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September 18, 2001

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Document Control Desk

Subject: Core Operating Limits Report (GGNS-MS-48.0, Revision 10)
Grand Gulf Nuclear Station
Unit 1
Docket No. 50-416
License No. NPF-29

Reference: GNRI-2001/00116, Technical Specification Amendment 148

GNRO-2001/00072

Ladies and Gentlemen:

Entergy Operations, Inc. is submitting for your use and information Revision 10 of the Core Operating Limits Report (COLR) for Grand Gulf Nuclear Station (GGNS).

GGNS Cycle-specific reload parameters for MCPR, LHGR, and MAPLHGR operating limits are controlled by the Mechanical Standard, GGNS-MS-48.0, called the Core Operating Limits Report for COLR.

Necessary COLR changes have been incorporated in accordance with approved Technical Specification changes (Referenced above).

The analytical methods used to determine the Cycle 12 core operating limits were previously approved by the NRC and are listed in Technical Specification 5.6.5.

This letter does not contain any commitments.

If you have any questions or require additional information, please contact Rita Jackson at (601) 437-2149.

Yours truly,

JCR/RRJ/amt
attachment: GGNS Core Operating Limits Report
cc:

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Standard No.: GGNS-MS-48.0
Revision: 10
Date: Sept. 5, 2001

GRAND GULF NUCLEAR STATION

CORE OPERATING LIMITS REPORT

SAFETY-RELATED

GRAND GULF NUCLEAR STATION **NUCLEAR PLANT ENGINEERING**

REVIEW AND APPROVAL SHEET

STANDARD NO.: GGNS-MS-48.0 REVISION: 10

STANDARD TITLE: Core Operating Limits Report

This document specifies items related to nuclear safety YES [X] NO [ ]

This document contains Special Requirements YES [ ] NO [X]

Signatures certify that the above standard was originated, verified, reviewed or waived and approved as noted below:

ORIGINATED BY: Scott Stanchfield DATE: 9/4/01

VERIFIED BY: Guy B. Spikes DATE: 9/5/01

REVIEWED BY: M. D. Withrow DATE: 9/5/01
Group Supervisor

DESIGN ENGINEERING SECTION	REVIEWED BY	REVIEW WAIVED BY	DATE
ELECTRICAL/I&C	N/A	A Banfield	9/5/01
MECHANICAL/CIVIL	N/A	A Banfield	9/5/01
ENGINEERING PROGRAMS	N/A	M. D. Withrow	9/5/01
SAFETY ANALYSIS	M. D. Withrow		9/5/01

ANII: N/A DATE:
(Insert N/A if not applicable)

APPROVED BY: M. D. Withrow DATE: 9/5/01
Responsible Manager

REVISION STATUS SHEET

STANDARD REVISION SUMMARY

REVISION	ISSUE DATE	DESCRIPTION
0	April 1, 1993	Issued for Cycle 6
1	November 12, 1993	Issued for Cycle 7
2	August, 26, 1994	Revised for Cycle 7 to update references for QDR 0159-94
3	May 18, 1995	Issued for Cycle 8
4	November 18, 1996	Issued for Cycle 9
5	July 31, 1997	Revised for Cycle 9 per GGCR1997-0074-00
6	May 11, 1998	Issued for Cycle 10
7	November 17, 1999	Issued for Cycle 11
8	May 9, 2000	Issued for E1A stability solution implementation (GNRI-2000/00004)
9	April 30, 2001	Issued for Cycle 12
10	Sept. 5, 2001	Revised for Cycle 12 to incorporate additional limits associated with EOC-RPT out of service. Incorporates applicable changes of SCN 01/0001

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PAGE REVISION STATUS

PAGE NO.	REVISION	PAGE NO.	REVISION
i	10	1	10
ii	10	2	10
iii	deleted	3	10
iv	deleted	4	9
v	10	5	9
vi	9	6	10

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APPENDIX/ATTACHMENT STATUS

ATTACHMENT NO.	REVISION	APPENDIX NO.	REVISION
1	4		
2	4		
3	4		
4	0		

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1.0 PURPOSE

On October 4, 1988, the NRC issued Generic Letter 88-16 [1] encouraging licensees to remove cycle-specific parameter limits from Technical Specifications and to place these limits in a formal report to be prepared by the licensee. As long as the parameter limits were developed with NRC-approved methodologies, the letter indicated that this would remove unnecessary burdens on licensee and NRC resources.

On October 29, 1992, Entergy Operations submitted a Proposed Amendment to the Grand Gulf Operating License requesting changes to the GGNS Technical Specifications to remove certain reactor physics parameter limits that change each fuel cycle [2]. This amendment committed to placing these operating limits in a separate Core Operating Limits Report (COLR) which is defined in Technical Specifications. This PCOL was approved by the NRC by SER dated January 21, 1993 [3].

The COLR is controlled via Mechanical Standard GGNS-MS-48.0. This standard is revised accordingly for each fuel cycle or remaining portion of a fuel cycle. Revision 10 of the COLR reports the Cycle 12 core operating and stability limits.

2.0 SCOPE

As defined in Technical Specification 1.1, the COLR is the GGNS document that provides the core operating limits for the current fuel cycle. This document is prepared in accordance with Technical Specification 5.6.5 for each reload cycle using NRC-approved analytical methods.

The Cycle 12 core operating and stability limits included in this report are:

- the Average Planar Linear Heat Generation Rate (APLHGR),
- the Minimum Critical Power Ratio (MCPR) (including EOC-RPT inoperable),
- the Linear Heat Generation Rate (LHGR) limit, and
- the E1A stability limits.

Operating limits are not included for EOC-RPT inoperable coincident with core average exposure greater than MOC (30,840 MWd/MTU).

3.0 REFERENCES

This section contains the background and cycle-specific references used in the safety analysis of Grand Gulf Cycle 12.

BACKGROUND REFERENCES:

1. MAEC-88/0313, Generic Letter 88-16, "Removal of Cycle-Specific Parameter Limits from Technical Specifications", October 4, 1988.
2. GNRO-92-00093, Proposed Amendment to Grand Gulf Operating License, PCOL-92/07, dated October 29, 1992.
3. GNRI-93-0008, Amendment 106 to Grand Gulf Operating License, January 21, 1993.

CURRENT CYCLE REFERENCES:

4. GEXI 2001-00049, K.V. Walters to J.B. Lee, "Transmittal of EMF-2541, Revision 1 (Grand Gulf Nuclear Station Cycle 12 Reload Analysis)," dated April 25, 2001.
5. GEXI 2000-00043, R.E. Kingston to J.B. Lee, "Transmittal of GGNS LHGR/MAPLHGR Relaxation Results," dated October 23, 2000.
6. GEXI 2001-00050, K.V. Walters to J.B. Lee, "Transmittal of EMF-2552(P), Revision 1 (Grand Gulf Nuclear Station Cycle 12 Plant Transient Analysis)," dated April 25, 2001.
7. GEXI 97-00035, R.E. Kingston to J.B. Lee, "Utilization of Power and Flow Dependent MAPLHGR and LHGR Limits," dated June 27, 1997.
8. NEDC-32910P, Grand Gulf Nuclear Station SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis With Relaxed ECCS Parameters, dated September 1999.
9. CEO 2000-00094, Jim Head to M.D. Withrow, "Revised E1A Related COLR Input," dated April 20, 2000.
10. GEXI 2001-00085, K.V. Walters to J.B Lee, "Grand Gulf Nuclear Station Cycle 12 Interim Startup and Operations Report," dated April 30, 2001.
11. GEXI 2001-00108, K.V. Walters to J.B. Lee, "Grand Gulf Nuclear Station Cycle 12 Operating Limits for EOC-RPT Assumed Inoperable," dated August 9, 2001.
12. GEXI 2001-00114, K.V. Walters to J.B. Lee, "Grand Gulf Nuclear Station Cycle 12 Operating Limits for EOC-RPT Assumed Inoperable with FHOOS," dated August 24, 2001.

4.0 DEFINITIONS

1. Average Planar Linear Heat Generation Rate (APLHGR) - the APLHGR shall be applicable to a specific planar height and is equal to the sum of the linear heat generation rates for all the fuel rods in the specified bundle at the specified height divided by the number of fuel rods in the fuel bundle.
2. Average Planar Exposure - the Average Planar Exposure shall be applicable to a specific planar height and is equal to the sum of the exposure of all the fuel rods in the specified bundle at the specified height divided by the number of fuel rods in the fuel bundle.
3. Critical Power Ratio (CPR) - the ratio of that power in the assembly, which is calculated by application of the fuel vendor's appropriate boiling correlation, to cause some point in the assembly to experience boiling transition, divided by the actual assembly operating power.
4. Core Operating Limits Report (COLR) - The Grand Gulf Nuclear Station specific document that provides core operating limits for the current reload cycle in accordance with Technical Specification 5.6.5.
5. Linear Heat Generation Rate (LHGR) - the LHGR shall be the heat generation per unit length of fuel rod. It is the integral of the heat flux over the heat transfer area associated with the unit length.
6. Minimum Critical Power Ratio (MCPR) - the MCPR shall be the smallest CPR which exists in the core.
7. MCPR Safety Limit - the minimum value of the CPR at which the fuel could be operated with the expected number of rods in boiling transition not exceeding 0.1% of the fuel rods in the core.
8. Aligned Drive Flow – Adjusted FCTR card input drive flow signal that accounts for actual variations in the core flow to drive flow relationship.
9. Monitored Region – The area of the core power and flow operating domain where the reactor may be susceptible to reactor instabilities under conditions exceeding the licensing basis of the current reactor system.
10. Restricted Region – The area of the core power and flow operating domain where the reactor is susceptible to reactor instabilities in the absence of restrictions on core void distributions.
11. Setpoint "Setup" – A FCTR card feature that sets the normal "non-setup" E1A APRM flow–biased scram and control rod block trip reference setpoints associated with the Exclusion and Restricted Regions higher to permit required reactor maneuvering in the Restricted Region when stability controls are in effect.
12. Beginning of Cycle (BOC) – The nominal Cycle 12 BOC core average exposure (CAE) is assumed to be 19,658 MWd/MTU [4], which is conservative considering the actual Cycle 12 BOC CAE is 19,609 MWd/MTU [10].
13. Middle of Cycle (MOC) – The Cycle 12 MOC CAE is 30,840 MWd/MTU [4], which corresponds to a cycle exposure of 11,182 MWd/MTU (30,840-19,658).
14. End of Cycle (EOC) – The Cycle 12 EOC CAE is 32,536 MWd/MTU [4], which corresponds to a cycle exposure of 12,878 MWd/MTU (32,536-19,658).

15. Extended End of Cycle (EEOC) – The Cycle 12 EEOC CAE is 33,388 MWd/MTU [4], which corresponds to a cycle exposure of 13,730 MWd/MTU (33,388-19,658).

5.0 GENERAL REQUIREMENTS

The attached core operating limits are applicable for operation in the Maximum Extended Operating Domain (MEOD).

5.1 Average Planar Linear Heat Generation Rates

Consistent with Technical Specification 3.2.1, all APLHGRs for ATRIUM10 bundles shall not exceed the limits reported in Attachment 1 as a function of exposure [4,11,12]. All APLHGRs for GE11 lattices shall not exceed the MAPLHGR limits reported in Reference 5 as a function of exposure multiplied by the smaller of either the power-dependent or flow-dependent MAPLHGR factors reported in Attachment 1 [4,11,12]. For each GE11 bundle type, Attachment 1 reports the MAPLHGR for the most limiting enriched lattice at each exposure for reference purposes.

For Cycle 12 Single Loop Operation (SLO), a SLO MAPLHGR multiplier of 0.87 is required for ATRIUM-10 fuel [4]. However, there is no SLO MAPLHGR multiplier required for GE11 fuel since the flow-dependent MAPLHGR factor reported in Figure 1-4 at the maximum SLO core flow is less than the SLO multipliers applied in the LOCA analysis [8].

5.2 Minimum Critical Power Ratio

Consistent with Technical Specification 3.2.2, the MCPR shall be equal to or greater than the limits reported in Attachment 2 as functions of power, flow, and exposure [4,11,12]. Attachment 2 provides MCPR limits for normal feedwater temperature as well as reduced feedwater temperature due to operation with feedwater heaters out of service (FHOOS). Reference 6 indicates that the normal feedwater temperature limits in Attachment 2 are applicable for feedwater temperatures as low as 411.5 °F considering the power uprate feedwater temperature of 421.5 °F [4].

Attachment 2 also contains the MCPR limits required for Single Loop Operation [4,11,12] and for operation with the EOC-RPT function inoperable [11,12].

5.3 Linear Heat Generation Rate

Consistent with Technical Specification 3.2.3, the LHGR for ATRIUM10 bundles shall not exceed the limits reported in Attachment 3 as a function of exposure multiplied by the smaller of either the power-dependent or flow-dependent LHGR factors reported in Attachment 3 [4,11,12]. All LHGRs for GE11 lattices shall not exceed the LHGR limits reported in References 5 as a function of exposure multiplied by the smaller of either the power-dependent or flow-dependent LHGR factors reported in Attachment 3 [4,7,11,12]. For each GE11 bundle type, Attachment 3 reports the LHGR for the most limiting enriched lattice at each exposure for reference purposes.

5.4 Stability

The stability regions and allowable values specified in Technical Specifications are reported in Attachment 4 [9]. Since the maximum licensed GGNS feedwater temperature reduction is 50 °F at rated power operation, an alternate set of stability limits is not required.

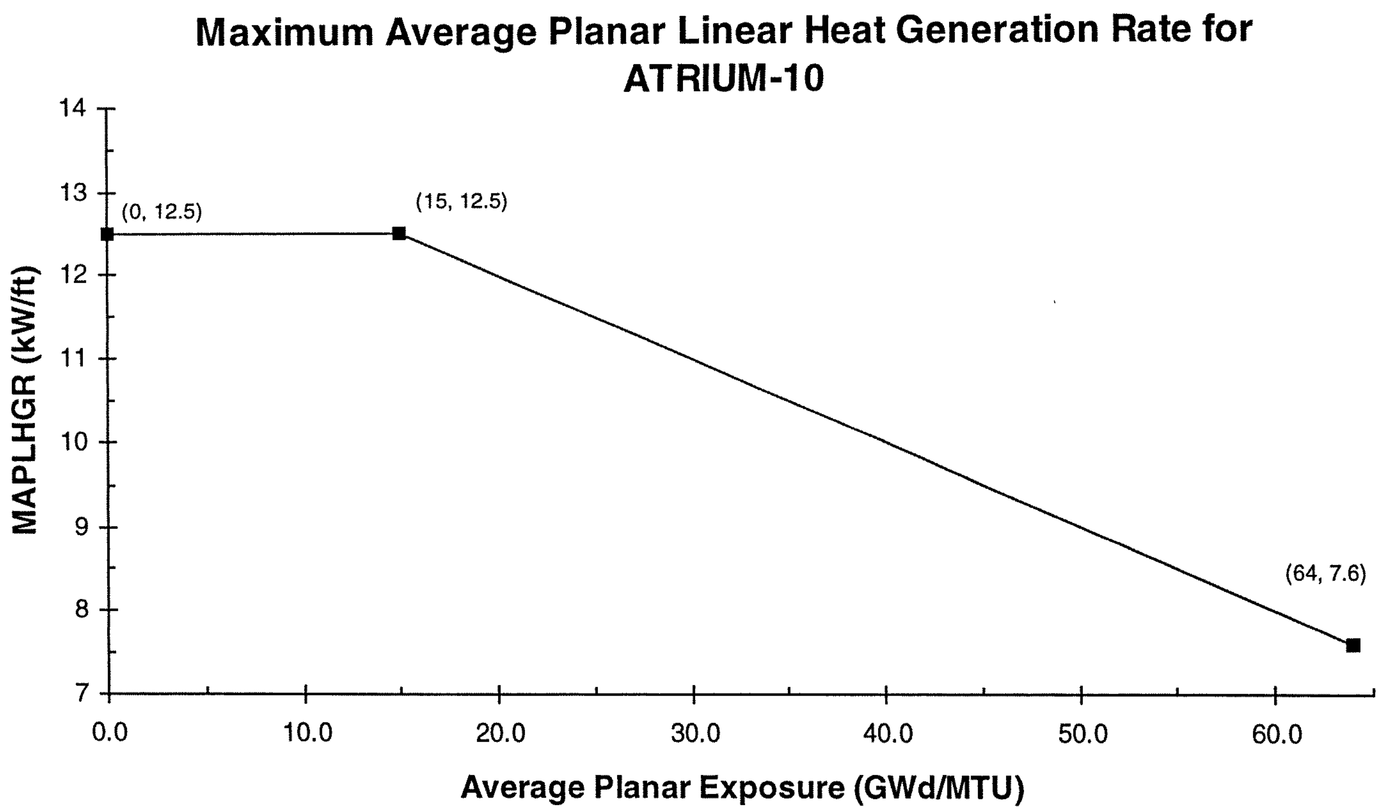

Figure 1-1 Maximum Average Planar Linear Heat Generation Rate for ATRIUM-10

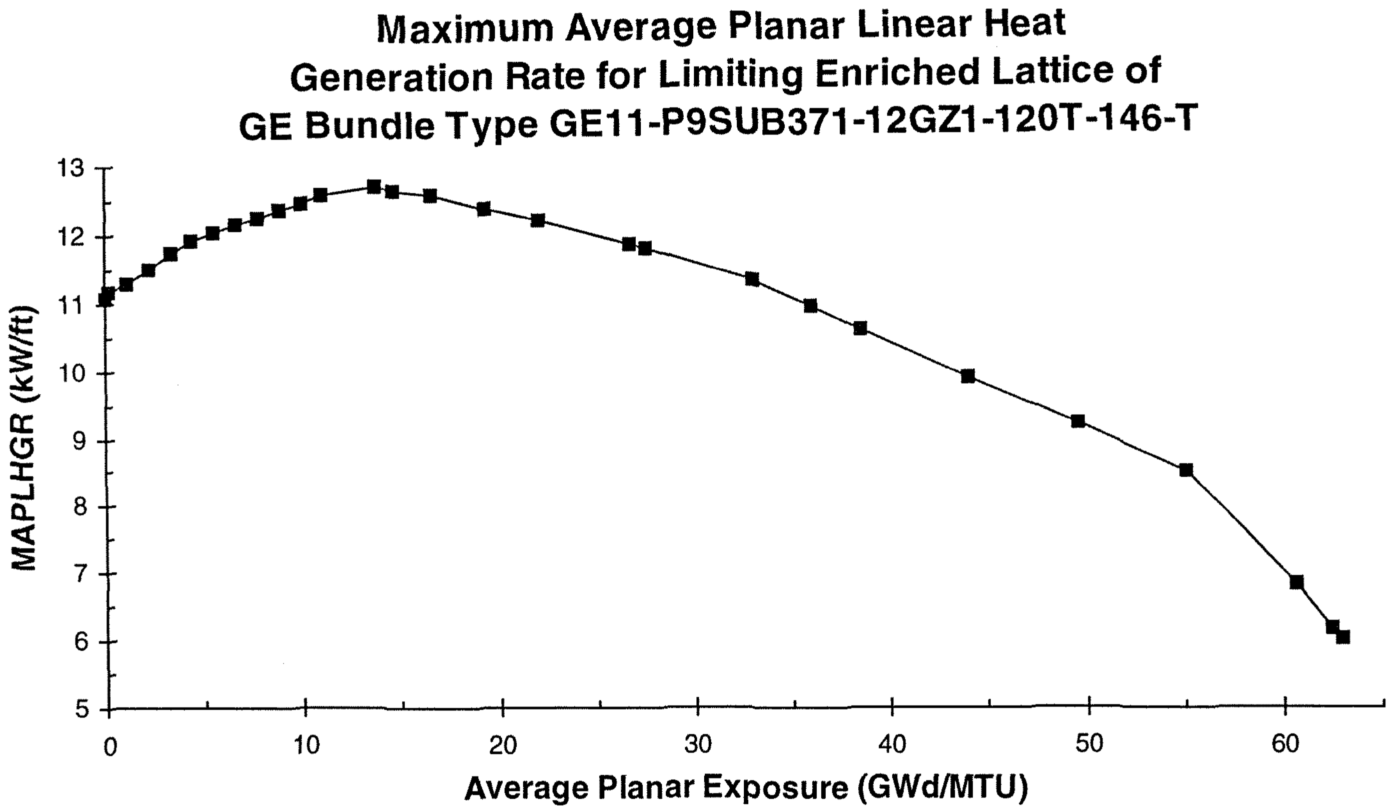

Figure 1-2a Maximum Average Planar Linear Heat Generation Rate for Limiting Enriched Lattice of GE Bundle Type GE11-P9SUB371-12GZ1-120T-146-T

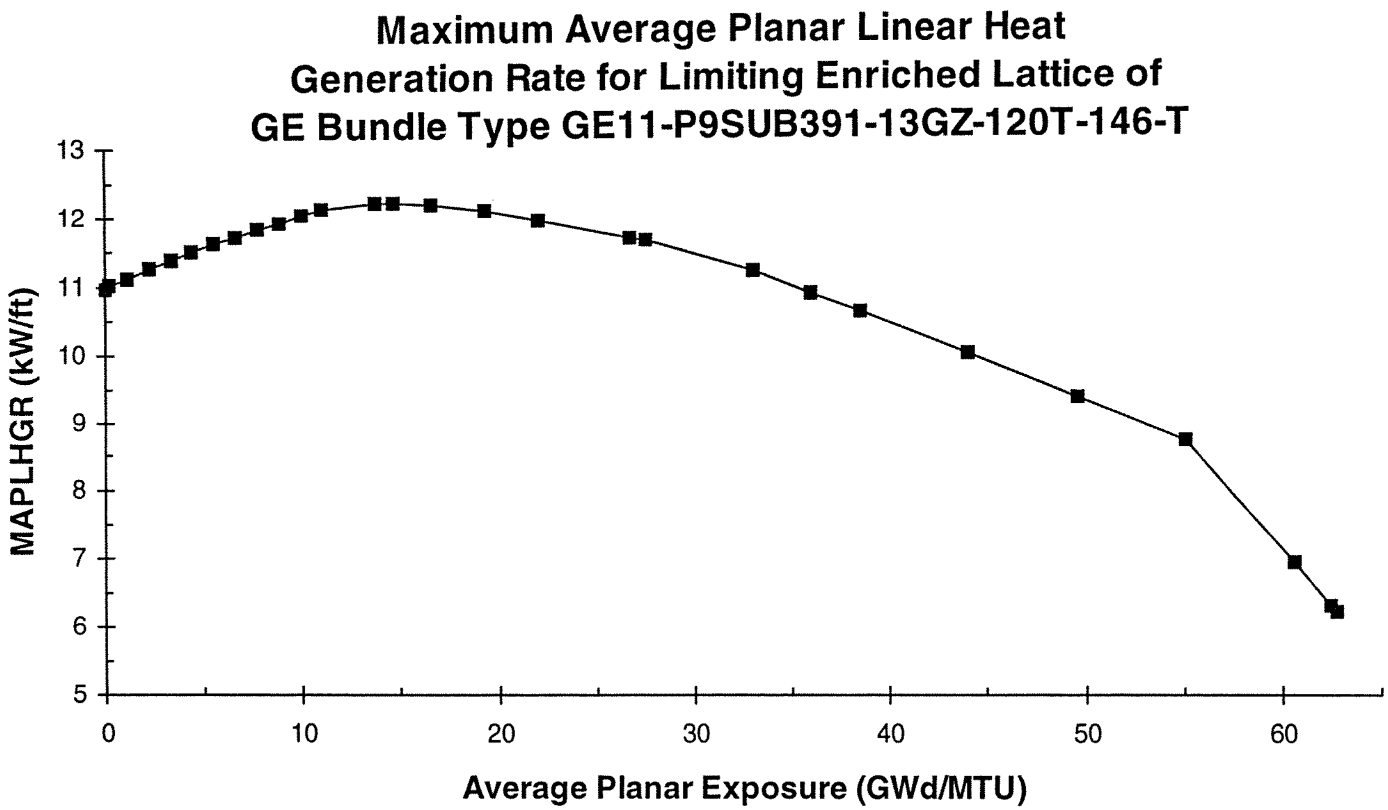

Figure 1-2b Maximum Average Planar Linear Heat Generation Rate for Limiting Enriched Lattice of GE Bundle Type GE11-P9SUB391-13GZ-120T-146-T

Maximum Average Planar Linear Heat Generation Rate for Limiting Enriched Lattice of GE Bundle Type GE11-P9SUB370-14GZ1-120T-146-T

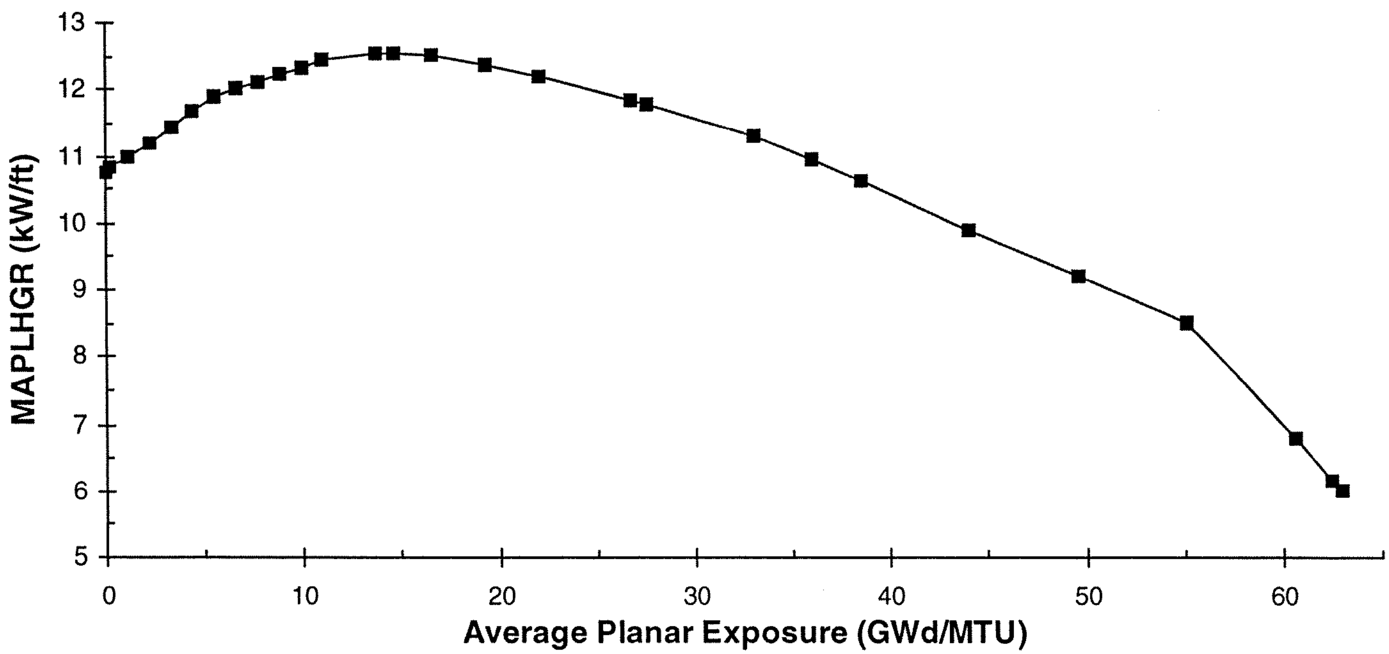

Figure 1-2c Maximum Average Planar Linear Heat Generation Rate for Limiting Enriched Lattice of GE Bundle Type GE11-P9SUB370-14GZ1-120T-146-T

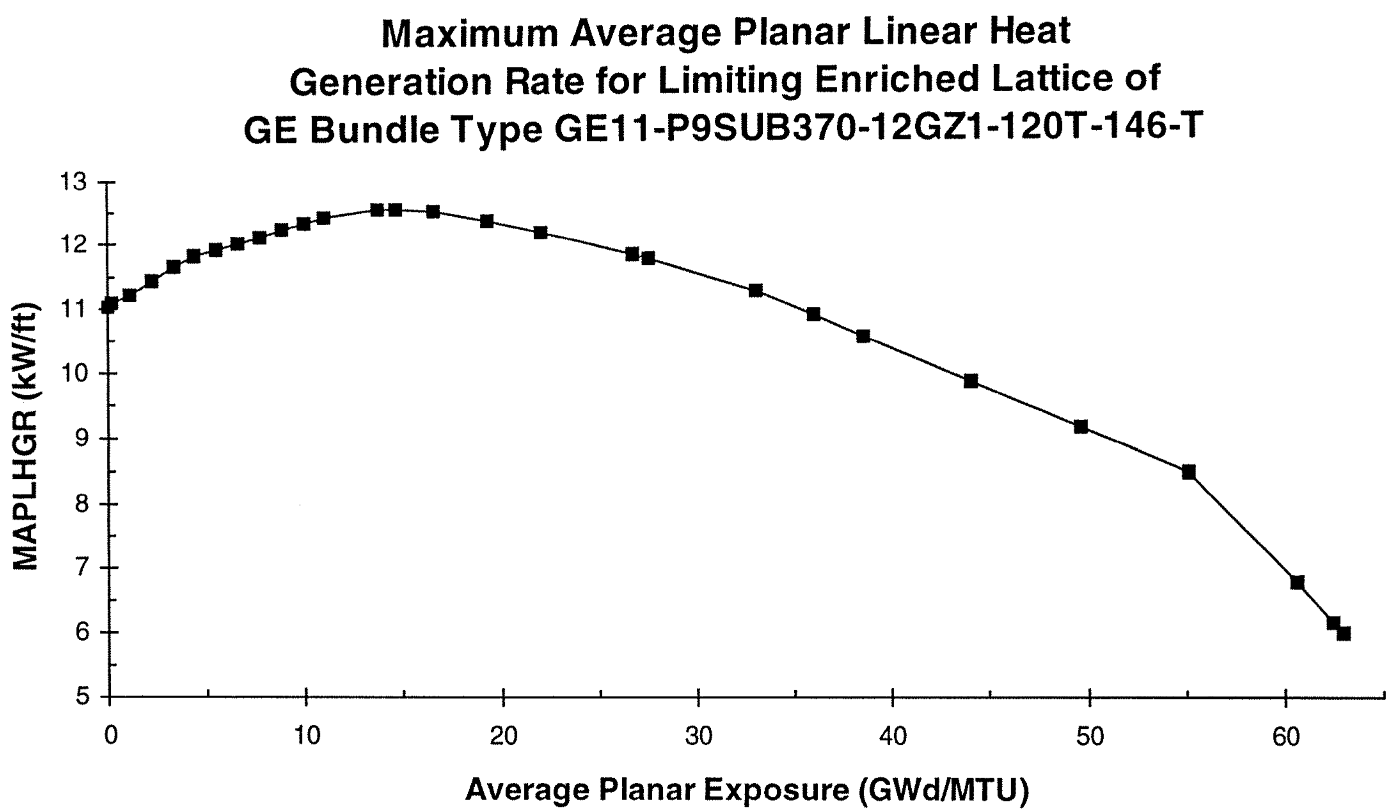

Figure 1-2d Maximum Average Planar Linear Heat Generation Rate for Limiting Enriched Lattice of GE Bundle Type GE11-P9SUB370-12GZ1-120T-146-T

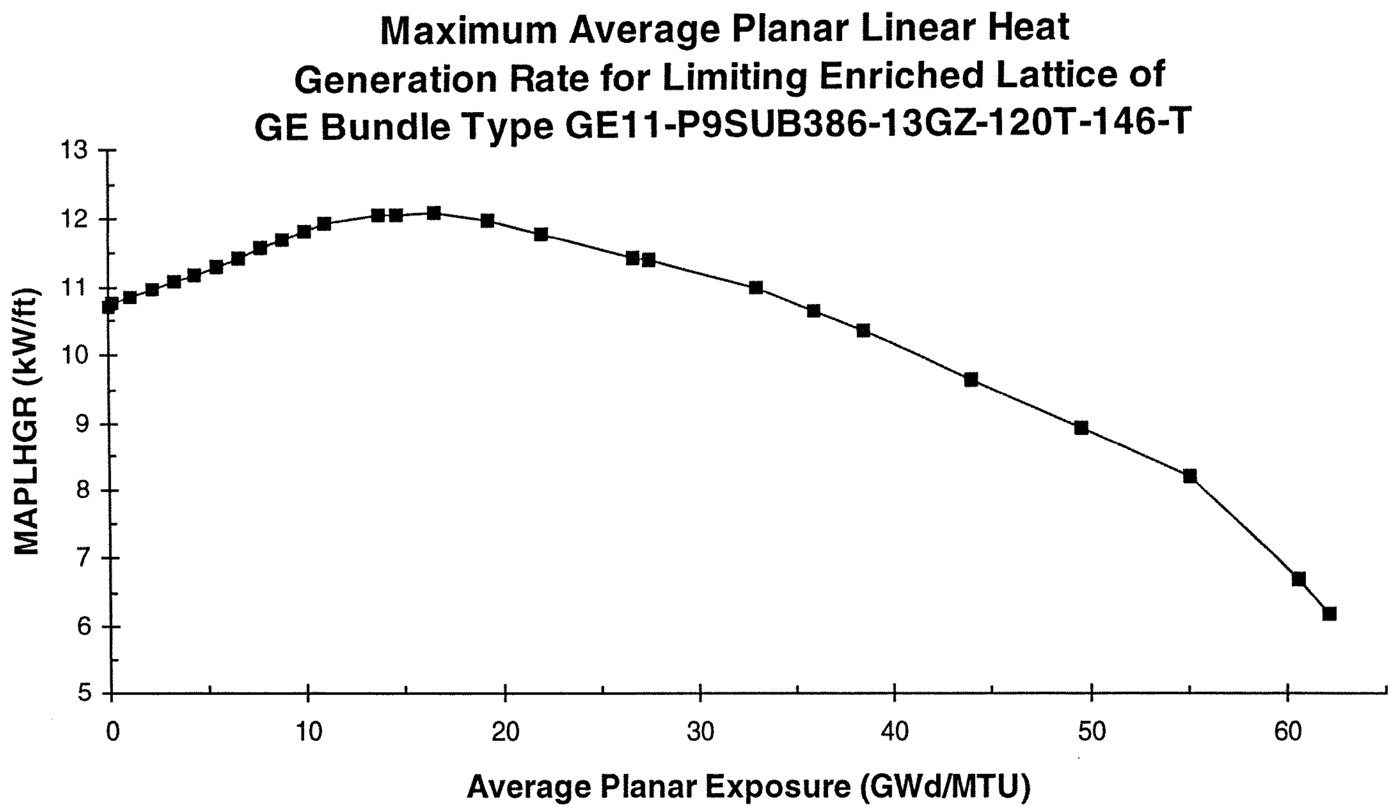

Figure 1-2e Maximum Average Planar Linear Heat Generation Rate for Limiting Enriched Lattice of GE Bundle Type GE11-P9SUB386-13GZ-120T-146-T

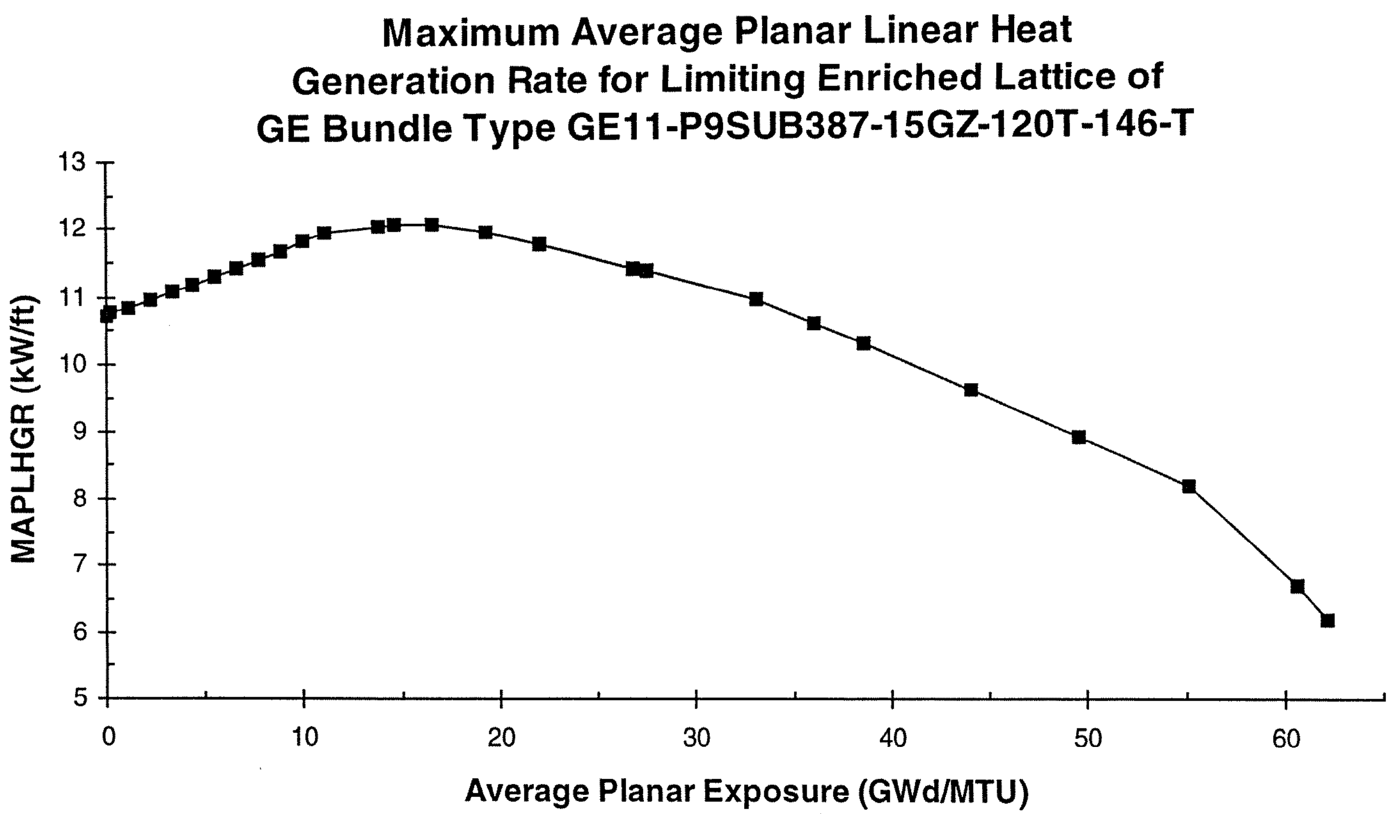

Figure 1-2f Maximum Average Planar Linear Heat Generation Rate for Limiting Enriched Lattice of GE Bundle Type GE11-P9SUB387-15GZ-120T-146-T

Table 1-1 MAPLHGRs for Limiting Enriched Lattices of GE11 Bundles

Exposure (GWd/MTU)	GE Bundle Type GE11-P9SUB371-12GZ1-120T-146-T	GE Bundle Type GE11-P9SUB391-13GZ-120T-146-T	GE Bundle Type GE11-P9SUB370-14GZ1-120T-146-T	GE Bundle Type GE11-P9SUB370-12GZ1-120T-146-T	GE Bundle Type GE11-P9SUB386-13GZ-120T-146-T	GE Bundle Type GE11-P9SUB387-15GZ-120T-146-T
0.00	11.09	10.97	10.75	11.03	10.86	10.71
0.22	11.16	11.01	10.82	11.10	10.93	10.77
1.10	11.30	11.12	10.98	11.24	11.03	10.85
2.20	11.50	11.25	11.20	11.45	11.16	10.96
3.31	11.72	11.39	11.43	11.67	11.29	11.07
4.41	11.92	11.50	11.68	11.81	11.42	11.18
5.51	12.02	11.61	11.90	11.91	11.53	11.30
6.61	12.13	11.71	12.01	12.01	11.63	11.42
7.72	12.23	11.82	12.11	12.11	11.73	11.54
8.82	12.34	11.92	12.22	12.22	11.83	11.66
9.92	12.45	12.03	12.32	12.32	11.93	11.79
11.02	12.55	12.12	12.42	12.42	12.03	11.91
13.78	12.67	12.20	12.53	12.53	12.10	12.02
14.66	12.63	12.20	12.52	12.52	12.10	12.03
16.53	12.55	12.18	12.50	12.50	12.10	12.05
19.29	12.36	12.08	12.35	12.35	12.01	11.93
22.05	12.16	11.93	12.15	12.15	11.87	11.74
26.79	11.81	11.68	11.81	11.81	11.62	11.39
27.56	11.76	11.63	11.75	11.75	11.57	11.34
33.07	11.28	11.21	11.27	11.27	11.14	10.94
36.05	10.89	10.88	10.89	10.89	10.81	10.58
38.58	10.56	10.60	10.55	10.55	10.53	10.28
44.09	9.85	9.99	9.85	9.85	9.86	9.57
49.60	9.15	9.35	9.15	9.15	9.18	8.86
55.12	8.46	8.68	8.45	8.45	8.52	8.16
60.63	6.79	6.92	6.78	6.78	6.81	6.69
62.14						6.18
62.48					6.18	
62.50	6.16	6.29	6.15	6.15		
62.77		6.20				
62.93			6.00	6.00		
62.95	6.01					
63.52						

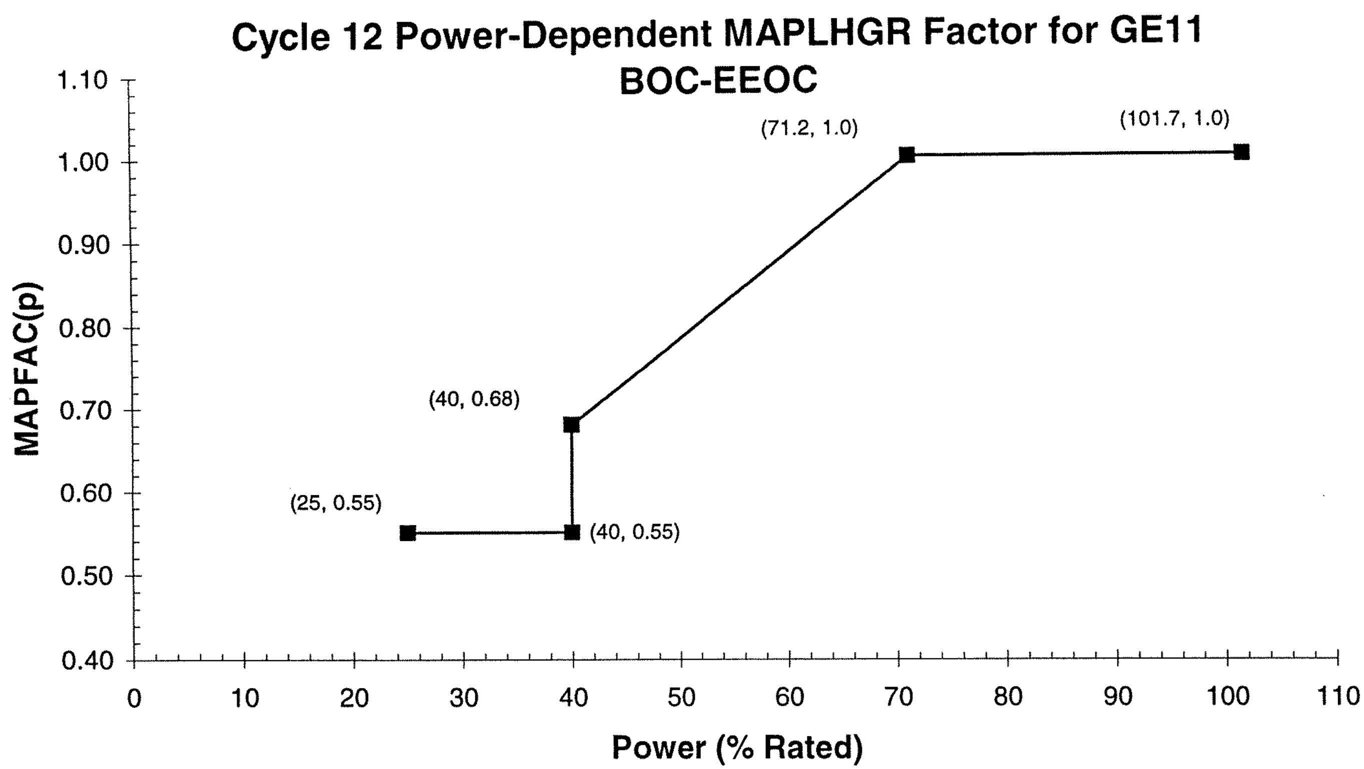

Figure 1-3 Cycle 12 Power-Dependent Maximum Average Planar Linear Heat Generation Rate Factor for GE11 BOC-EEOC

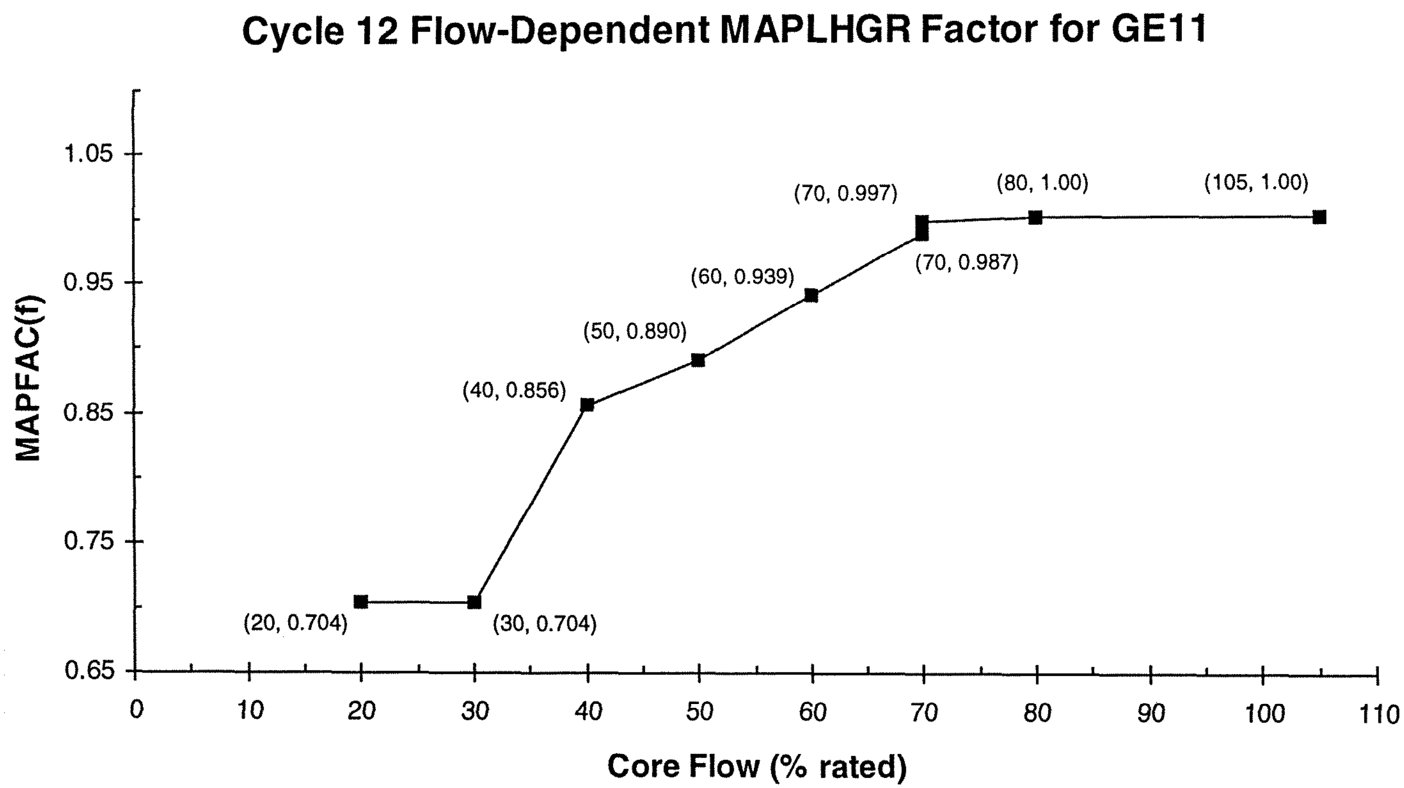

Figure 1-4 Cycle 12 Flow-Dependent Maximum Average Planar Linear Heat Generation Rate Factor for GE11

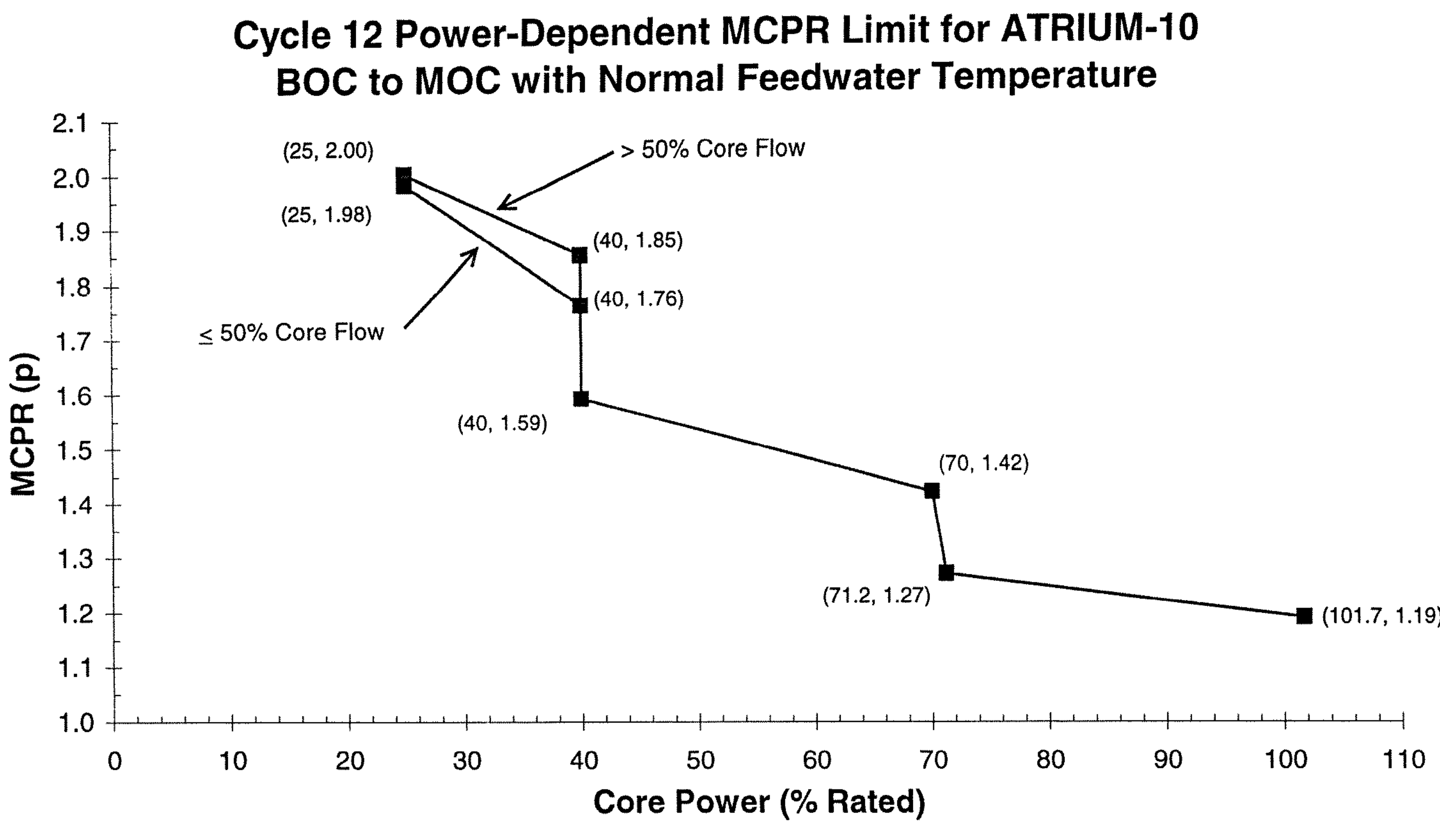

**Figure 2-1a Cycle 12 Power-Dependent MCPR Limit for ATRIUM-10
BOC to MOC with Normal Feedwater Temperature**

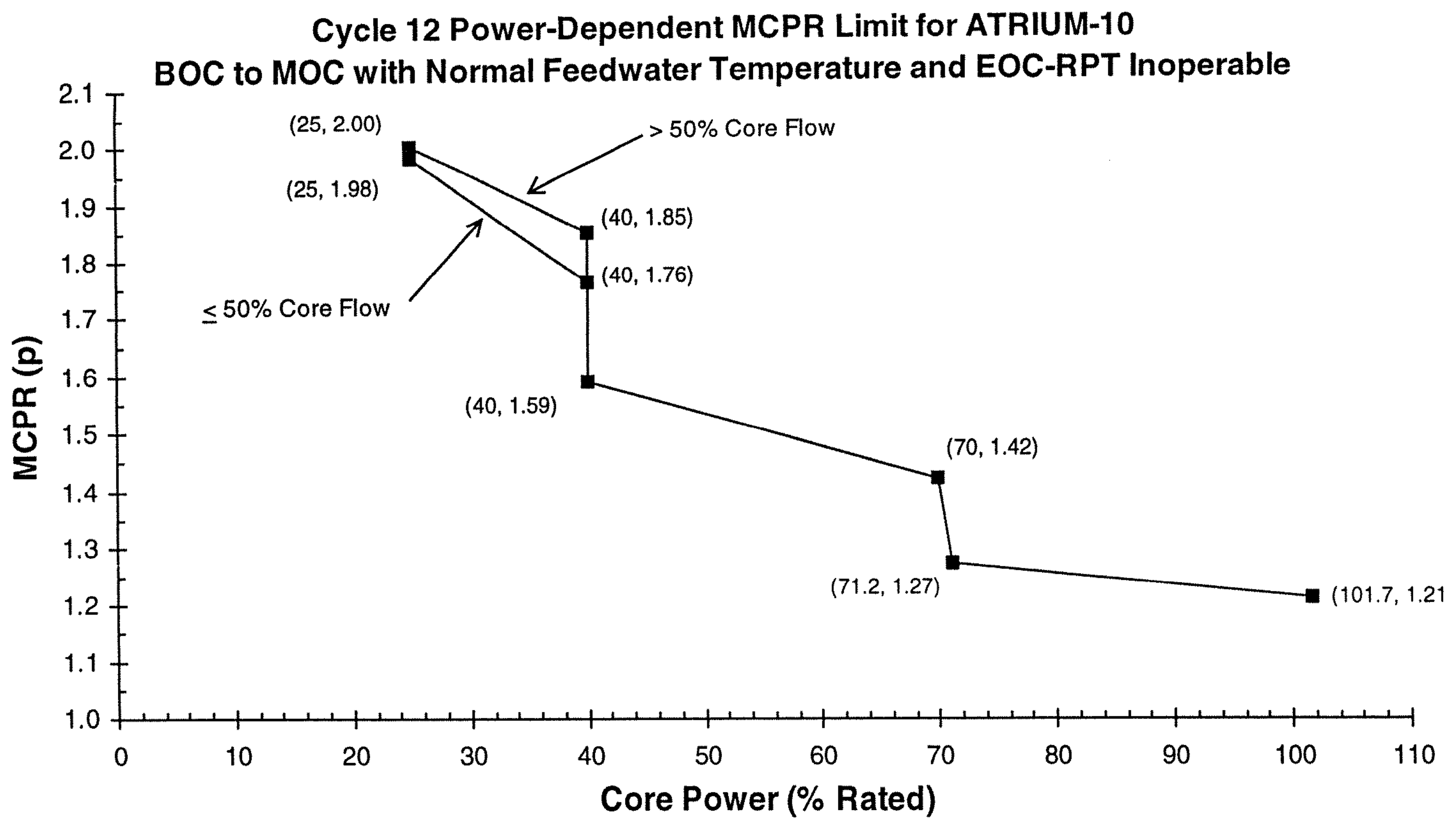

Figure 2-1b Cycle 12 Power-Dependent MCPR Limit for ATRIUM-10
BOC to MOC with Normal Feedwater Temperature and EOC-RPT Inoperable

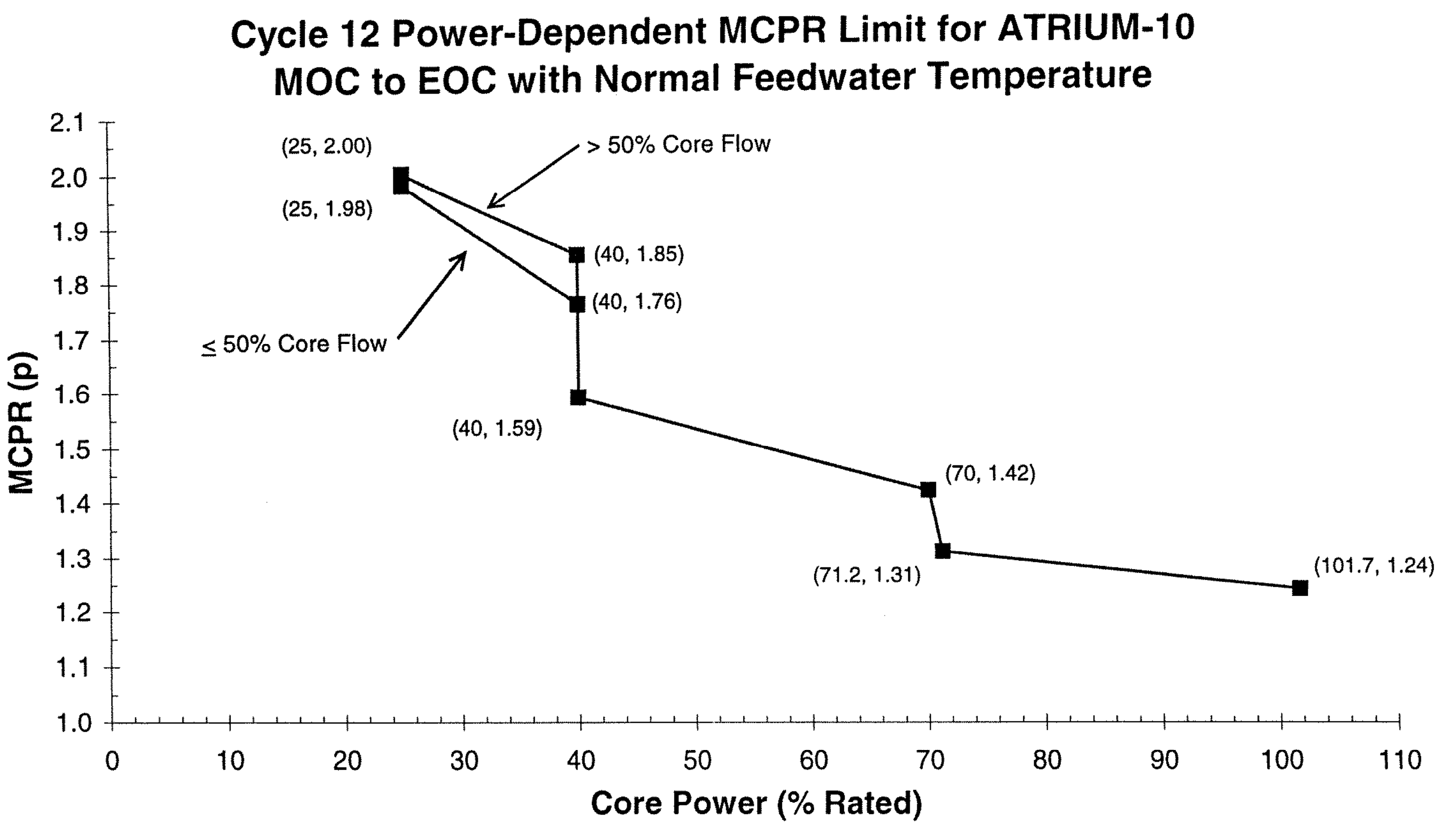

Figure 2-1c Cycle 12 Power-Dependent MCPR Limit for ATRIUM-10 MOC to EOC with Normal Feedwater Temperature

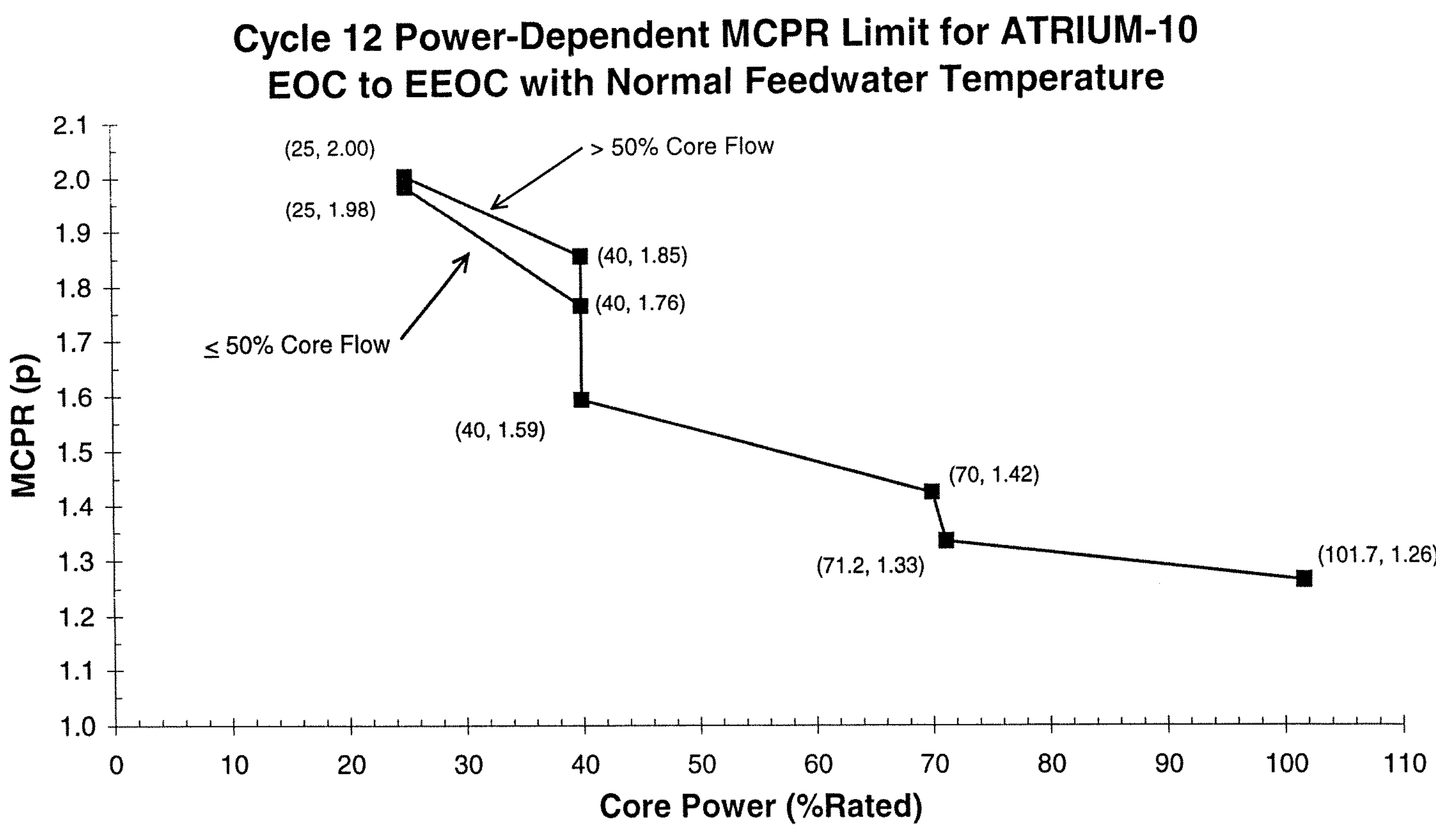

Figure 2-1d Cycle 12 Power-Dependent MCPR Limit for ATRIUM-10 EOC to EEOC with Normal Feedwater Temperature

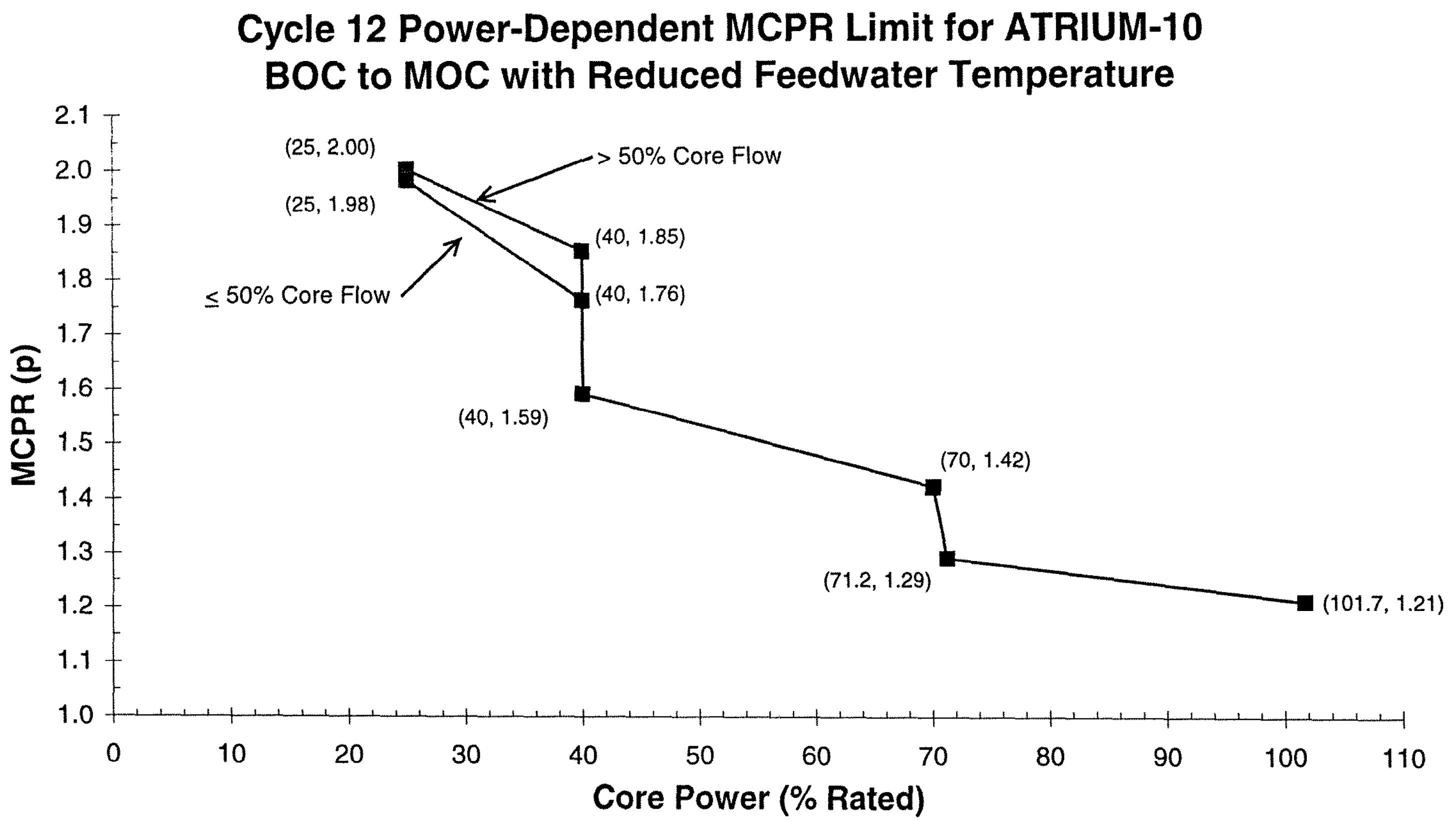

Figure 2-2a Cycle 12 Power-Dependent MCPR Limit for ATRIUM-10 BOC to MOC with Reduced Feedwater Temperature

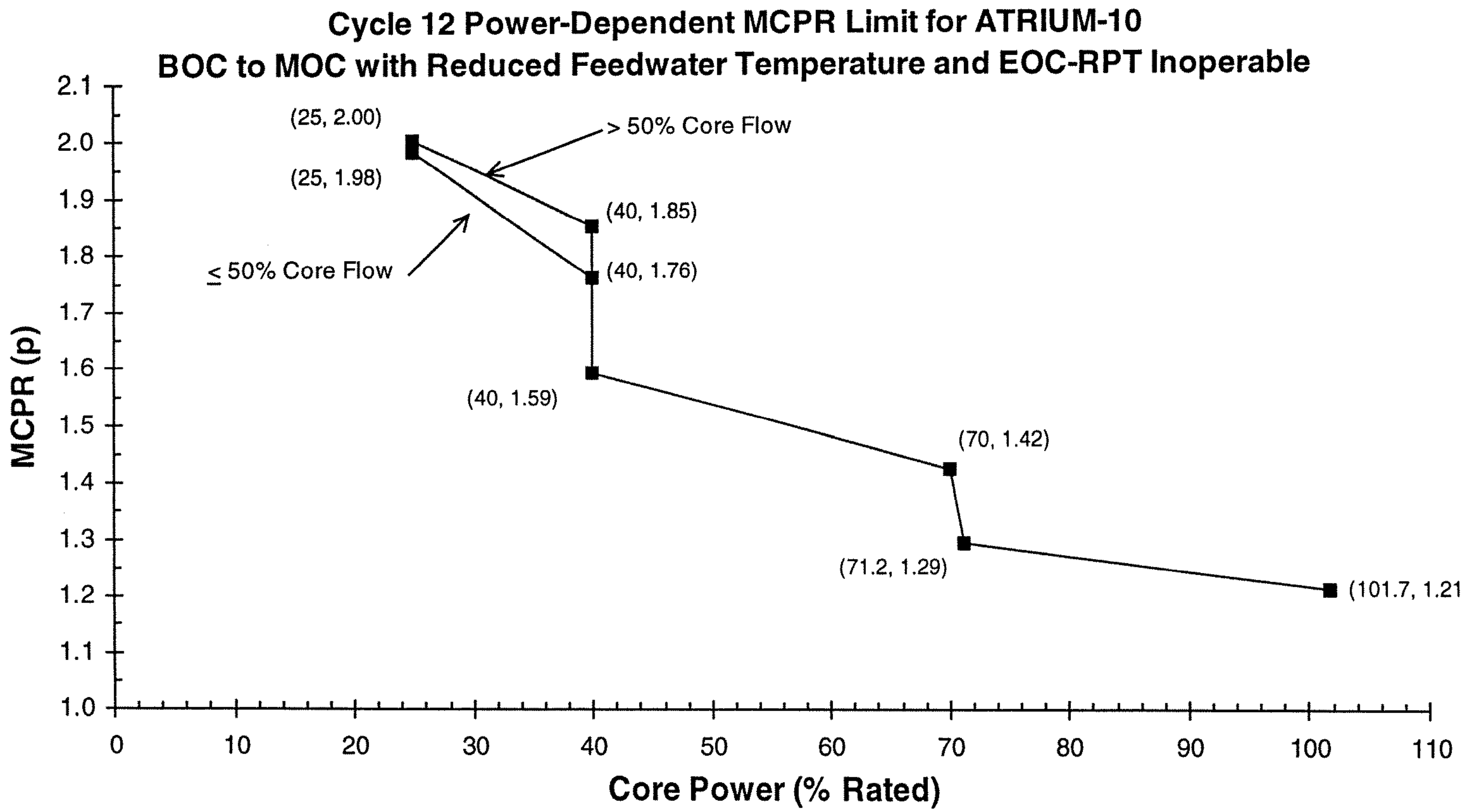

Figure 2-2b Cycle 12 Power-Dependent MCPR Limit for ATRIUM-10
BOC to MOC with Reduced Feedwater Temperature and EOC-RPT Inoperable

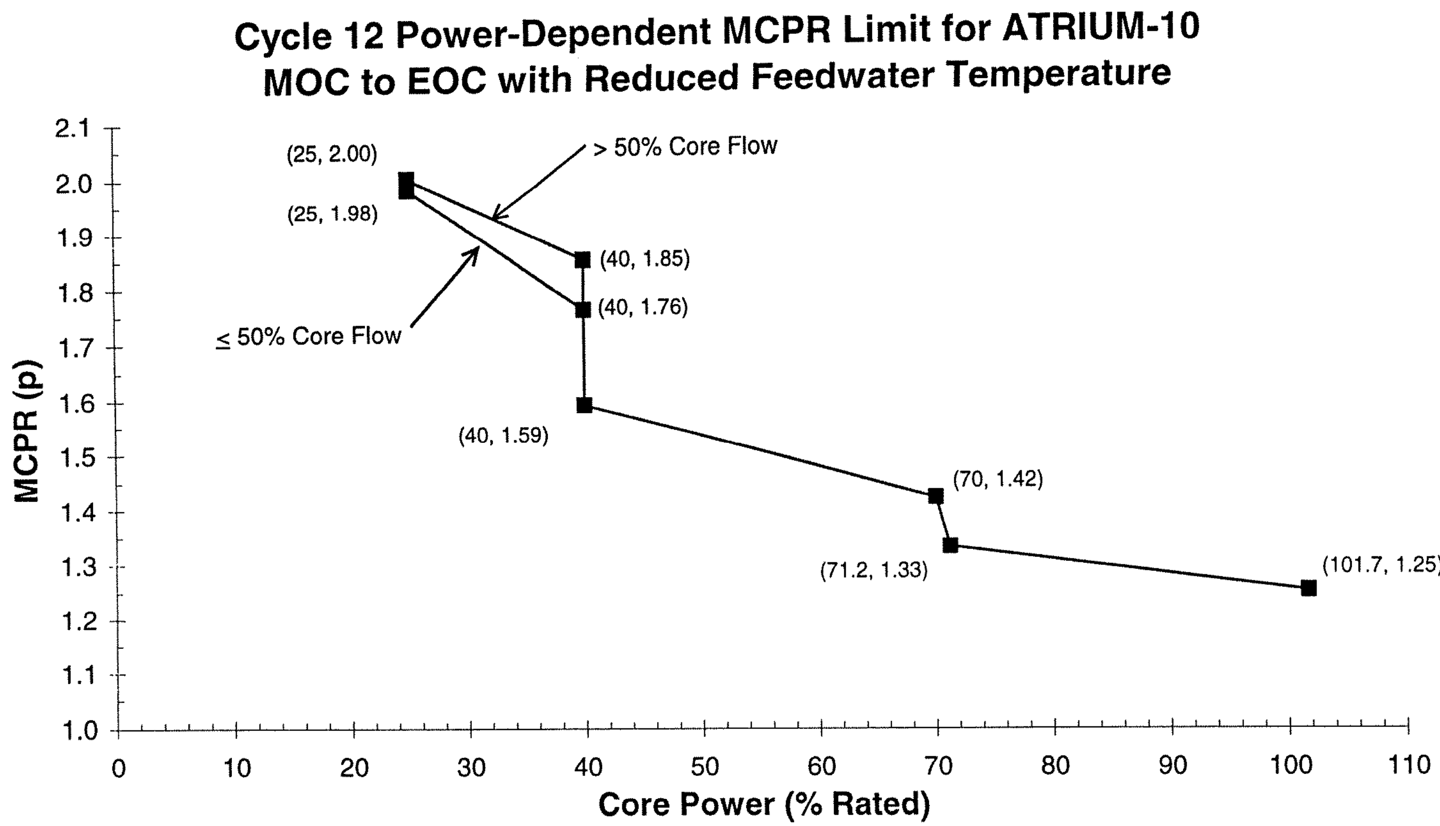

**Figure 2-2c Cycle 12 Power-Dependent MCPR Limit for ATRIUM-10
MOC to EOC with Reduced Feedwater Temperature**

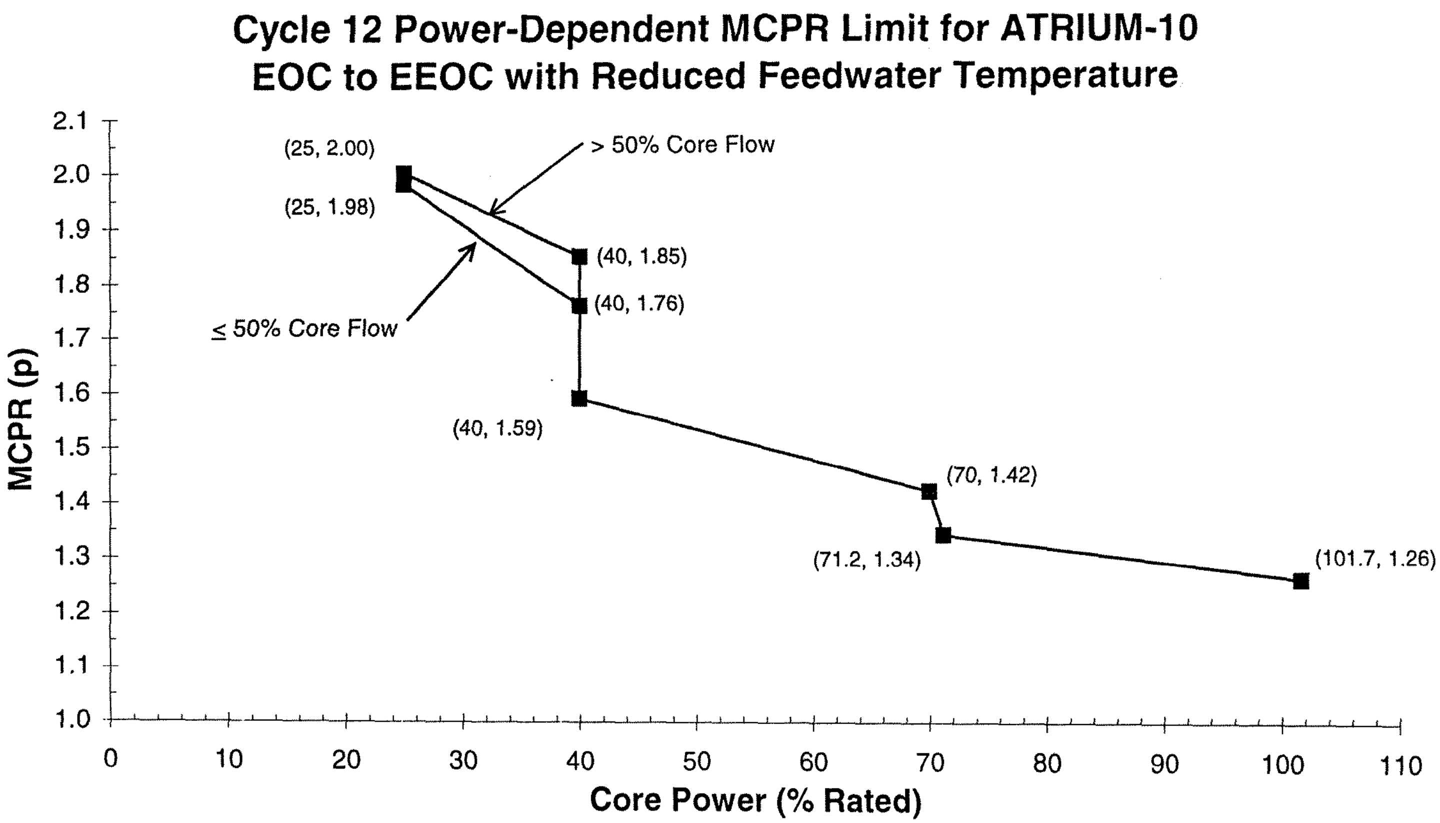

Figure 2-2d Cycle 12 Power-Dependent MCPR Limit for ATRIUM-10 EOC to EEOC with Reduced Feedwater Temperature

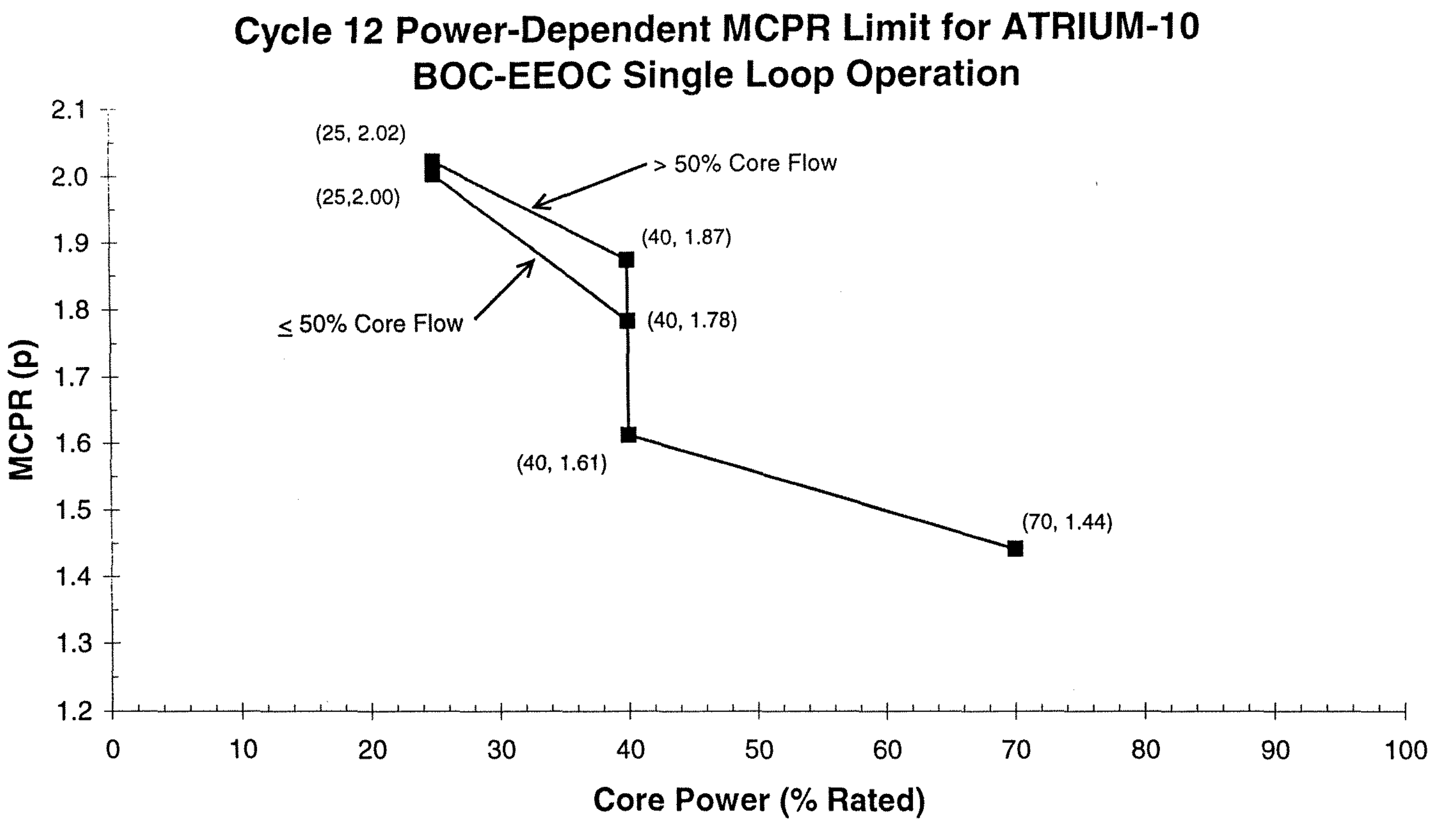

Figure 2-3 Cycle 12 Power-Dependent MCPR Limit for ATRIUM-10 BOC-EEOC Single Loop Operation

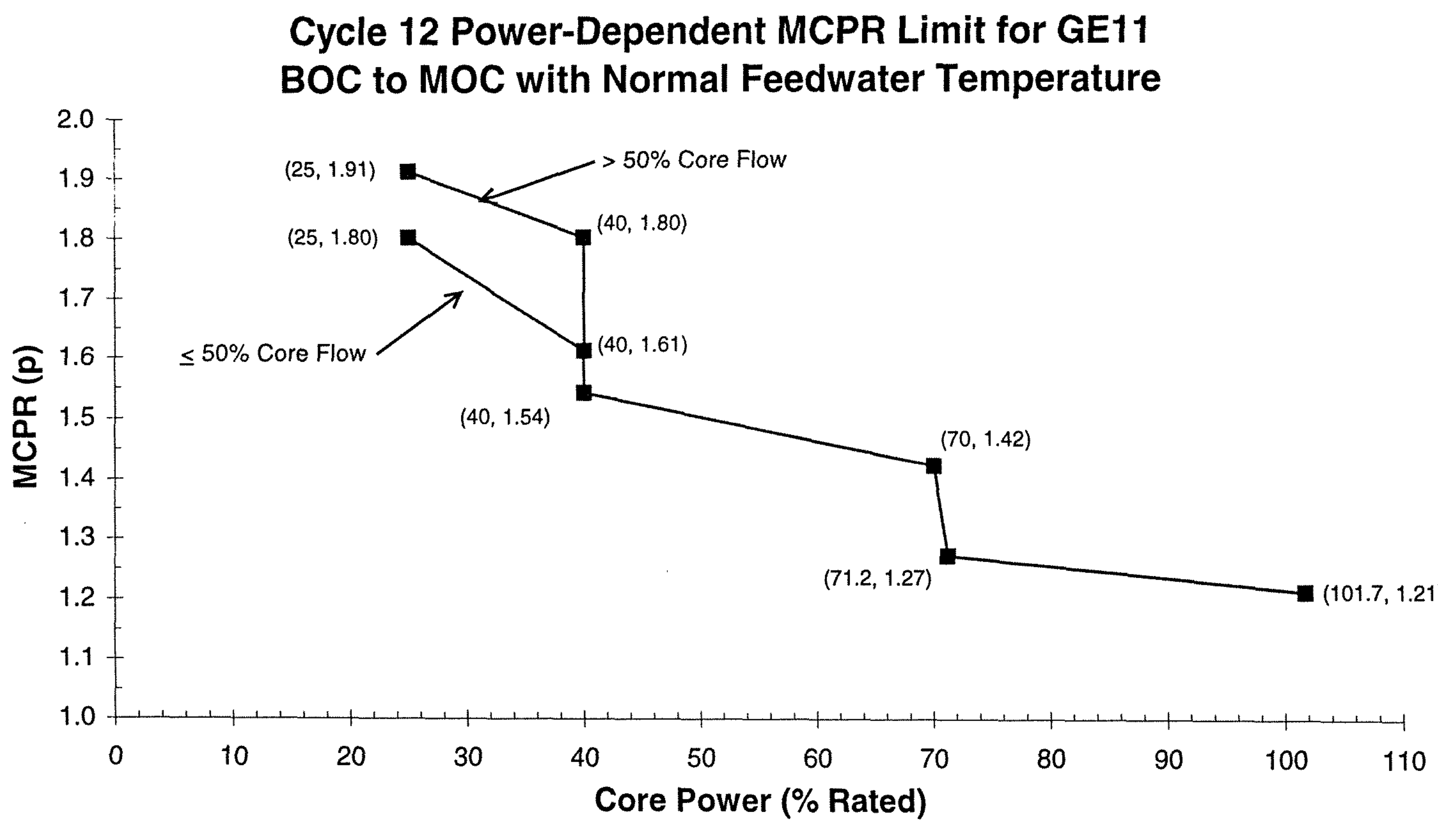

Figure 2-4a Cycle 12 Power-Dependent MCPR Limit for GE11 BOC to MOC with Normal Feedwater Temperature

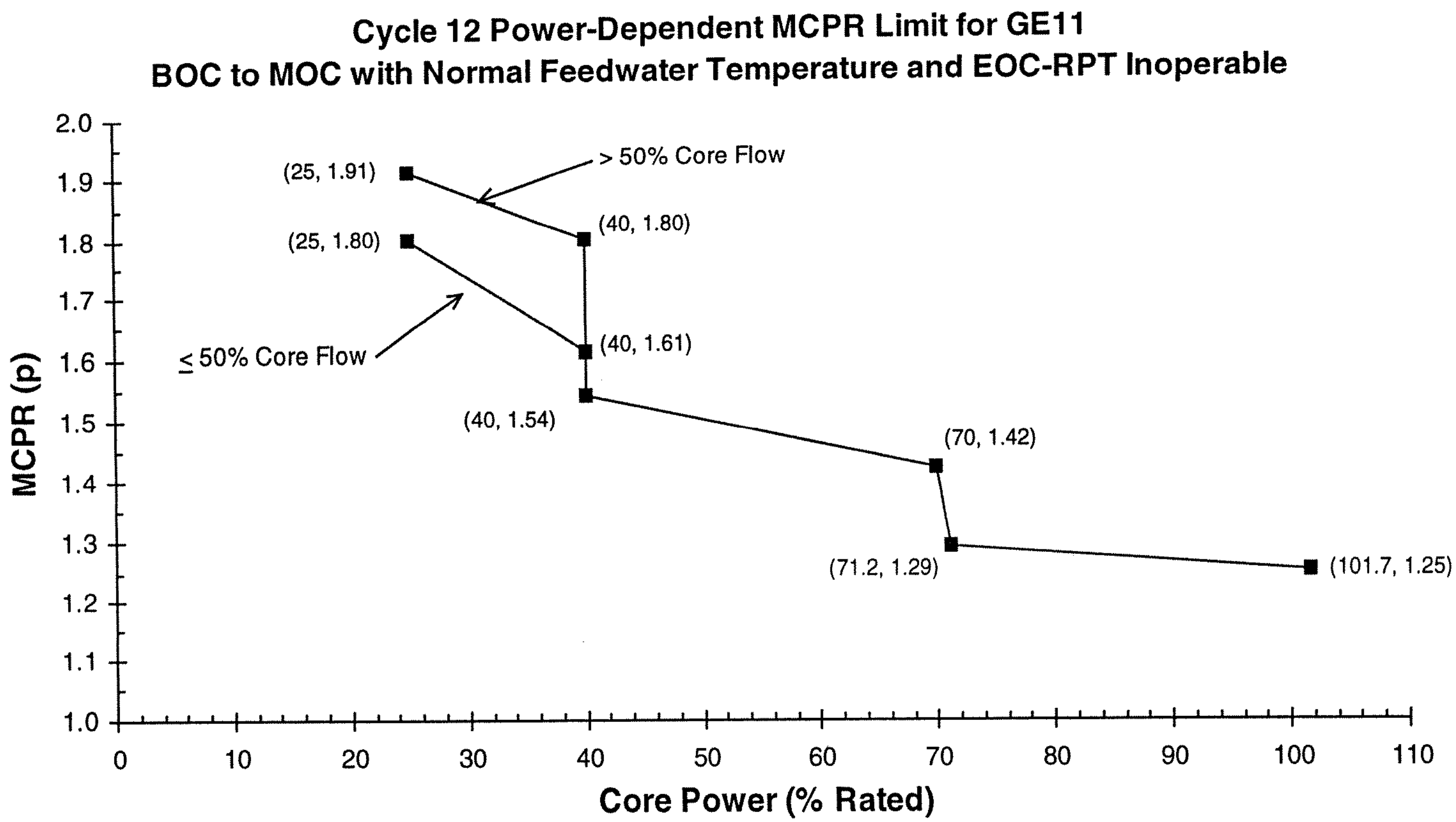

Figure 2-4b Cycle 12 Power-Dependent MCPR Limit for GE11
BOC to MOC with Normal Feedwater Temperature and EOC-RPT Inoperable

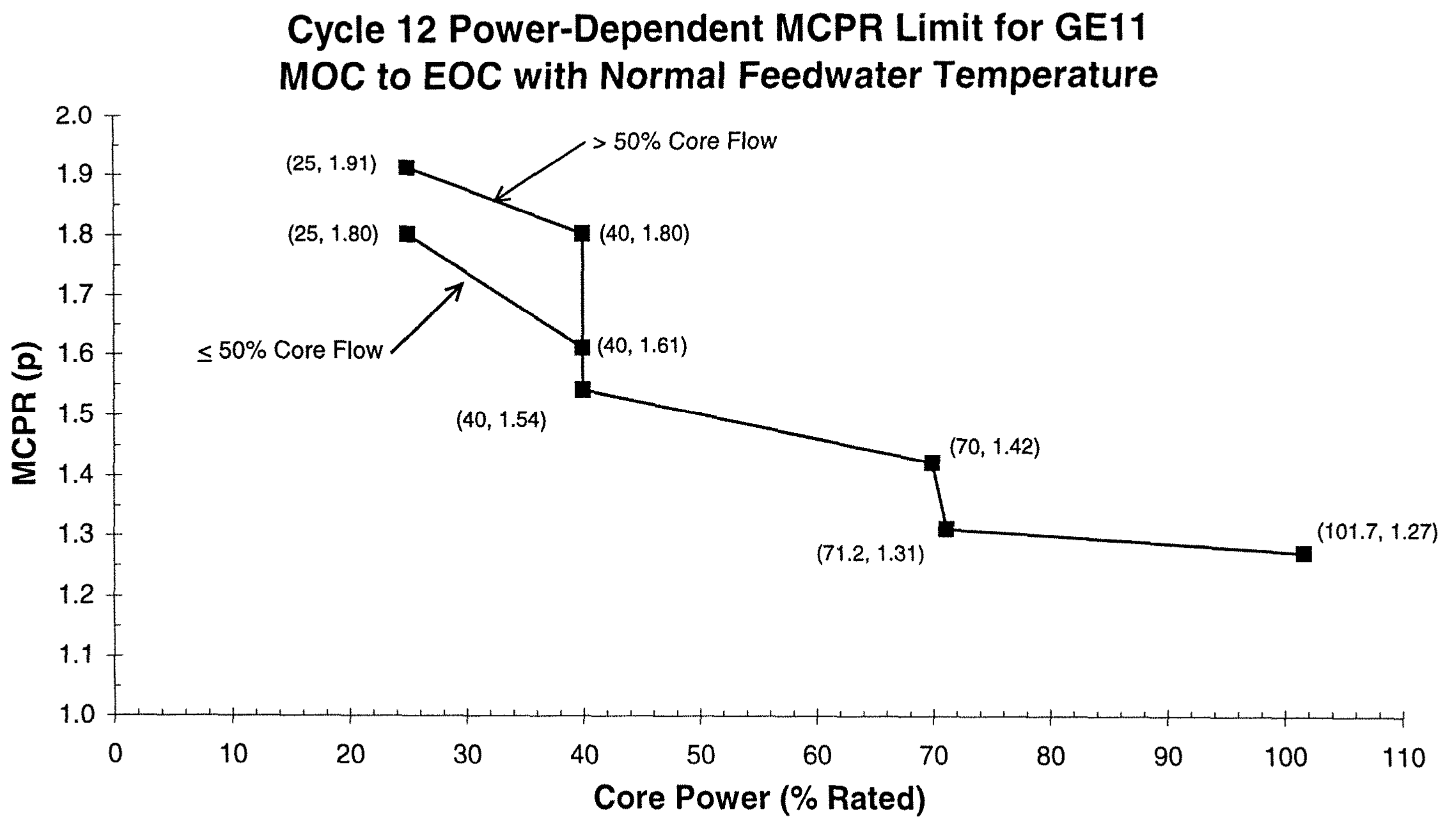

Figure 2-4c Cycle 12 Power-Dependent MCPR Limit for GE11 MOC to EOC with Normal Feedwater Temperature

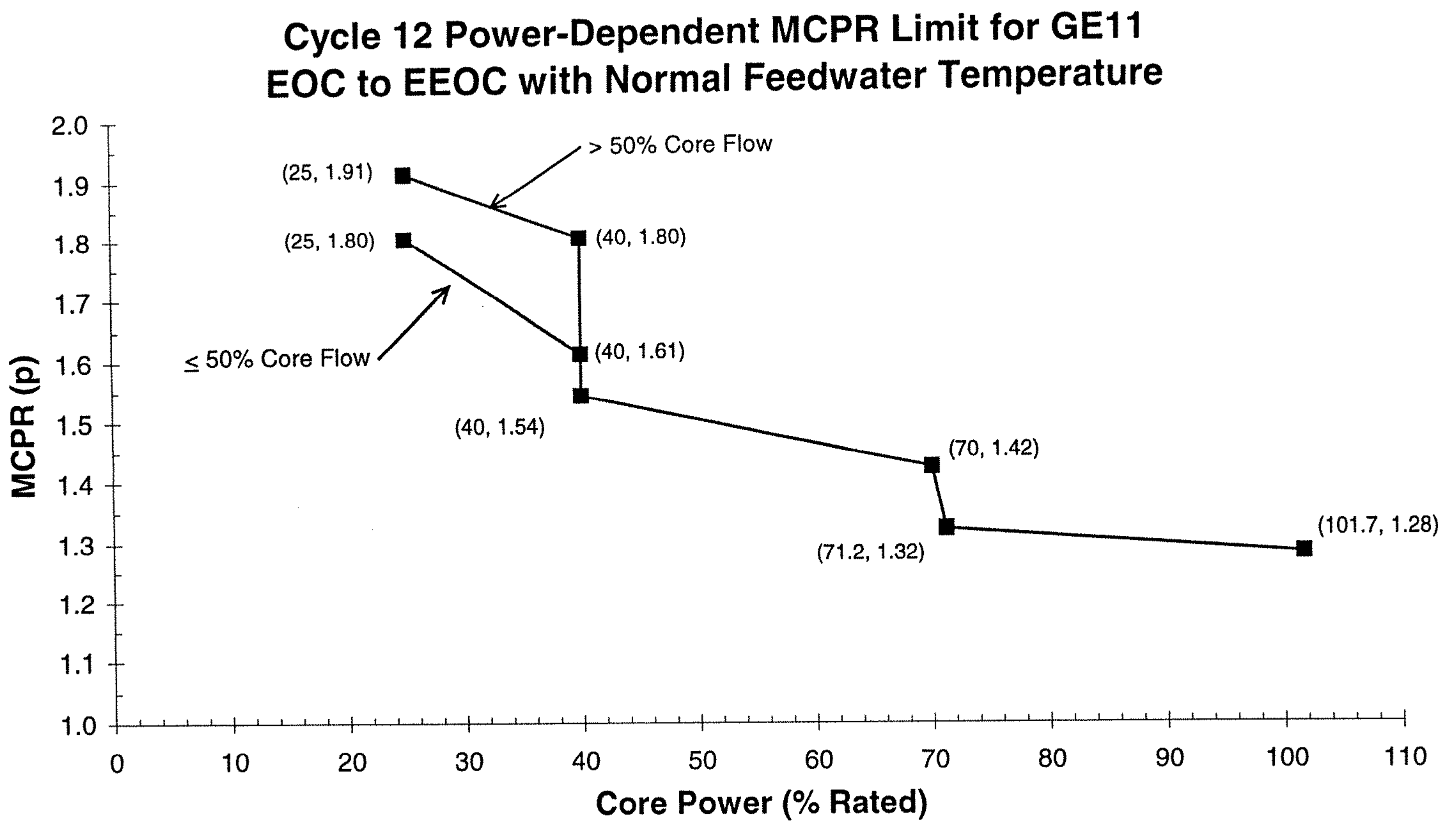

Figure 2-4d Cycle 12 Power-Dependent MCPR Limit for GE11 EOC to EEOC with Normal Feedwater Temperature

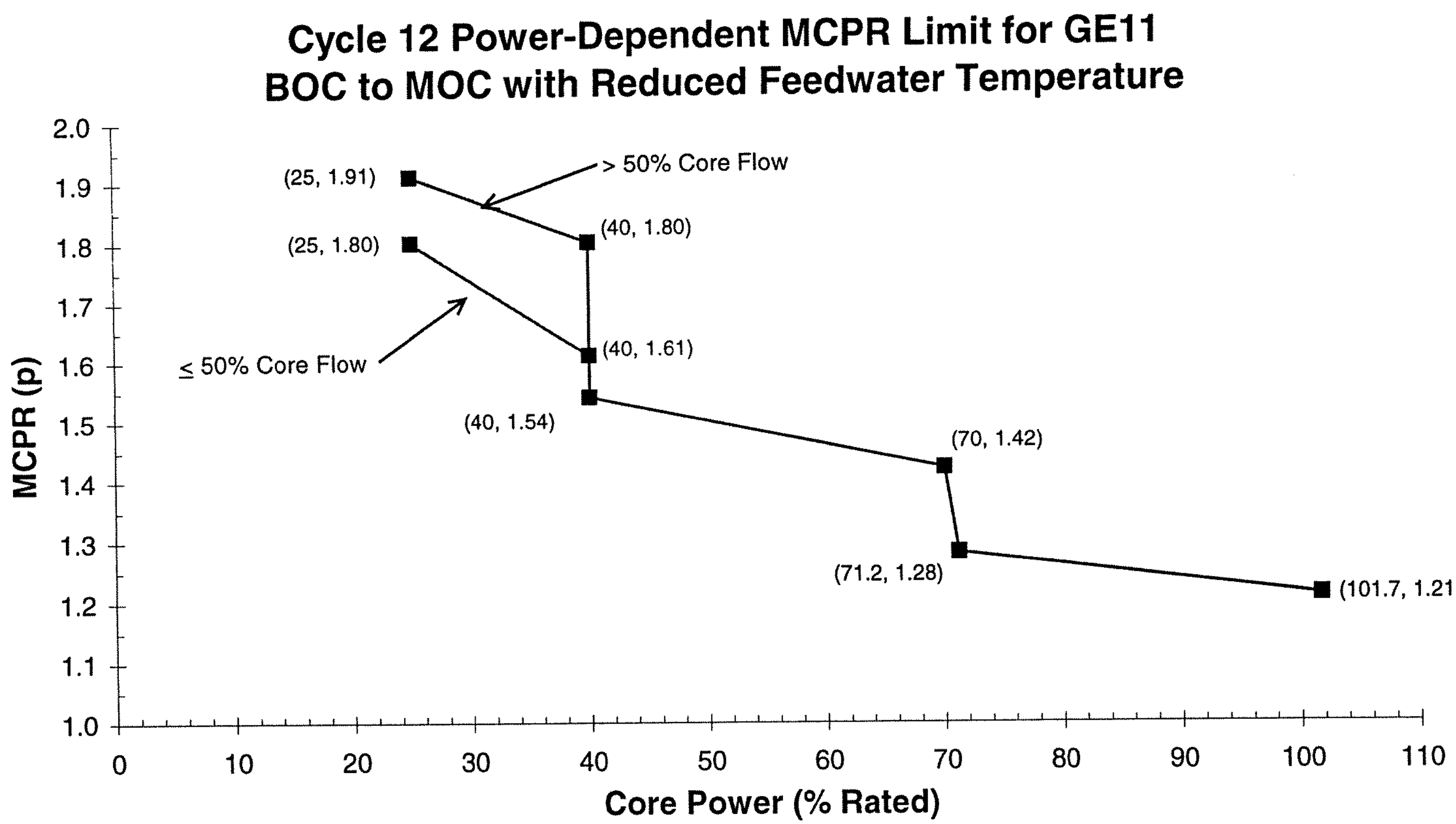

Figure 2-5a Cycle 12 Power-Dependent MCPR Limit for GE11 BOC to MOC with Reduced Feedwater Temperature

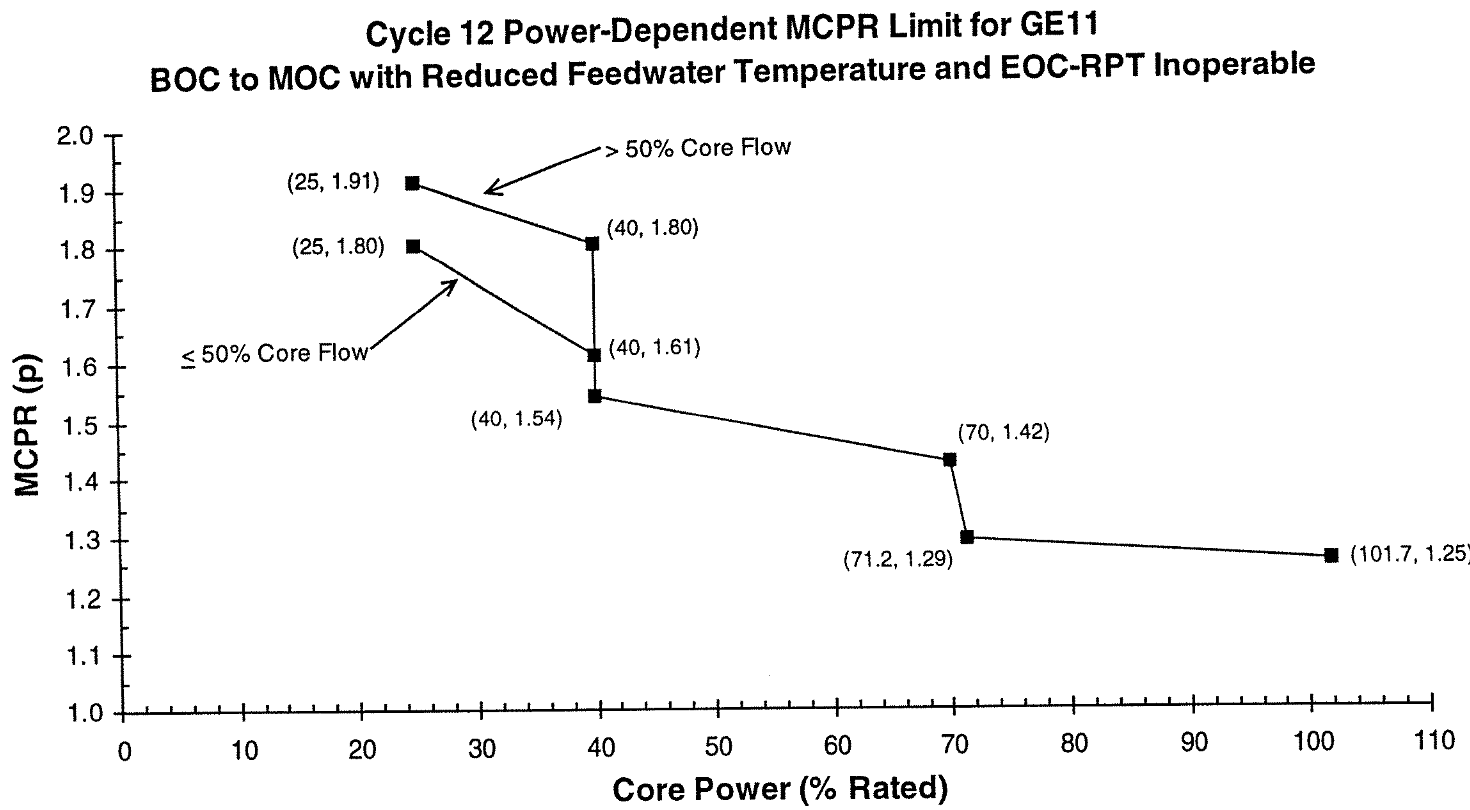

Figure 2-5b Cycle 12 Power-Dependent MCPR Limit for GE11
BOC to MOC with Reduced Feedwater Temperature and EOC-RPT Inoperable

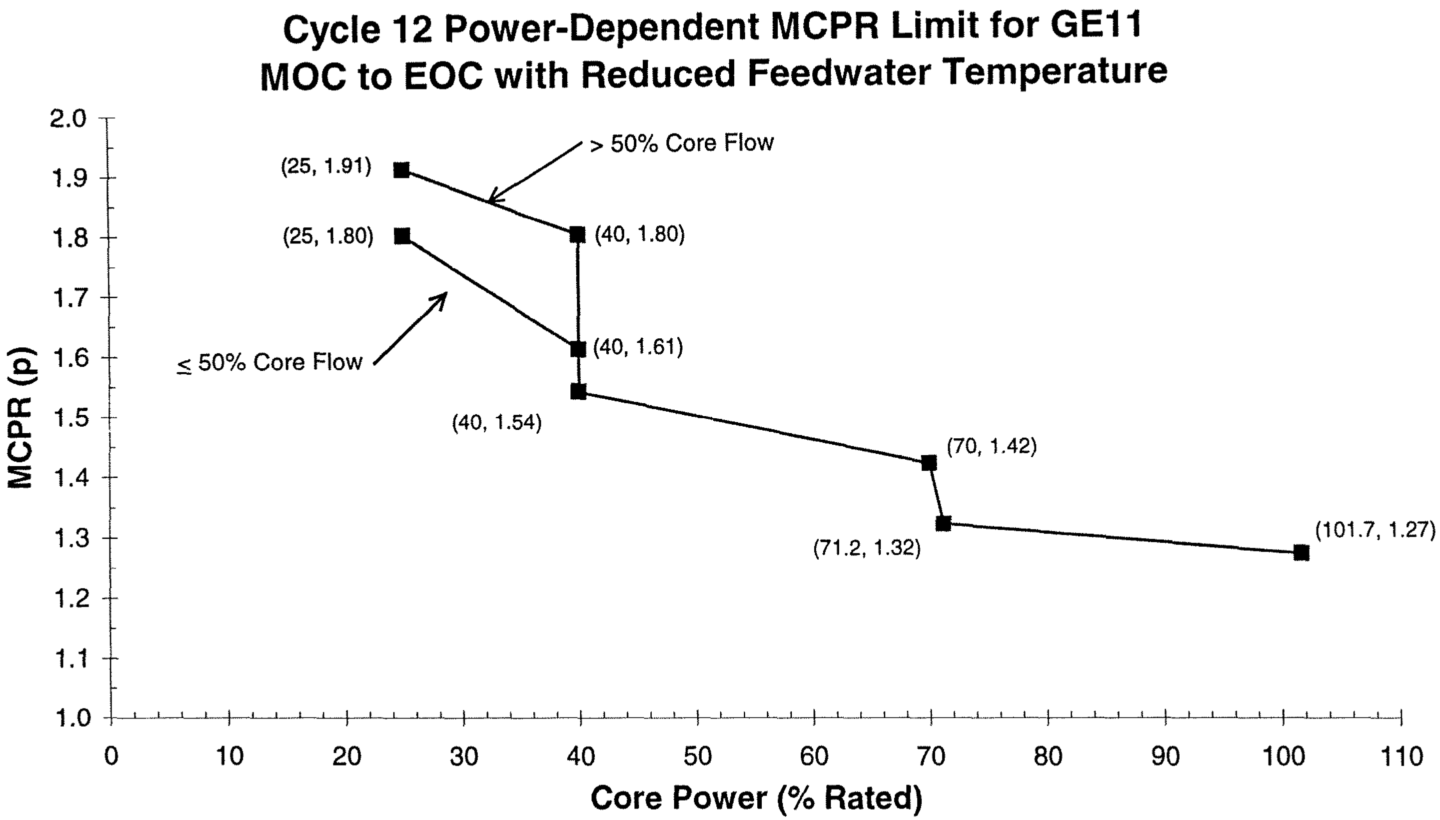

Figure 2-5c Cycle 12 Power-Dependent MCPR Limit for GE11
MOC to EOC with Reduced Feedwater Temperature

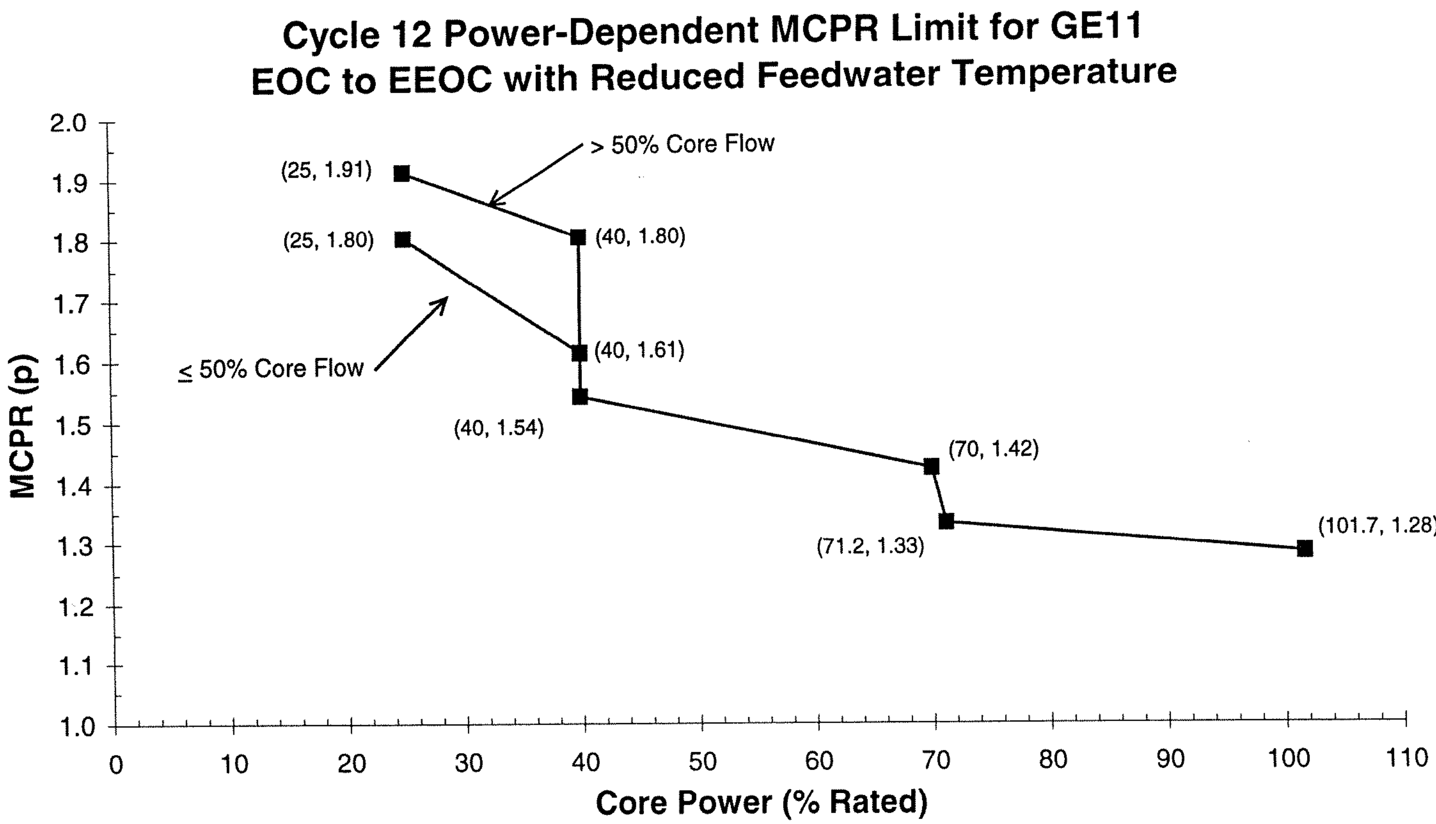

**Figure 2-5d Cycle 12 Power-Dependent MCPR Limit for GE11
EOC to EEOC with Reduced Feedwater Temperature**

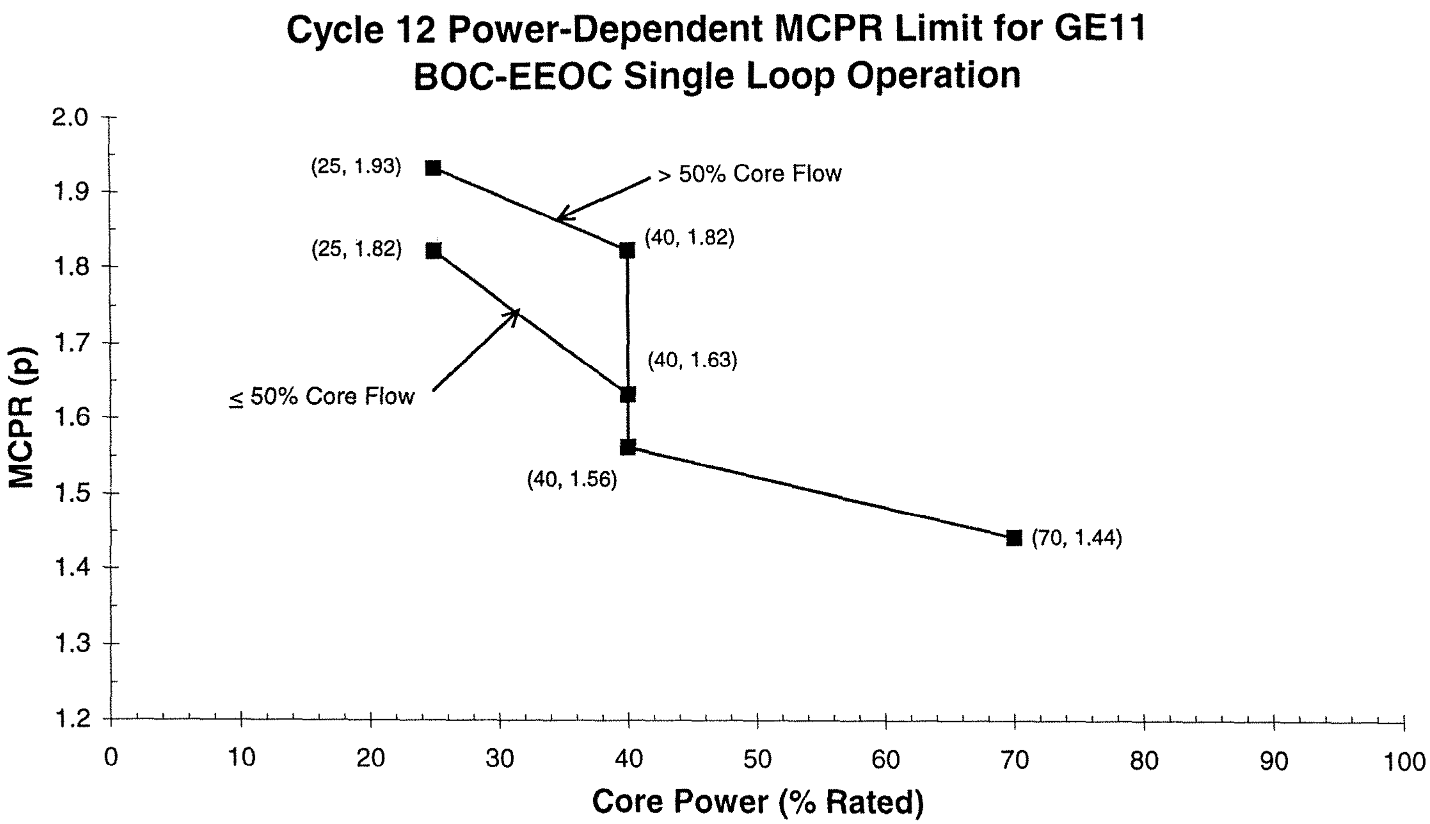

Figure 2-6 Cycle 12 Power-Dependent MCPR Limit for GE11 BOC-EEOC Single Loop Operation

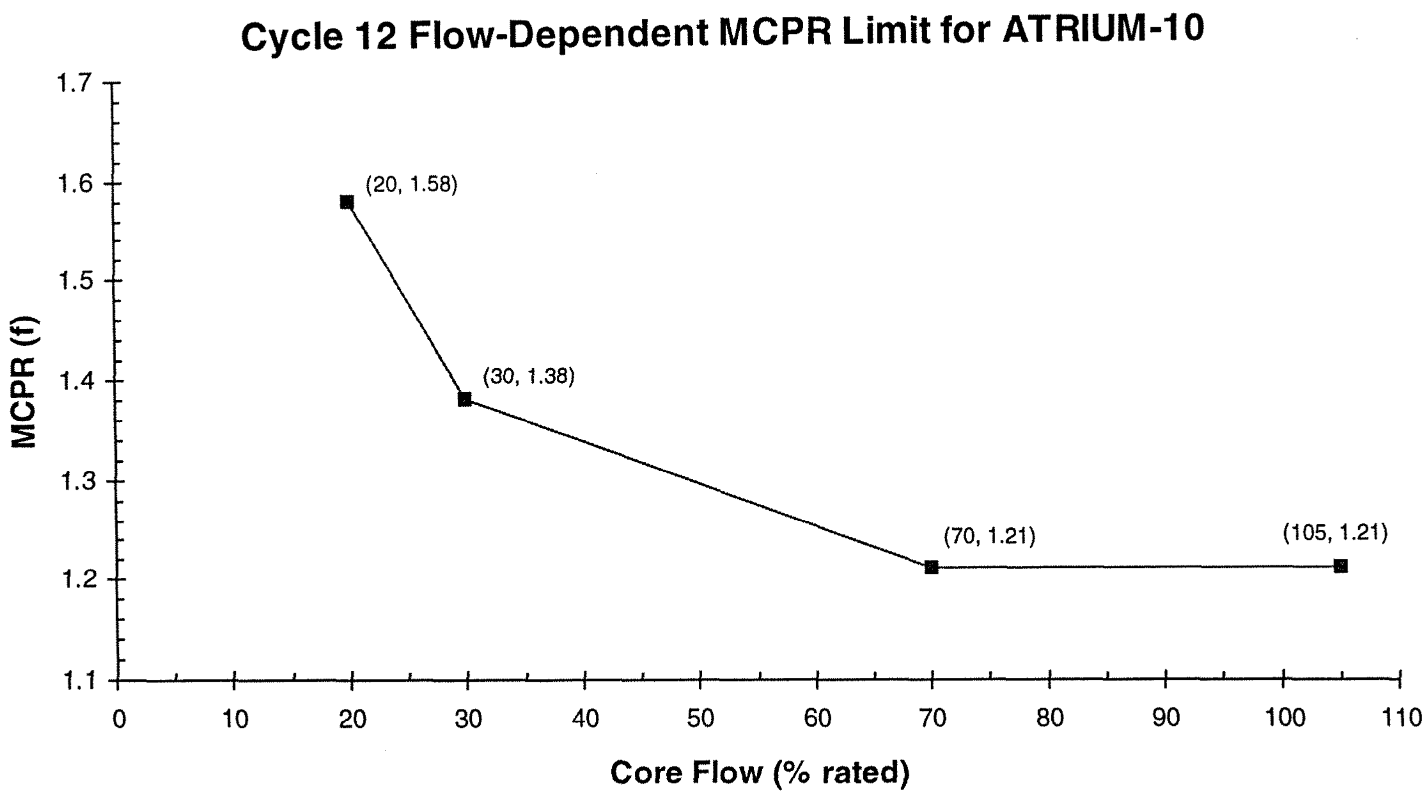

Figure 2-7 Cycle 12 Flow-Dependent MCPR Limit for ATRIUM-10

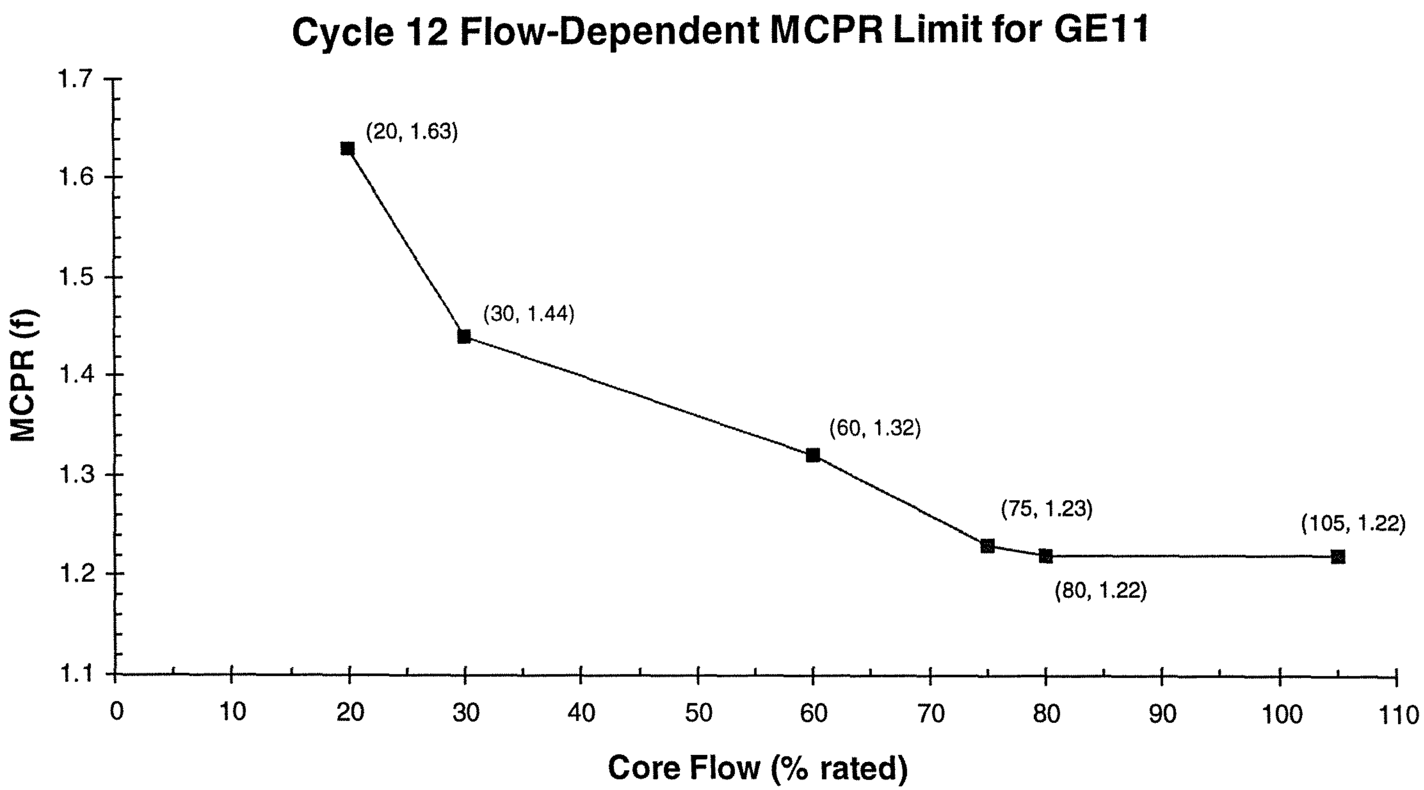

Figure 2-8 Cycle 12 Flow-Dependent MCPR Limit for GE11

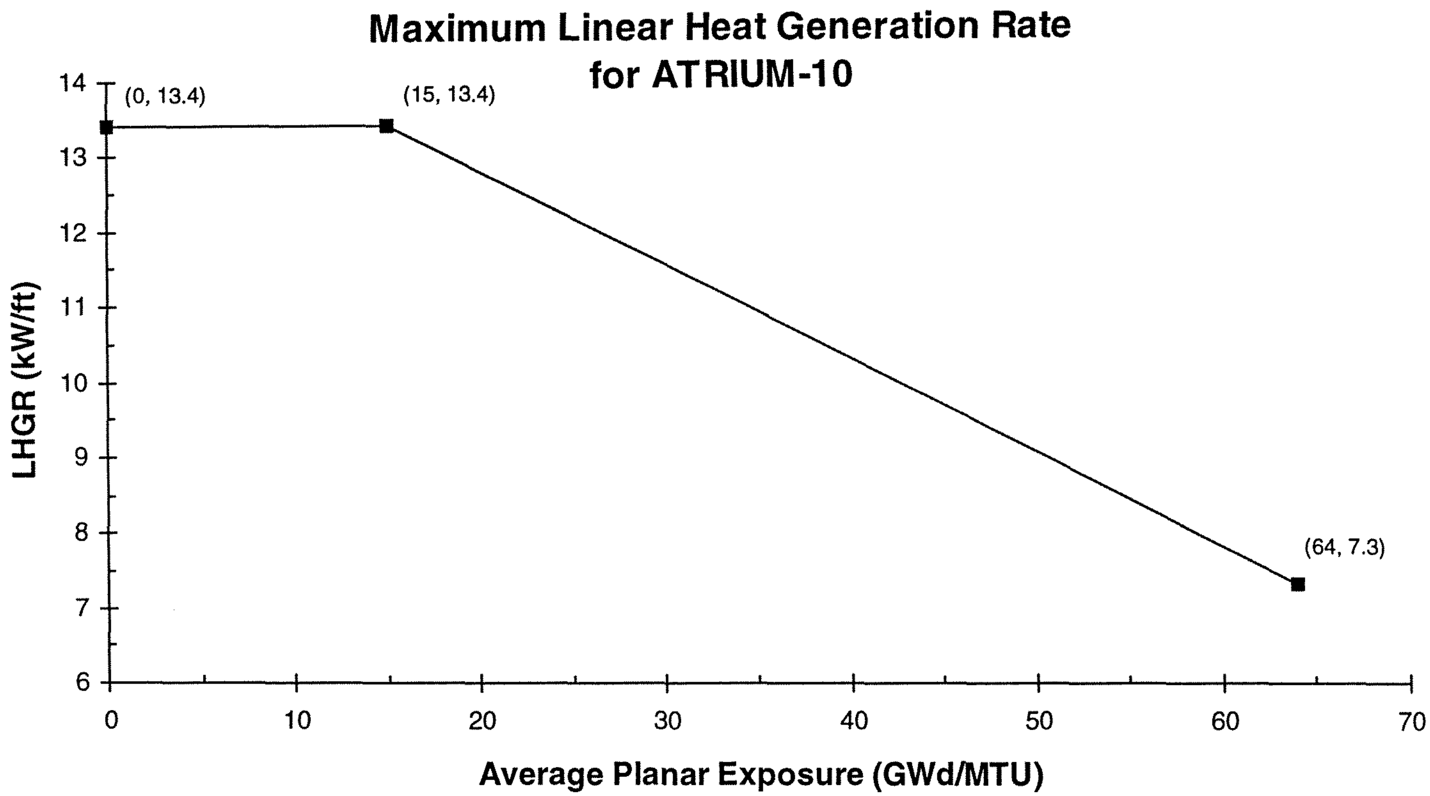

Figure 3-1 Maximum Linear Heat Generation Rate for ATRIUM-10

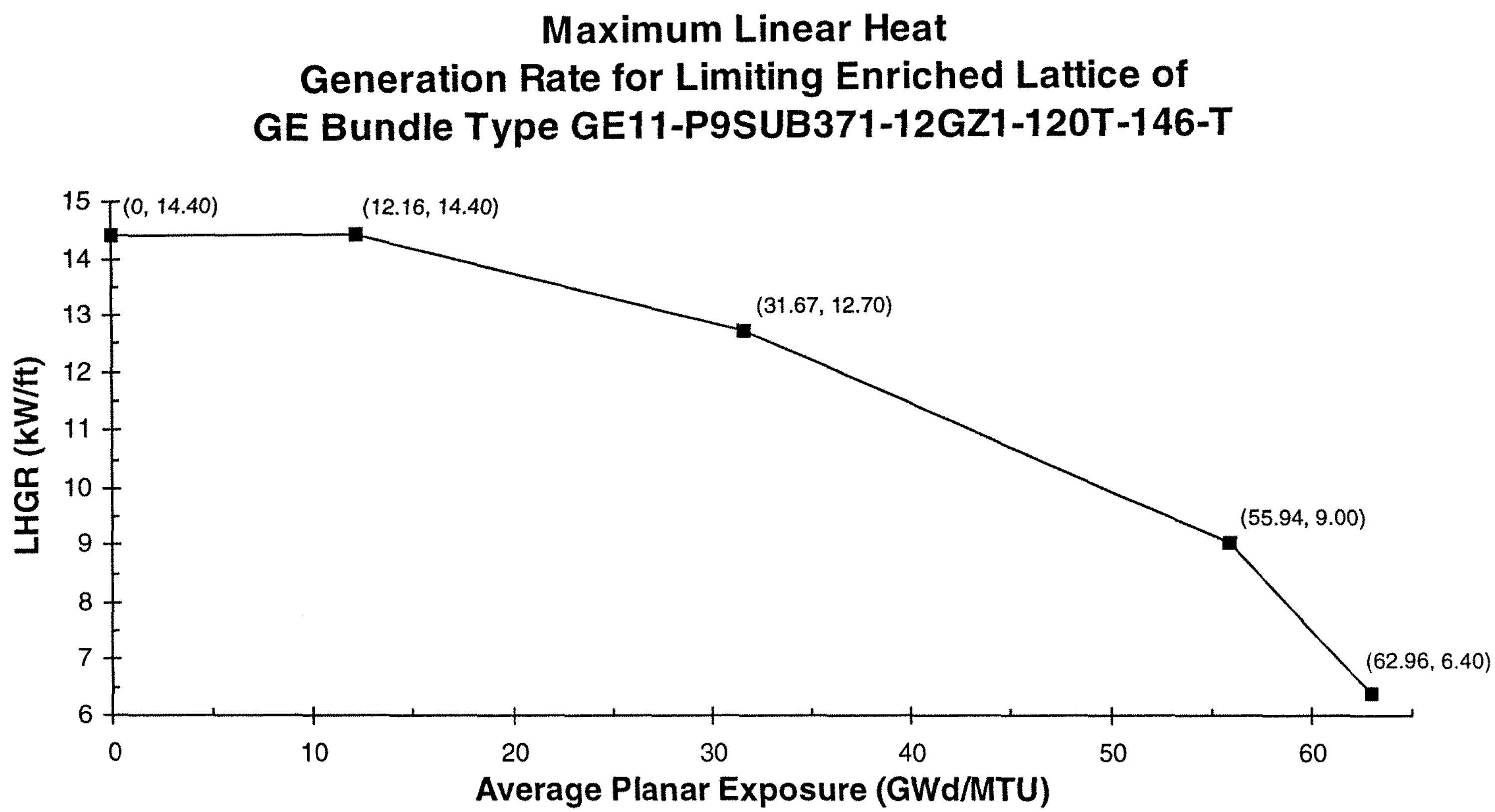

Figure 3-2a Maximum Linear Heat Generation Rate for Limiting Enriched Lattice of GE Bundle Type GE11-P9SUB371-12GZ1-120T-146-T

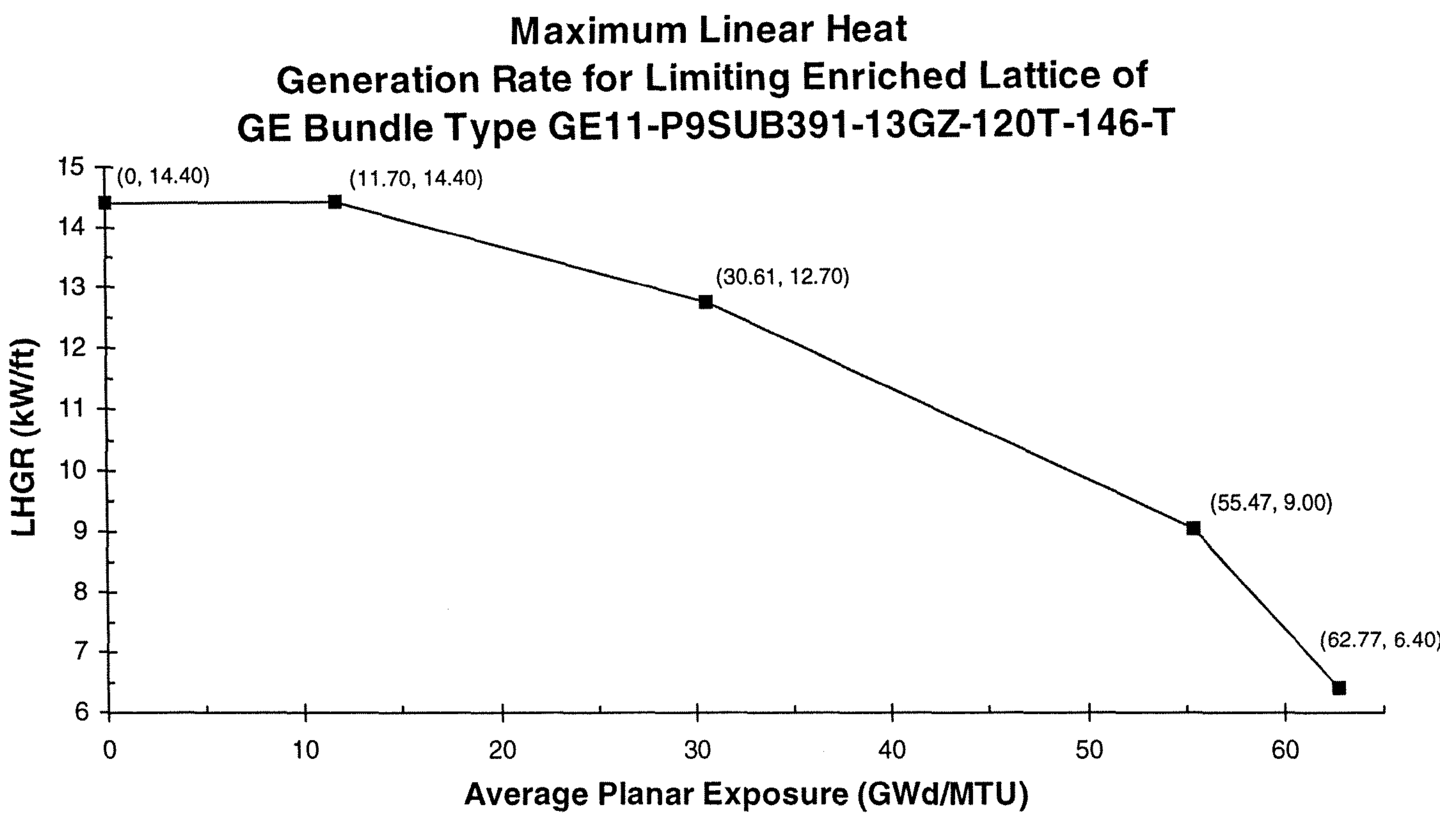

Figure 3-2b Maximum Linear Heat Generation Rate for Limiting Enriched Lattice of GE Bundle Type GE11-P9SUB391-13GZ-120T-146-T

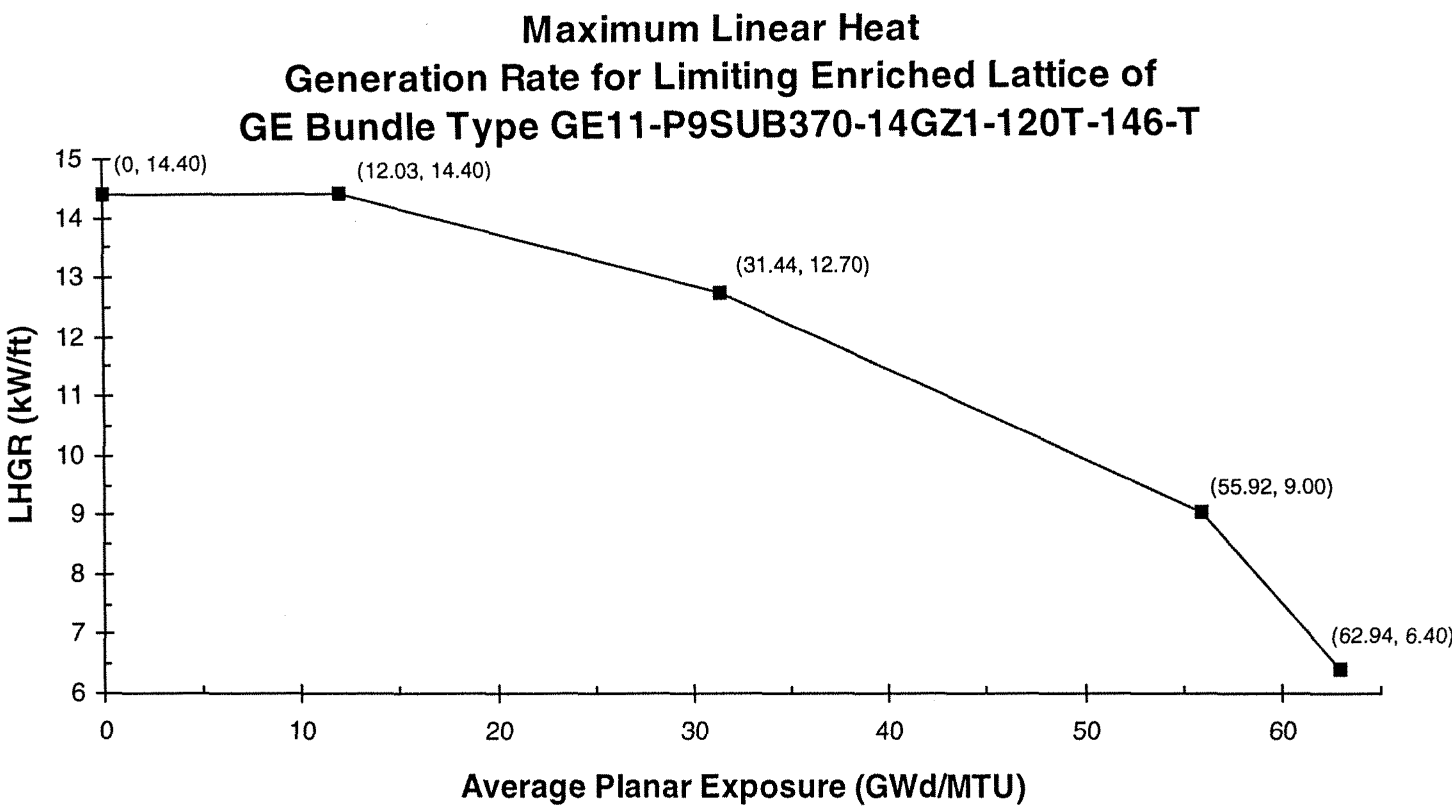

Figure 3-2c Maximum Linear Heat Generation Rate for Limiting Enriched Lattice of GE Bundle Type GE11-P9SUB370-14GZ1-120T-146-T

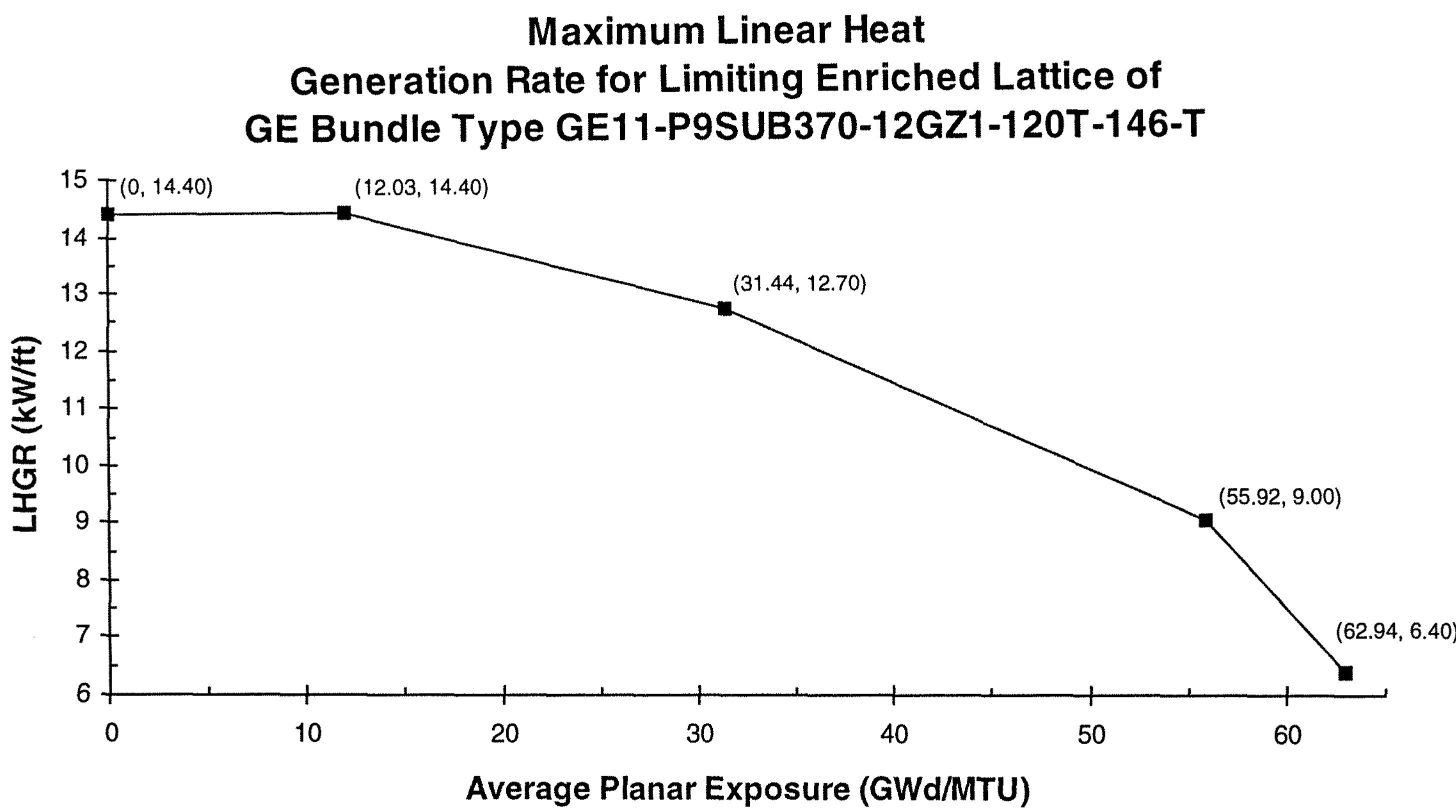

Figure 3-2d Maximum Linear Heat Generation Rate for Limiting Enriched Lattice of GE Bundle Type GE11-P9SUB370-12GZ1-120T-146-T

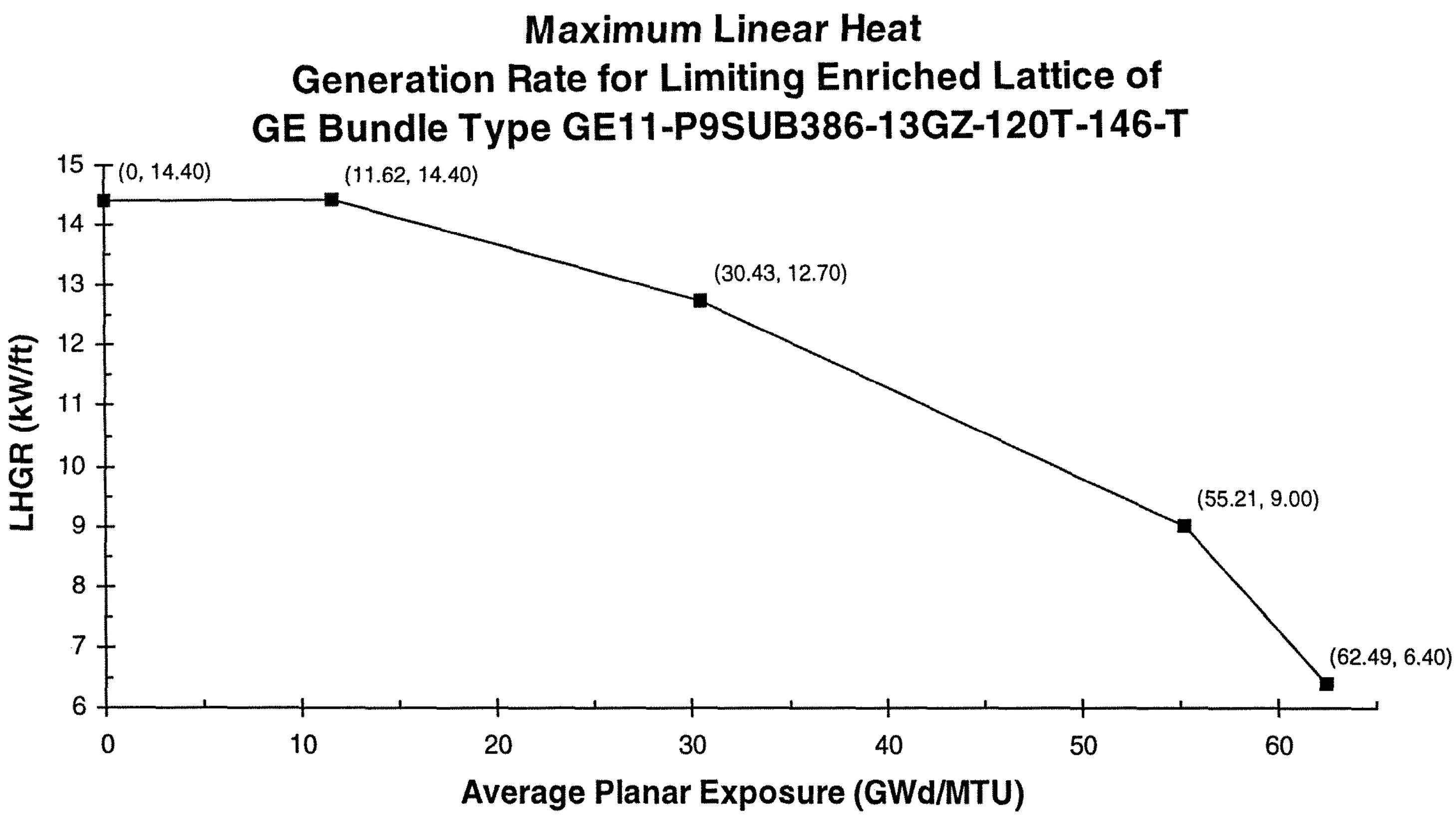

Figure 3-2e Maximum Linear Heat Generation Rate for Limiting Enriched Lattice of GE Bundle Type GE11-P9SUB386-13GZ-120T-146-T

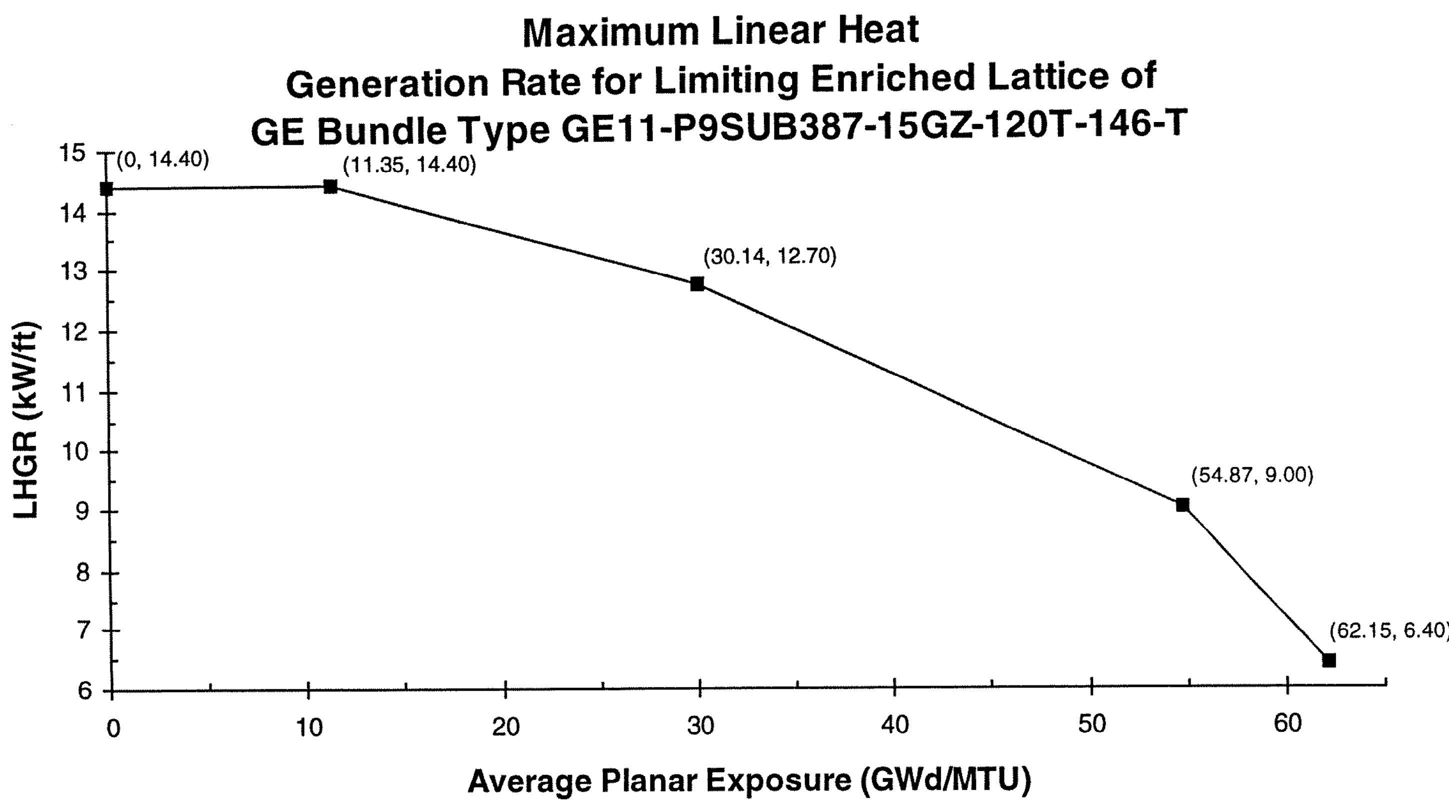

Figure 3-2f Maximum Linear Heat Generation Rate for Limiting Enriched Lattice of GE Bundle Type GE11-P9SUB387-15GZ-120T-146-T

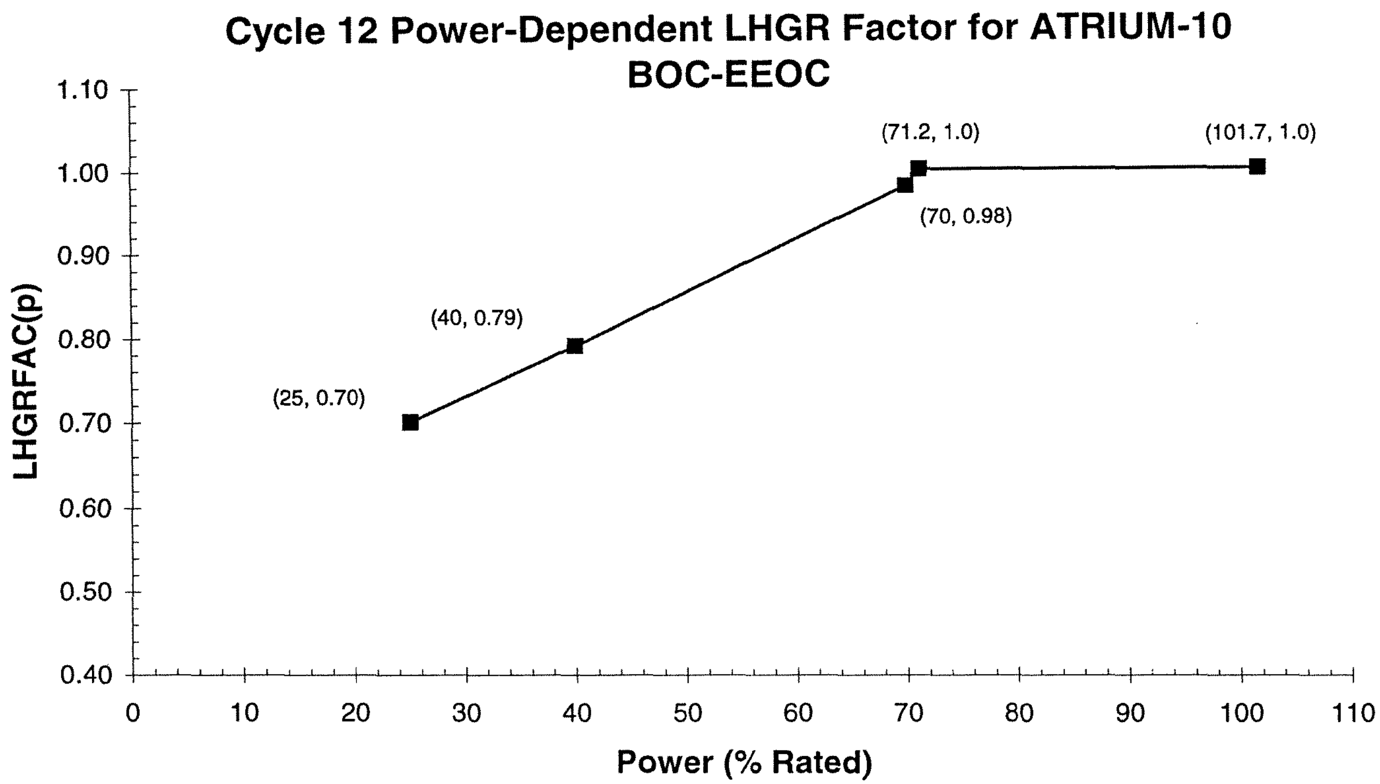

Figure 3-3 Cycle 12 Power-Dependent Linear Heat Generation Rate Factor for ATRIUM-10 BOC-EEOC

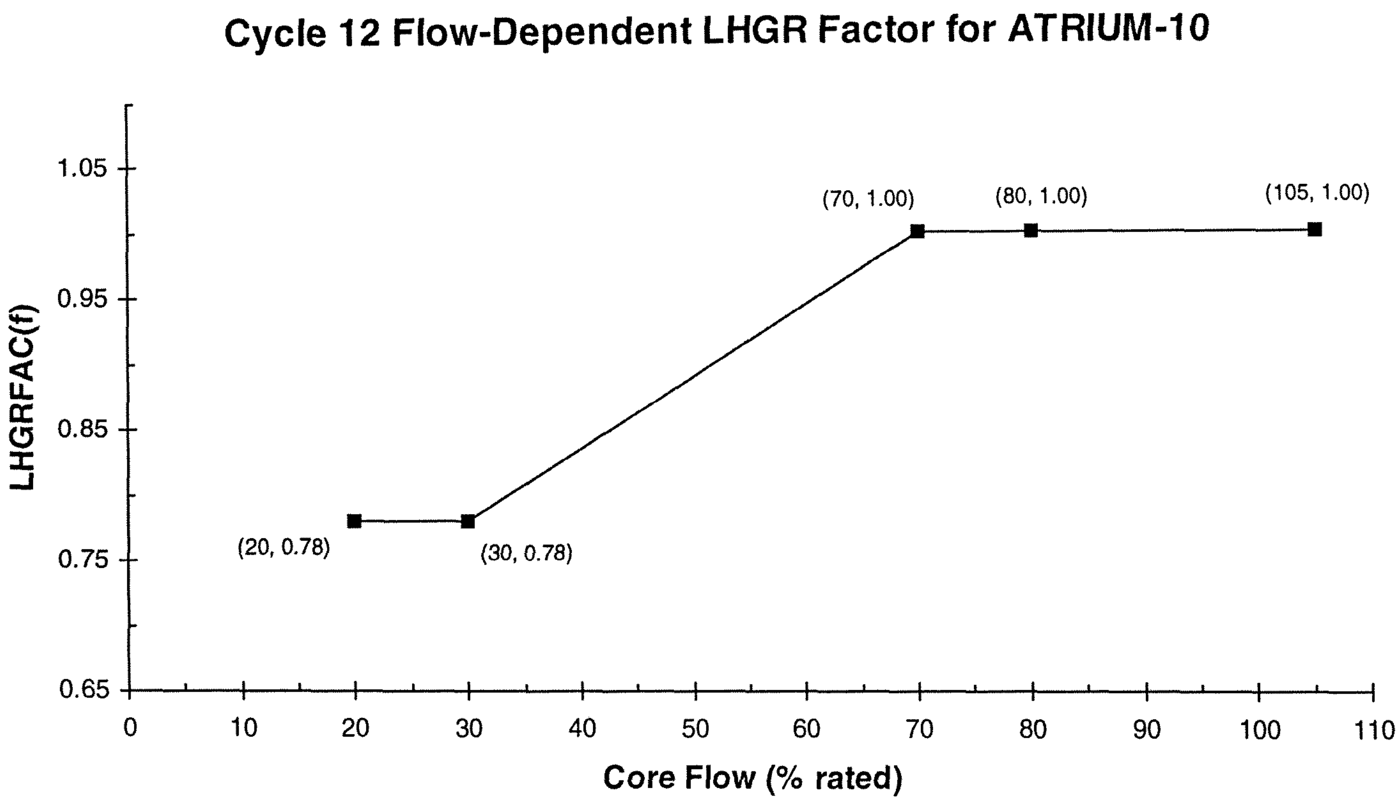

Figure 3-4 Cycle 12 Flow-Dependent Linear Heat Generation Rate Factor for ATRIUM-10

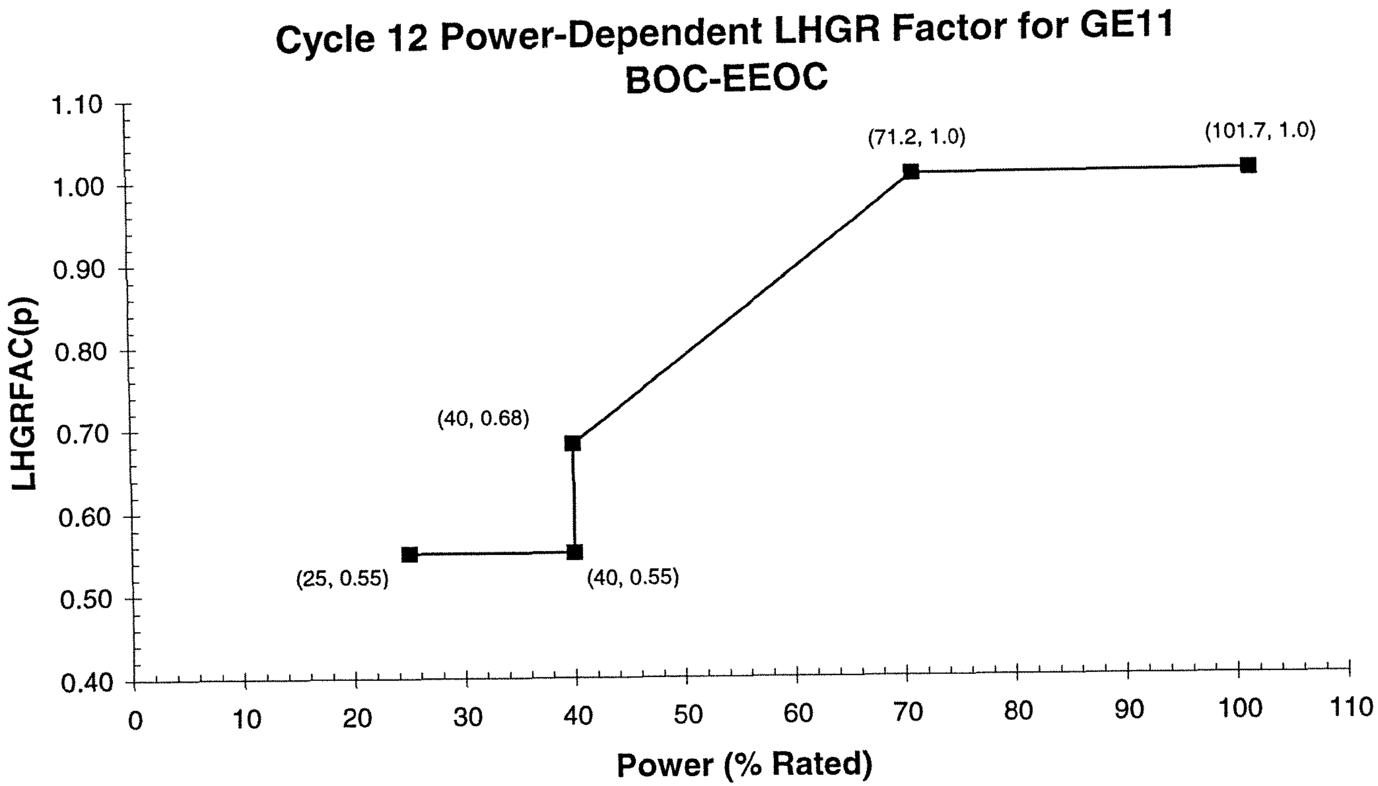

Figure 3-5 Cycle 12 Power-Dependent Linear Heat Generation Rate Factor for GE11 BOC-EEOC

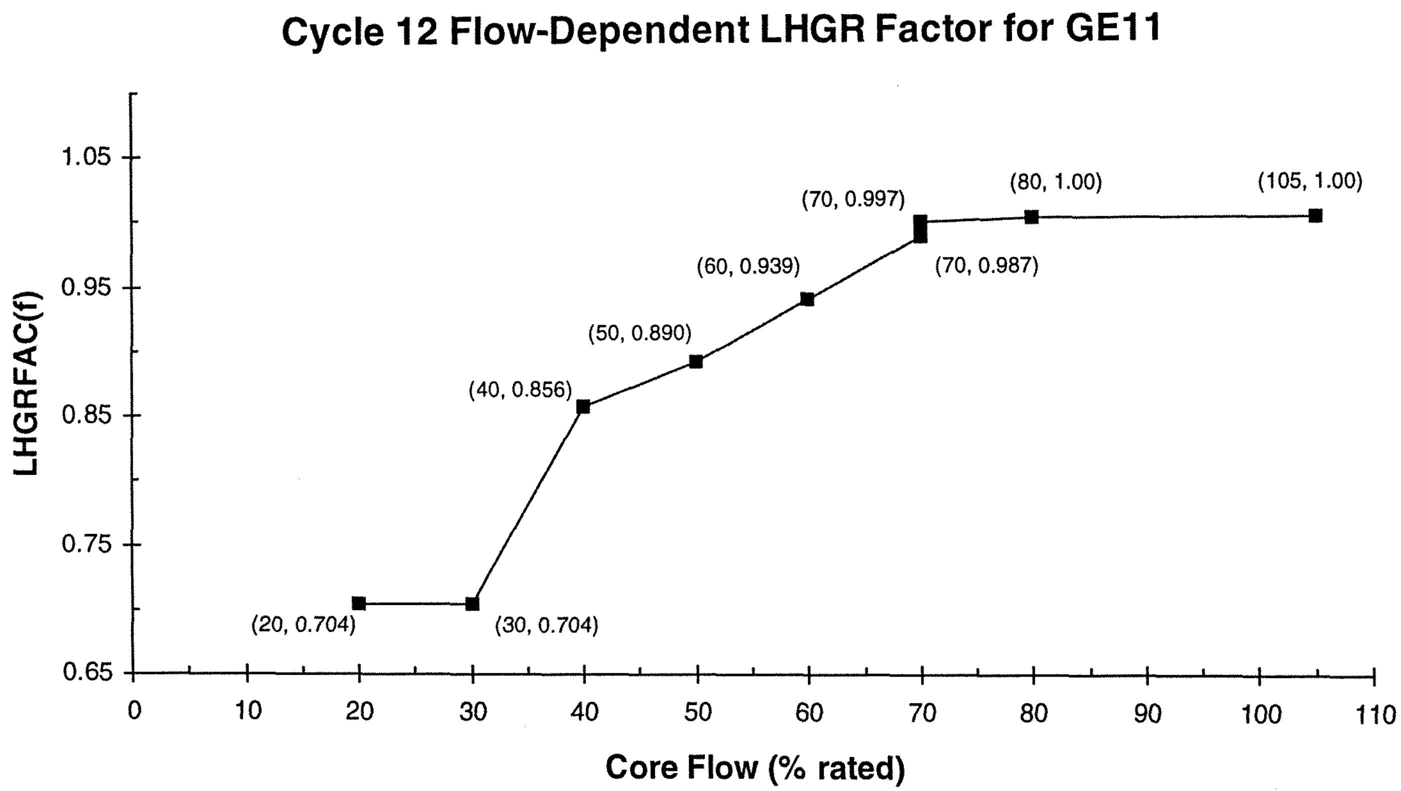

Figure 3-6 Cycle 12 Flow-Dependent Linear Heat Generation Rate Factor for GE11

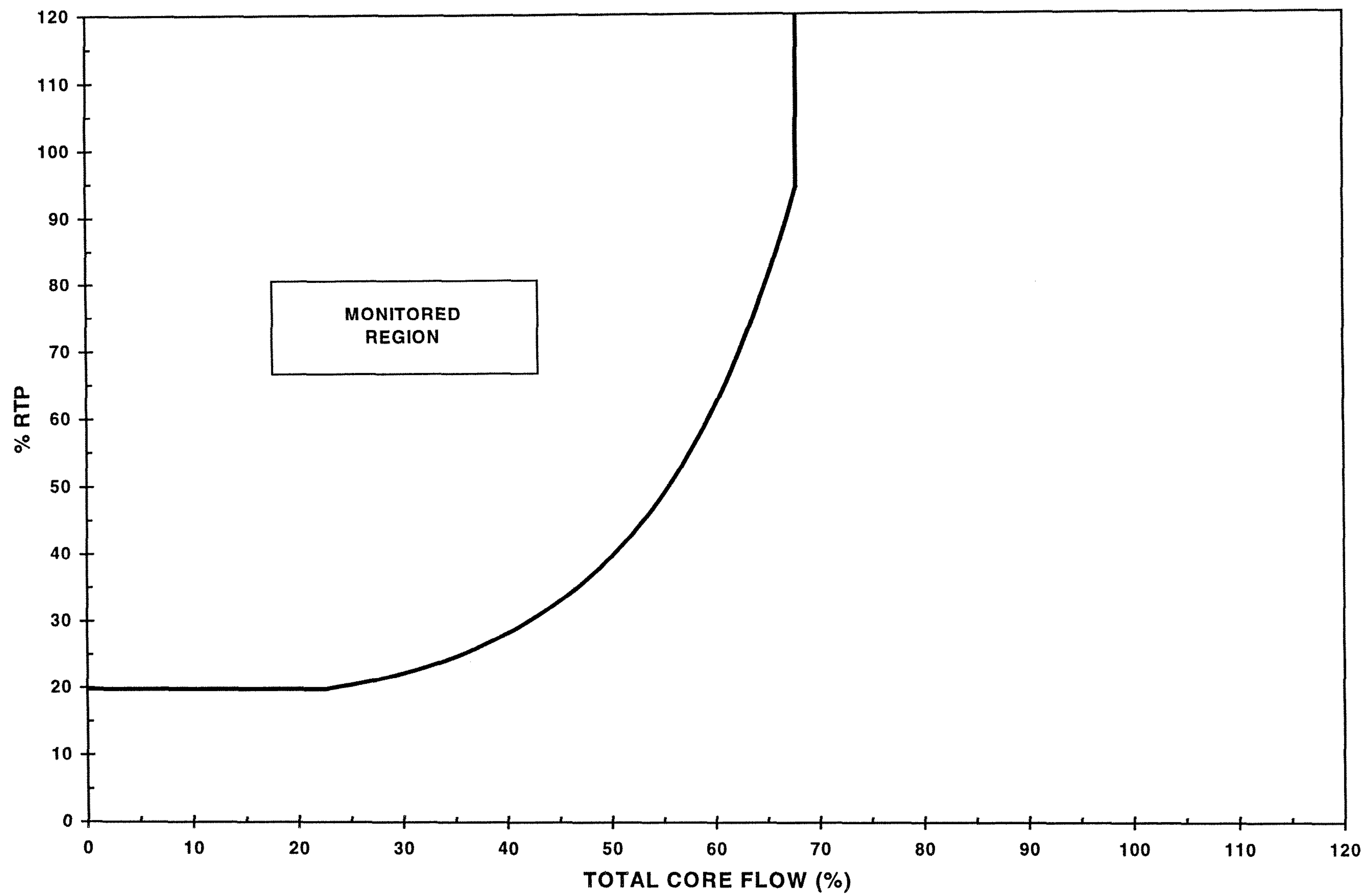

Figure 4-1 Monitored Region Boundary

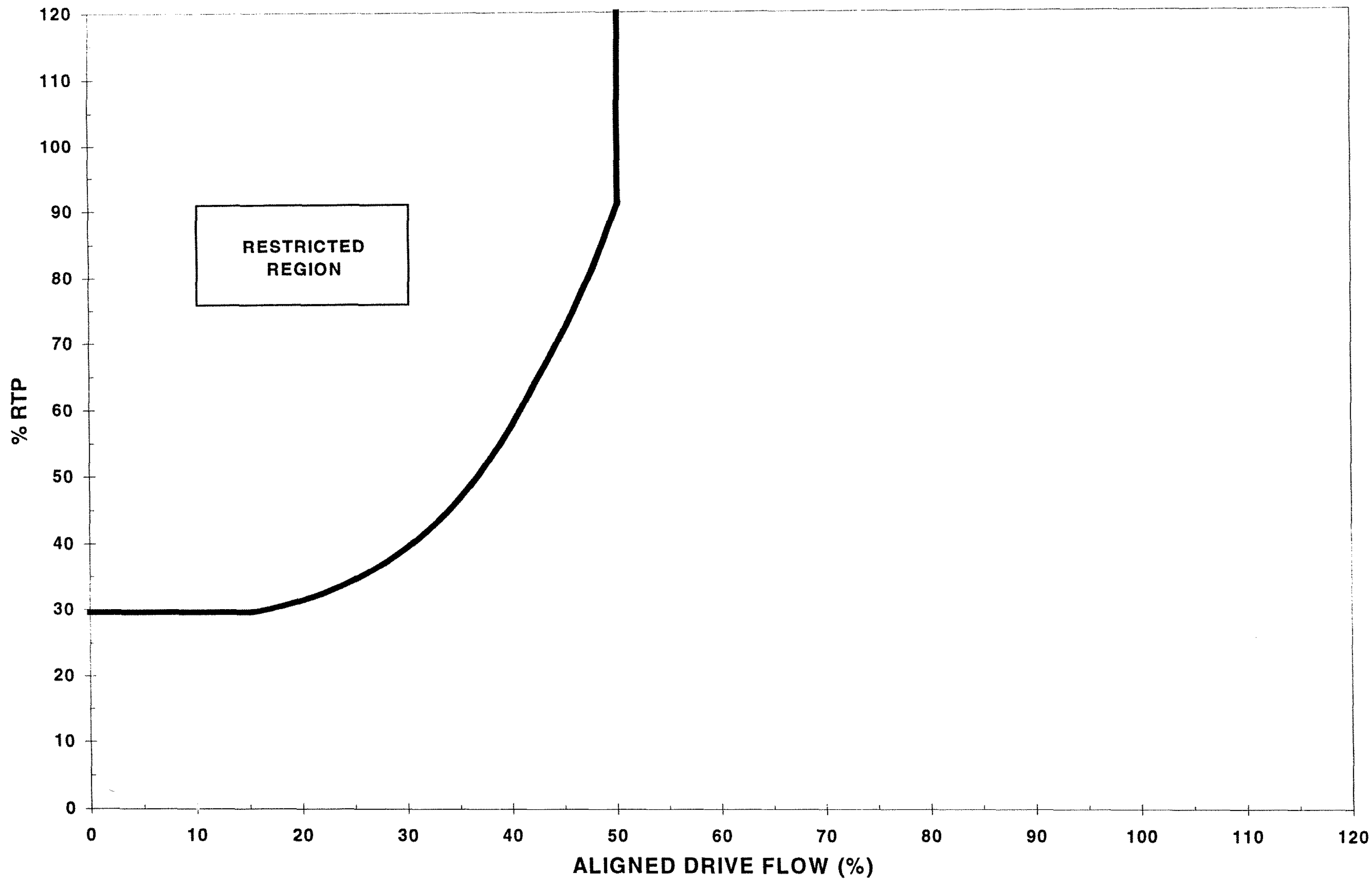

Figure 4-2 Restricted Region Boundary for Two-Loop Operation

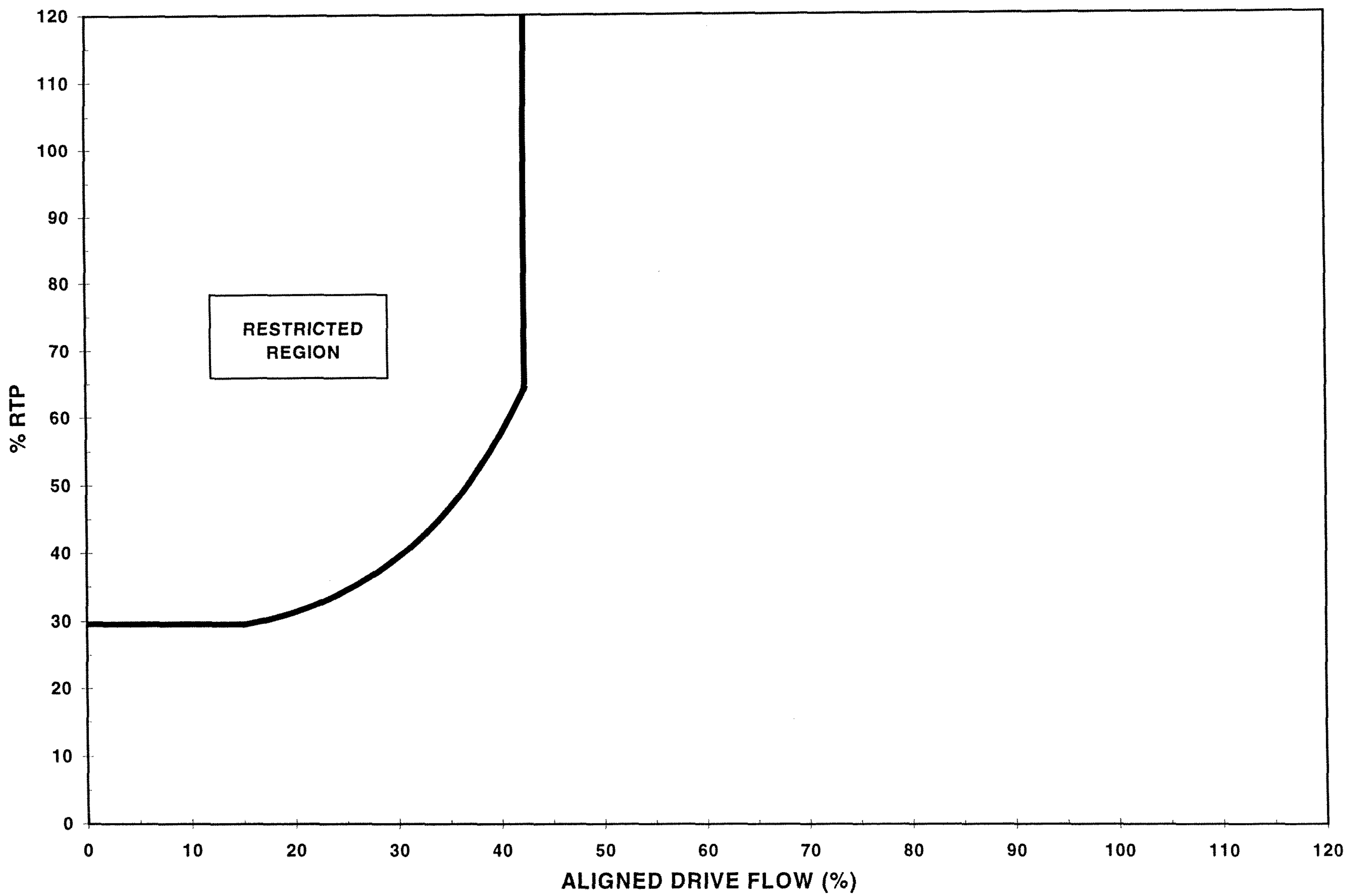

Figure 4-3 Restricted Region Boundary for Single-Loop Operation

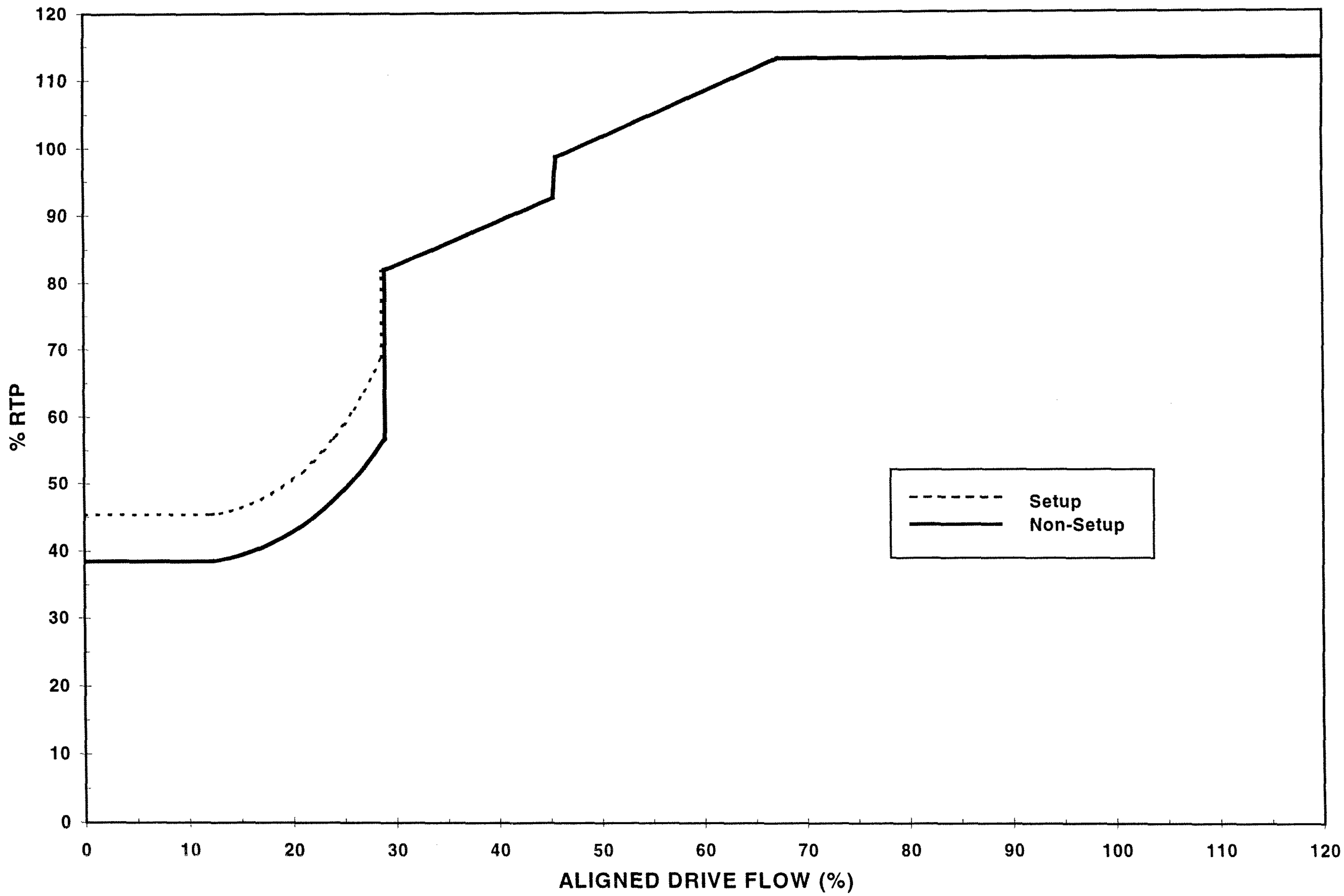

Figure 4-4 APRM Flow-Biased Simulated Thermal Power – High Scram Allowable Values for Two-Loop Operation

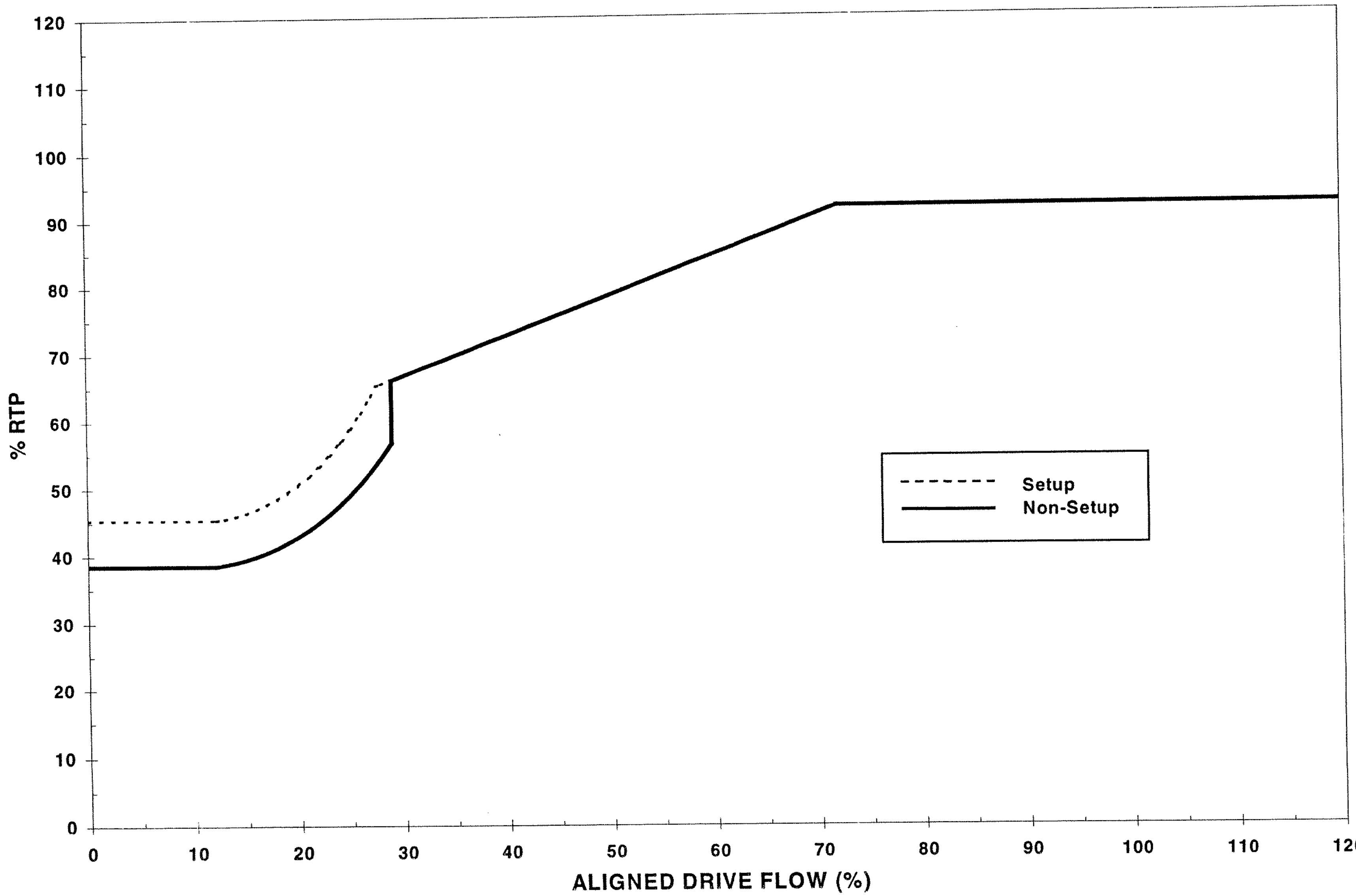

Figure 4-5 APRM Flow-Biased Simulated Thermal Power – High Scram Allowable Values for Single-Loop Operation