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GNRO-2012/00061

June 7, 2012

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

SUBJECT: Core Operating Limits Report Cycle 19
Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416
License No. NPF-29

Dear Sir or Madam:

Entergy Operations Inc., is submitting revised pages to the Core Operating Limits Report (COLR) for Grand Gulf Nuclear Station (GGNS) (reference: Licensing Basis Document Change Request LBDCR 12019) as required by GGNS Technical Specifications 5.6.5.d for a Cycle 19 Revision. The analytical methods used to determine the Cycle 19 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.

Should you have any questions or require additional information, please contact Christina L. Perino at 601-437-6299.

Sincerely,

Rita R. Jackson for Christina Perino

CLP/cj

Attachment: Core Operating Limits Report (COLR) Cycle 19

cc:

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Attachment to

GNRO-2012/00061

Core Operating Limits Report (COLR) Cycle 19

Grand Gulf Nuclear Station

Core Operating Limits Report

CORE OPERATING LIMITS REPORT

REASON FOR REVISION

This revision provides the Cycle 19 core operating limits. 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 Licensing Commitment 29132. This COLR reports the Cycle 19 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 19 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 Option III stability limits.

3.0 REFERENCES

This section contains the background, cycle-specific, and methodology references used in the safety analysis of Grand Gulf Cycle 19.

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.

3.1.4 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.

3.2 Current Cycle References

3.2.1 ECH-NE-12-00027 Revision 0, Supplemental Reload Licensing Report for Grand Gulf Nuclear Station Reload 18 Cycle 19 at CLTP, dated April 2012.

3.2.2 ECH-NE-10-00021 Revision 3, GNF2 Fuel Design Cycle-Independent Analyses for Entergy Grand Gulf Nuclear Station, dated March 2011.

3.2.3 ECH-NE-12-00033 Revision 0, Fuel Bundle Information Report for Grand Gulf Nuclear Station Reload 18 Cycle 19 at CLTP, dated April 2012.

3.2.4 NEDC-32910P, Revision 1, Grand Gulf Nuclear Station SAFER/GESTR-LOCA Accident Analysis With Relaxed ECCS Parameters, dated October 1999.

3.2.5 GGNS-SA-08-00006 Revision 0, Grand Gulf Nuclear Station GE14 ECCS-LOCA Evaluation, dated July 2008.

3.2.6 GGNS-SA-09-00002 Revision 1, Grand Gulf Nuclear Station GNF2 ECCS-LOCA Evaluation, dated December 2009.

3.2.7 ECH-NE-11-00111 Revision 0, GGNS Cycle 19 GESTAR Assessment, dated December 2011.

3.2.8 ECH-NE-10-00042 Revision 0, GESTAR & Fuel Reliability Evaluations of GNF2 Spacer Issue, dated May 2010.

3.2.9 ECH-NE-10-00041 Revision 0, Entergy GNF2 Fuel Transition: Disposition of Bent Flow Wing Effects on NFI-Revision 1, dated May 2010.

3.2.10 OG02-0119-260, "Backup Stability Protection (BSP) for Inoperable Option III Solution," dated July 17, 2002.

3.3 Methodology References

The Technical Specifications (TS) supported by each methodology reference are provided in brackets ({ }).

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 {TS 3.2.1, TS 3.2.2, TS 3.2.3}.

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 {TS 3.2.3}.

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 {TS 3.2.3}.

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 {TS 3.2.3}.

3.3.5 Deleted

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 {TS 3.2.1, TS 3.2.2, TS 3.2.3}.

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 {TS 3.2.1, TS 3.2.2, TS 3.2.3}.

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 {TS 3.2.2, TS 3.2.3} .

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 {TS 3.2.2}.

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 {TS 3.2.2}.

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 {TS 3.2.2}.

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 {TS 3.2.2}.

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 {TS 3.2.2}.

3.3.14 ANF-1358(P)(A) Revision 3, "The Loss of Feedwater Heating Transient in Boiling Water Reactors," Framatome ANP, September 2005 {TS 3.2.2}.

3.3 Methodology References (continued)

3.3.15 EMF-1997(P)(A) Revision 0, "ANFB-10 Critical Power Correlation," Siemens Power Corporation, July 1998 {TS 3.2.2}.

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 {TS 3.2.2}.

3.3.17 EMF-2209(P)(A) Revision 2, "SPCB Critical Power Correlation, Siemens Power Corporation," September 2003 {TS 3.2.2}.

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 {TS 3.2.2}.

3.3.19 EMF-2361 (P)(A) Revision 0, "EXEM BWR-2000 ECCS Evaluation Model," Framatome ANP Richland, Inc., May 2001 {TS 3.2.1}.

3.3.20 Deleted

3.3.21 Deleted

3.3.22 NEDC-33383P, Revision 1, "GEXL97 Correlation Applicable to ATRIUM-10 Fuel," June, 2008 {TS 3.2.2}.

3.3.23 EMF-2292(P)(A) Revision 0, "ATRIUM-10: Appendix K Spray Heat Transfer Coefficients, Siemens Power Corporation," September 2000 {TS 3.2.1}.

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 {TS 3.2.4}.

3.3.25* NEDE-24011-P-A, General Electric Standard Application for Reactor Fuel (GESTAR-II) {TS 3.2.1, TS 3.2.2, TS 3.2.3}.

3.3.26* NEDO-32465-A, Licensing Topical Report, Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications. {TS 3.2.2, 3.3.1.1}

3.3.27* NEDO-31960-A, BWR Owner's Group Long-Term Stability Solutions Licensing Methodology and Reload Applications. {TS 3.2.2, 3.3.1.1}

* Note: These references are applicable when GE fuel is in the reactor.

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 Oscillation Power Range Monitor (OPRM) - Provides automatic detection and suppression of reactor core thermal-hydraulic instabilities through monitoring neutron flux changes.

4.9 Backup Stability Protection (BSP) Scram Region - The area of the core power and flow operating domain where the reactor is susceptible to reactor instabilities under conditions exceeding the licensing basis of the current reactor system. An immediate manual scram is required upon entry.

4.10 Backup Stability Protection (BSP) Controlled Entry Region - The area of the core power and flow operating domain where the reactor is susceptible to reactor instabilities. Compliance with at least one alternate stability control is required upon entry.

4.11 End of Rated (EOR) - The Cycle exposure corresponding to all rods out, 100% power, 100% flow, and normal feedwater temperature [3.2.1].

4.12 Middle of Cycle (MOC) - The Cycle 19 MOC Core Average Exposure (CAE) is EOR-6,272 MWd/ST [3.2.1].

4.13 End of Cycle (EOC) - The Cycle 19 EOC CAE is 30,365 MWd/ST [3.2.1].

CORE OPERATING LIMITS REPORT

5.0 GENERAL REQUIREMENTS

5.1 Average Planar Linear Heat Generation Rates

Consistent with Technical Specification 3.2.1, all APLHGRs shall not exceed the exposure-dependent limits reported in Figures 1-1 and 1-2 [3.2.1].

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 [3.2.1,3.2.2].

Additional MCPR operating limits are provided to support operation with EOC-RPT inoperable as described in Technical Specification 3.3.4.1.

5.3 Linear Heat Generation Rate

Consistent with Technical Specification 3.2.3, the LHGRs for any GNF2 or GE14 rod at any axial location shall not exceed the nodal exposure-dependent limits reported in Reference 3.2.3 multiplied by the smaller of either the power-dependent or flow-dependent LHGR factors reported in Figures 3-1 and 3-2, respectively [3.2.2,3.2.9].

5.4 Stability

The OPRM upscale Period Based Detection Algorithm (PBDA) trip setpoints are reported in Table 1. The Backup Stability Protection (BSP) regions boundaries are reported in Figure 4 [3.2.1,3.2.10]. BSP measures support operation with the OPRM upscale trip function inoperable as described in Technical Specification 3.3.1.1 Condition J.

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. For single-loop operation (SLO), the following additional requirements must be satisfied.

1. THE APLHGRs shall not exceed the exposure-dependent limits determined in accordance with Section 5.1 reduced by a 0.83 SLO multiplier. [3.2.1].

2. THE LHGRs shall not exceed the smaller of the nodal exposure-dependent limits determined in accordance with Section 5.3 above or the nodal exposure-dependent limits reported in Reference 3.2.3 reduced by a 0.83 SLO multiplier [3.2.1].

3. The MCPR shall be equal to or greater than the limits determined in accordance with Section 5.2 above increased by 0.03 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].

Table 1
OPRM Upscale Period-Based Detection Algorithm Trip Setpoints

PBDA Trip Amplitude	Maximum Confirmation Count Trip Setting
1.10	13

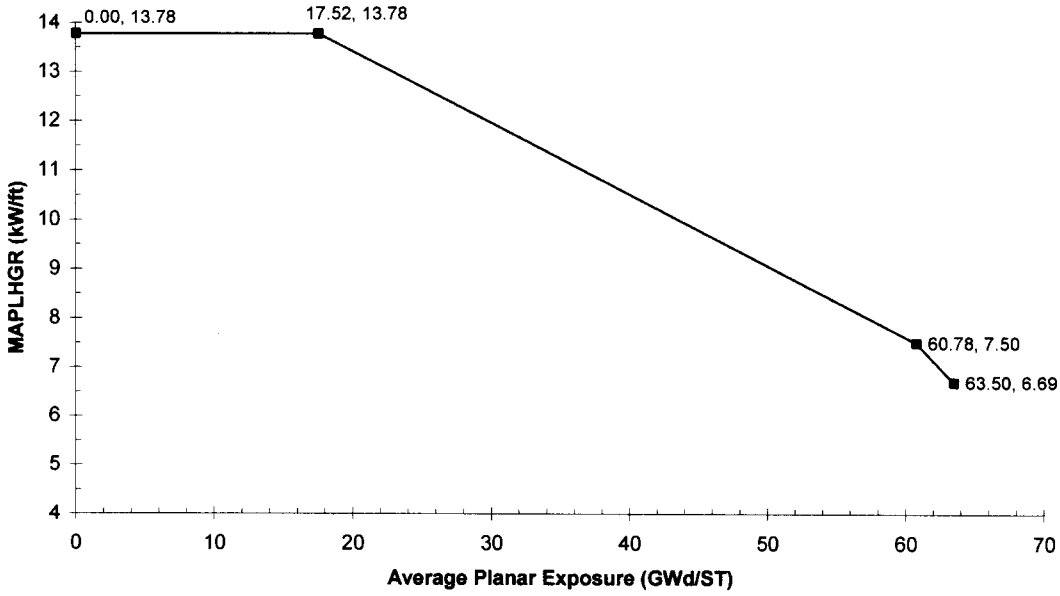

Figure 1-1
Maximum Average Planar Linear Heat generation Rate for GNF2
Note: Actual Limits described in Sections 5.1 and 5.5

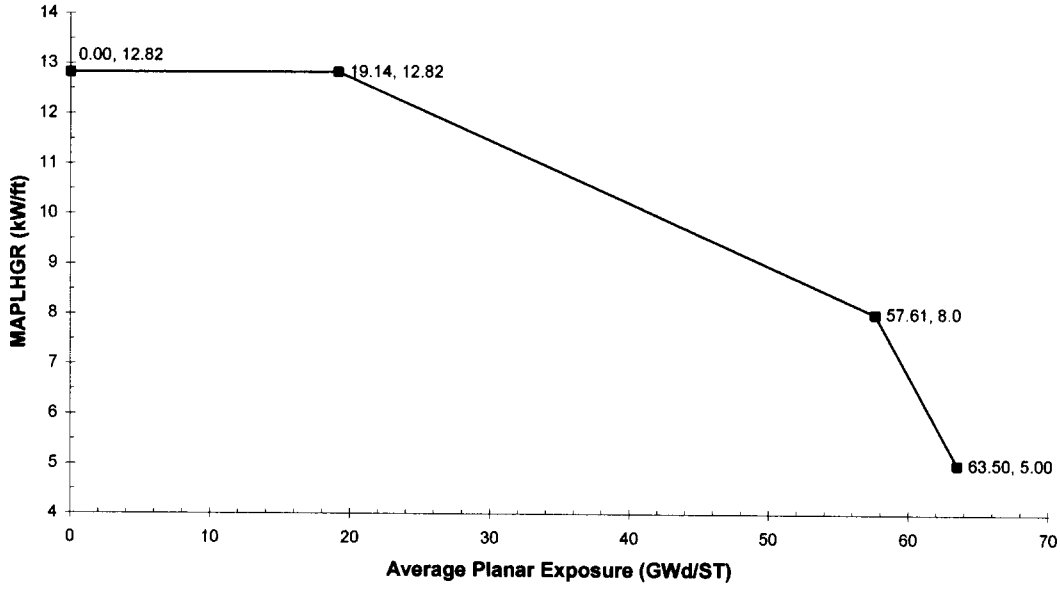

Figure 1-2
Maximum Average Planar Linear Heat generation Rate for GE14
Note: Actual Limits described in Sections 5.1 and 5.5

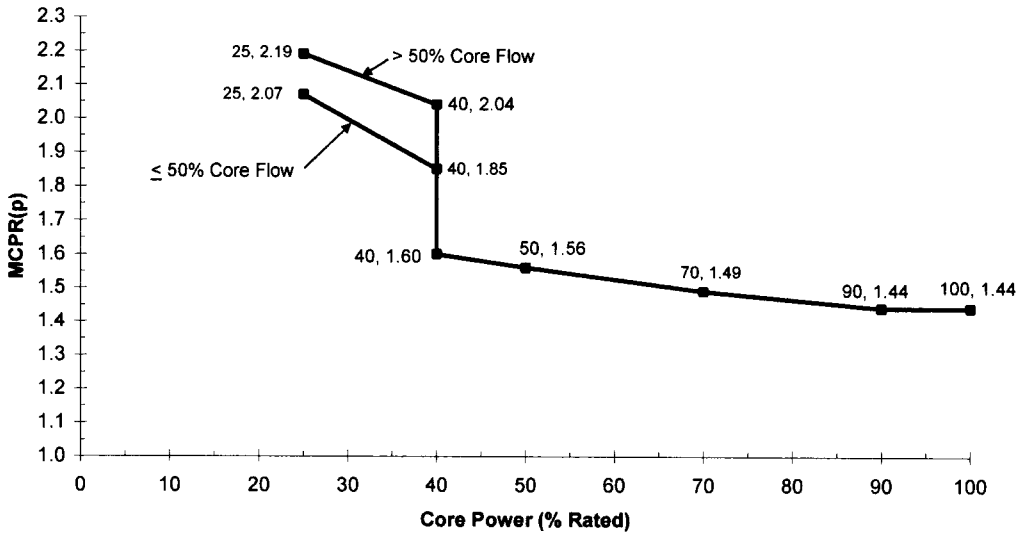

Figure 2-1a
Cycle 19 Power-Dependent MCPR Limits for GNF2
BOC to MOC

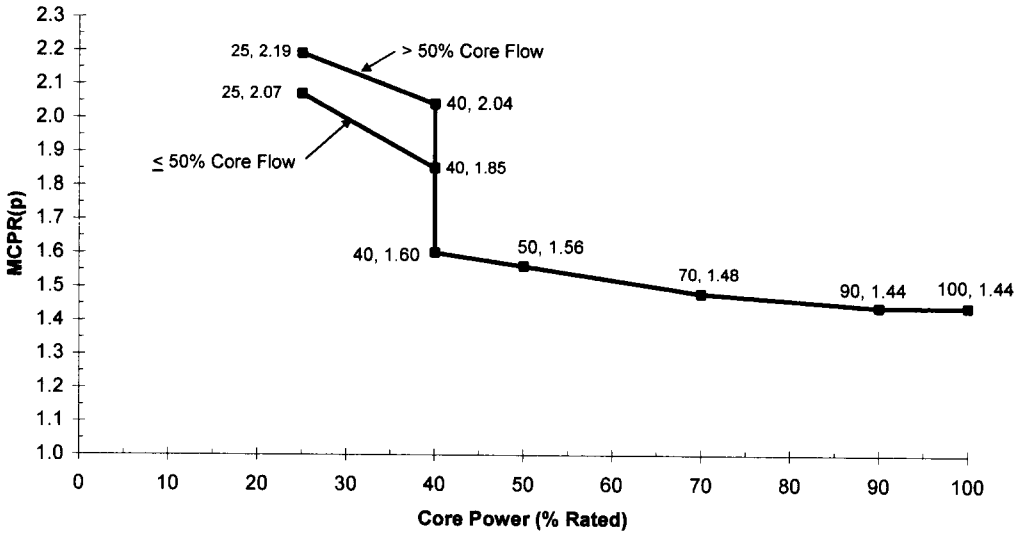

Figure 2-1b
Cycle 19 Power-Dependent MCPR Limits for GE14
BOC to MOC

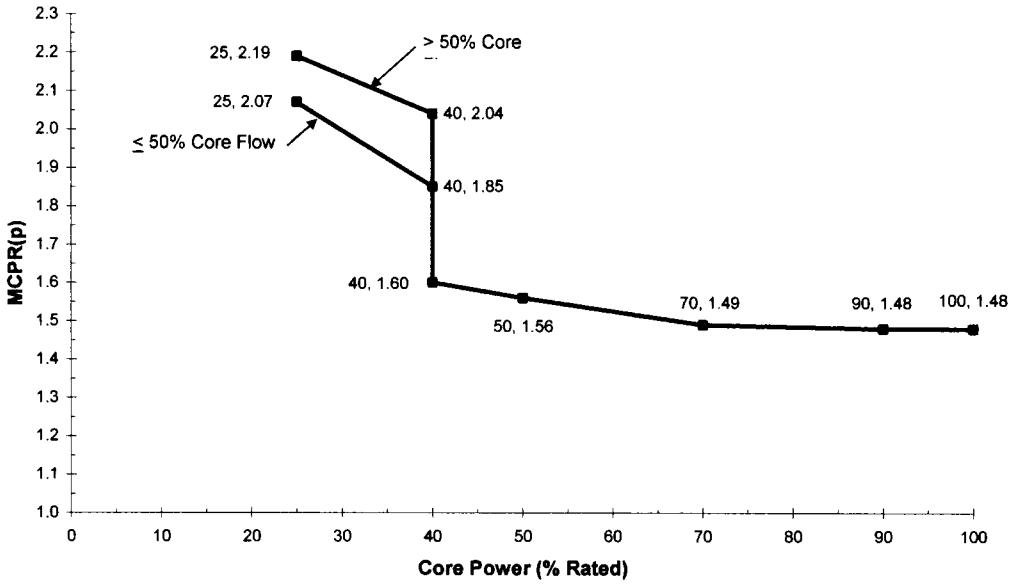

Figure 2-2a
Cycle 19 Power-Dependent MCPR Limits for GNF2
BOC to MOC with EOC-RPT Inoperable

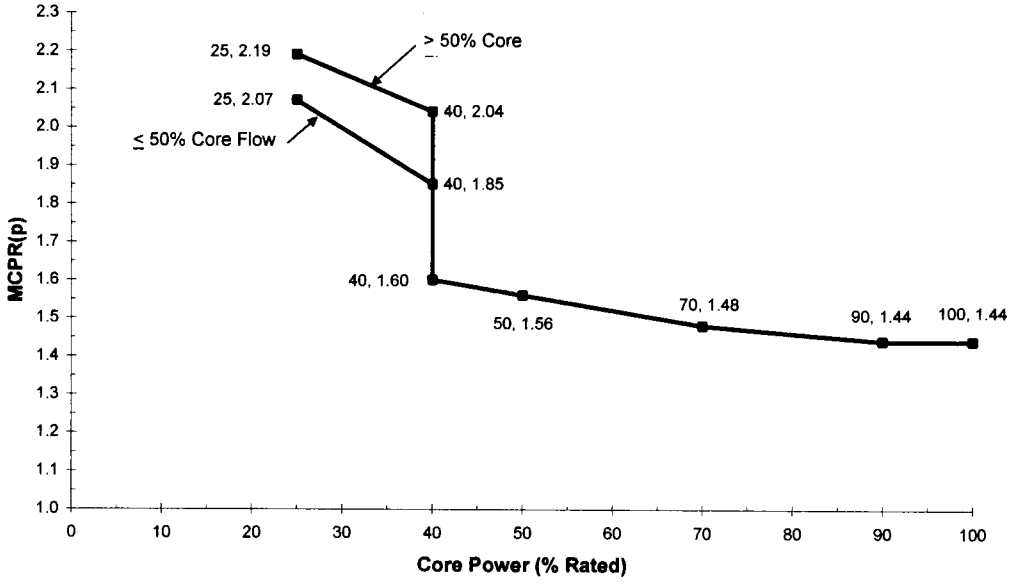

Figure 2-2b
Cycle 19 Power-Dependent MCPR Limits for GE14
BOC to MOC with EOC-RPT Inoperable

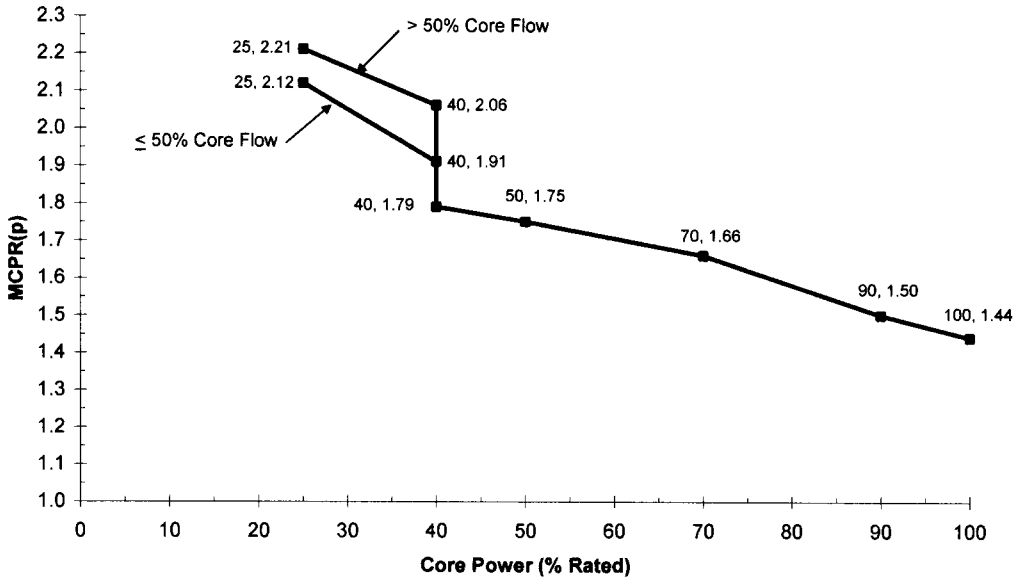

Figure 2-3a
Cycle 19 Power-Dependent MCPR Limits for GNF2
MOC to EOC

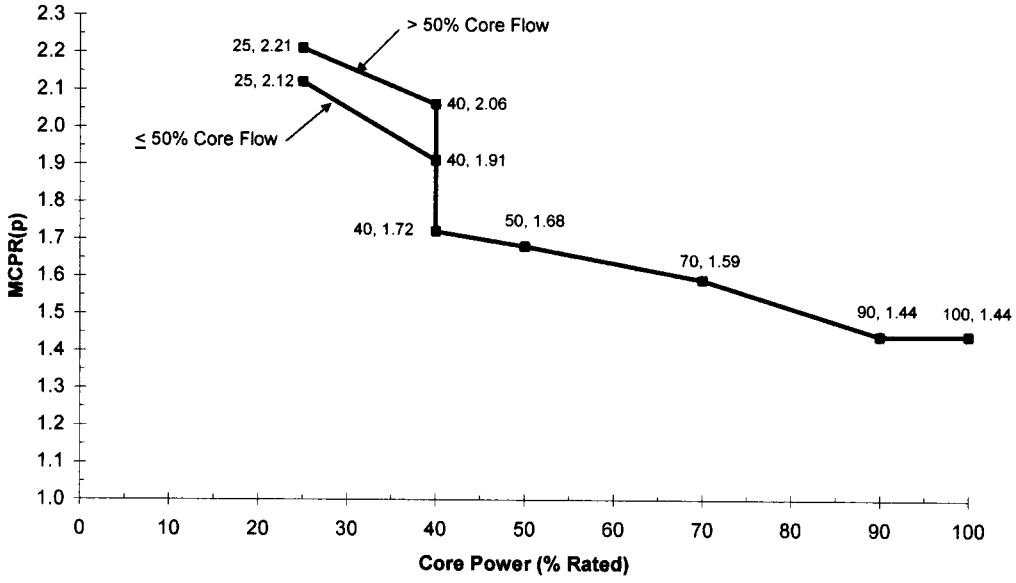

Figure 2-3b
Cycle 19 Power-Dependent MCPR Limits for GE14
MOC to EOC

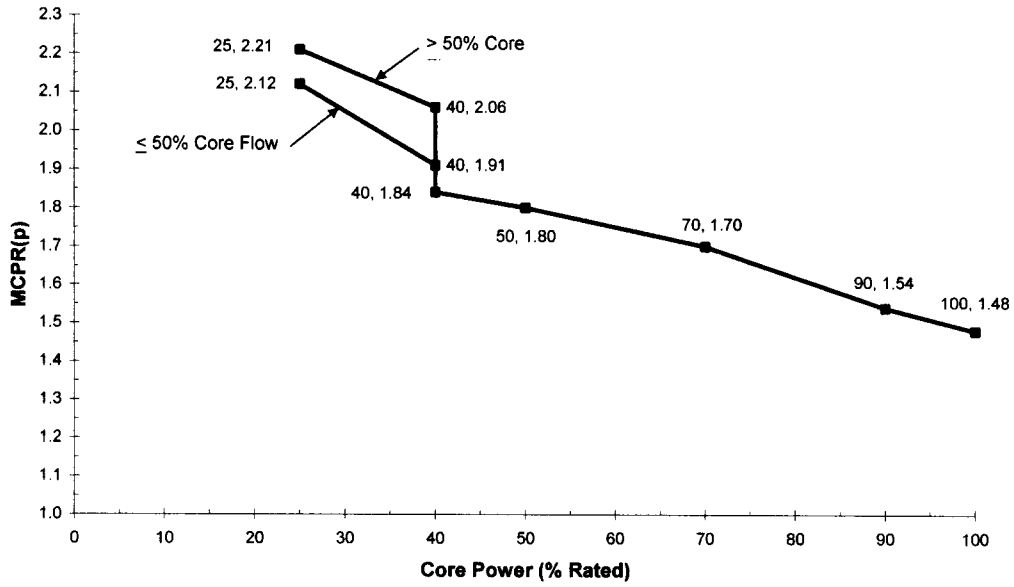

Figure 2-4a
Cycle 19 Power-Dependent MCPR Limits for GNF2
MOC to EOC with EOC-RPT Inoperable

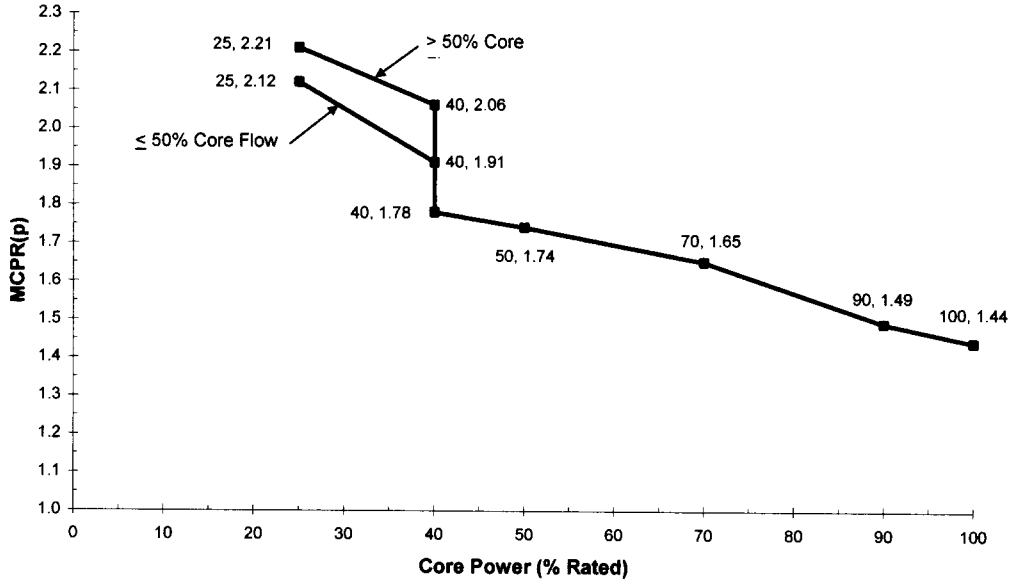

Figure 2-4b
Cycle 19 Power-Dependent MCPR Limits for GE14
MOC to EOC with EOC-RPT Inoperable

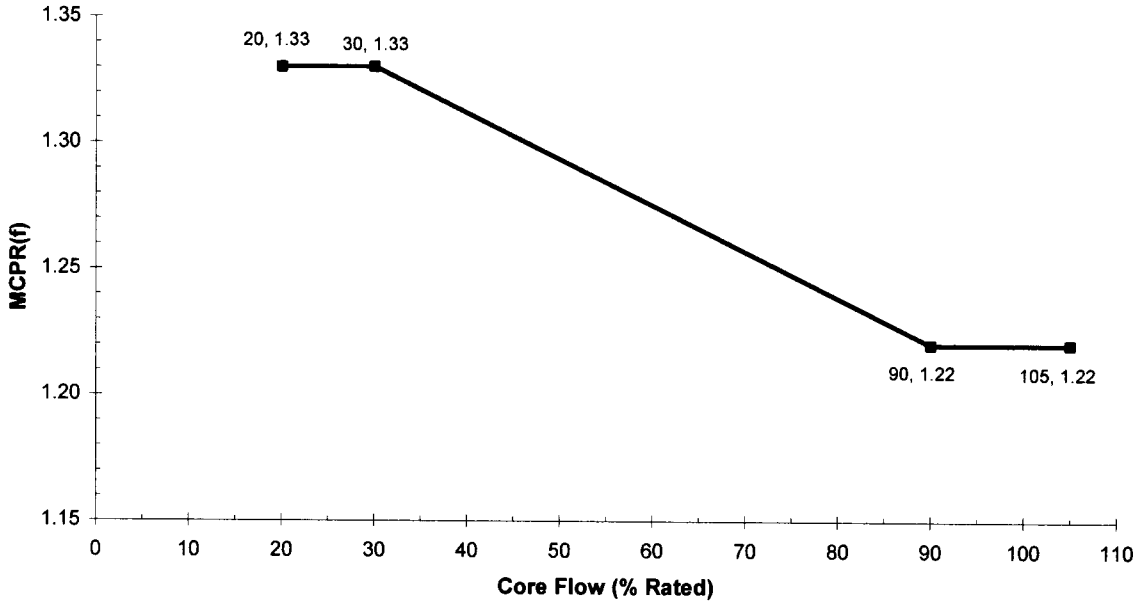

Figure 2-5
Cycle 19 Flow-Dependent MCPR Limits for GNF2 and GE14

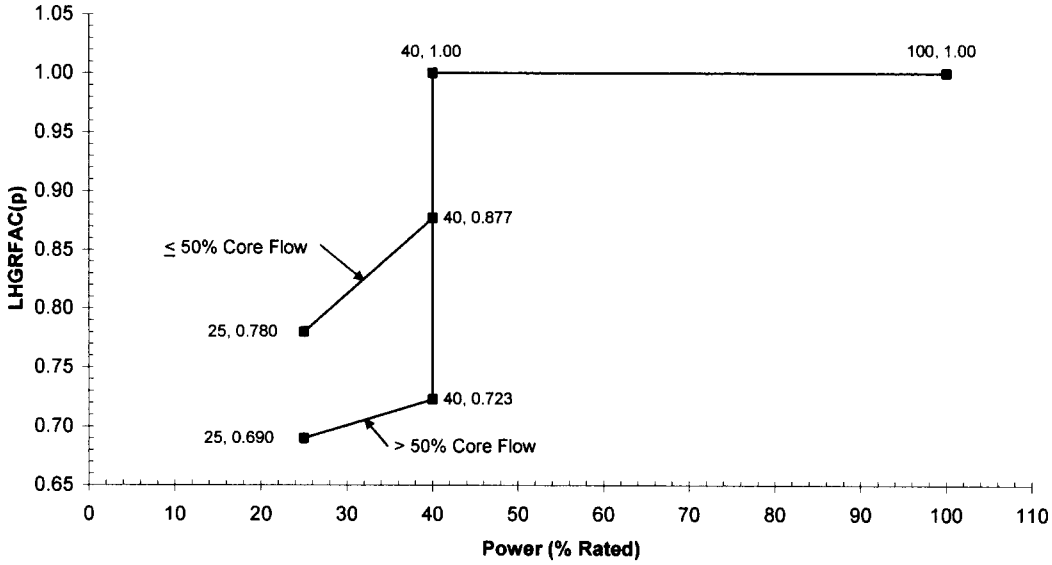

Figure 3-1a
Cycle 19 Power-Dependent LHGR Factor BOC-MOC for GNF2 and GE14
Note: These factors to be applied to the exposure-dependent limits as descibed in Section 5.3

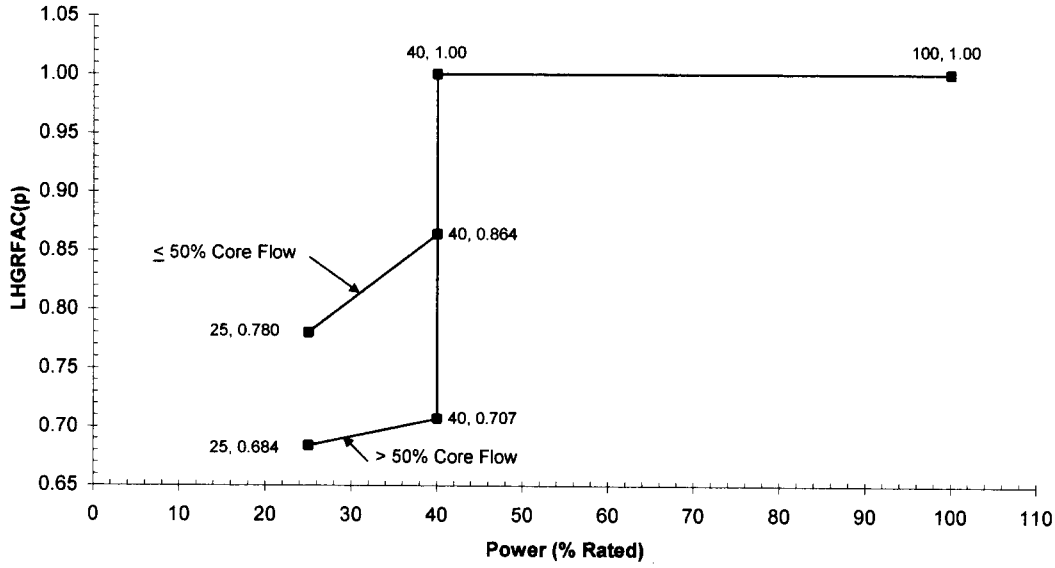

Figure 3-1b
Cycle 19 Power-Dependent LHGR Factor MOC-EOC for GNF2 and GE14
Note: These factors to be applied to the exposure-dependent limits as descibed in Section 5.3

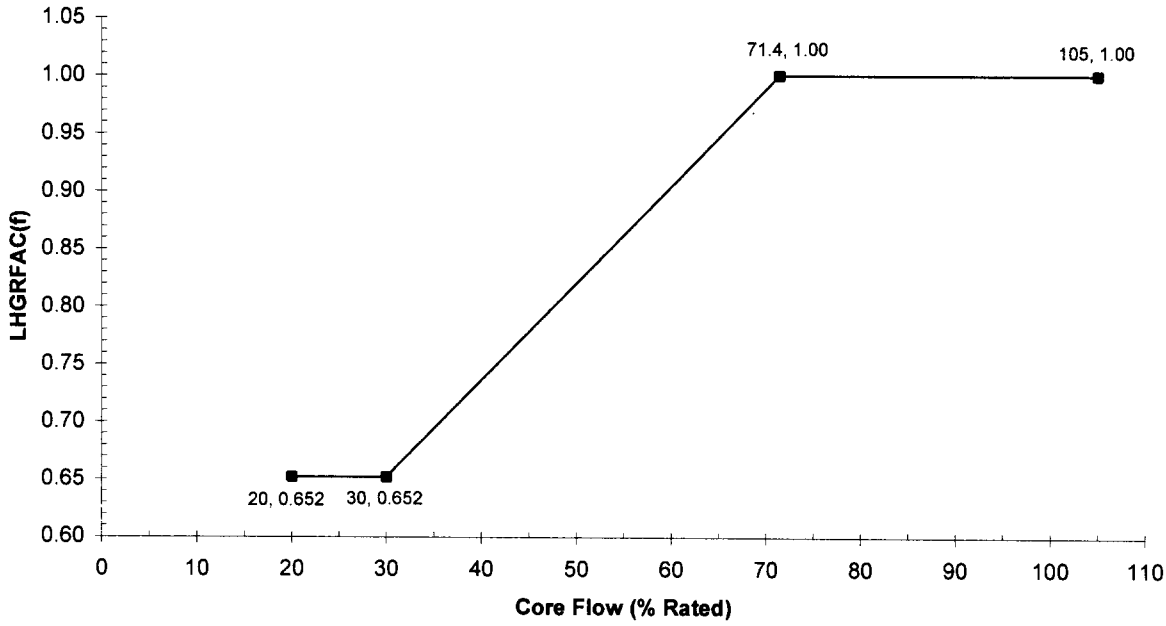

Figure 3-2
Cycle 19 Flow-Dependent LHGR Factor for GNF2 and GE14
Note: These factors to be applied to the exposure-dependent limits as described in Section 5.3

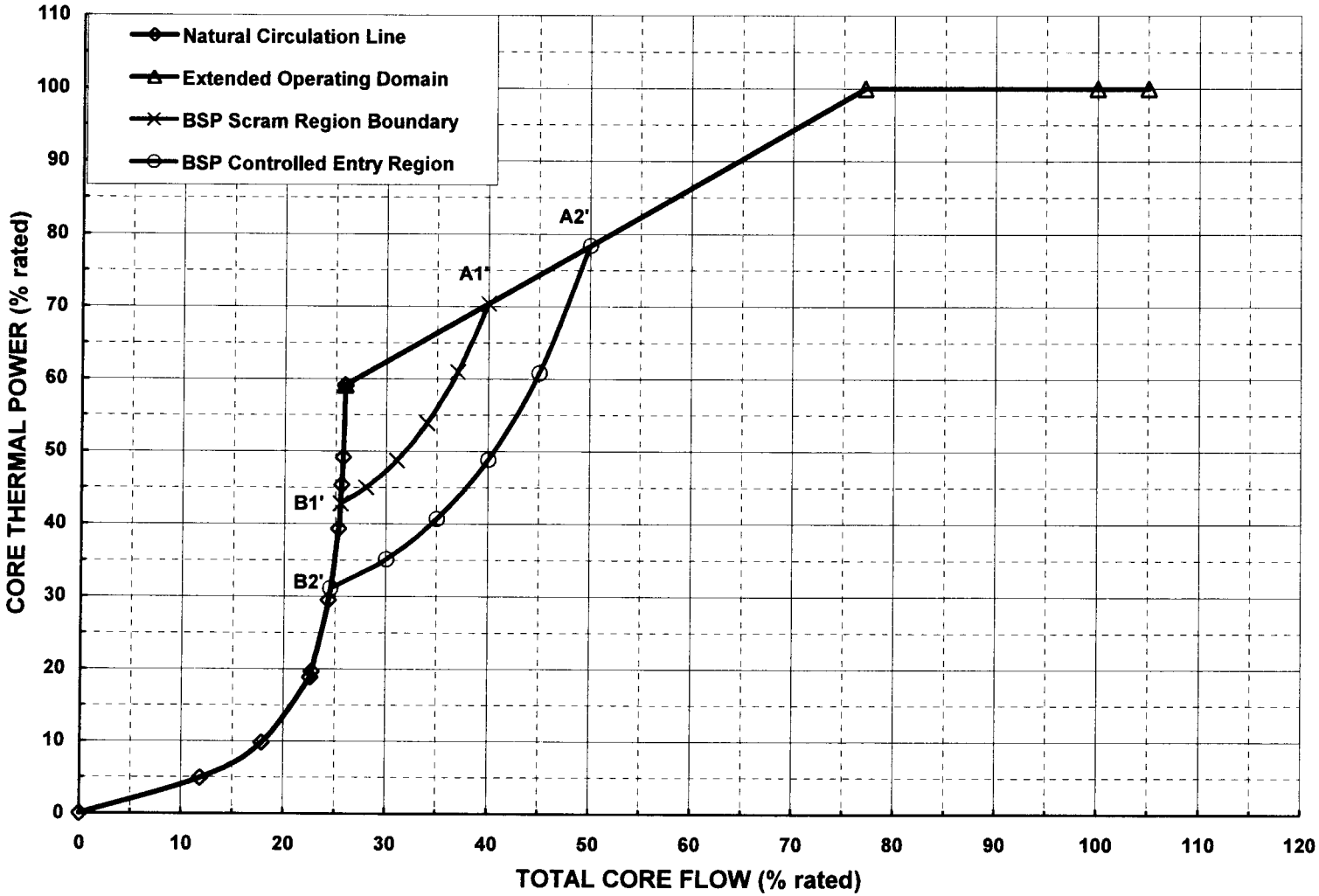

Figure 4 Backup Stability Protection Region Boundaries