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GNRO-2004/00022

March 23, 2004

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

Attention: Document Control Desk

Subject: Core Operating Limits Report Revision Cycle 14 - LDC 04009

Grand Gulf Nuclear Station
Unit 1
Docket No. 50-416
License No. NPF-29

Ladies and Gentlemen:

Entergy Operations, Inc. is submitting a Revision of the Core Operating Limits Report (COLR) for Grand Gulf Nuclear Station (GGNS) (reference: Licensing Document Change LDC 04009) as required by GGNS Technical Specification 5.6.5. for Cycle 14. The analytical methods used to determine the Cycle 14 Core Operating Limits were previously approved by the NRC and are listed in GGNS Technical Specification 5.6.5. **This letter does not contain any commitments**. If you have any questions or require additional information, please contact Mike Larson (601) 437-6685.

Yours truly,

Charles A. Bottemiller
Manager, Plant Licensing

MJL
attachment: GGNS Core Operating Limits Report
cc: see next page

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U.S. Nuclear Regulatory Commission ATTN: Mr. Bhalchandra Vaidya, NRR/DLPM (w/2) **ATTN: FOR ADDRESSEE ONLY** ATTN: U.S. Postal Delivery Address Only Mail Stop OWFN/7D-1 Washington, D.C. 20555-0001	ALL LETTERS – U.S. POSTAL SERVICE MAIL DELIVERY ADDRESS ONLY

Grand Gulf Nuclear Station

Core Operating Limits Report

REASON FOR REVISION

This Revision provides the GGNS core operating limits for Cycle 14. These limits are based on a core power of 3898 MWt.

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CORE OPERATING LIMITS REPORT

1.0 PURPOSE

On October 4, 1988, the NRC issued Generic Letter 88-16 [3.1.1] 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 [3.1.2]. 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 [3.1.3].

The COLR is controlled as a License Basis Document and revised accordingly for each fuel cycle or remaining portion of a fuel cycle. Any revisions to the COLR must be submitted to the NRC for information as required by Tech Spec 5.6.5 and tracked by LCTS 29132. This COLR reports the Cycle 14 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 14 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.

3.0 REFERENCES

This section contains the background, cycle-specific, and methodology references used in the safety analysis of Grand Gulf Cycle 14.

3.1 Background References

3.1.1 MAEC-88/0313, Generic Letter 88-16, "Removal of Cycle-Specific Parameter Limits from Technical Specifications", October 4, 1988.

3.1.2 GNRO-92-00093, Proposed Amendment to Grand Gulf Operating License, PCOL-92/07, dated October 29, 1992.

3.1.3 GNRI-93-0008, Amendment 106 to Grand Gulf Operating License, January 21, 1993.

3.2 Current Cycle References

3.2.1 FAB03-1145, J.L. Raklios to J.B. Lee, "Transmittal of Final Grand Gulf Cycle 14 RAR, PTAR, and FCDR," dated November 20, 2003.

3.2.2 GEXI 2000-00043, R.E. Kingston to J.B. Lee, "Transmittal of GGNS LHGR/MAPLHGR Relaxation Results," dated October 23, 2000.

3.2.3 FAB04-072, J.L. Raklios to J.B. Lee, "Grand Gulf Cycle 14 Final Core Loading Report – Revision 1," dated March 8, 2004.

3.2.4 GEXI 97-00035, R.E. Kingston to J.B. Lee, "Utilization of Power and Flow Dependent MAPLHGR and LHGR Limits," dated June 27, 1997.

3.2.5 NEDC-32910P, "Grand Gulf Nuclear Station SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis With Relaxed ECCS Parameters," dated September 1999.

3.2.6 CEO 2000-00094, Jim Head to M.D. Withrow, "Revised E1A Related COLR Input," dated April 20, 2000.

3.2.7 Deleted

3.2.8 GEXI 2000-00116, K.V. Walters to J.B. Lee, "Technical Specification and COLR References for Grand Gulf Nuclear Station and River Bend Station," November 3, 2000.

3.3 Methodology References

3.3.1 XN-NF-81-58(P)(A) Revision 2 and Supplements 1 and 2, “RODEX2 Fuel Rod Thermal-Mechanical Response Evaluation Model,” Exxon Nuclear Company, March 1984.

3.3.2 XN-NF-85-67(P)(A) Revision 1, “Generic Mechanical Design for Exxon Nuclear Jet Pump BWR Reload Fuel,” Exxon Nuclear Company, September 1986.

3.3.3 EMF-85-74(P) Revision 0 Supplement 1 (P)(A) and Supplement 2 (P)(A), “RODEX2A (BWR) Fuel Rod Thermal-Mechanical Evaluation Model, Siemens Power Corporation,” February 1998.

3.3.4 ANF-89-98(P)(A) Revision 1 and Supplement 1, “Generic Mechanical Design Criteria for BWR Fuel Designs,” Advanced Nuclear Fuels Corporation, May 1995.

3.3.5 EMF-93-177(P)(A) and Supplement 1, “Mechanical Design for BWR Fuel Channels, Siemens Power Corporation,” August 1995.

3.3.6 XN-NF-80-19(P)(A) Volume 1 and Supplements 1 and 2, “Exxon Nuclear Methodology for Boiling Water Reactors – Neutronic Methods for Design and Analysis, Exxon Nuclear Company,” March 1983.

3.3.7 XN-NF-80-19(P)(A) Volume 4 Revision 1, “Exxon Nuclear Methodology for Boiling Water Reactors: Application of the ENC Methodology to BWR Reloads, Exxon Nuclear Company,” June 1986.

3.3.8 EMF-2158(P)(A) Revision 0, “Siemens Power Corporation Methodology for Boiling Water Reactors: Evaluation and Validation of CASMO-MICROBURN-B2, Siemens Power Corporation,” October 1999.

3.3.9 XN-NF-80-19(P)(A) Volume 3 Revision 2, “Exxon Nuclear Methodology for Boiling Water Reactors, THERMEX: Thermal Limits Methodology Summary Description,” Exxon Nuclear Company, January 1987.

3.3.10 XN-NF-84-105(P)(A), Volume 1 and Supplements 1 and 2, “XCOBRA-T: A Computer Code for BWR Transient Thermal Hydraulic Core Analysis,“ Exxon Nuclear Company, February 1987.

3.3.11 ANF-524(P)(A) Revision 2 and Supplements 1 and 2, “ANF Critical Power Methodology for Boiling Water Reactors,“ Advanced Nuclear Fuels Corporation, November 1990.

3.3.12 ANF-913 (P)(A), Volume 1, Revision 1 and Volume 1 Supplements 2, 3 and 4, “COTRANSA2: A Computer Program for Boiling Water Reactor Transient Analyses,“ Advanced Nuclear Fuels Corporation, August 1990.

3.3.13 XN-NF-825(P)(A) Supplement 2, “BWR/6 Generic Rod Withdrawal Error Analysis, $MCPR_p$ for Plant Operation Within the Extended Operating Domain,“ Exxon Nuclear Company, October 1986.

3.3.14 ANF-1358(P)(A) Revision 1, “The Loss of Feedwater Heating Transient in Boiling Water Reactors,“ Advanced Nuclear Fuels Corporation, September 1992.

3.3.15 EMF-1997(P)(A) Revision 0, “ANFB-10 Critical Power Correlation,” Siemens Power Corporation, July 1998.

3.3 Methodology References (continued)

3.3.16 EMF-1997(P), Supplement 1(P)(A), Revision 0, “ANFB-10 Critical Power Correlation: High Local Peaking Results, Siemens Power Corporation,“ July 1998.

3.3.17 EMF-2209(P)(A) Revision 1 and errata sheet, “SPCB Critical Power Correlation, Siemens Power Corporation,“ July 2000.

3.3.18 EMF-2245(P)(A) Revision 0, “Application of Siemens Power Corporation’s Critical Power Correlations to Co-Resident Fuel,“ Siemens Power Corporation, August 2000.

3.3.19 XN-NF-80-19(P)(A), Volumes 2, 2A, 2B, and 2C, “Exxon Nuclear Methodology for Boiling Water Reactors: EXEM BWR ECCS Evaluation Model,“ Exxon Nuclear Company, September 1982.

3.3.20 ANF-91-048(P)(A), “Advanced Nuclear Fuels Corporation Methodology for Boiling Water Reactors EXEM BWR Evaluation Model, Advanced Nuclear Fuel Corporation,“ January 1993.

3.3.21 ANF-91-048(P)(A), Supplements 1 and 2, “BWR Jet Pump Model Revision for RELAX,“ Siemens Power Corporation, October 1997.

3.3.22 XN-CC-33(A) Revision 1, “HUXY: A Generalized Multirod Heatup Code with 10 CFR 50 Appendix K Heatup Option Users Manual,“ Exxon Nuclear Company, November 1975.

3.3.23 EMF-2292(P)(A) Revision 0, “ATRIUM-10: Appendix K Spray Heat Transfer Coefficients, Siemens Power Corporation,“ September 2000.

3.3.24 EMF-CC-074(P)(A) Volume 4 Revision 0, “BWR Stability Analysis-Assessment of STAIF with Input from MICROBURN-B2,“ Siemens Power Corporation, August 2000.

3.3.25 NEDE-24011-P-A, General Electric Standard Application for Reactor Fuel (GESTAR-II)

4.0 DEFINITIONS

4.1 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.

4.2 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.

4.3 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.

4.4 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.

4.5 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.

4.6 Minimum Critical Power Ratio (MCPR) - the MCPR shall be the smallest CPR which exists in the core.

4.7 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.

4.8 Aligned Drive Flow – Adjusted FCTR card input drive flow signal that accounts for actual variations in the core flow to drive flow relationship.

4.9 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.

4.10 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.

4.11 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.

4.12 Middle of Cycle (MOC) – The Cycle 14 MOC Core Average Exposure (CAE) is 30,856 MWd/MTU [3.2.1].

4.13 End of Cycle (EOC) – The Cycle 14 EOC CAE is 32,504 MWd/MTU [3.2.1].

4.14 Extended End of Cycle (EEOC) – The Cycle 14 EEOC CAE is 33,327 MWd/MTU [3.2.1].

5.0 GENERAL REQUIREMENTS

5.1 Average Planar Linear Heat Generation Rates

Consistent with Technical Specification 3.2.1, all APLHGRs for ATRIUM10 and 9x9-5 bundles shall not exceed the exposure-dependent limits reported in Figures 1-1 and 1-2, respectively [3.2.1, 3.2.3]. All APLHGRs for GE11 lattices shall not exceed the MAPLHGR limits reported in Reference 3.2.2 as a function of exposure multiplied by the smaller of either the power-dependent or flow-dependent MAPLHGR factors reported in Figures 1-4 and 1-5, respectively [3.2.1, 3.2.3]. For GE11 bundles, Figure 1-3 reports the MAPLHGR for the most limiting enriched lattice at each exposure for reference purposes.

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 Figure(s) 2 as functions of power, flow, and exposure [3.2.1, 3.2.3]. These figures are applicable to all fuel types.

Additional MCPR operating limits are provided to support operation with EOC-RPT inoperable as described in Technical Specification 3.3.4.1. These figures are applicable to all fuel types.

5.3 Linear Heat Generation Rate

Consistent with Technical Specification 3.2.3, the LHGR for ATRIUM10 and 9x9-5 bundles shall not exceed the exposure-dependent limits reported in Figures 3-1 and 3-2, respectively, multiplied by the smaller of either the power-dependent or flow-dependent LHGR factors reported in Figures 3-4 and 3-6 [3.2.1, 3.2.3]. All LHGRs for GE11 lattices shall not exceed the LHGR limits reported in References 3.2.2 as a function of exposure multiplied by the smaller of either the power-dependent or flow-dependent LHGR factors reported in Figures 3-5 and 3-7 [3.2.1, 3.2.3, 3.2.4]. For GE11 bundles, Figure 3-3 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 Figure(s) 4 [3.2.6].

5.5 Applicability

The following core operating limits are applicable for operation in the Maximum Extended Operating Domain (MEOD), with Feedwater Heaters Out of Service (FHOOS), and EOC-RPT inoperable. For operation with EOC-RPT inoperable, the alternate MCPR limits described in Section 5.2 above must be implemented. Since the maximum licensed GGNS feedwater temperature reduction is 50 °F at rated power operation, an alternate set of stability limits is not required. For single-loop operation (SLO), the following additional requirements must be satisfied.

1. A SLO MAPLHGR multiplier of 0.87 is required for ATRIUM10 fuel [3.2.1, 3.2.3]. There is no MAPLHGR multiplier required for GE11 fuel since the flow-dependent MAPLHGR and LHGR factors reported in Figures 1-5 and 3-7 at the maximum SLO core flow are less than the SLO multipliers applied in the LOCA analysis [3.2.1, 3.2.3, 3.2.5].

2. The MCPR shall be equal to or greater than the limits determined in accordance with Section 5.2 above increased by 0.02 to account for the difference between the two-loop and single-loop MCPR safety limits for the allowable range of single-loop operation [3.2.1, 3.2.3].

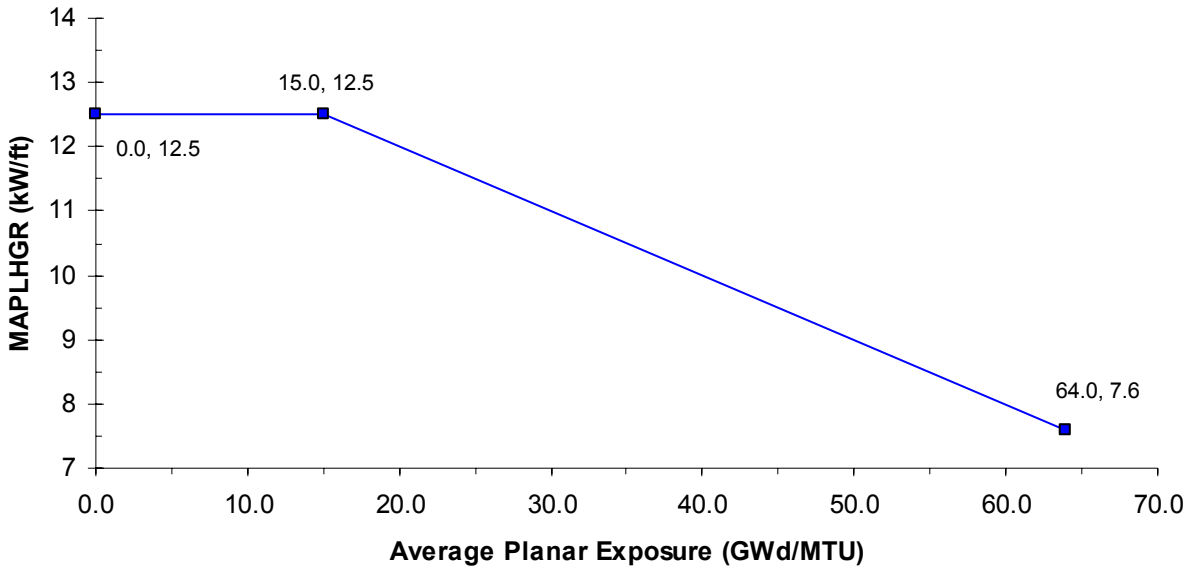

Figure 1-1
Maximum Average Planar Linear Heat Generation Rate for ATRIUM-10
Note: Actual limits described in Sections 5.1 and 5.5

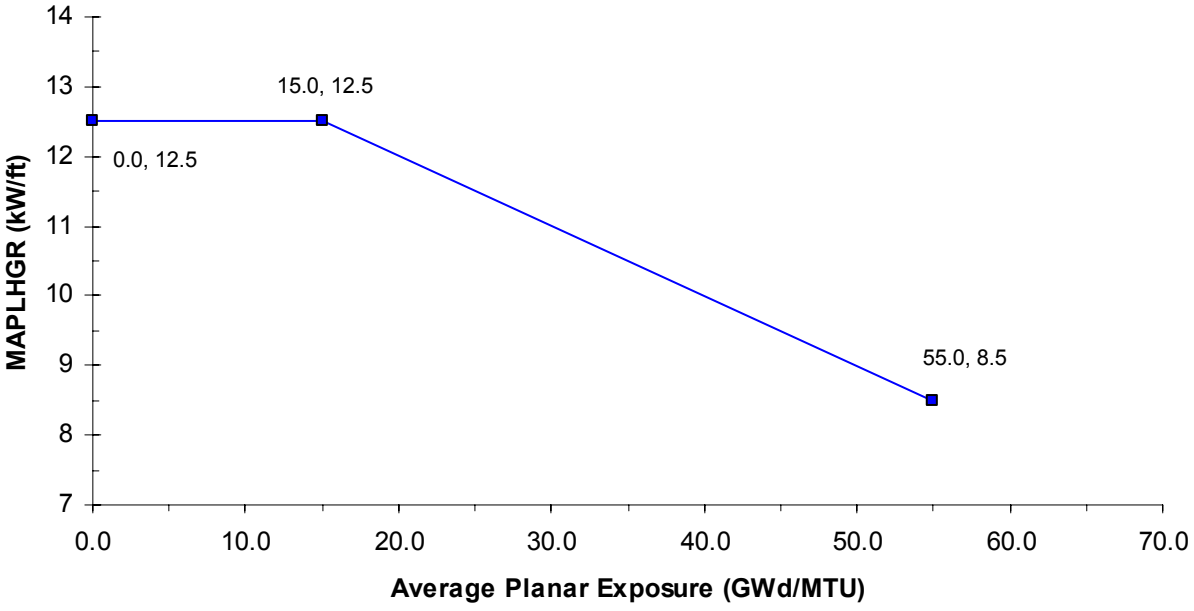

Figure 1-2
Maximum Average Planar Linear Heat Generation Rate for 9x9-5
Note: Actual limits described in Sections 5.1 and 5.5

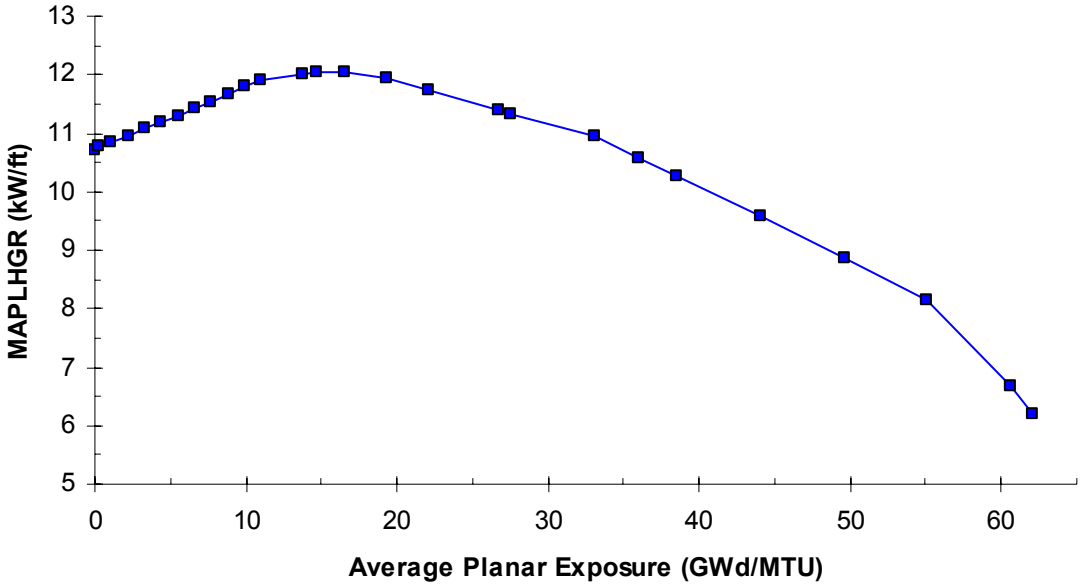

Figure 1-3
Maximum Average Planar Linear Heat Generation Rate for Limiting Enriched Lattice of GE Bundle Type GE11-P9SUB387-15GZ-120T-146-T
Note: Actual limits described in Sections 5.1 and 5.5

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

Exposure (GWd/MTU)	GE Bundle Type GE11-P9SUB387-15GZ-120T-146-T
0.00	10.71
0.22	10.77
1.10	10.85
2.20	10.96
3.31	11.07
4.41	11.18
5.51	11.30
6.61	11.42
7.72	11.54
8.82	11.66
9.92	11.79
11.02	11.91
13.78	12.02
14.66	12.03
16.53	12.05
19.29	11.93
22.05	11.74
26.79	11.39
27.56	11.34
33.07	10.94
36.05	10.58
38.58	10.28
44.09	9.57
49.60	8.86
55.12	8.16
60.63	6.69
62.14	6.18

Note: Actual limits described in Section 5.1

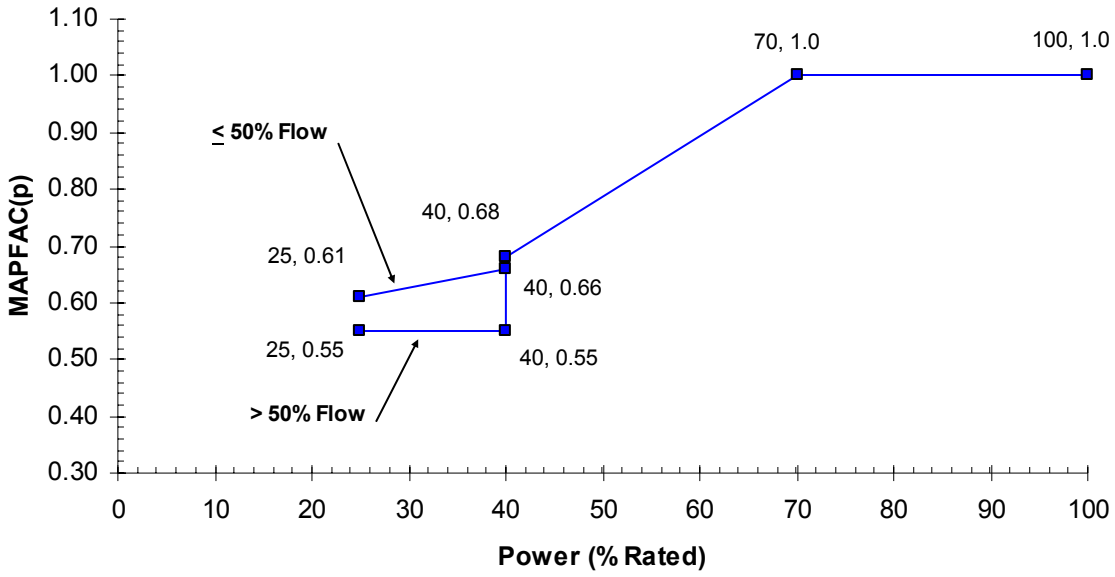

Figure 1-4
Cycle 14 Power-Dependent MAPLHGR Factor for GE11 BOC-EEOC
Note: These factors are to be applied to the exposure-dependent limits as described in Section 5.1

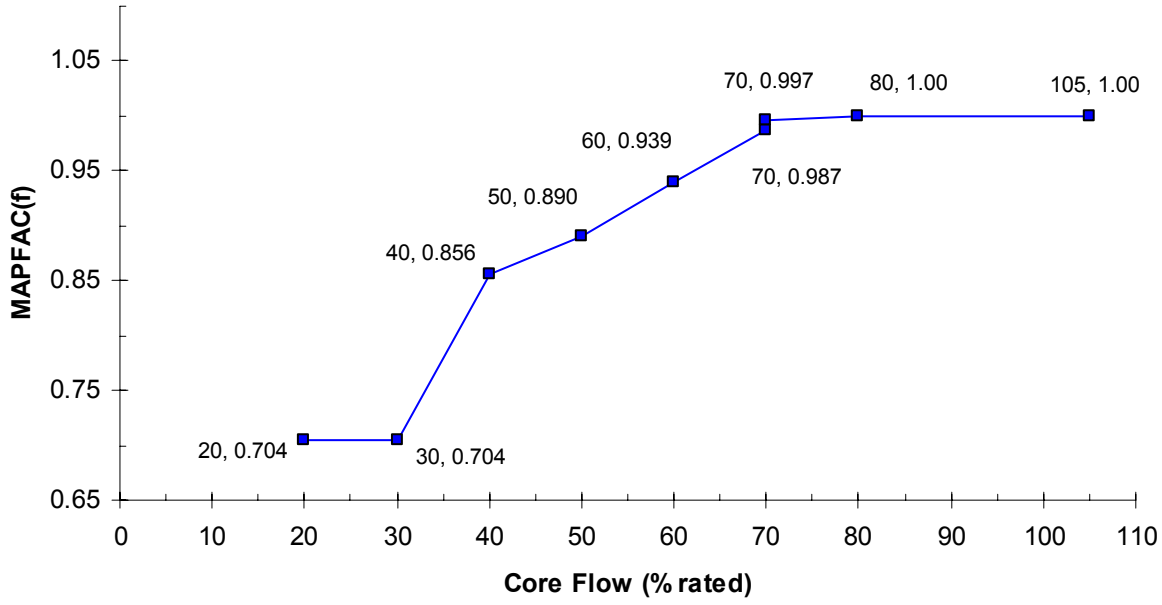

Figure 1-5
Cycle 14 Flow-Dependent MAPLHGR Factor for GE11
Note: These factors are to be applied to the exposure-dependent limits as described in Section 5.1

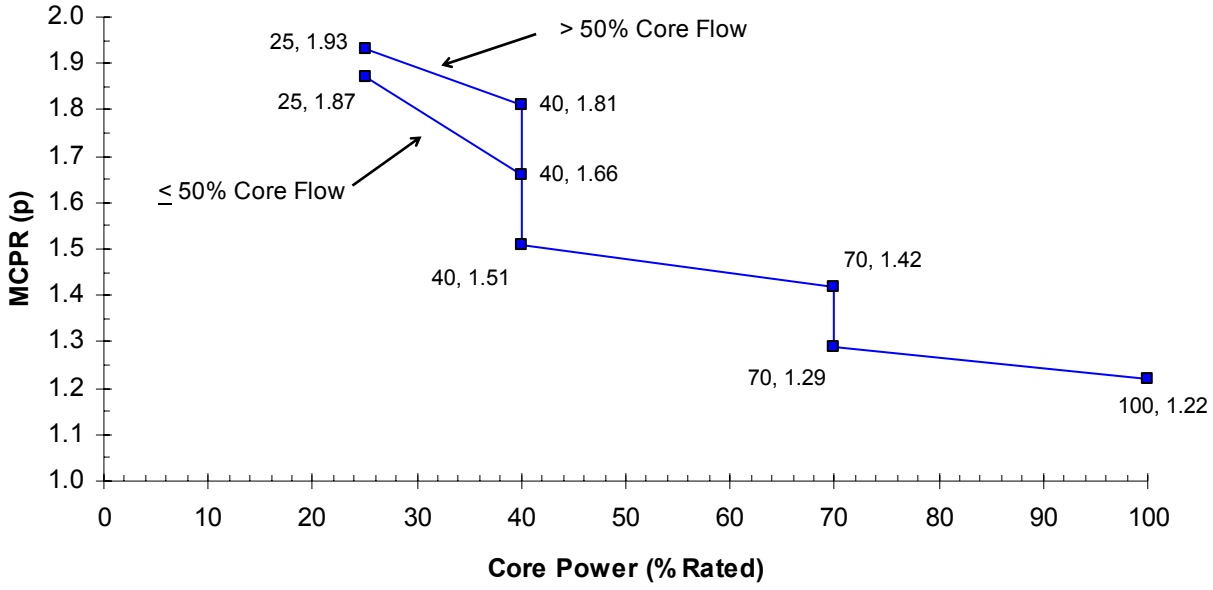

Figure 2-1 Cycle 14 Power-Dependent MCPR Limits BOC to MOC

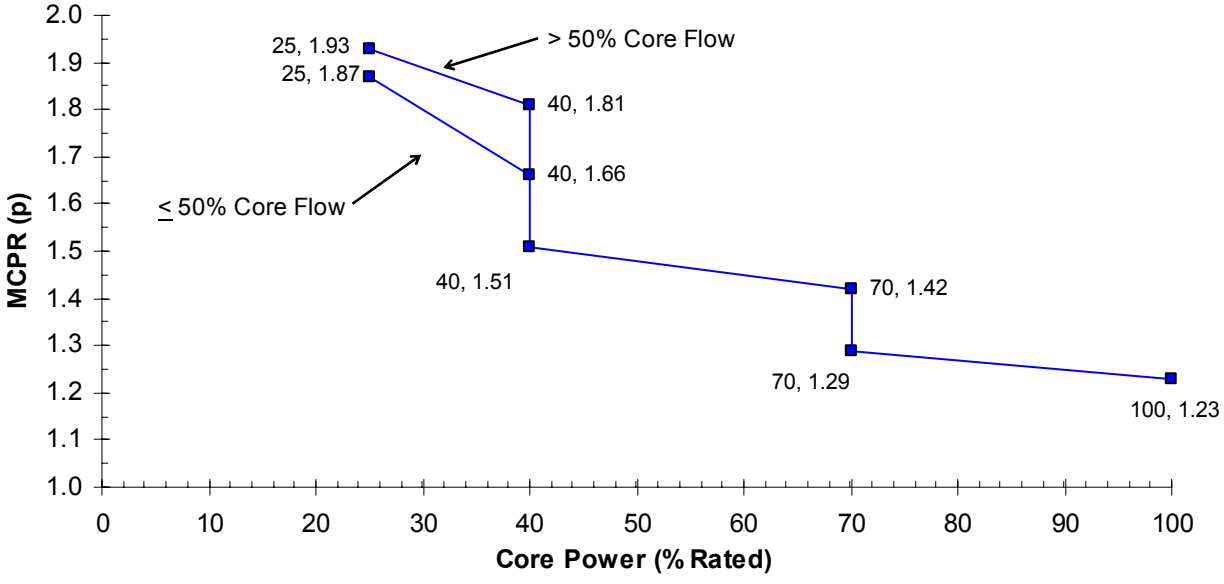

Figure 2-2 Cycle 14 Power-Dependent MCPR Limits BOC to MOC with EOC-RPT Inoperable

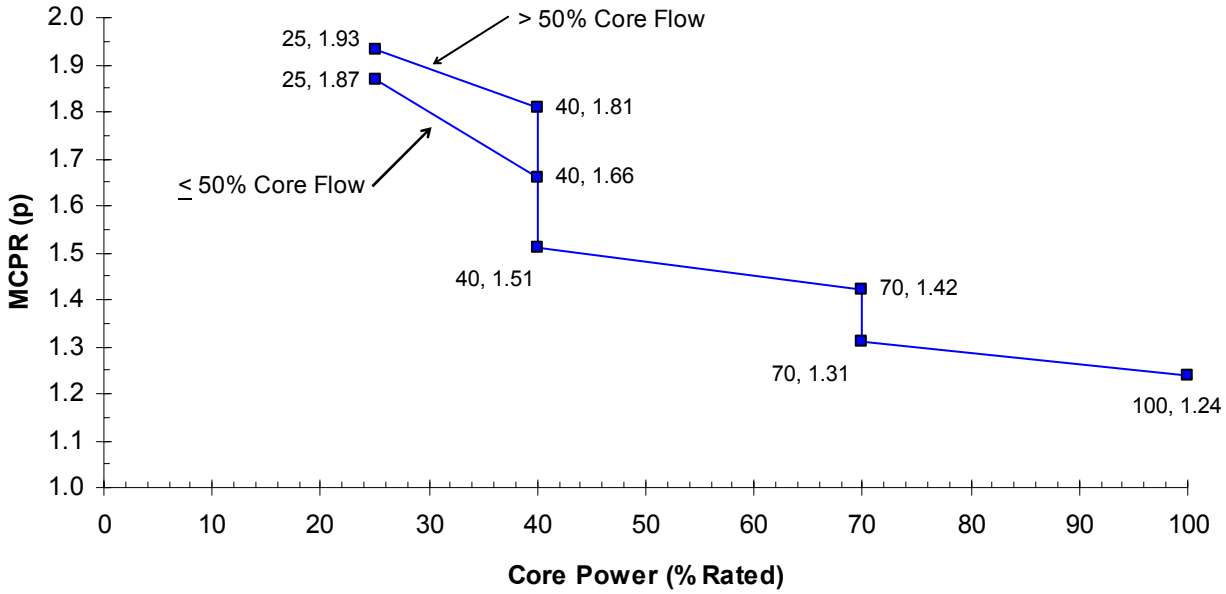

Figure 2-3 Cycle 14 Power-Dependent MCPR Limits MOC to EOC

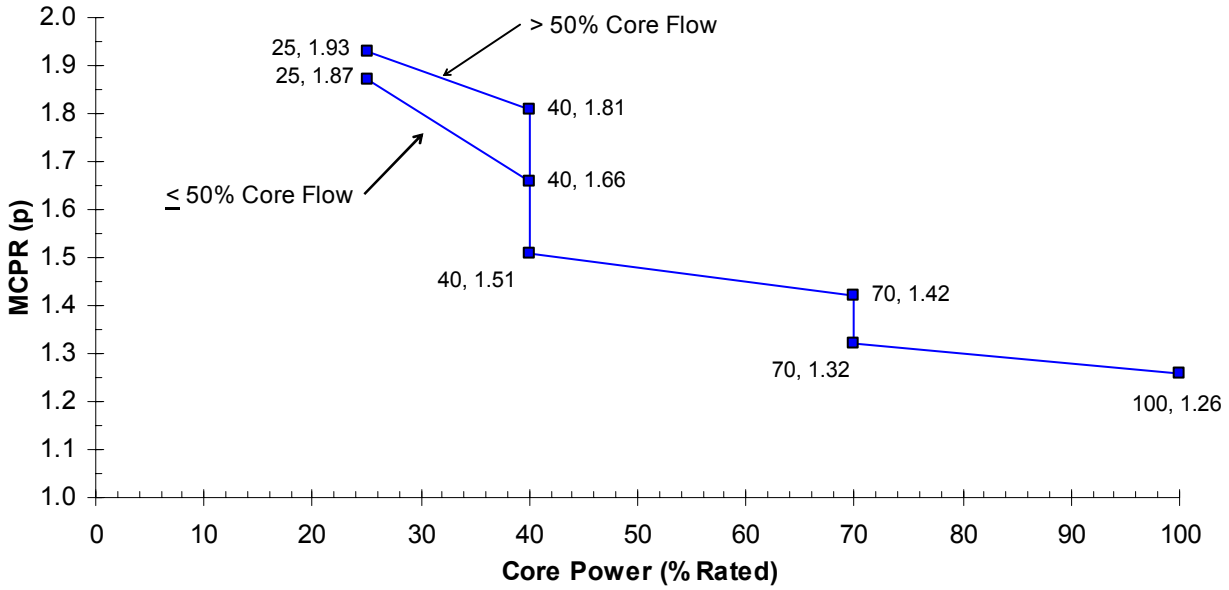

Figure 2-4 Cycle 14 Power-Dependent MCPR Limits MOC to EOC with EOC-RPT Inoperable

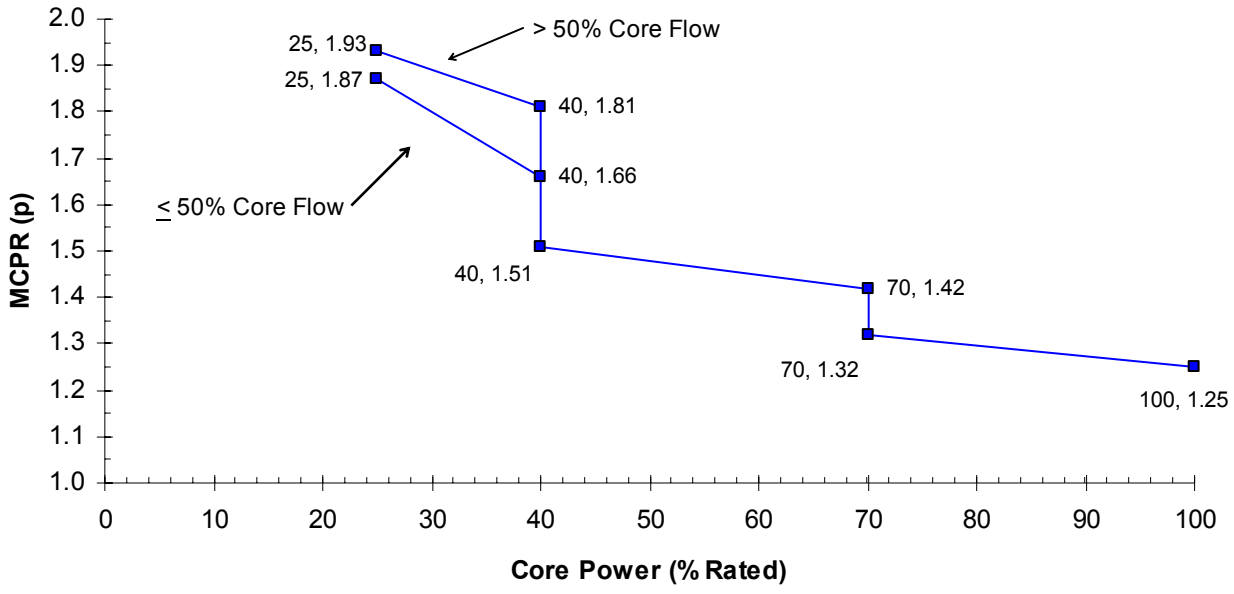

Figure 2-5 Cycle 14 Power-Dependent MCPR Limits
EOC to EEOC

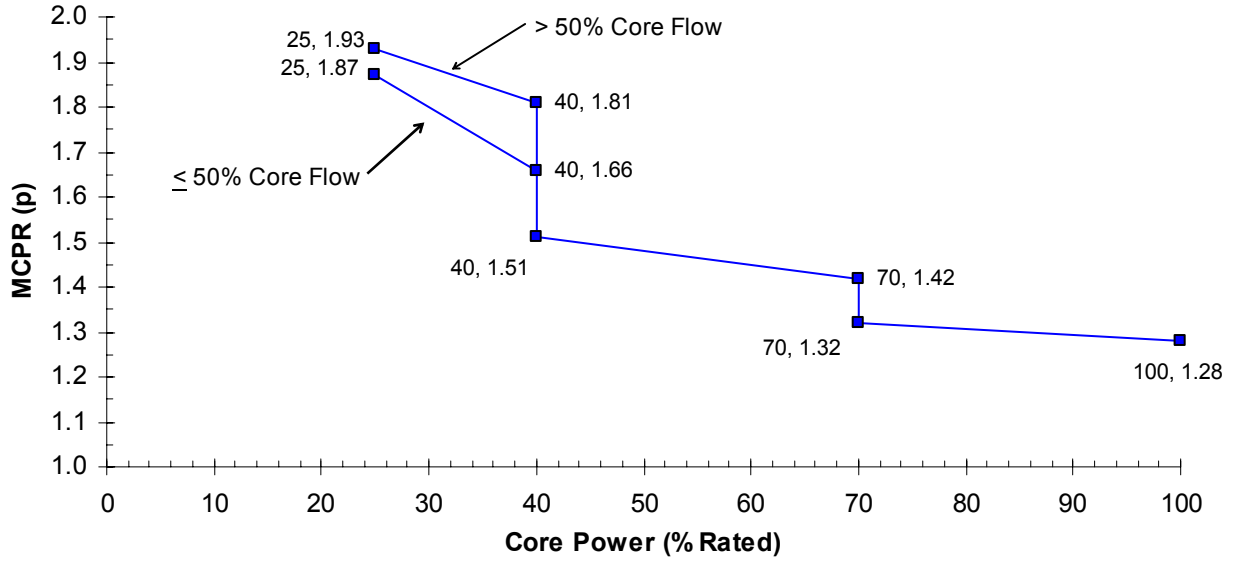

Figure 2-6 Cycle 14 Power-Dependent MCPR Limits
EOC to EEOC with EOC-RPT Inoperable

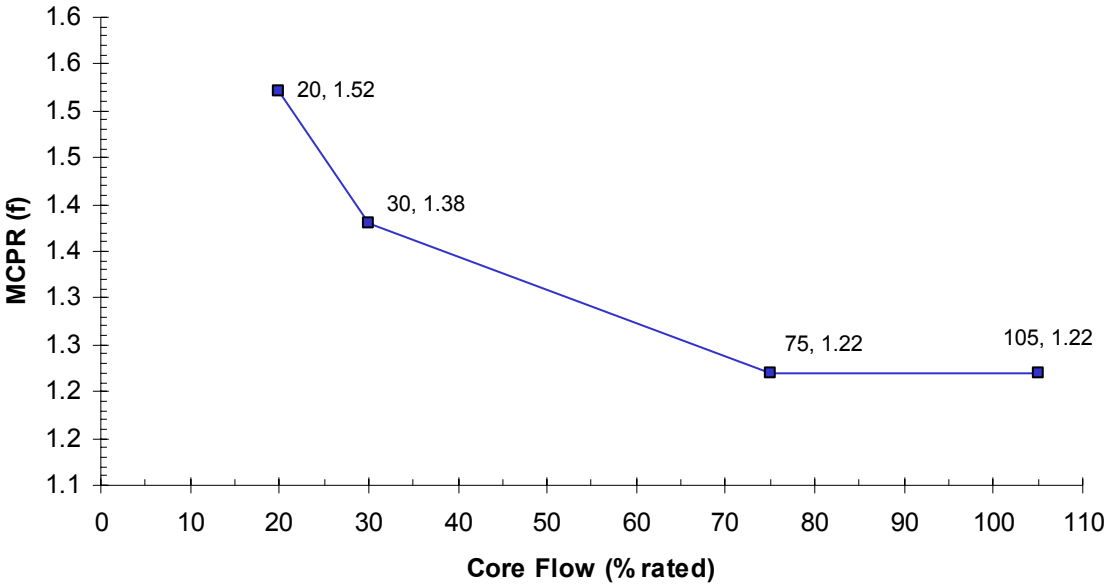

Figure 2-7 Cycle 14 Flow-Dependent MCPR Limits

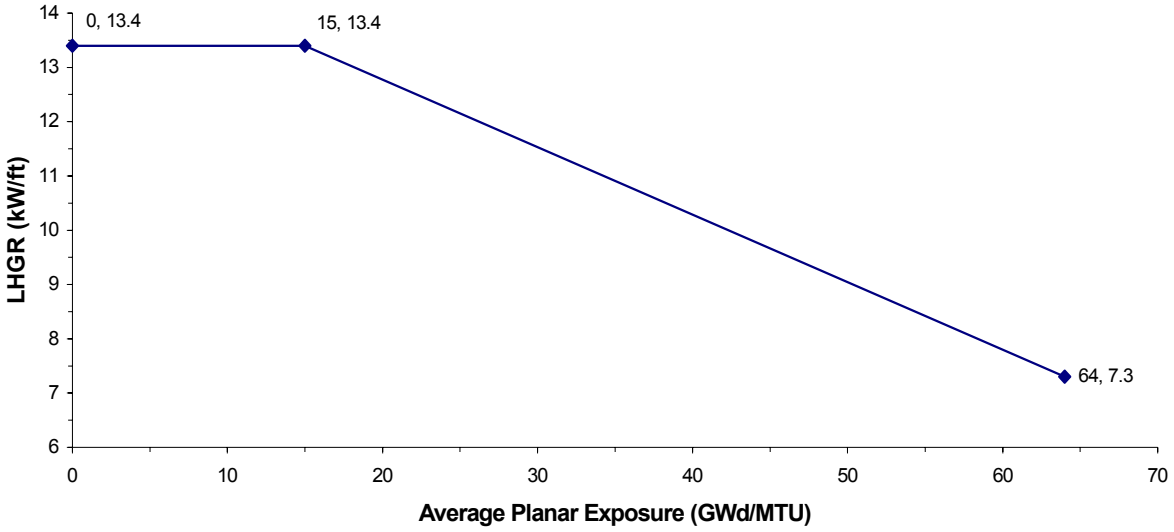

Figure 3-1
Maximum Linear Heat Generation Rate for ATRIUM-10
Note: Actual limits described in Section 5.3

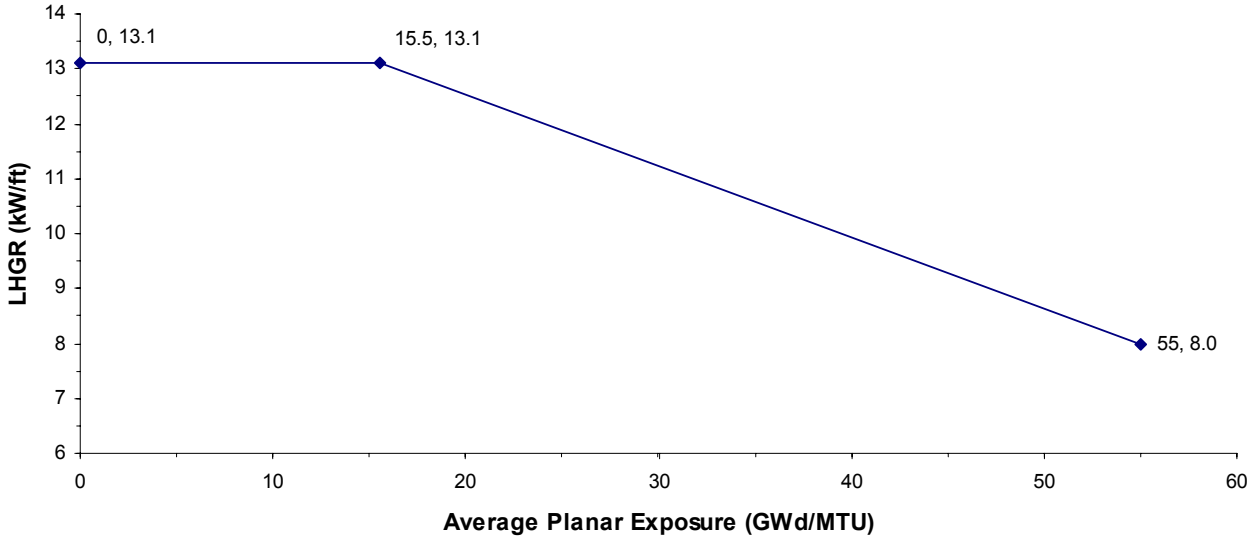

Figure 3-2
Maximum Linear Heat Generation Rate for 9x9-5
Note: Actual limits described in Section 5.3

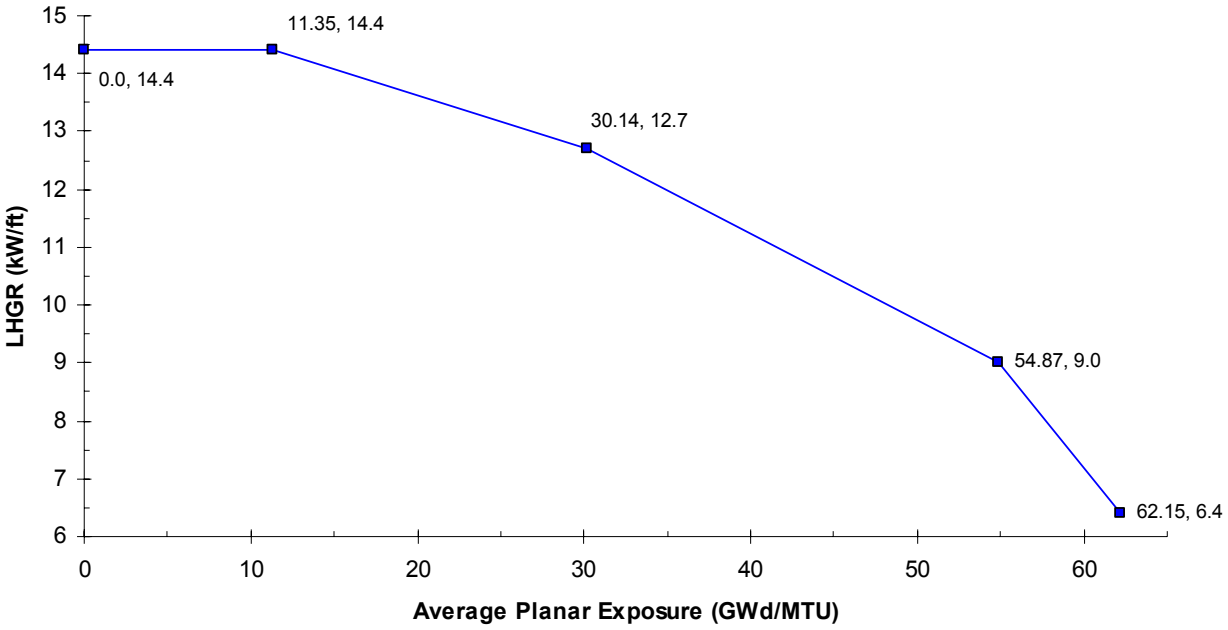

Figure 3-3
Maximum Linear Heat Generation Rate for Limiting Enriched Lattice of GE Bundle Type GE11-P9SUB387-15GZ-120T-146-T
Note: Actual limits described in Section 5.3

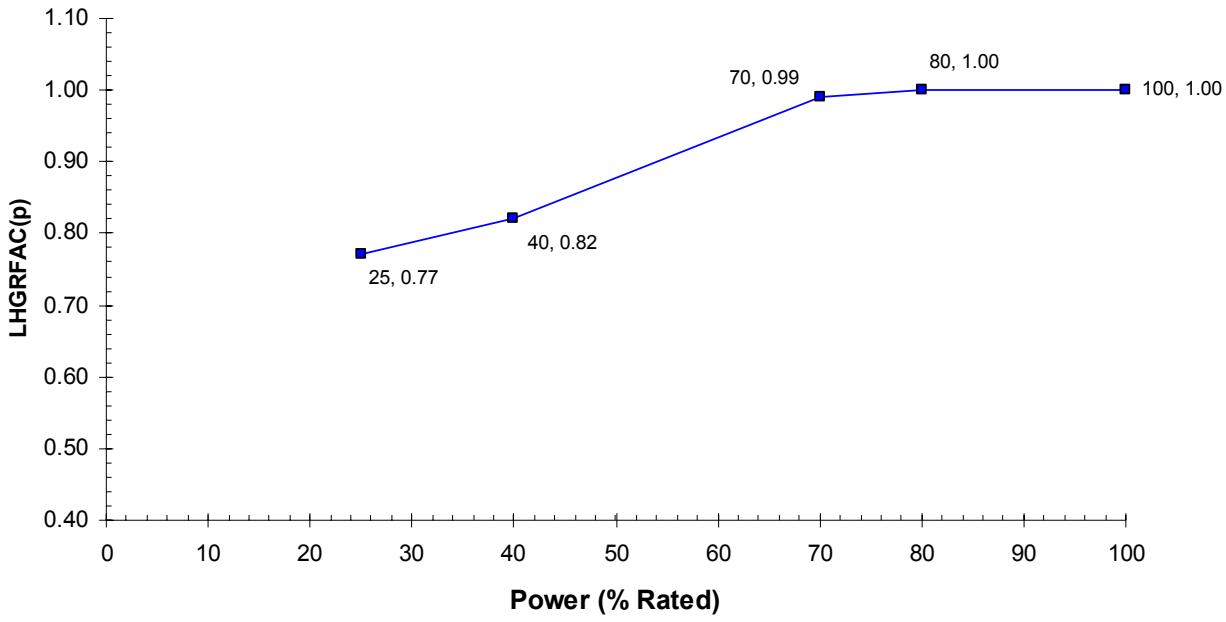

Figure 3-4
Cycle 14 Power-Dependent LHGR Factor for ATRIUM-10 and 9x9-5 BOC-EEOC
Note: These factors to be applied to the exposure-dependent limits as described in Section 5.3

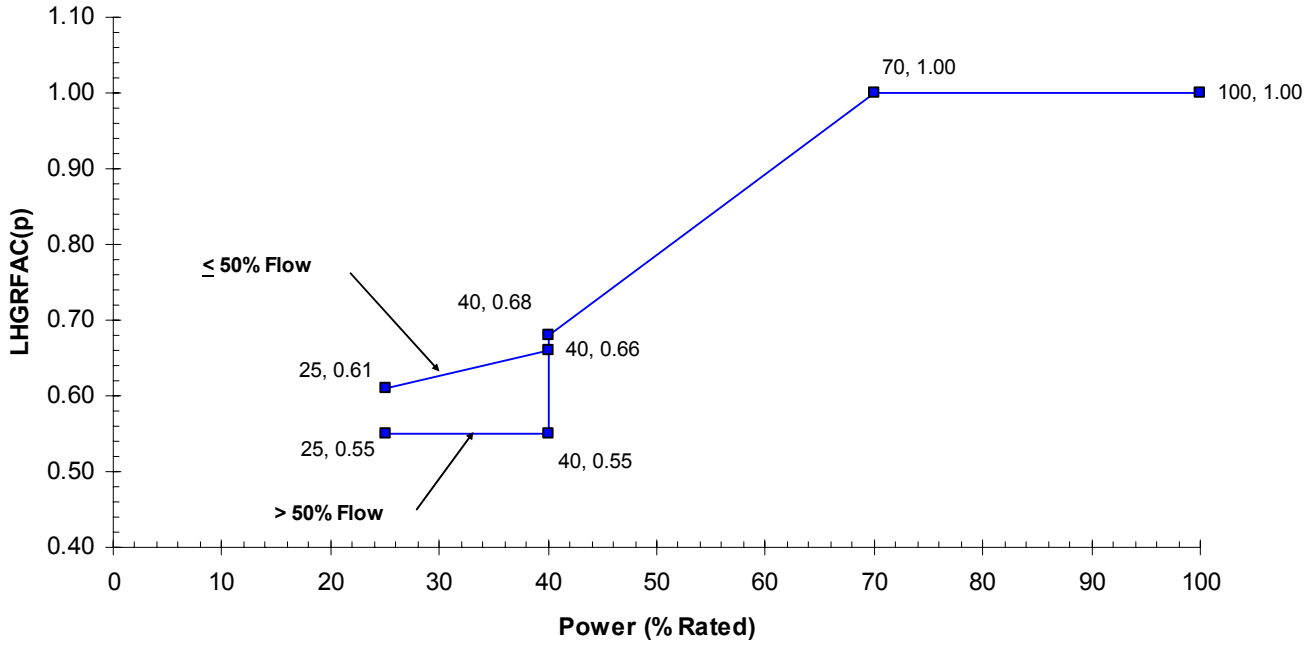

Figure 3-5
Cycle 14 Power-Dependent LHGR Factor for GE11 BOC-EEOC
Note: These factors to be applied to the exposure-dependent limits as described in Section 5.3

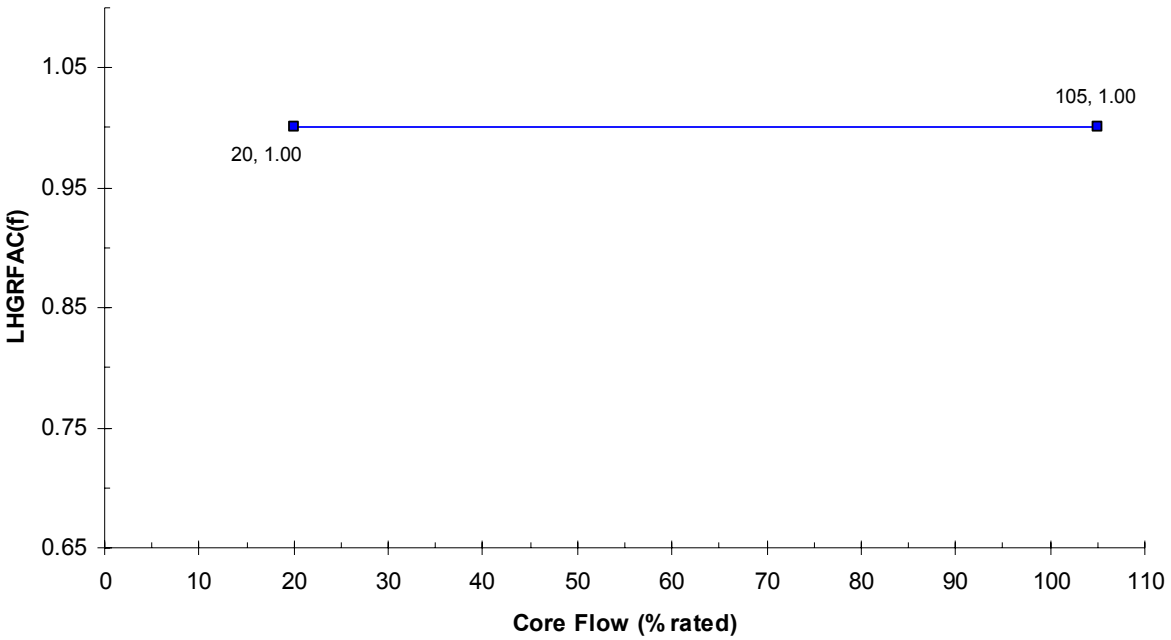

Figure 3-6
Cycle 14 Flow-Dependent LHGR Factor for ATRIUM-10 and 9x9-5
Note: These factors to be applied to the exposure-dependent limits as described in Section 5.3

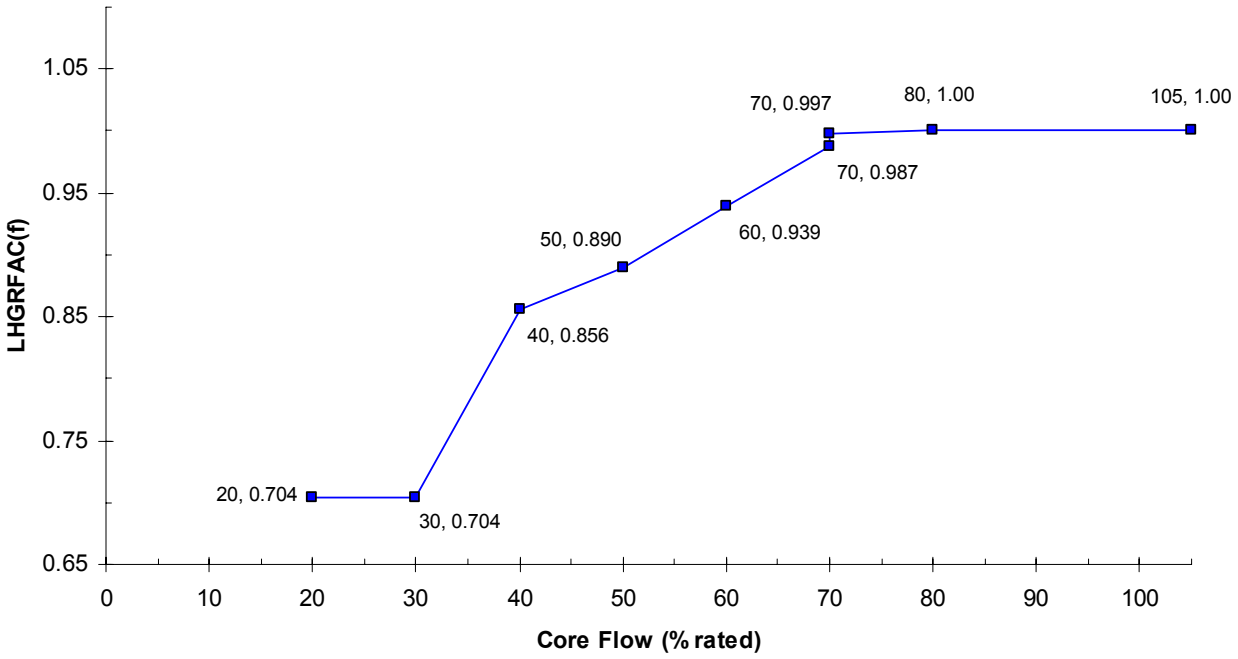

Figure 3-7
Cycle 14 Flow-Dependent LHGR Factor for GE11
Note: These factors to be applied to the exposure-dependent limits as described in Section 5.3

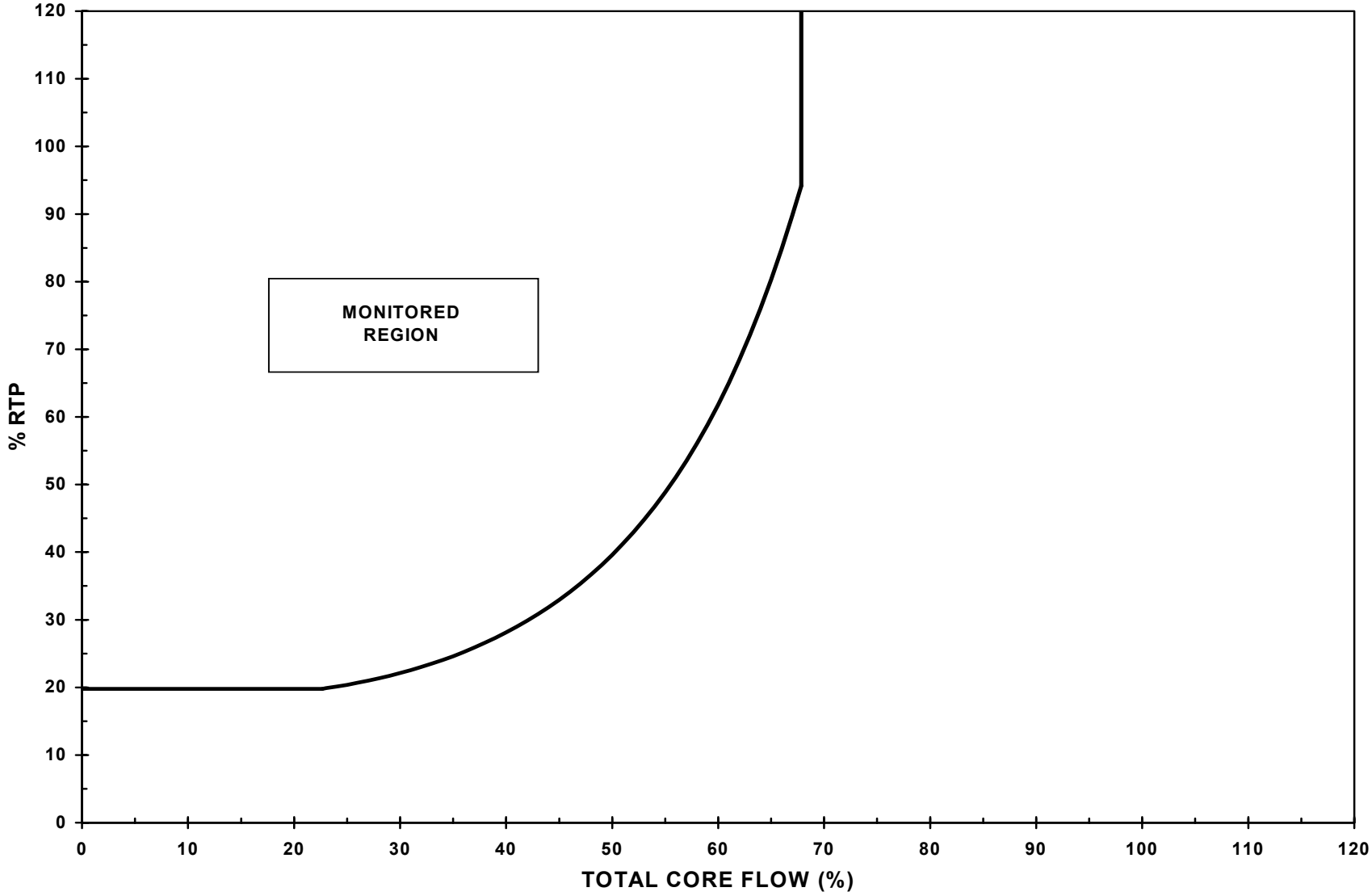

Figure 4-1 Monitored Region Boundary

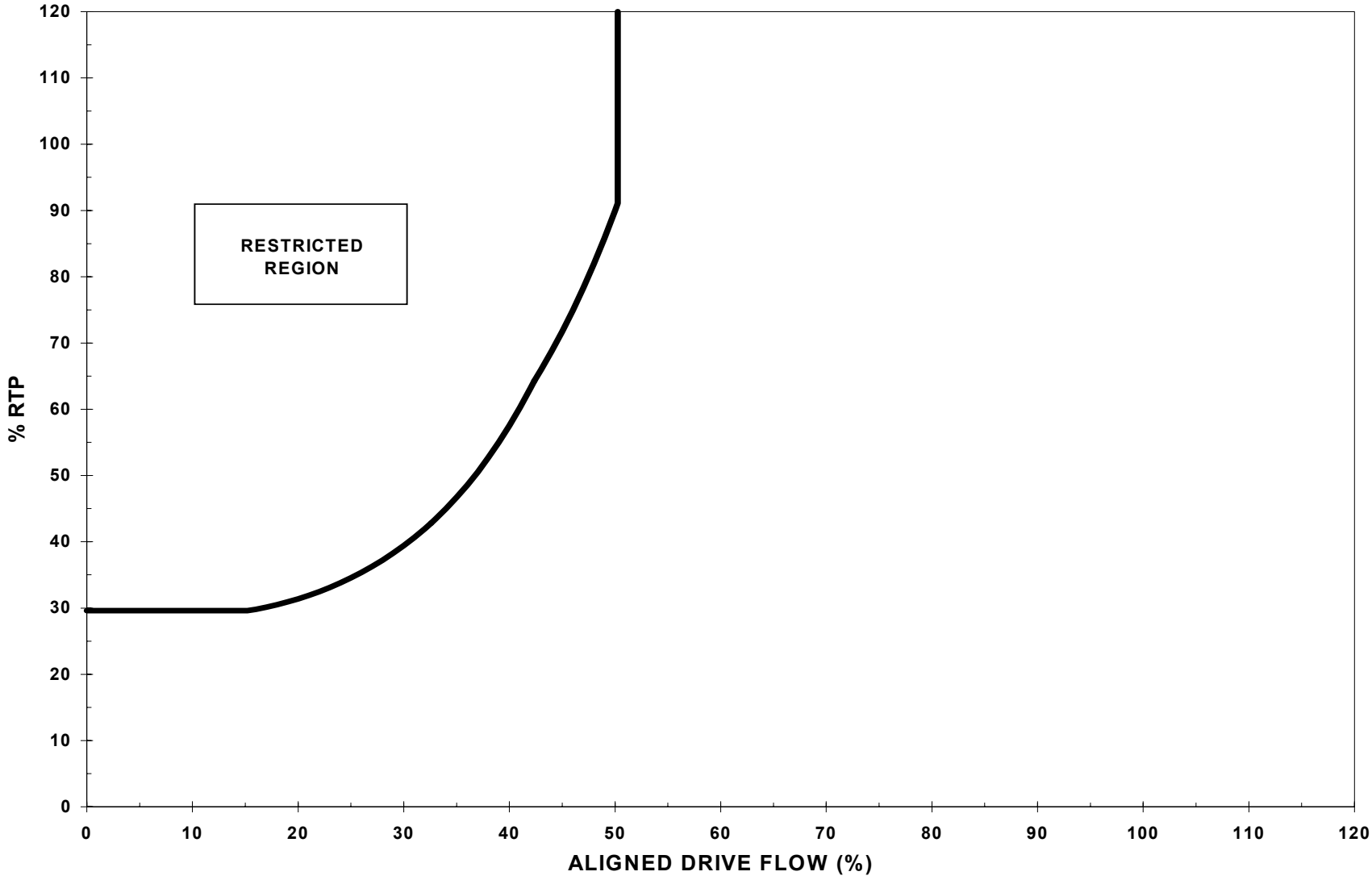

Figure 4-2 Restricted Region Boundary for Two-Loop Operation

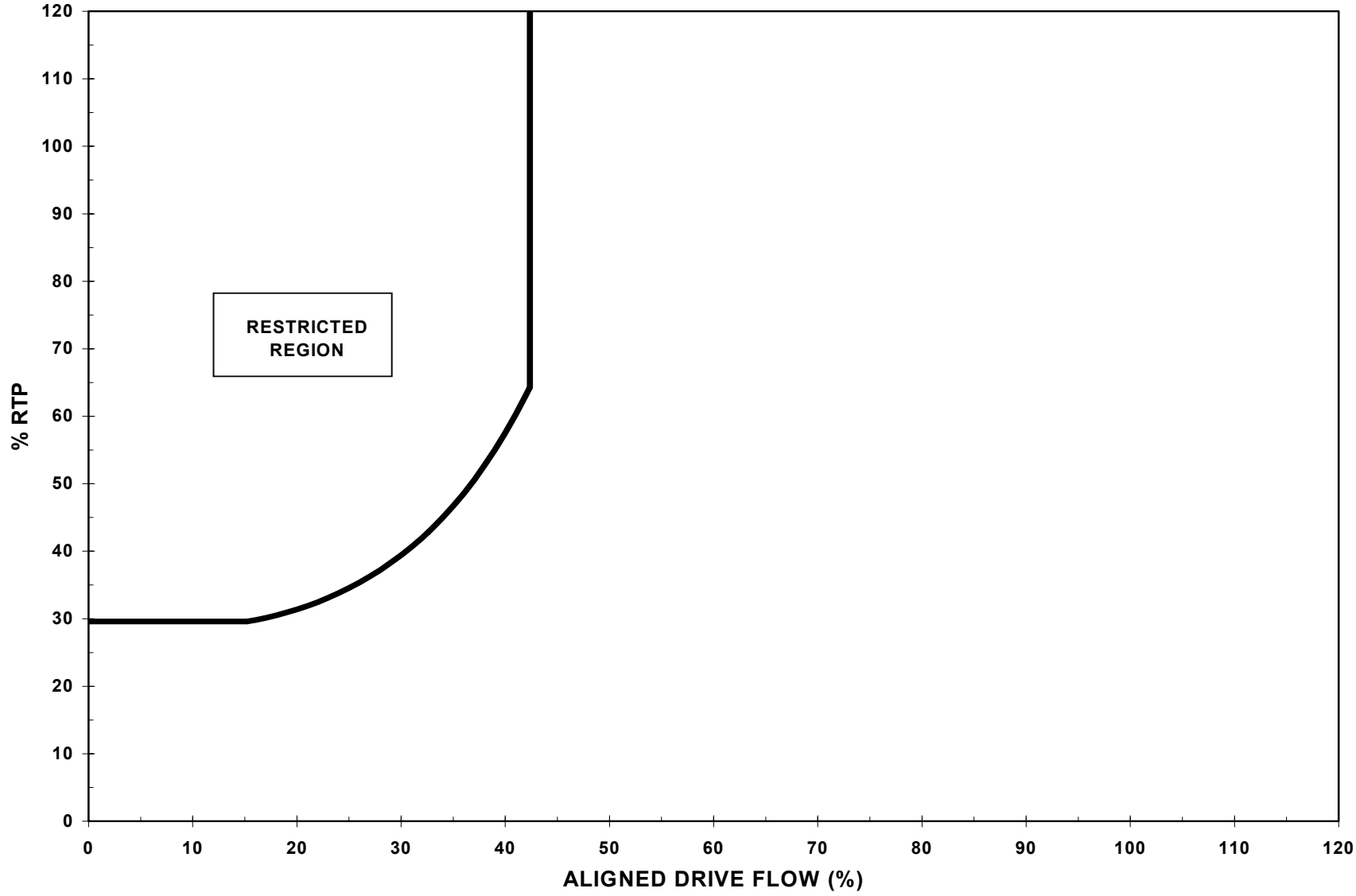

Figure 4-3 Restricted Region Boundary for Single-Loop Operation

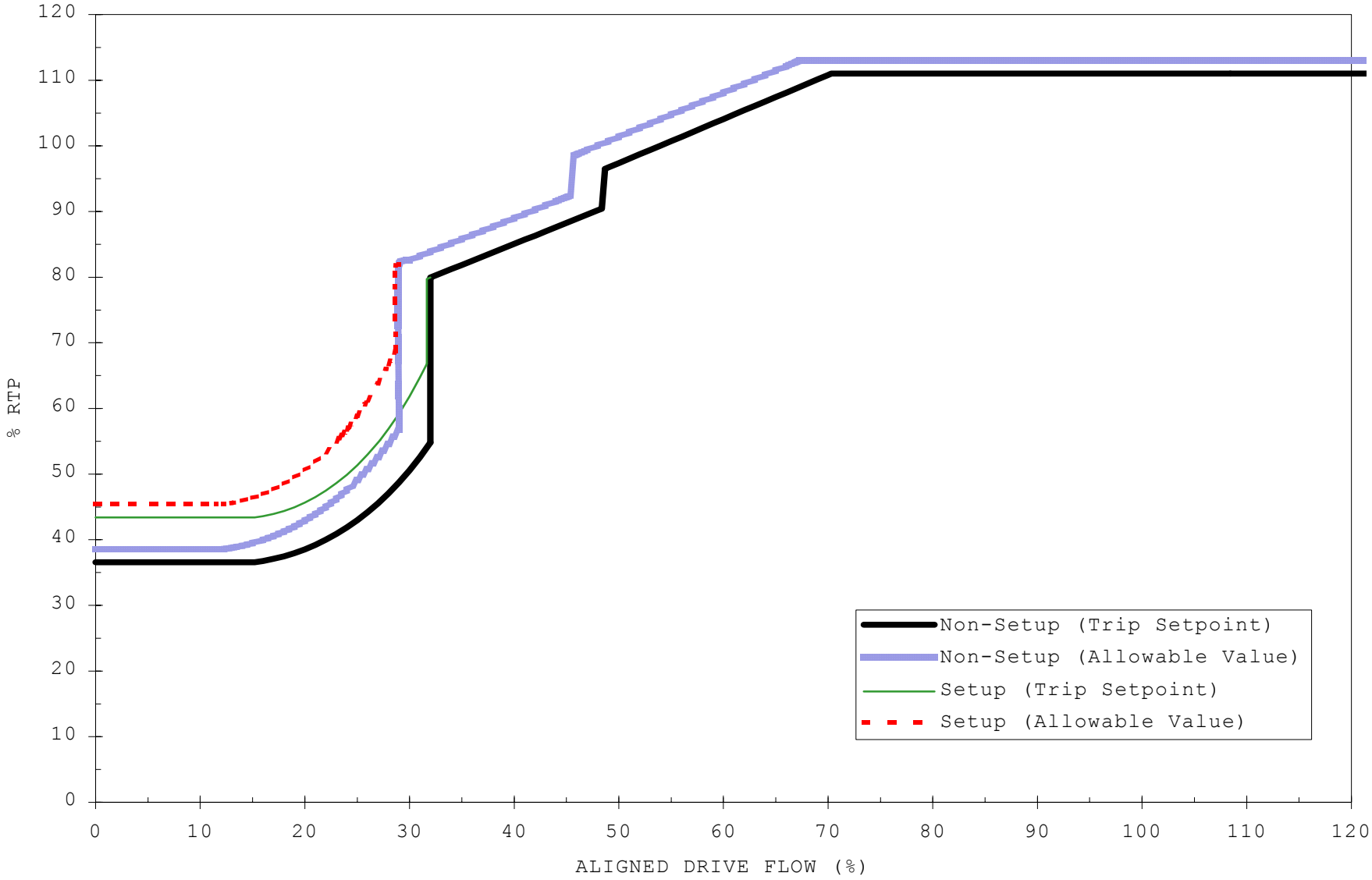

Figure 4-4 APRM Flow-Biased Simulated Thermal Power – High Scram Allowable Values for Two-Loop Operation

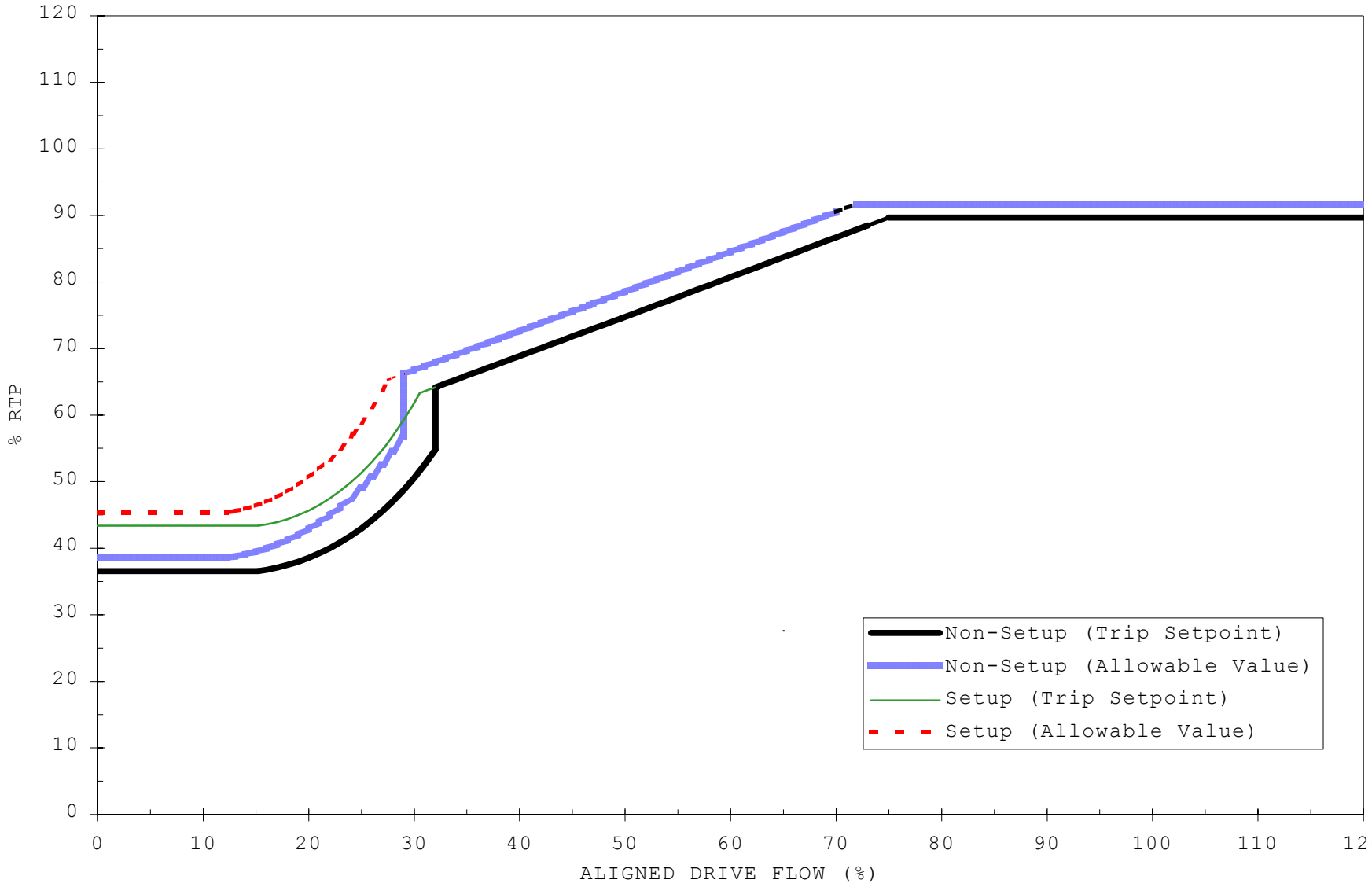

Figure 4-5 APRM Flow-Biased Simulated Thermal Power – High Scram Allowable Values for Single-Loop Operation