	15.6

CR-3 Cycle 15 Reload Allowable LHR Limits
Batch 14D2 and 15E2 (Mark-B10I) LHR^{allow}
Allowable Peak LHR for Specified Burnup Range, kW/ft

NAS Level	0-150 EFPD 13396 – 17871 MWd/mtU	150-300 EFPD 17871 – 22347 MWd/mtU	300-450 EFPD 22347 – 26822 MWd/mtU	450-600 EFPD 26822 – 31298 MWd/mtU	600-725 EFPD 31298 – 35028 MWd/mtU
1	14.4	14.1	13.5	12.9	12.3
2	14.6	14.3	13.6	13.0	12.3
3	15.0	14.7	14.0	13.1	12.4
4	15.1	14.7	14.0	13.1	12.4
5	15.2	14.8	14.1	13.2	12.5
6	15.0	14.7	14.0	13.2	12.4
7	14.6	14.3	13.6	13.0	12.3
8	14.4	14.1	13.5	12.9	12.3

These tables are referred to by Technical Specification. LCO 3.2.5

Power Peaking Factors (Continued)

This Limit is referred to by Technical Specification LCO 3.2.5

Enthalpy Rise Hot Channel Factor $F^N_{\Delta H}$ (for NAS)

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

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 15 Allowable Radial Peaks (ARP)

Axial Peak	Axial Location[1] (X/L)	ARP[2]	Axial Peak	Axial Location[1] (X/L)	ARP[2]
1.1	0.00	1.9281	1.5	0.00	1.9790
1.1	0.10	1.9264	1.5	0.10	1.9041
1.1	0.14	1.9262	1.5	0.14	1.8847
1.1	0.20	1.9254	1.5	0.20	1.9034
1.1	0.40	1.9240	1.5	0.40	1.9694
1.1	0.60	1.9229	1.5	0.60	1.8275
1.1	0.80	1.9224	1.5	0.80	1.6786
1.1	0.88	1.9000	1.5	0.88	1.6328
1.1	0.90	1.8798	1.5	0.90	1.6358
1.1	1.00	1.8000	1.5	1.00	1.5712
1.2	0.00	2.0085	1.7	0.00	1.7737
1.2	0.10	2.0050	1.7	0.10	1.6867
1.2	0.14	2.0046	1.7	0.14	1.6635
1.2	0.20	2.0035	1.7	0.20	1.6795
1.2	0.40	2.0008	1.7	0.40	1.7622
1.2	0.60	1.9993	1.7	0.60	1.6947
1.2	0.80	1.8783	1.7	0.80	1.5617
1.2	0.88	1.8304	1.7	0.88	1.5218
1.2	0.90	1.8185	1.7	0.90	1.5308
1.2	1.00	1.7394	1.7	1.00	1.4687
1.3	0.00	2.0936	1.9	0.00	1.6083
1.3	0.10	2.0878	1.9	0.10	1.5149
1.3	0.14	2.0874	1.9	0.14	1.4891
1.3	0.20	2.0858	1.9	0.20	1.5027
1.3	0.40	2.0827	1.9	0.40	1.5812
1.3	0.60	1.9721	1.9	0.60	1.5791
1.3	0.80	1.8095	1.9	0.80	1.4620
1.3	0.88	1.7599	1.9	0.88	1.4259
1.3	0.90	1.7547	1.9	0.90	1.4364
1.3	1.00	1.6824	1.9	1.00	1.3811

[1]Based on an active core height of 142.75 inches. Linear interpolation is acceptable.
[2]These limits have been increased to reflect the 3.8% peaking uncertainty treated by SCD.

Reactor Protection System (RPS) Instrumentation

RCS Variable Low Pressure Setpoint Equation

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

This limit is referred to by ITS Table 3.3.1-1, Item 5

Reactor Coolant System DNB Pressure Limits

RCS loop pressure ≥ 2064 psig

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

These limits are referred to by SR 3.4.1.1

Reactor Coolant System DNB Temperature Limit

RCS Hot Leg Temperature $\leq$ 605.8°F

(Assumes 20% OTSG tube plugging).

These limits are referred to by SR 3.4.1.2

Reactor Coolant System DNB Flow Rate Limits

RCS total flow rate ≥ 133.5 E6 lb/hr with four RCPs operating, or ≥ 99.7 E6 lb/hr with three RCPs operating.

(Assumes 20% OTSG tube plugging).

These limits are referred to by SR 3.4.1.3

Boron Concentration

The refueling boron concentration must be greater than 2755 ppmB.

The value includes 1%Δk/k for uncertainties and is based on a 698 EFPD cycle 14. The refueling boron concentration must be increased by 2 ppm for each EFPD that the cycle 14 length is less than 698 EFPD, and 1 ppm/EFPD may be deducted for each EFPD that the cycle 14 length is more than 698 EFPD.

The Mode 6 refueling boron concentration must be greater than 1522 ppmB for the cycle 15 core configuration or during offload of the cycle 15 core, subject to the following:

1) allowances are included for a cycle 15 length as short as 643 EFPD;
2) must be corrected for the actual expected ^{10}B isotopic atom percent if less than the basis of 19.8 ^{10}B isotopic atom percent;
3) no allowance is included for intermediate cycle 15 core locations;
4) control rod assemblies and APSR's do not affect the required refueling boron concentration.

This limit is referred to by Technical Specification LCO 3.9.1

Revision History

Revision 0 – November 2005; Original Cycle 15 COLR.

Revision 1 – November 2005; Revision to include Batch 14D2 into Heat Flux Hot Channel Factor F_Q due to core redesign. Additionally the LHR^{avg} values for Mark-B-HTP fuel were updated with Batch specific values.

Revision 2 – September 2007; Cycle 15 COLR update to add Mode 6 refueling boron concentration.