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TRM1 - TECHNICAL REQUIREMENTS MANUAL UNIT 1

REMOVE MANUAL TABLE OF CONTENTS DATE: 03/11/2020

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A001
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ID: TEXT 3.2.1
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Manual Name: TRM1

Manual Title: TECHNICAL REQUIREMENTS MANUAL UNIT 1

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Title: INSTRUMENTATION SEISMIC MONITORING INSTRUMENTATION

TEXT 3.3.3 2 11/09/2007
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TEXT 3.3.4 11 06/29/2017
Title: INSTRUMENTATION TRM POST-ACCIDENT MONITORING INSTRUMENTATION

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Title: INSTRUMENTATION THIS PAGE INTENTIONALLY LEFT BLANK

TEXT 3.3.6 5 03/05/2019
Title: INSTRUMENTATION TRM ISOLATION ACTUATION INSTRUMENTATION

TEXT 3.3.7 2 11/10/2015
Title: INSTRUMENTATION MAIN TURBINE OVERSPEED PROTECTION SYSTEM

TEXT 3.3.8 1 10/22/2003
Title: INSTRUMENTATION INTENTIONALLY LEFT BLANK

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TEXT 3.4.1 1 04/26/2006
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Title: REACTOR COOLANT SYSTEM INTENTIONALLY LEFT BLANK

TEXT 3.4.3 1 11/09/2007
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TEXT B3.3.8 1 10/22/2003
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TEXT B3.7.5.3 0 11/19/2002
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TEXT B3.7.6 4 06/04/2013
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Title: ELECTRICAL POWER BASES DEGRADED VOLTAGE PROTECTION

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TEXT B3.10.4 1 04/17/2008
Title: INTENTIONALLY LEFT BLANK

TEXT B3.11.1.1 0 11/19/2002
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TEXT B3.11.4.3 0 11/19/2002
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TEXT B3.12.2 1 12/03/2010
Title: LOADS CONTROL PROGRAM BASES HEAVY LOADS REQUIREMENTS

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TEXT B3.12.3 0 11/19/2002

Title: LOADS CONTROL PROGRAM BASES LIGHT LOADS REQUIREMENTS

3.2 Core Operating Limits Report (COLR)

3.2.1 Core Operating Limits Report (COLR)

TRO 3.2.1 The Core Operating Limits specified in the attached COLR shall be met.

APPLICABILITY: Specified in the referenced Technical Specifications.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Core Operating Limits not met.	A.1 Perform action(s) described in referenced Technical Specification.	Specified in referenced Technical Specifications.

TECHNICAL REQUIREMENT SURVEILLANCE

SURVEILLANCE	FREQUENCY
----------NOTE---------- No associated Surveillances. Surveillances are implemented in the applicable Technical Specifications. ----------	N/A

Susquehanna SES
Unit 1 Cycle 21

CORE OPERATING LIMITS REPORT

Nuclear Fuels Engineering

March 2020

CORE OPERATING LIMITS REPORT
REVISION DESCRIPTION INDEX

Rev. No.	Affected Sections	Description/Purpose of Revision
0	ALL	Issuance of this COLR is in support of Unit 1 Cycle 21 operation.
1	9.0	Figure 9.1 is revised to account for the cycle achieving a greater core average exposure than what was assumed to initially analyze Unit 1 Cycle 21 (U1C21), addressing CR-2020-02163. Updated U1C21 licensing analysis results (Framatome, formerly AREVA, report ANP-3625, Rev. 1) at a bounding core average exposure only affects the Power / Flow Map Region II Stability Boundary.
	ALL	Removed Effective Date from footer to align formatting to current process.

SUSQUEHANNA STEAM ELECTRIC STATION
Unit 1 Cycle 21
CORE OPERATING LIMITS REPORT

Table of Contents

1.0 INTRODUCTION

This CORE OPERATING LIMITS REPORT for Susquehanna Unit 1 Cycle 21 is prepared in accordance with the requirements of Susquehanna Unit 1, Technical Specification 5.6.5. As required by Technical Specifications 5.6.5, core shutdown margin, the core operating limits, RBM setpoints, and OPRM setpoints presented herein were developed using NRC-approved methods and are established such that all applicable limits of the plant safety analysis are met.

2.0 DEFINITIONS

Terms used in this COLR but not defined in Section 1.0 of the Technical Specifications or Section 1.1 of the Technical Requirements Manual are provided below.

2.1 The AVERAGE PLANAR EXPOSURE at a specified height shall be equal to the total energy produced per unit length at the specified height divided by the total initial weight of uranium per unit length at that height.

2.2 The PELLET EXPOSURE shall be equal to the total energy produced per unit length of fuel rod at the specified height divided by the total initial weight of uranium per unit length of that rod at that height.

2.3 FDLRX is the ratio of the maximum LHGR calculated by the core monitoring system for each fuel bundle divided by the LHGR limit for the applicable fuel bundle type.

2.4 $LHGRFAC_f$ is a multiplier applied to the LHGR limit when operating at less than 108 Mlbm/hr core flow. The $LHGRFAC_f$ multiplier protects against both fuel centerline melting and cladding strain during anticipated system transients initiated from core flows less than 108 Mlbm/hr.

2.5 $LHGRFAC_p$ is a multiplier applied to the LHGR limit when operating at less than RATED THERMAL POWER. The $LHGRFAC_p$ multiplier protects against both fuel centerline melting and cladding strain during anticipated system transients initiated from partial power conditions.

2.6 MFLCPR is the ratio of the applicable MCPR operating limit for the applicable fuel bundle type divided by the MCPR calculated by the core monitoring system for each fuel bundle.

2.7 MAPRAT is the ratio of the maximum APLHGR calculated by the core monitoring system for each fuel bundle divided by the APLHGR limit for the applicable fuel bundle type.

2.8 OPRM is the Oscillation Power Range Monitor. The Oscillation Power Range Monitor (OPRM) will reliably detect and suppress anticipated stability related power oscillations while providing a high degree of confidence that the MCPR safety limit is not violated.

2.9 N_P is the OPRM setpoint for the number of consecutive confirmations of oscillation half-cycles that will be considered evidence of a stability related power oscillation.

2.10 S_P is the OPRM trip setpoint for the peak to average OPRM signal.

2.11 F_P is the core flow, in Mlbm / hr, below which the OPRM RPS trip is activated.

3.0 SHUTDOWN MARGIN

3.1 References

Technical Specification 3.1.1

3.2 Description

The SHUTDOWN MARGIN shall be equal to or greater than:

a) 0.38% Δk/k with the highest worth rod analytically determined

OR

b) 0.28% Δk/k with the highest worth rod determined by test

Since core reactivity will vary during the cycle as a function of fuel depletion and poison burnup, Beginning of Cycle (BOC) SHUTDOWN MARGIN (SDM) tests must also account for changes in core reactivity during the cycle. Therefore, the SDM measured at BOC must be equal to or greater than the applicable requirement from either 3.2.a or 3.2.b plus an adder, "R". The adder, "R", is the difference between the calculated value of maximum core reactivity (that is, minimum SDM) during the operating cycle and the calculated BOC core reactivity. If the value of "R" is zero (that is, BOC is the most reactive point in the cycle) no correction to the BOC measured value is required.

The SHUTDOWN MARGIN limits provided in 3.2a and 3.2b are applicable in MODES 1, 2, 3, 4; and 5. This includes core shuffling.

4.0 AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)

4.1 References

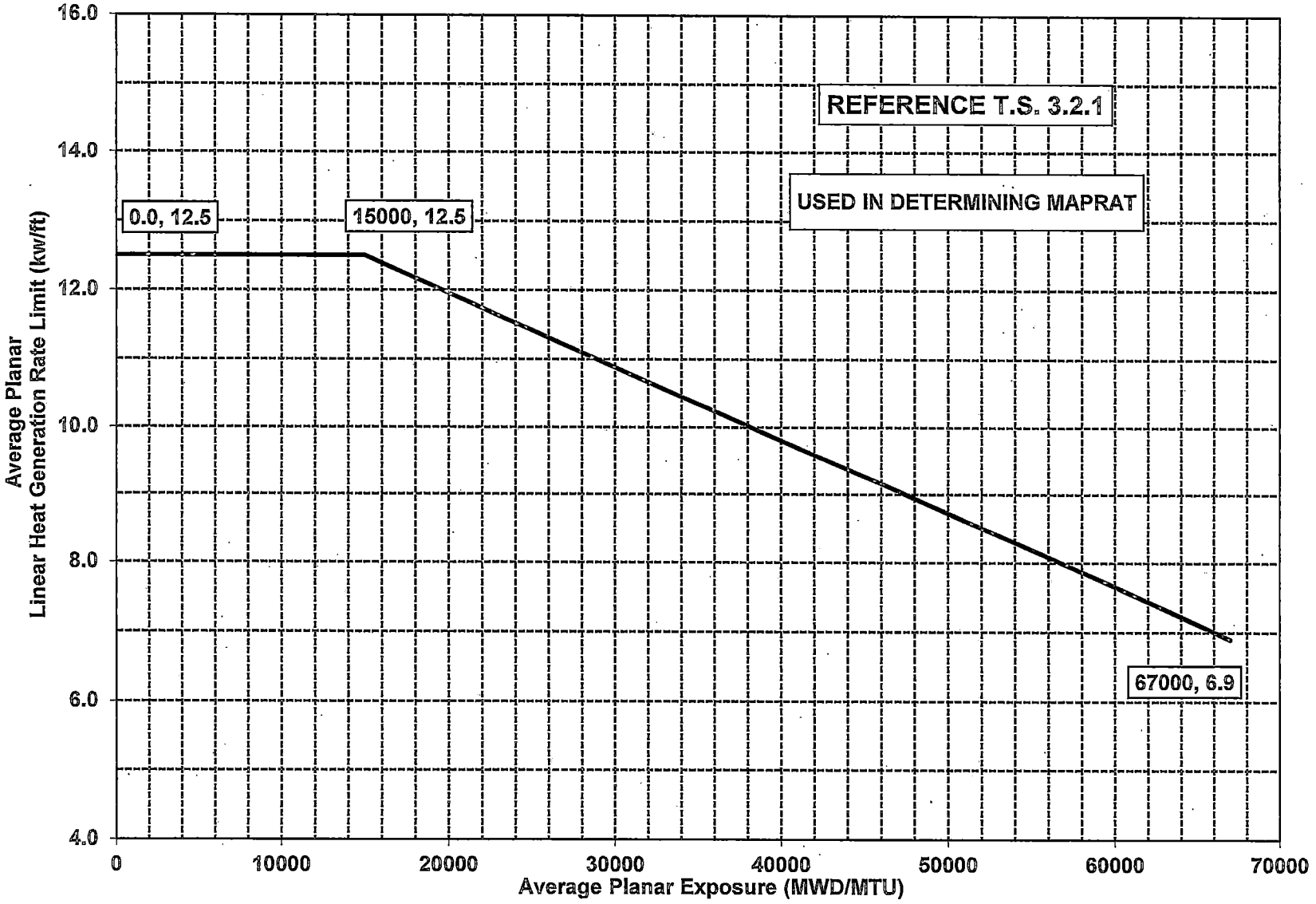
Technical Specification 3.2.1

4.2 Description

The APLHGRs for ATRIUM™-10 fuel shall not exceed the limit shown in Figure 4.2-1.

The APLHGR limits in Figure 4.2-1 are valid in Two Loop Operation for Main Turbine Bypass Operable and Inoperable, EOC-RPT Operable and Inoperable, Backup Pressure Regulator Operable and Inoperable, and with one Turbine Stop Valve (TSV) or Turbine Control Valve (TCV) closed. The APLHGR limits for Single Loop operation are provided in Section 8.0.

SSES UNIT 1 CYCLE 21



AVERAGE PLANAR LINEAR HEAT GENERATION RATE LIMIT VERSUS
AVERAGE PLANAR EXPOSURE - TWO LOOP OPERATION
ATRIUM™-10 FUEL
FIGURE 4.2-1

5.0 MINIMUM CRITICAL POWER RATIO (MCPR)

5.1 References

Technical Specification 3.2.2, 3.3.4.1, 3.7.6, and 3.7.8

Technical Requirements Manual 3.3.7

5.2 Description

The MCPR limit is specified as a function of core power, core flow, average scram insertion time per Section 5.3 and plant equipment operability status. The MCPR limits for all fuel types (ATRIUM™-10) shall be the greater of the Flow-Dependent or the Power-Dependent MCPR, depending on the applicable equipment operability status.

a) Main Turbine Bypass / EOC-RPT / Backup Pressure Regulator Operable

Figure 5.2-1: Flow-Dependent MCPR value determined from BOC to EOC

Figure 5.2-2: Power-Dependent MCPR value determined from BOC to EOC

b) Main Turbine Bypass Inoperable

Figure 5.2-3: Flow-Dependent MCPR value determined from BOC to EOC

Figure 5.2-4: Power-Dependent MCPR value determined from BOC to EOC

c) EOC-RPT Inoperable

Figure 5.2-5: Flow-Dependent MCPR value determined from BOC to EOC

Figure 5.2-6: Power-Dependent MCPR value determined from BOC to EOC

d) Backup Pressure Regulator Inoperable

Figure 5.2-7: Flow-Dependent MCPR value determined from BOC to EOC

Figure 5.2-8: Power Dependent MCPR value determined from BOC to EOC

e) One Turbine Stop Valve (TSV) or Turbine Control Valve (TCV) Closed

Figure 5.2-9: Flow-Dependent MCPR value determined from BOC to EOC

Figure 5.2-10:Power-Dependent MCPR value determined from BOC to EOC

The MCPR limits in Figures 5.2-1 through 5.2-10 are valid for Two Loop operation.

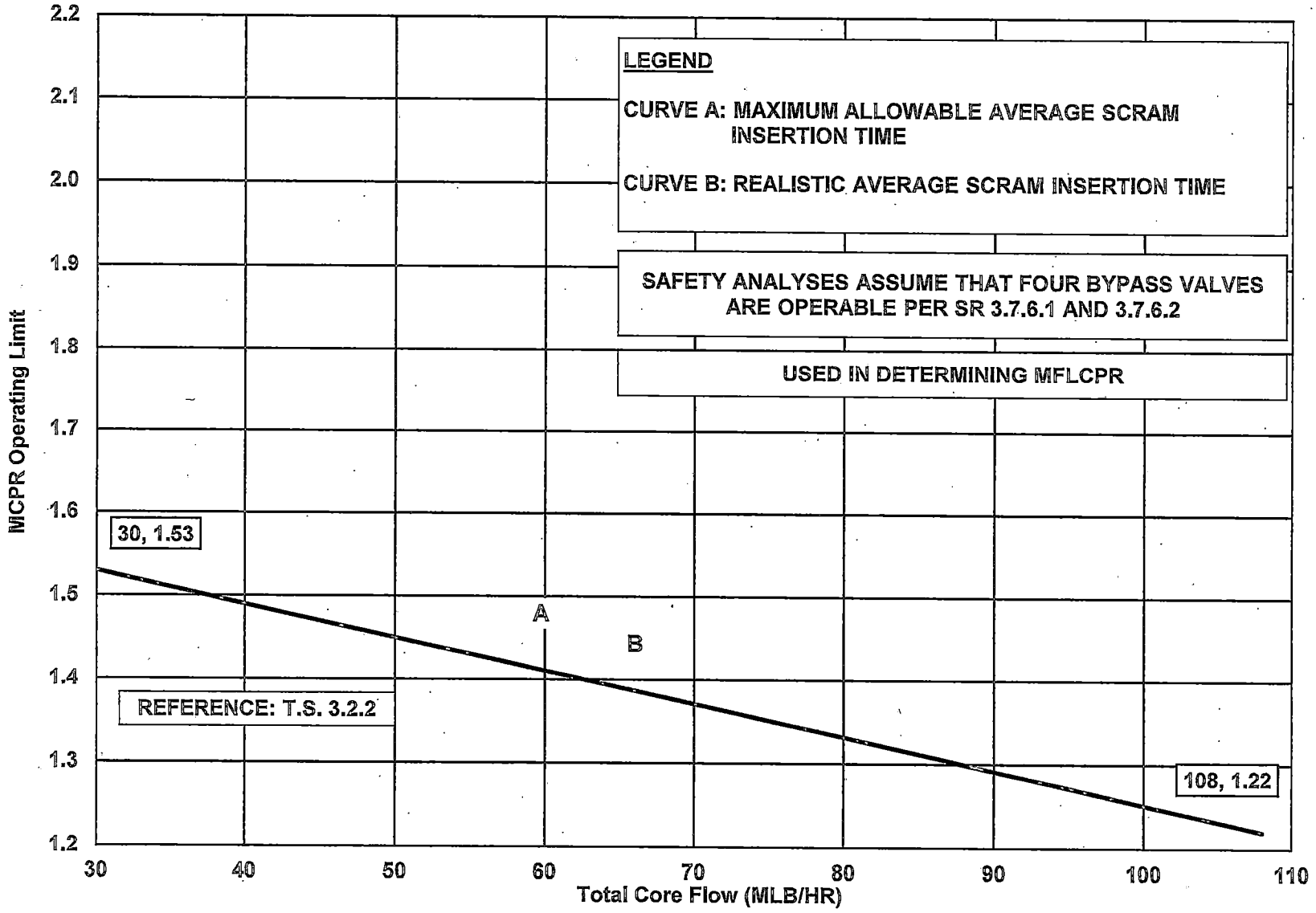
The MCPR limits for Single Loop operation are provided in Section 8.0.

5.3 Average Scram Time Fraction

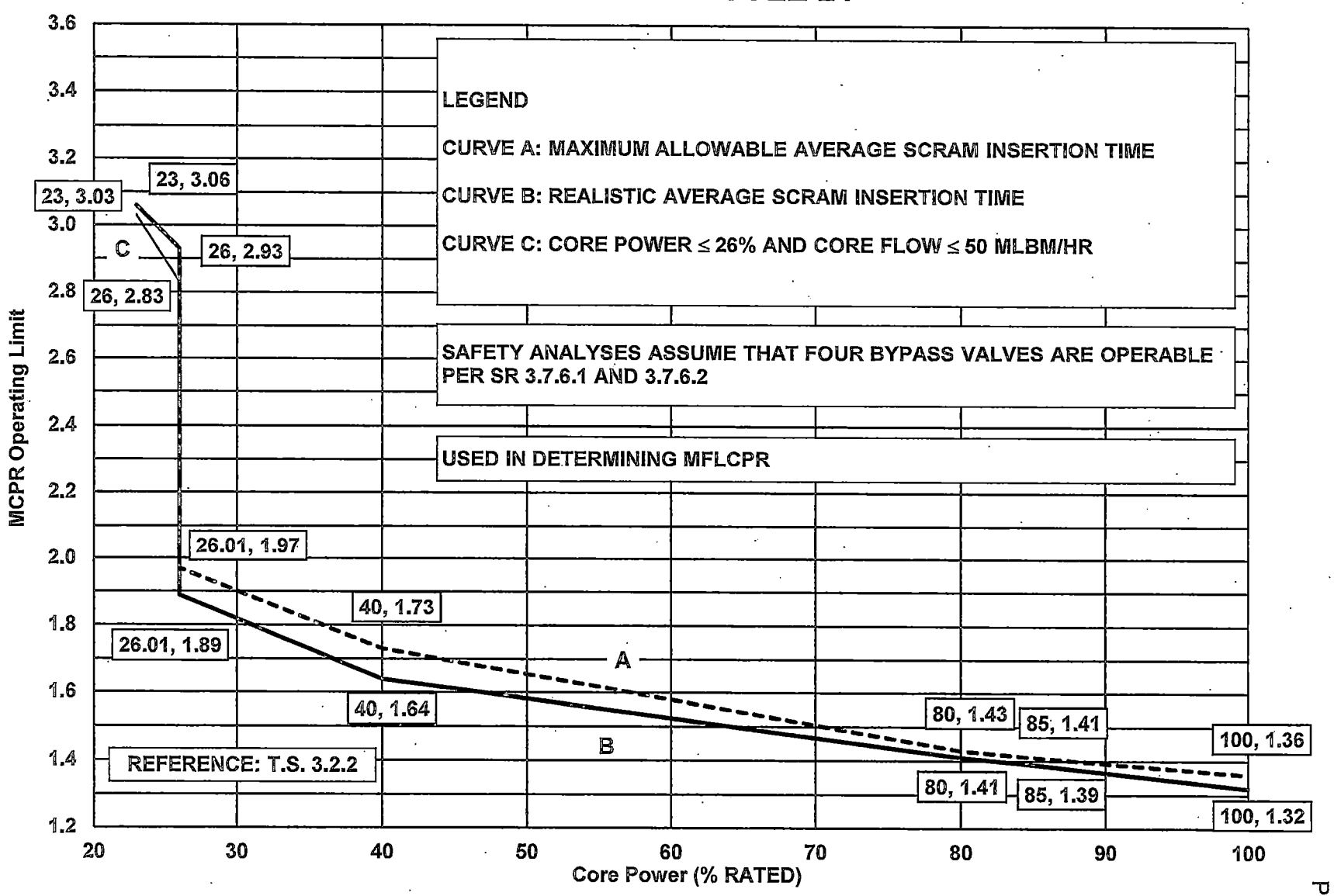
If the average measured scram times are greater than the Realistic Scram times listed in Table 5.3-1 then the MCPR operating limits corresponding to the Maximum Allowable Average Scram Insertion Time must be implemented. Determining MCPR operating limits based on interpolation between scram insertion times is not permitted. The evaluation of scram insertion time data, as it relates to the attached table should be performed per Reactor Engineering procedures.

Main Turbine Bypass / EOC-RPT / Backup Pressure Regulator Operable

SSES UNIT 1 CYCLE 21



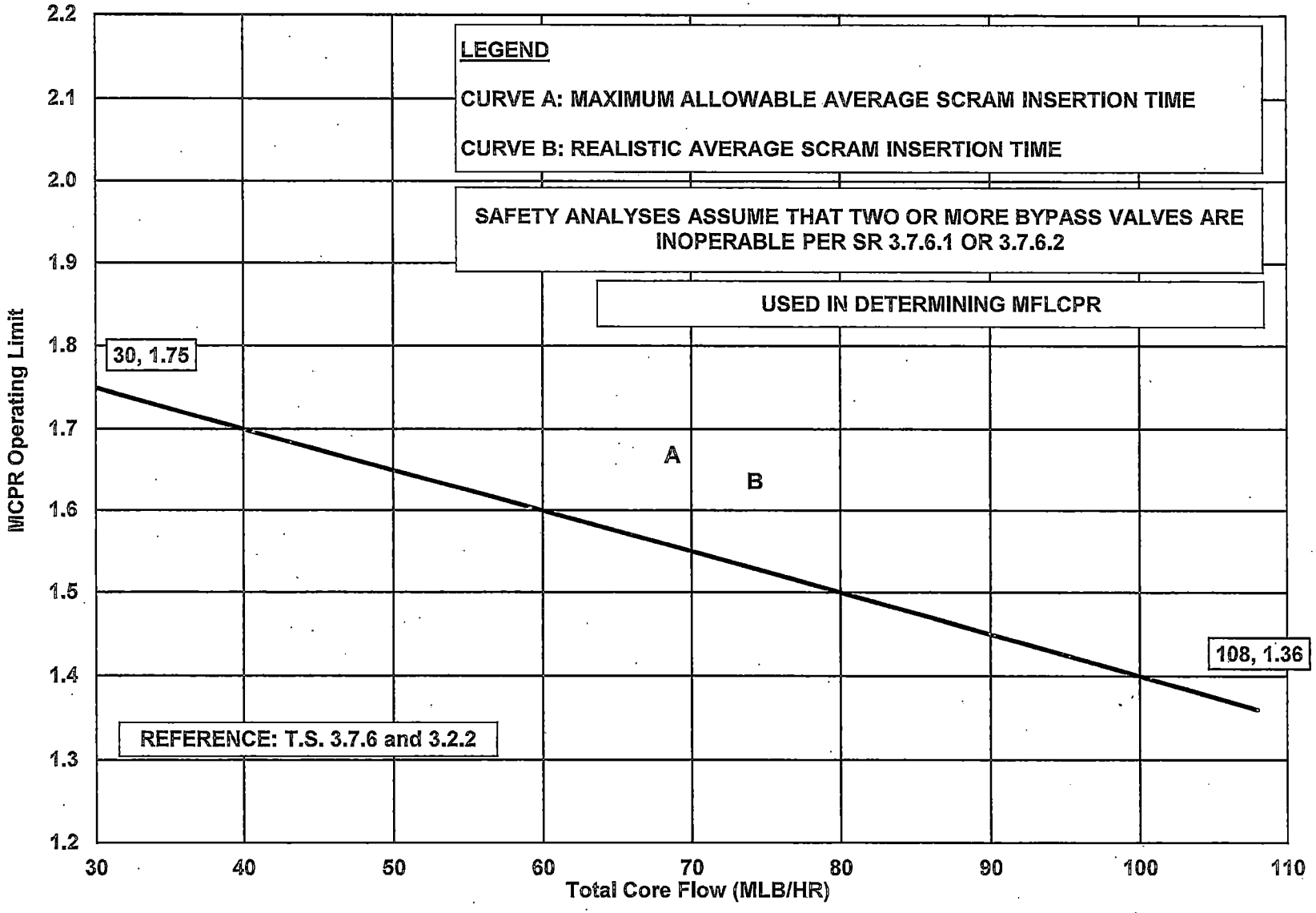
MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
MAIN TURBINE BYPASS / EOC-RPT / BACKUP PRESSURE REGULATOR OPERABLE
TWO LOOP OPERATION (BOC TO EOC)
FIGURE 5.2-1



MCPR OPERATING LIMIT VERSUS CORE POWER
MAIN TURBINE BYPASS / EOC-RPT / BACKUP PRESSURE REGULATOR OPERABLE
TWO LOOP OPERATION (BOC TO EOC)
FIGURE 5.2-2

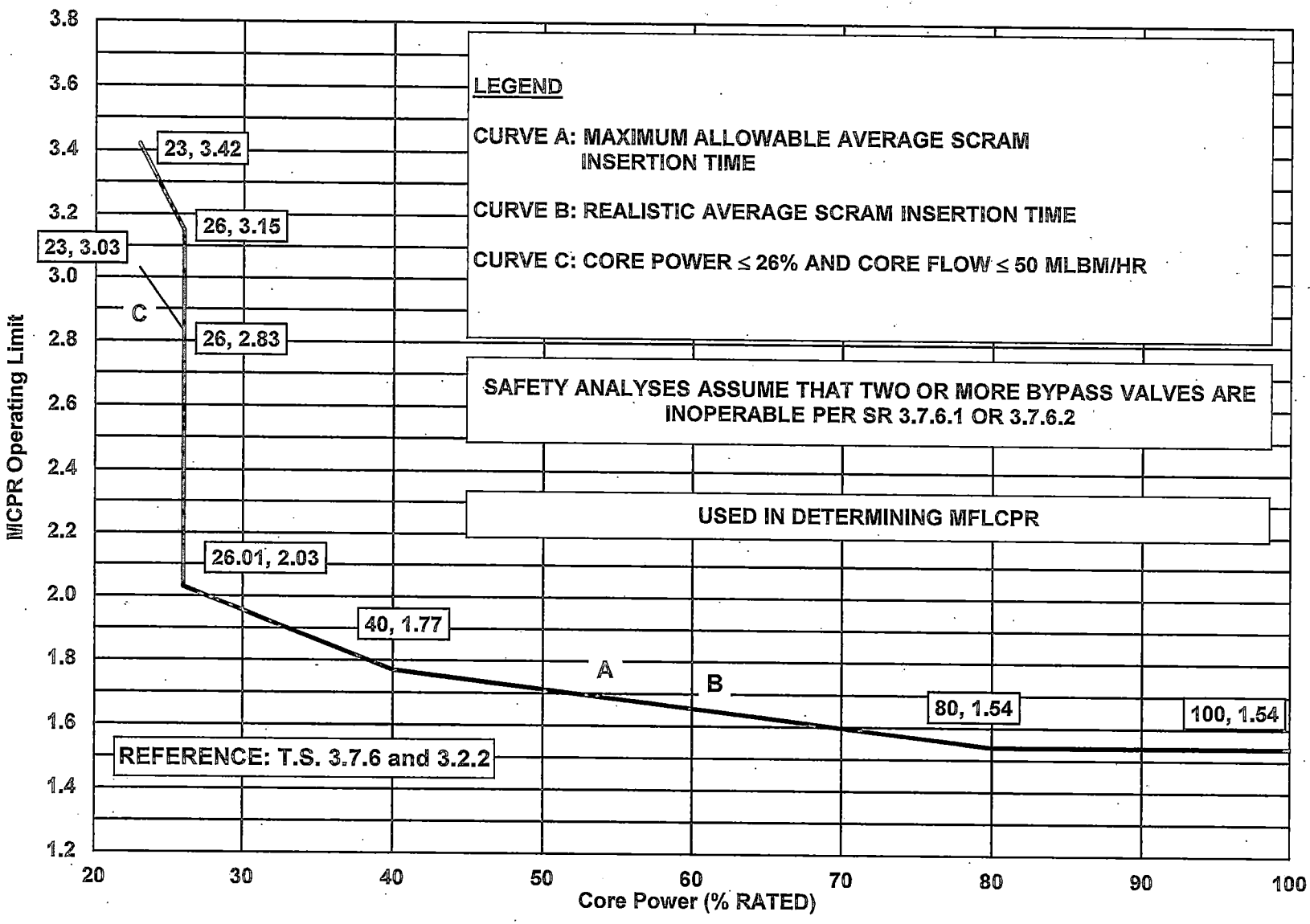
Main Turbine Bypass Inoperable

SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
MAIN TURBINE BYPASS INOPERABLE
TWO LOOP OPERATION (BOC TO EOC)
FIGURE 5.2-3

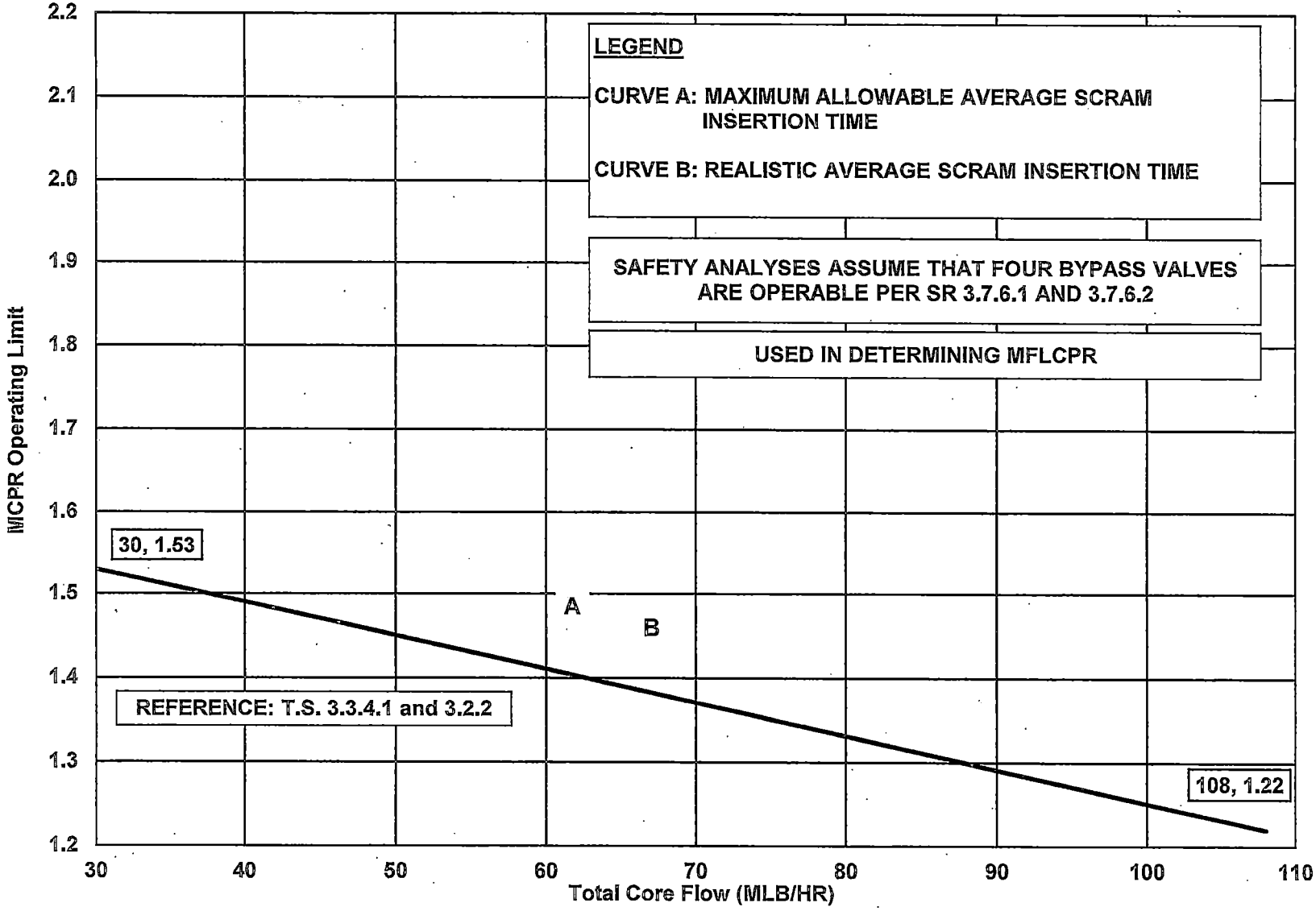
SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS CORE POWER
MAIN TURBINE BYPASS INOPERABLE
TWO LOOP OPERATION (BOC to EOC)
FIGURE 5.2-4

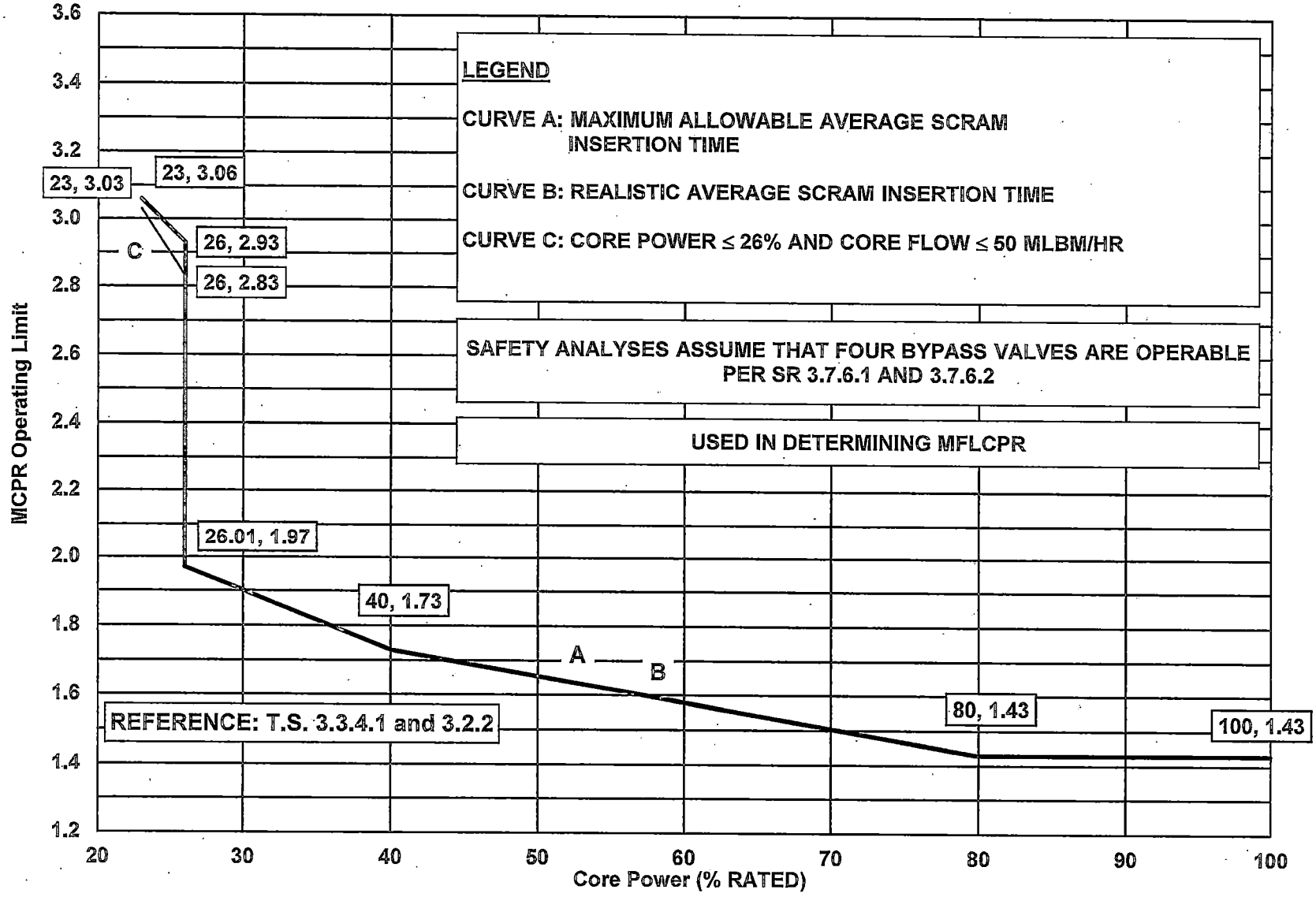
EOC-RPT
Inoperable

SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
EOC-RPT INOPERABLE
TWO LOOP OPERATION (BOC TO EOC)
FIGURE 5.2-5

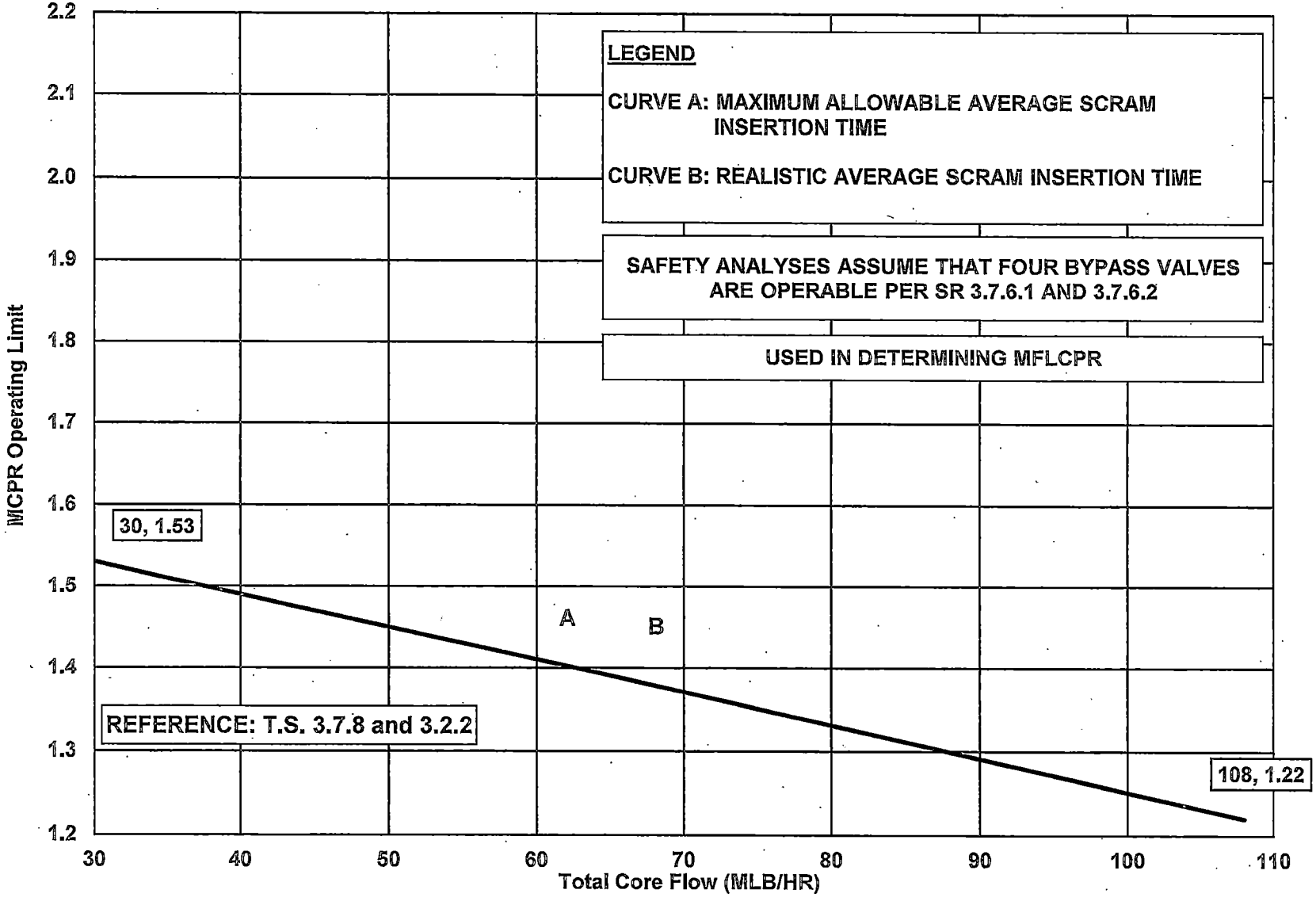
SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS CORE POWER
EOC-RPT INOPERABLE
TWO LOOP OPERATION (BOC to EOC)
FIGURE 5.2-6

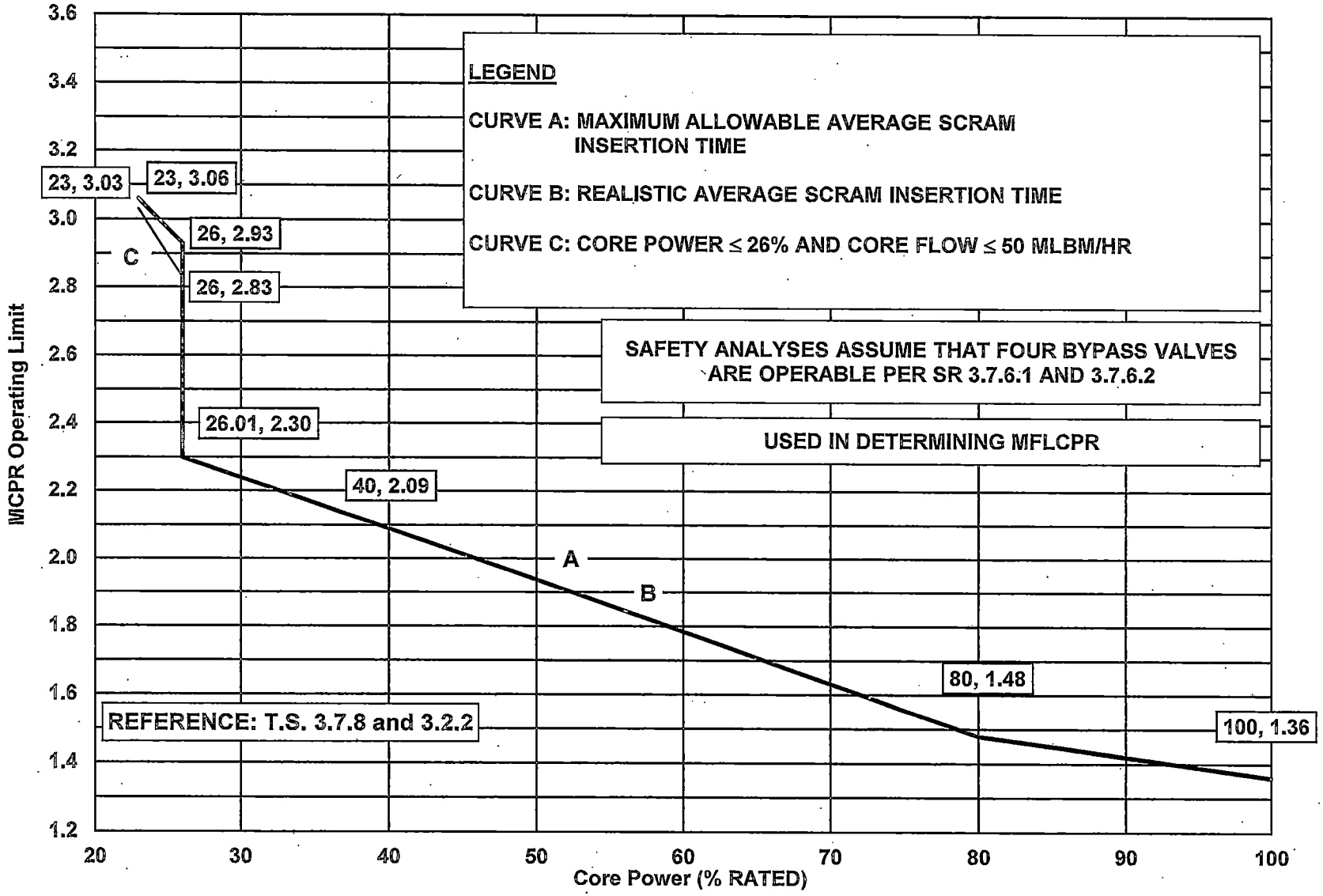
Backup Pressure Regulator Inoperable

SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
BACKUP PRESSURE REGULATOR INOPERABLE
TWO LOOP OPERATION (BOC TO EOC)
FIGURE 5.2-7

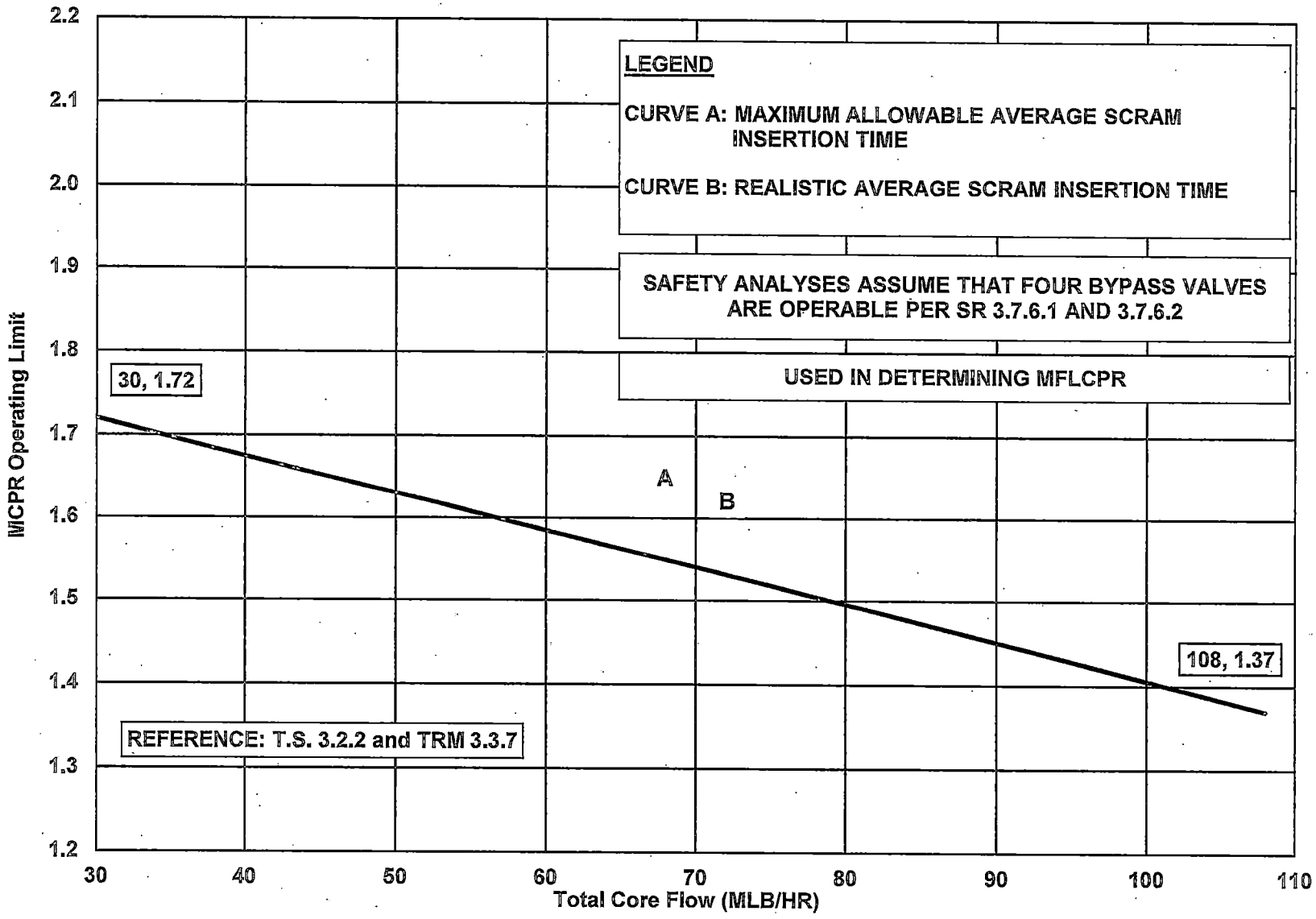
SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS CORE POWER
BACKUP PRESSURE REGULATOR INOPERABLE
TWO LOOP OPERATION (BOC to EOC)
FIGURE 5.2-8

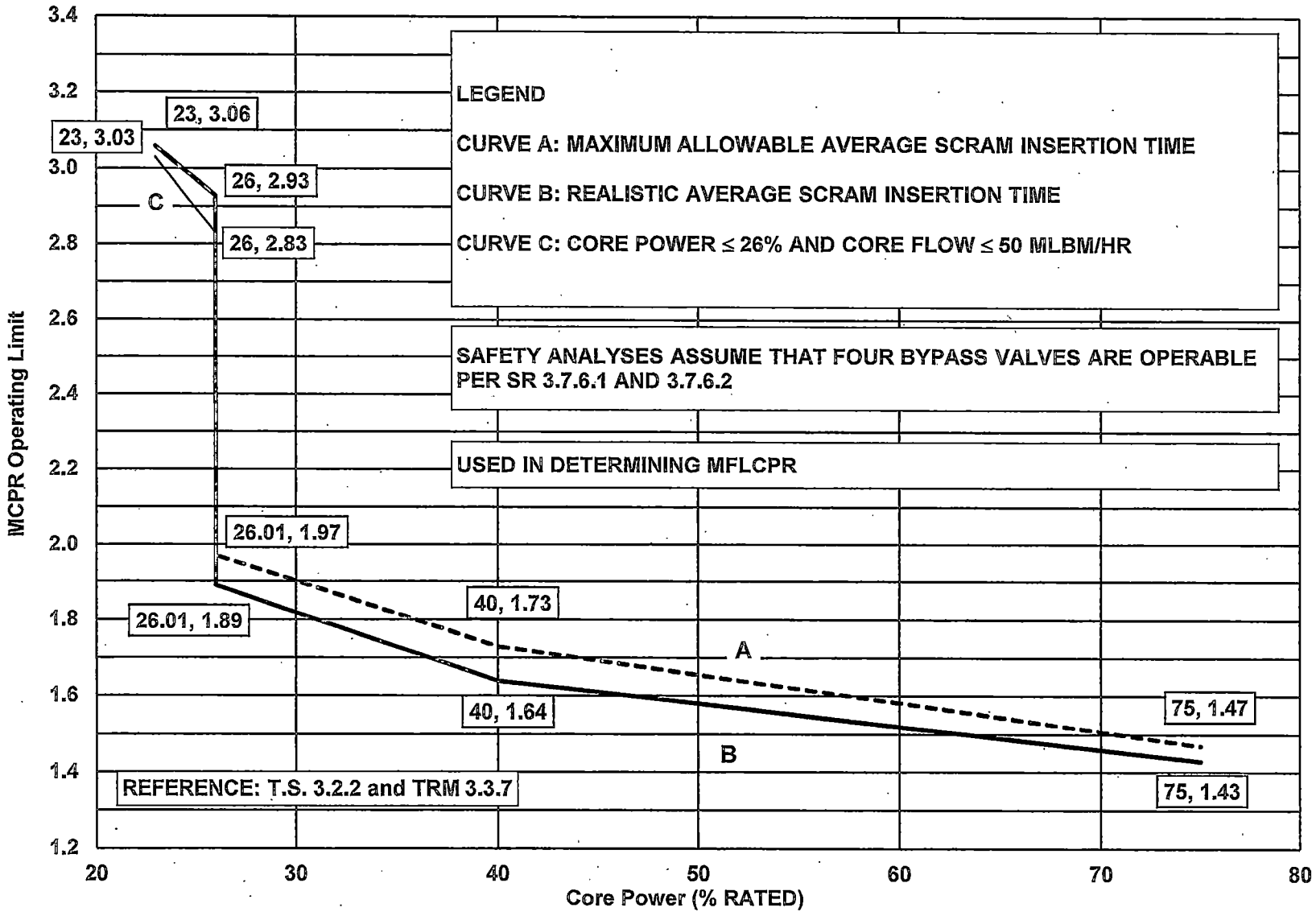
One TSV or TCV Closed

SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
ONE TSV OR TCV CLOSED*
TWO LOOP OPERATION (BOC TO EOC)
FIGURE 5.2-9

*Operation with one TSV or TCV closed is only supported at power levels ≤ 75% rated power.



MCPR OPERATING LIMIT VERSUS CORE POWER
ONE TSV OR TCV CLOSED
TWO LOOP OPERATION (BOC TO EOC)
FIGURE 5.2-10

Table 5.3-1

Average Scram Time Fraction Table For Use With Scram Time Dependent MCPR Operating Limits

Control Rod Position	Average Scram Time to Position (seconds)		
45	0.470		0.520
39	0.630		0.860
25	1.500		1.910
5	2.700		3.440
Average Scram Insertion Time	Realistic		Maximum Allowable

6.0 LINEAR HEAT GENERATION RATE (LHGR)

6.1 References

Technical Specification 3.2.3, 3.3.4.1, 3.7.6, and 3.7.8

Technical Requirements Manual 3.3.7

6.2 Description

The maximum LHGR for ATRIUM™-10 fuel shall not exceed the LHGR limit determined from Figure 6.2-1. The LHGR limit in Figure 6.2-1 is valid for Main Turbine Bypass Operable and Inoperable, EOC-RPT Operable and Inoperable, Backup Pressure Regulator Operable and Inoperable, and with one Turbine Stop Valve (TSV) or Turbine Control Valve (TCV) closed.

To protect against both fuel centerline melting and cladding strain during anticipated system transients initiated from reduced power and flow conditions, power and flow dependent LHGR limit multipliers are provided in the following figures:

a) Main Turbine Bypass / EOC-RPT / Backup Pressure Regulator Operable

Figure 6.2-2: Flow-Dependent LHGR Limit Multiplier

Figure 6.2-3: Power-Dependent LHGR Limit Multiplier

b) Main Turbine Bypass or EOC-RPT or Backup Pressure Regulator Inoperable

Figure 6.2-4: Flow-Dependent LHGR Limit Multiplier

Figure 6.2-5: Power-Dependent LHGR Limit Multiplier

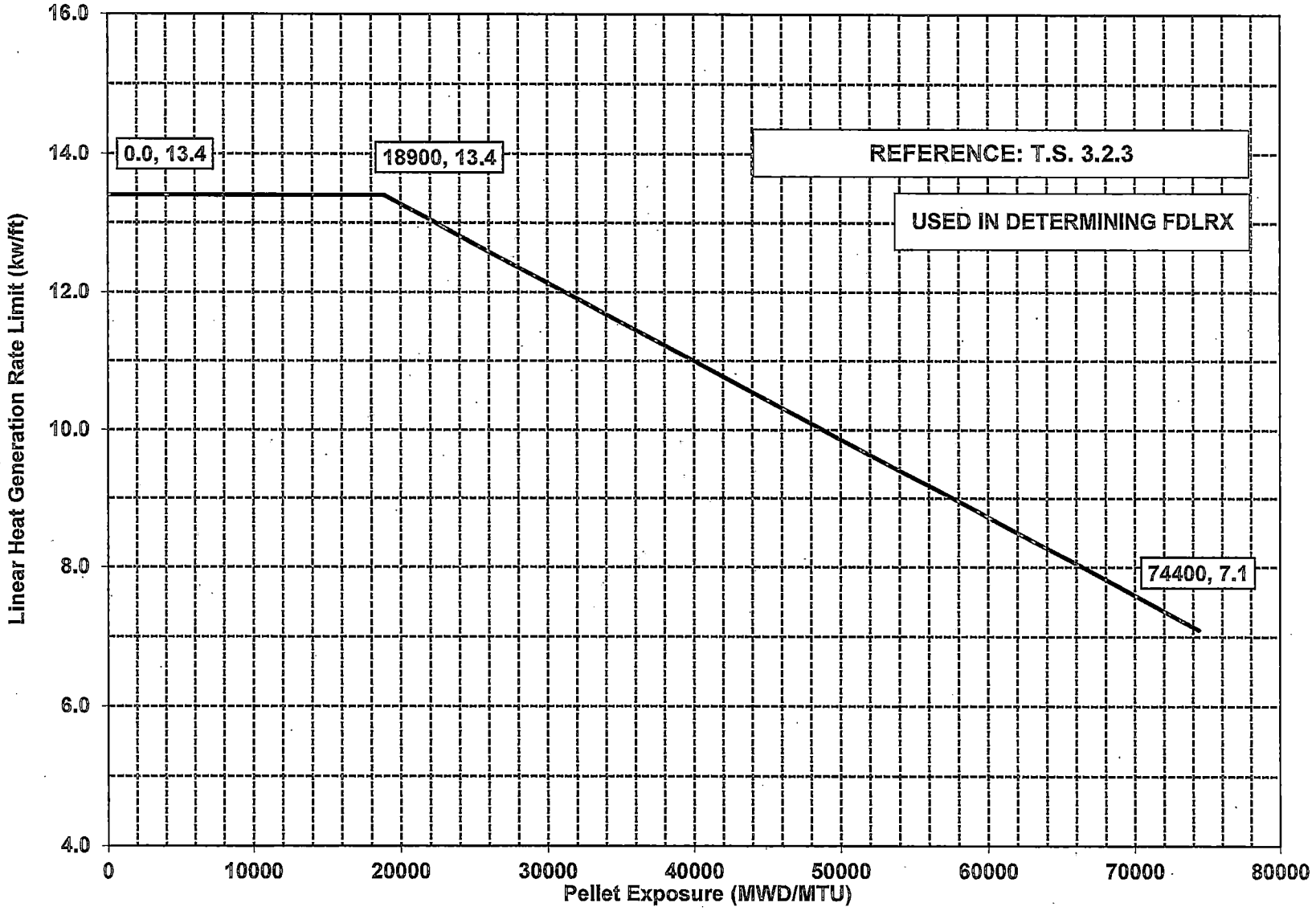
c) One Turbine Stop Valve (TSV) or Turbine Control Valve (TCV) Closed

Figure 6.2-6: Flow-Dependent LHGR Limit Multiplier

Figure 6.2-7: Power-Dependent LHGR Limit Multiplier

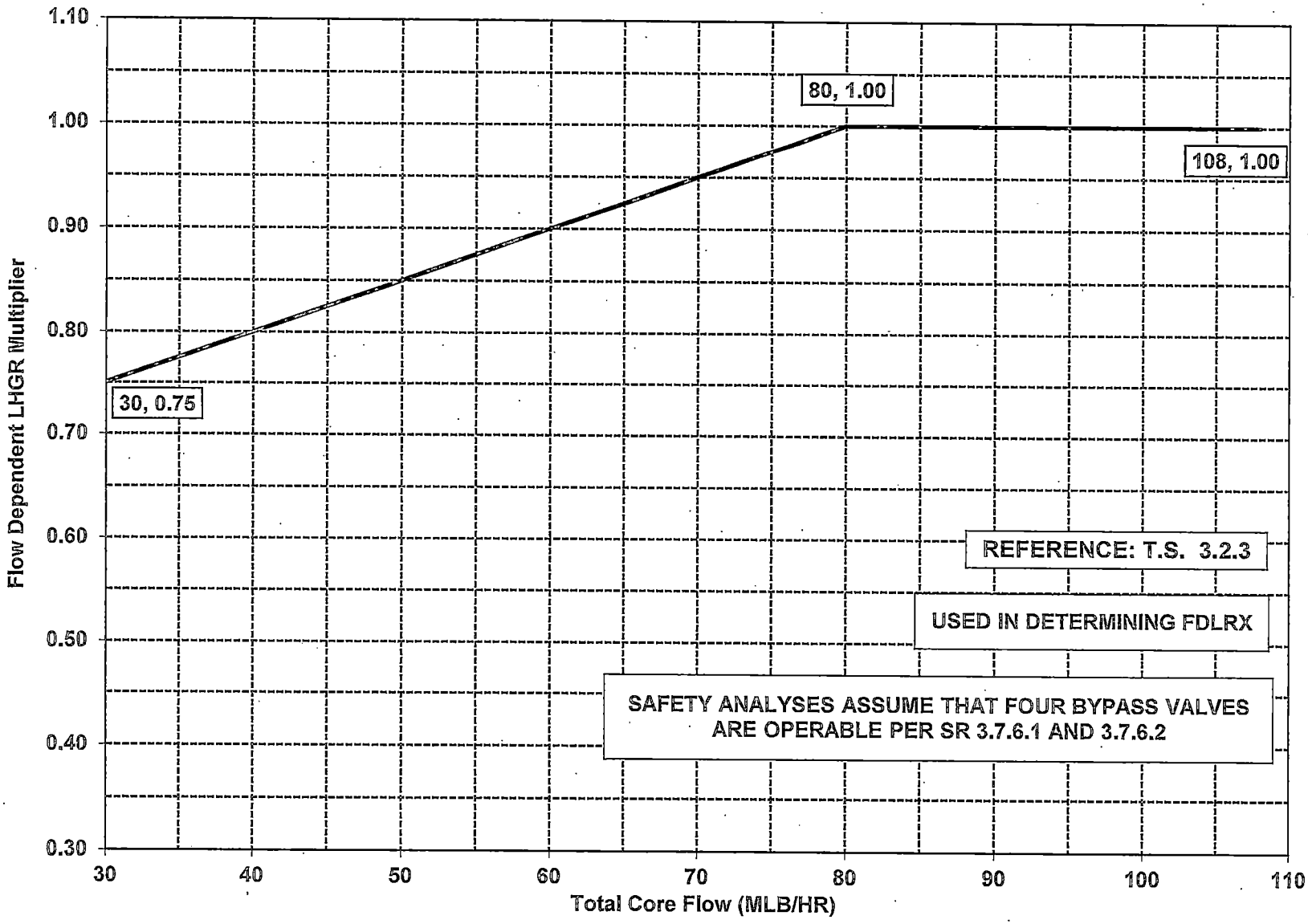
The LHGR limits and LHGR limit multipliers in Figures 6.2-1 through 6.2-7 are valid for both Two Loop and Single Loop operation.

SSES UNIT 1 CYCLE 21

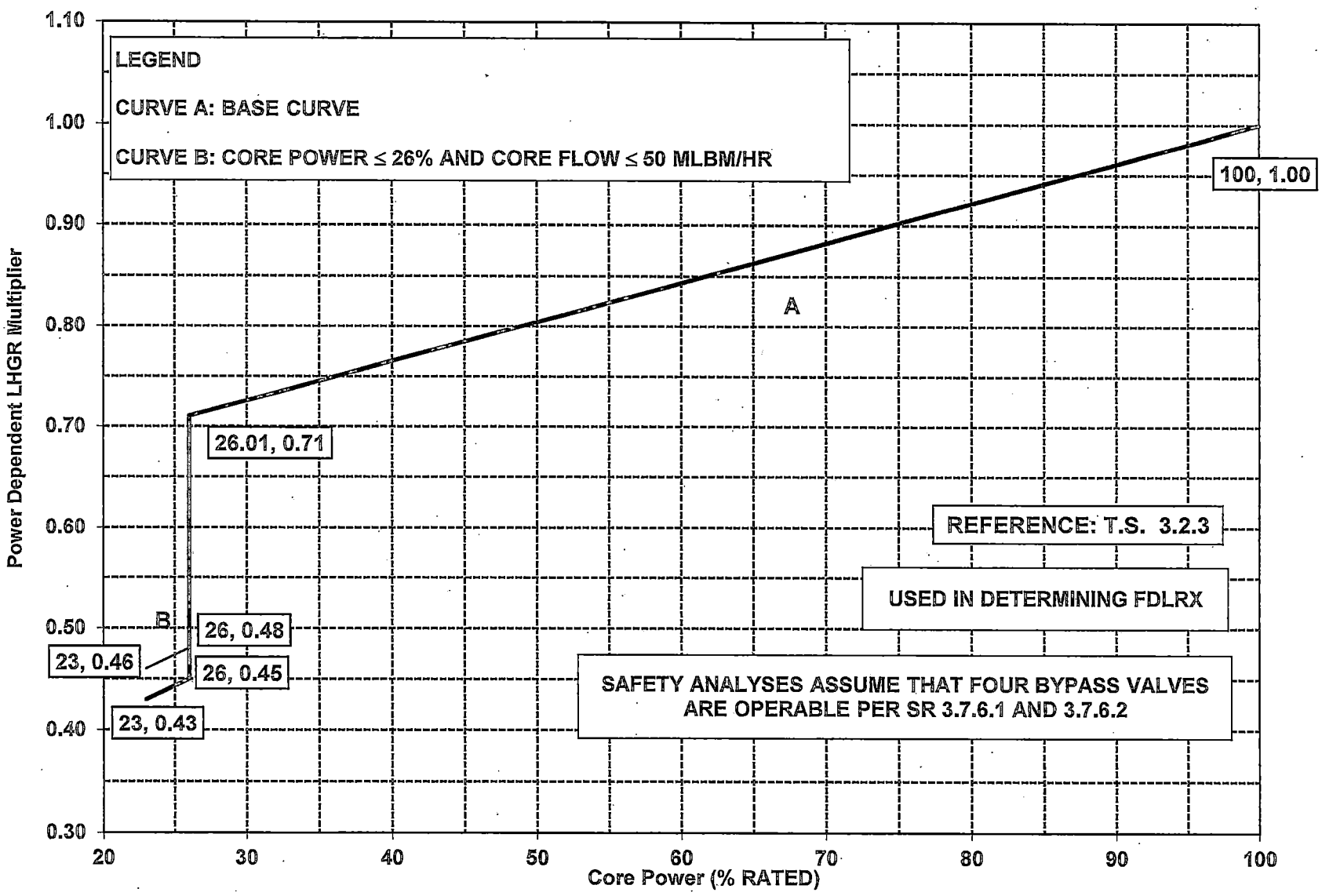


LINEAR HEAT GENERATION RATE LIMIT VERSUS PELLET EXPOSURE
ATRIUM™-10 FUEL
FIGURE 6.2-1

Main Turbine Bypass / EOC-RPT / Backup Pressure Regulator Operable

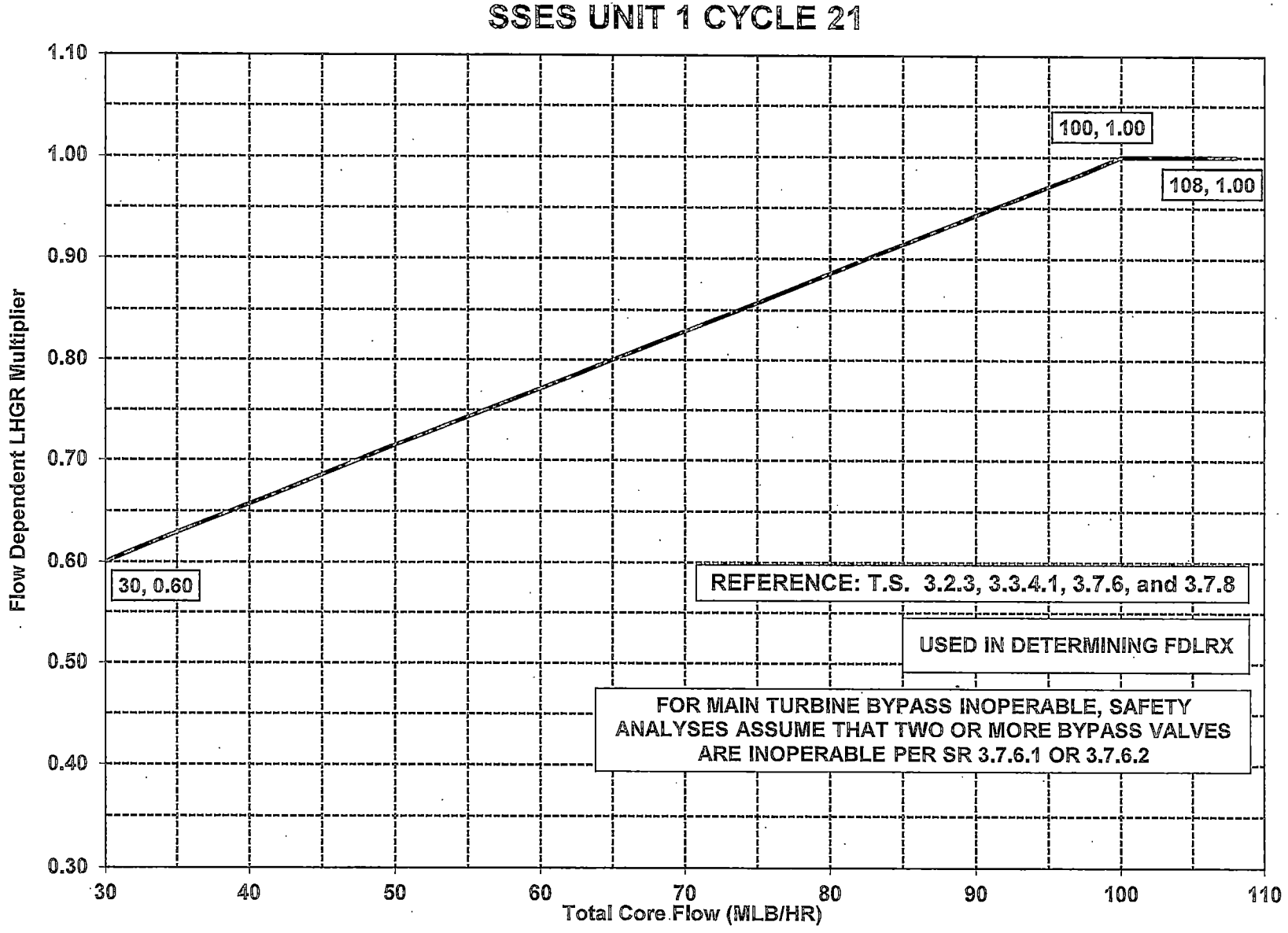


FLOW DEPENDENT LHGR LIMIT MULTIPLIER
MAIN TURBINE BYPASS / EOC-RPT / BACKUP PRESSURE REGULATOR OPERABLE
ATRIUM™-10 FUEL
FIGURE 6.2-2



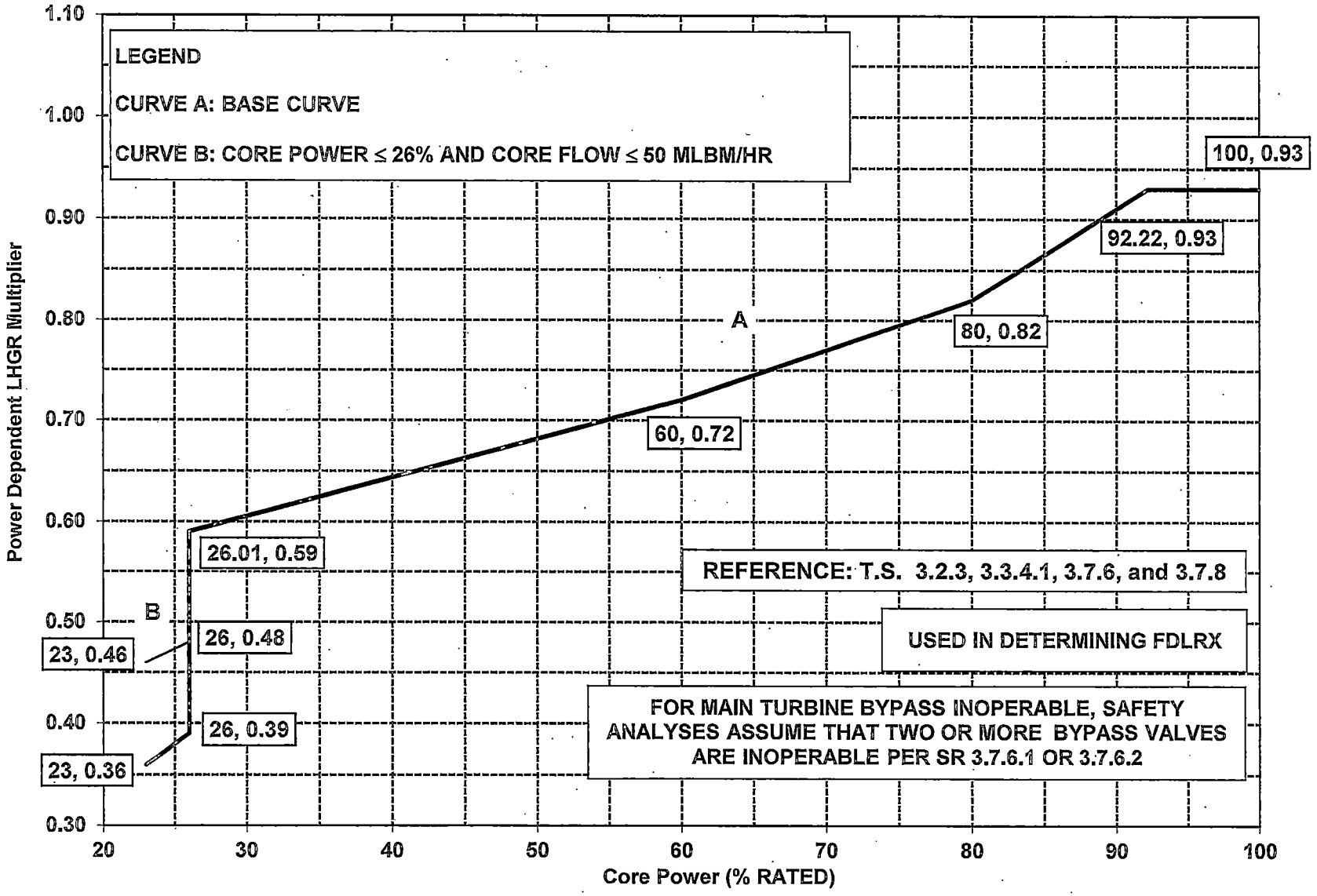
POWER DEPENDENT LHGR LIMIT MULTIPLIER
MAIN TURBINE BYPASS / EOC-RPT / BACKUP PRESSURE REGULATOR OPERABLE
ATRIUM™-10 FUEL
FIGURE 6.2-3

Main Turbine Bypass or EOC-RPT or Backup Pressure Regulator Inoperable



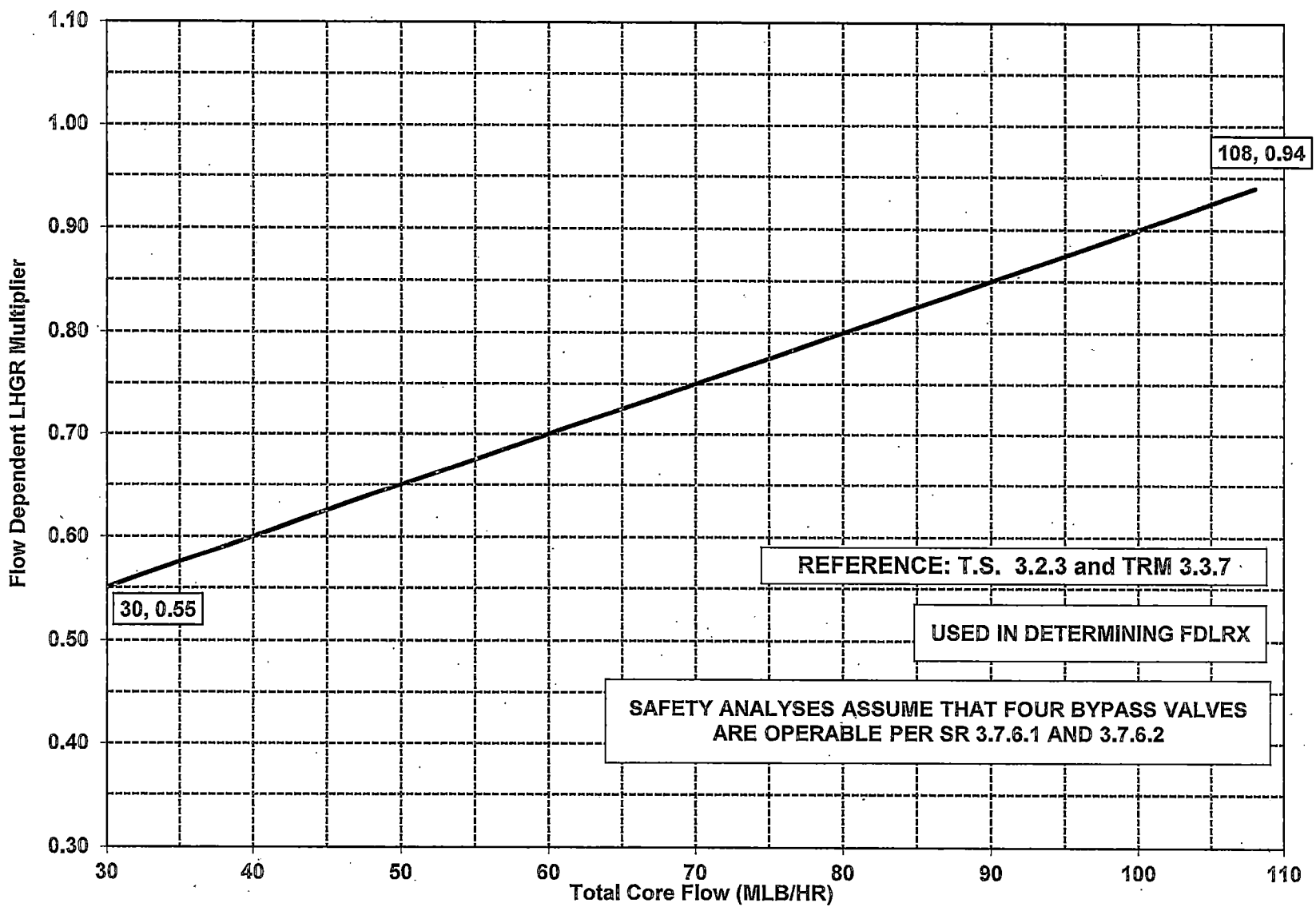
FLOW DEPENDENT LHGR LIMIT MULTIPLIER
MAIN TURBINE BYPASS OR EOC-RPT OR BACKUP PRESSURE REGULATOR INOPERABLE
ATRIUM™-10 FUEL
FIGURE 6.2-4

SSES UNIT 1 CYCLE 21



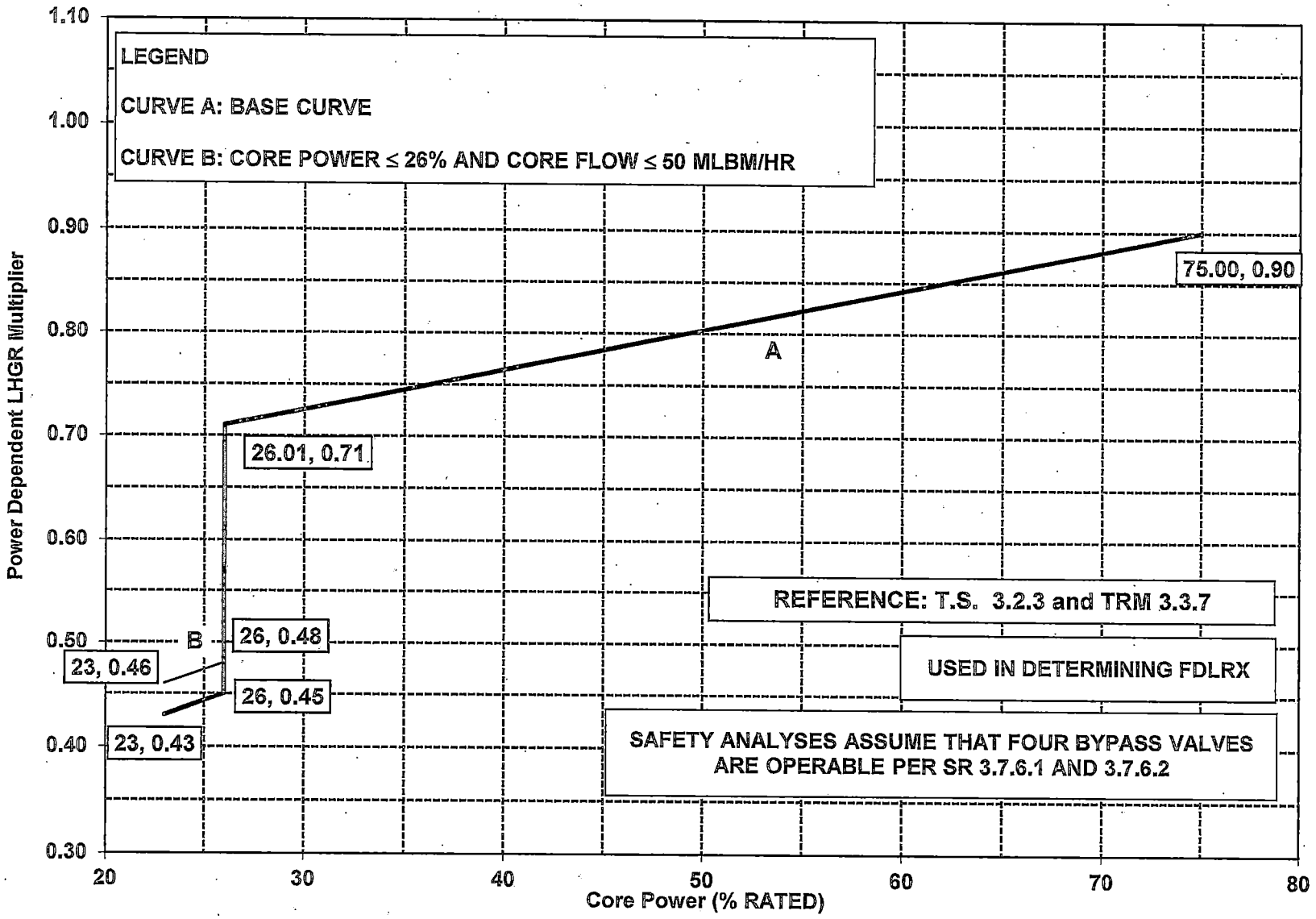
POWER DEPENDENT LHGR LIMIT MULTIPLIER
MAIN TURBINE BYPASS OR EOC-RPT OR BACKUP PRESSURE REGULATOR INOPERABLE
ATRIUM™-10 FUEL
FIGURE 6.2-5

One TSV or TCV Closed



FLOW DEPENDENT LHGR LIMIT MULTIPLIER
ONE TSV OR TCV CLOSED*
ATRIUM™-10 FUEL
FIGURE 6.2-6

***Operation with one TSV or TCV closed is only supported at power levels ≤ 75% rated power.**



POWER DEPENDENT LHGR LIMIT MULTIPLIER
ONE TSV OR TCV CLOSED
ATRIUM™-10 FUEL
FIGURE 6.2-7

7.0 ROD BLOCK MONITOR (RBM) SETPOINTS AND OPERABILITY REQUIREMENTS

7.1 References

Technical Specification 3.3.2.1

7.2 Description

The RBM Allowable Value and Trip Setpoints for;

a) Low Power Range Setpoint,
b) Intermediate Power Range Setpoint,
c) High Power Range Setpoint,
d) Low Power Range - Upscale,
e) Intermediate Power Range - Upscale, and
f) High Power Range - Upscale

shall be established as specified in Table 7.2-1. The RBM setpoints are valid for Two Loop and Single Loop Operation, Main Turbine Bypass Operable and Inoperable, EOC-RPT Operable and Inoperable, Backup Pressure Regulator Operable and Inoperable, and with one Turbine Stop Valve (TSV) or Turbine Control Valve (TCV) closed.

The RBM system design objective is to block erroneous control rod withdrawal initiated by the operator before fuel design limits are violated. If the full withdrawal of any control rod would not violate a fuel design limit, then the RBM system is not required to be operable. Table 7.2-2 provides RBM system operability requirements to ensure that fuel design limits are not violated.

Table 7.2-1
RBM Setpoints

Function	Allowable Value(1)	Nominal Trip Setpoint
Low Power Range Setpoint	28.0	24.9
Intermediate Power Range Setpoint	63.0	61.0
High Power Range Setpoint	83.0	81.0
Low Power Range - Upscale	123.4	123.0
Intermediate Power Range - Upscale	117.4	117.0
High Power Range - Upscale	105.6	105.2

(1) Power setpoint function (Low, Intermediate, and High Power Range Setpoints) determined in percent of RATED THERMAL POWER. Upscale trip setpoint function (Low, Intermediate, and High Power Range - Upscale) determined in percent of reference level.

Table 7.2-2
RBM System Operability Requirements

Thermal Power (% of Rated)	MCPR (2,3)
≥ 28 and < 90	< 1.76
≥ 90 and < 95	< 1.47
≥ 95	< 1.68

(2) Applicable to Main Turbine Bypass Operable and Inoperable, EOC-RPT Operable and Inoperable, Backup Pressure Regulator Operable and Inoperable, and with one Turbine Stop Valve (TSV) or Turbine Control Valve (TCV) closed.

(3) Applicable to both Two Loop and Single Loop Operation.

8.0 RECIRCULATION LOOPS - SINGLE LOOP OPERATION

8.1 References

Technical Specification 3.2.1, 3.2.2, 3.3.4.1, 3.4.1, 3.7.6, and 3.7.8

Technical Requirements Manual 3.3.7

8.2 Description

APLHGR

The APLHGR limit for ATRIUM™-10 fuel shall be equal to the APLHGR Limit from Figure 8.2-1.

The APLHGR limits in Figure 8.2-1 are valid in Single Loop Operation for Main Turbine Bypass Operable and Inoperable, EOC-RPT Operable and Inoperable, Backup Pressure Regulator Operable and Inoperable, and with one Turbine Stop Valve (TSV) or Turbine Control Valve (TCV) closed.

Minimum Critical Power Ratio Limit

The MCPR limit is specified as a function of core power, core flow, and plant equipment operability status. The MCPR limits for all fuel types (ATRIUM™-10) shall be the greater of the Flow-Dependent or the Power-Dependent MCPR, depending on the applicable equipment operability status.

a) Main Turbine Bypass / EOC-RPT / Backup Pressure Regulator Operable

Figure 8.2-2: Flow-Dependent MCPR value determined from BOC to EOC

Figure 8.2-3: Power-Dependent MCPR value determined from BOC to EOC

b) Main Turbine Bypass Inoperable

Figure 8.2-4: Flow-Dependent MCPR value determined from BOC to EOC

Figure 8.2-5: Power-Dependent MCPR value determined from BOC to EOC

c) EOC-RPT Inoperable

Figure 8.2-6: Flow-Dependent MCPR value determined from BOC to EOC

Figure 8.2-7: Power-Dependent MCPR value determined from BOC to EOC

d) Backup Pressure Regulator Inoperable

Figure 8.2-8: Flow-Dependent MCPR value determined from BOC to EOC

Figure 8.2-9: Power-Dependent MCPR value determined from BOC to EOC

e) One Turbine Stop Valve (TSV) or Turbine Control Valve (TCV) Closed

Figure 8.2-10:Flow-Dependent MCPR value determined from BOC to EOC

Figure 8.2-11:Power-Dependent MCPR value determined from BOC to EOC

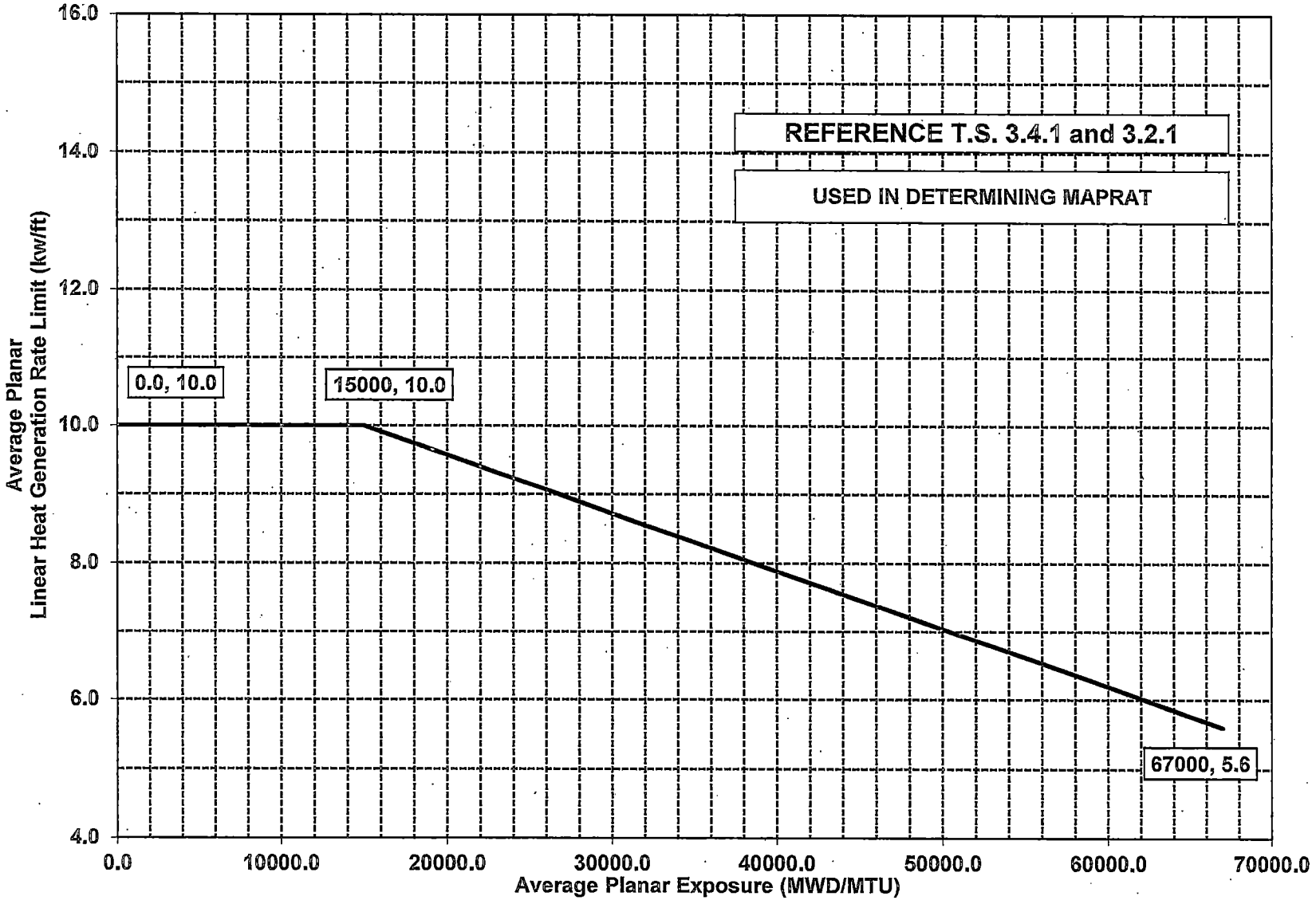
The MCPR limits in Figures 8.2-2 through 8.2-11 are valid only for Single Loop operation.

Linear Heat Generation Rate Limit

The LHGR limits for Single Loop Operation are defined in Section 6.0.

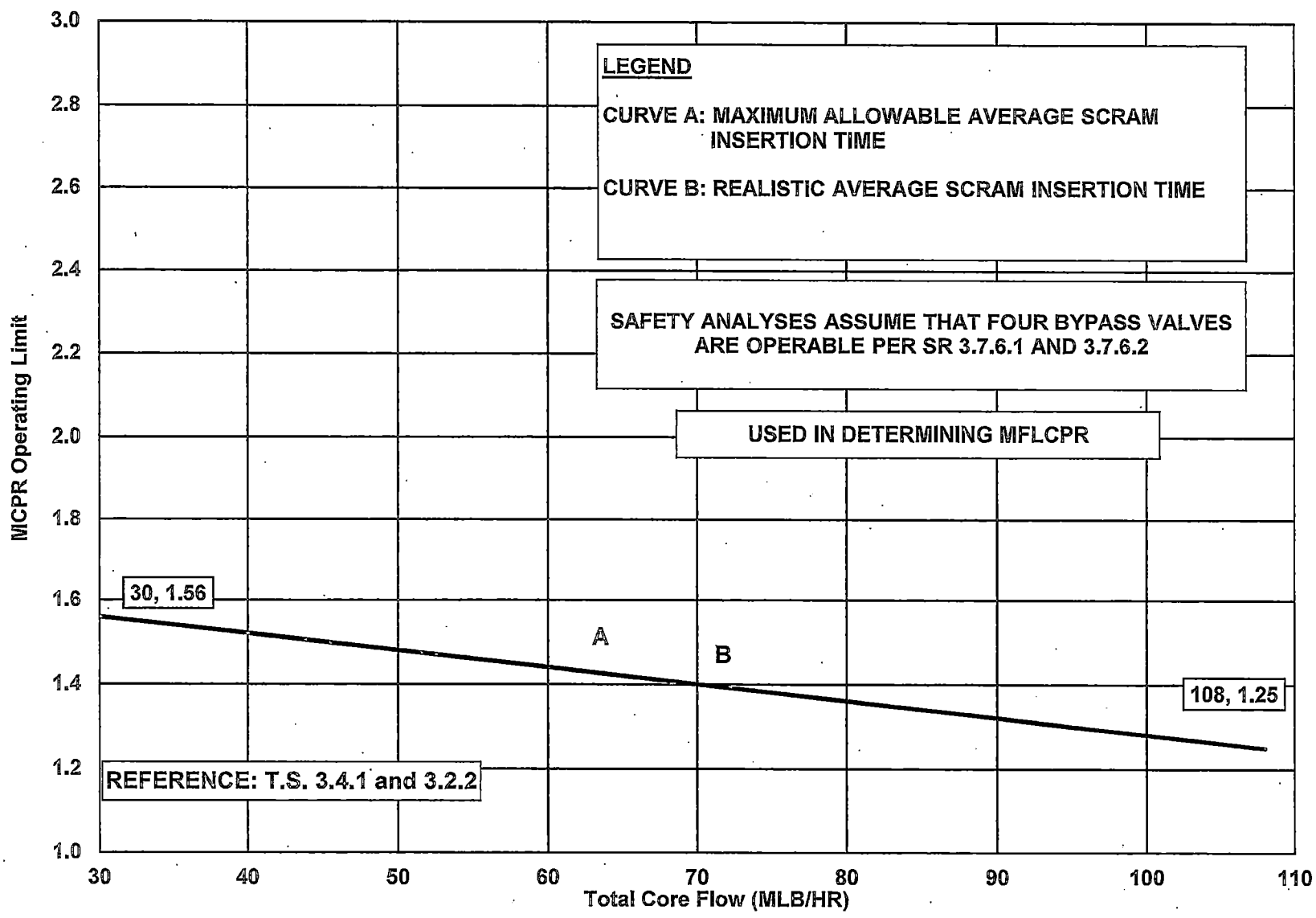
RBM Setpoints and Operability Requirements

The RBM setpoints and operability requirements for Single Loop Operation are defined in Section 7.0.



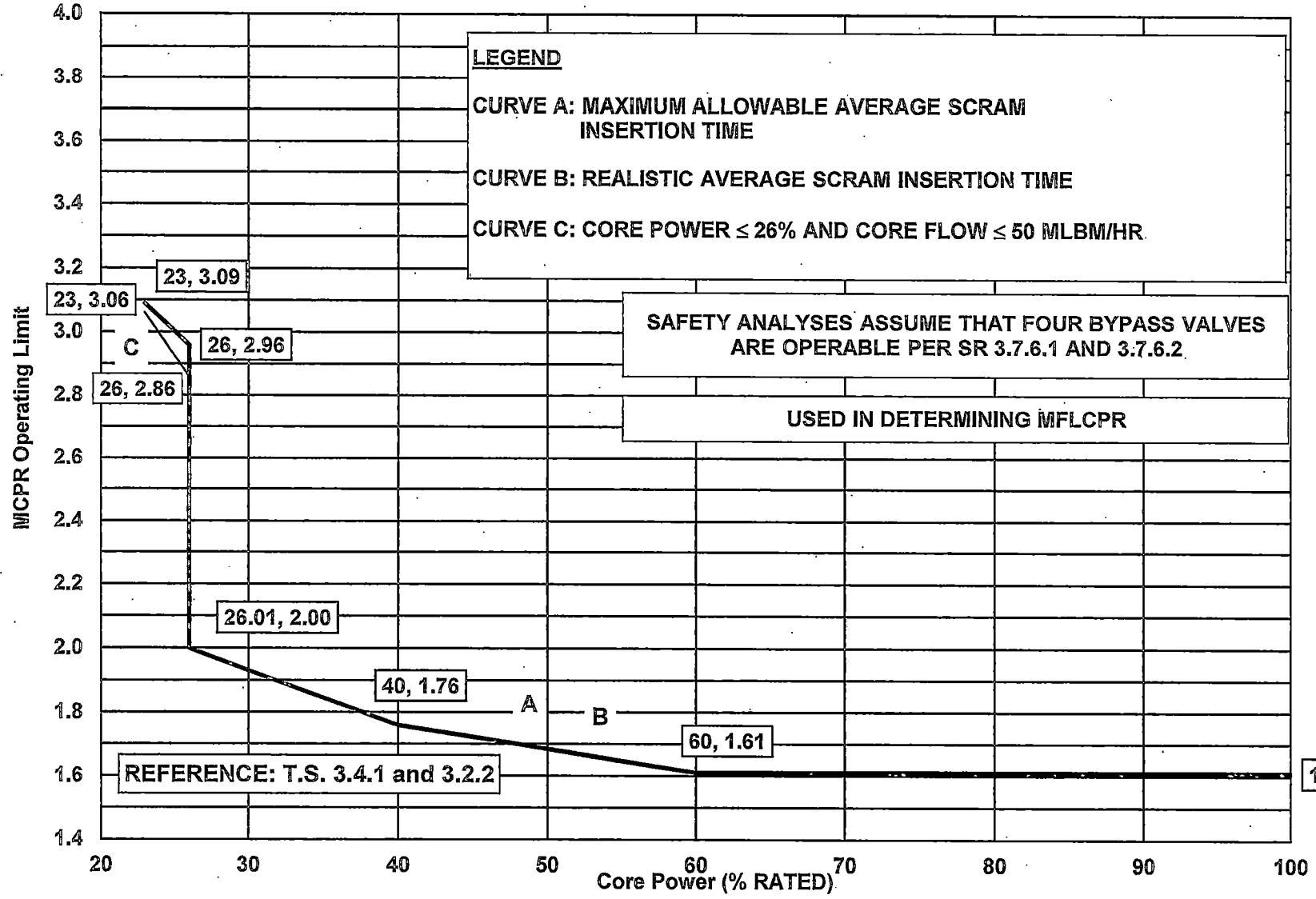
AVERAGE PLANAR LINEAR HEAT GENERATION RATE LIMIT VERSUS
AVERAGE PLANAR EXPOSURE - SINGLE LOOP OPERATION
ATRIUM™-10 FUEL
FIGURE 8.2-1

Main Turbine Bypass / EOC-RPT / Backup Pressure Regulator Operable



MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
MAIN TURBINE BYPASS / EOC-RPT / BACKUP PRESSURE REGULATOR OPERABLE
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-2

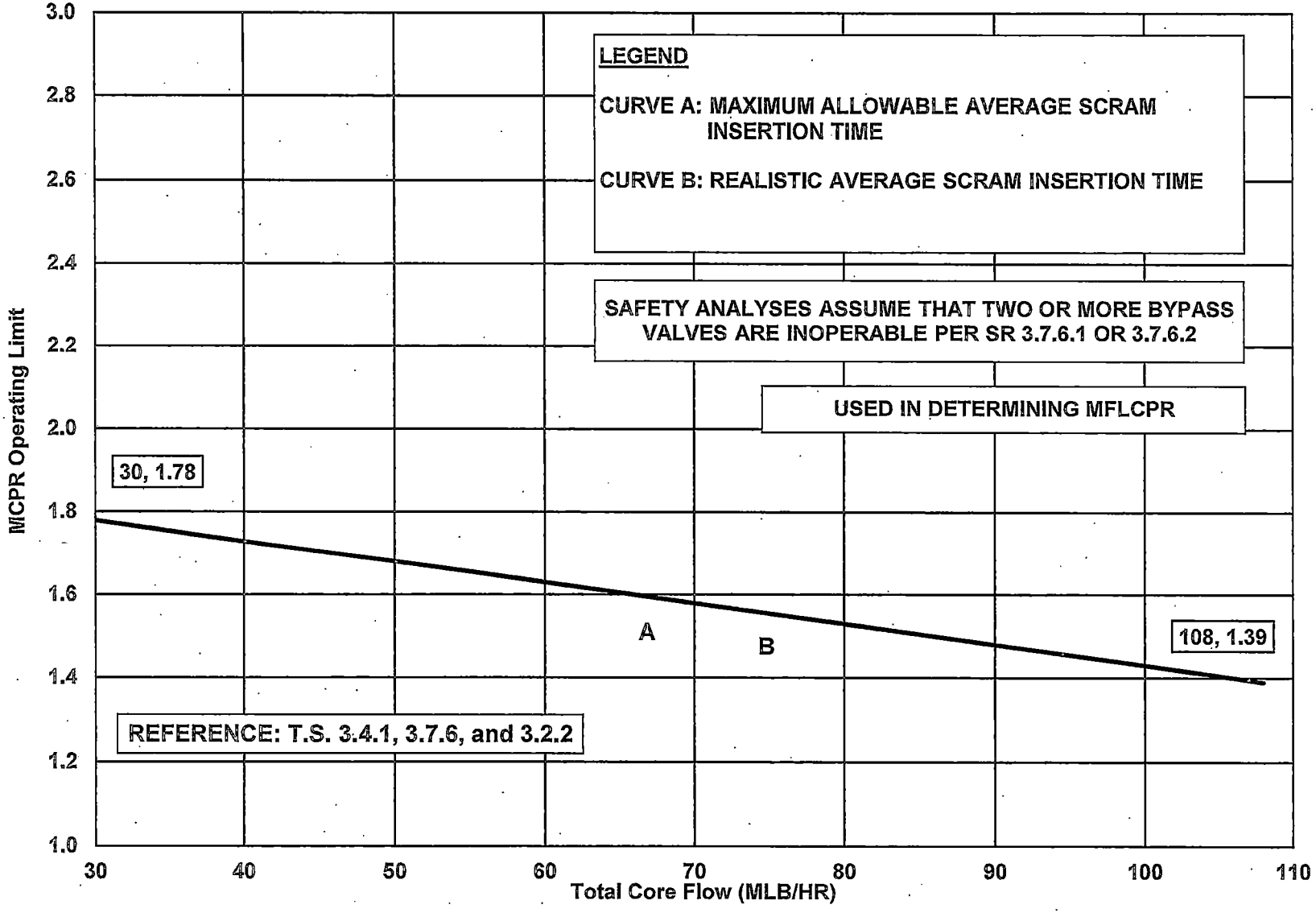
SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS CORE POWER
MAIN TURBINE BYPASS / EOC-RPT / BACKUP PRESSURE REGULATOR OPERABLE
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-3

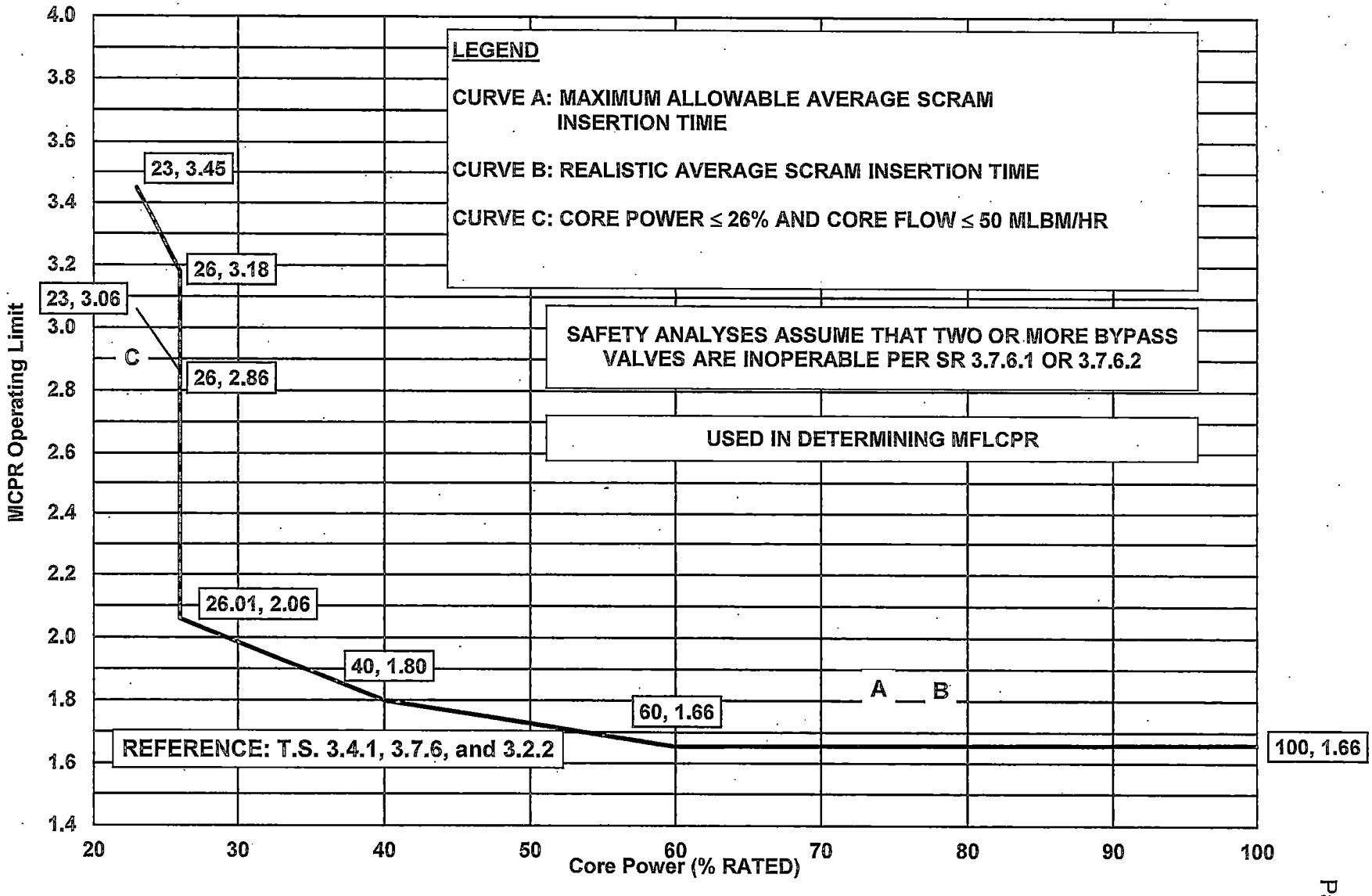
Main Turbine Bypass Inoperable

SSES UNIT 1 CYCLE 21



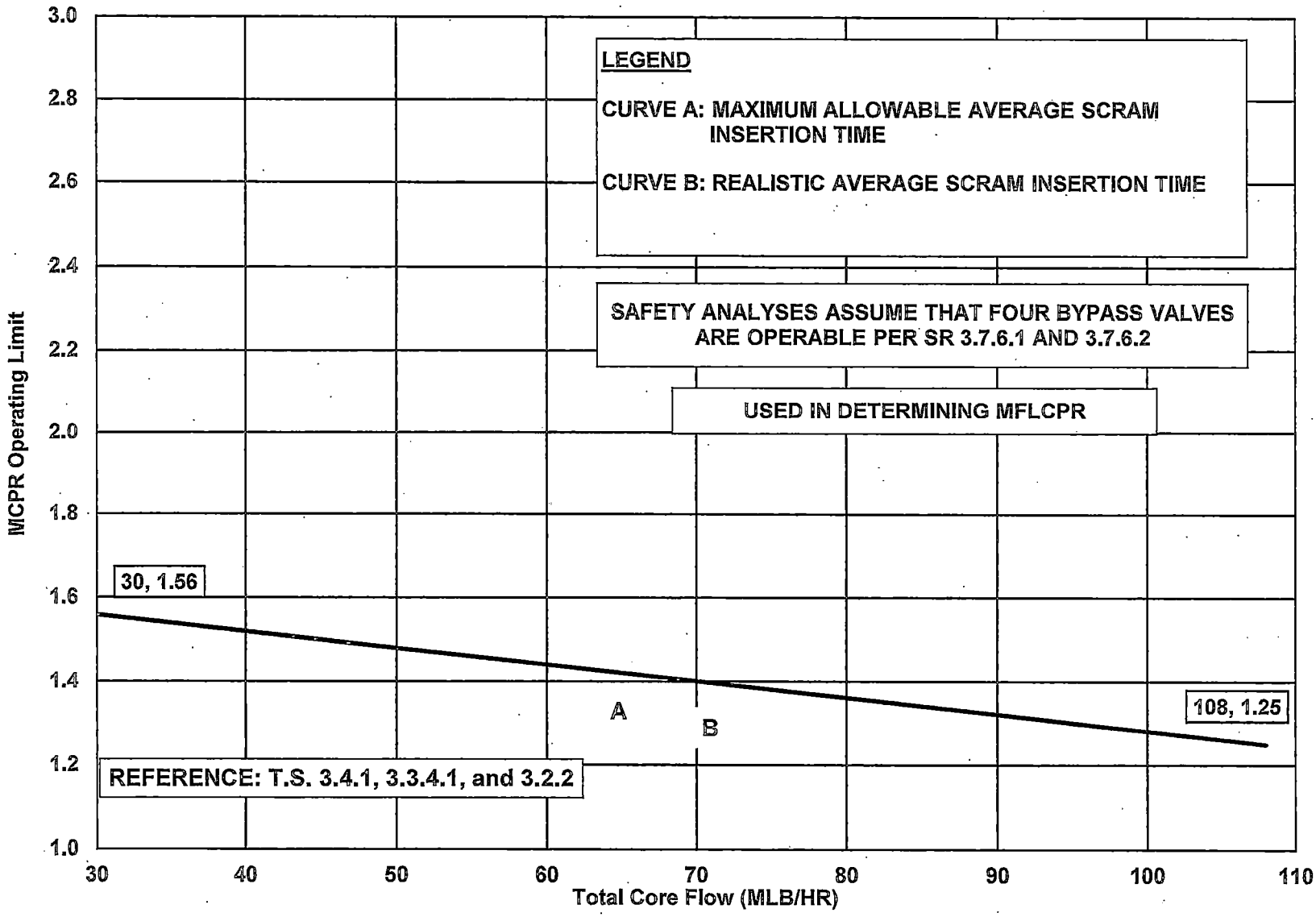
MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
MAIN TURBINE BYPASS INOPERABLE
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-4

SSES UNIT 1 CYCLE 21



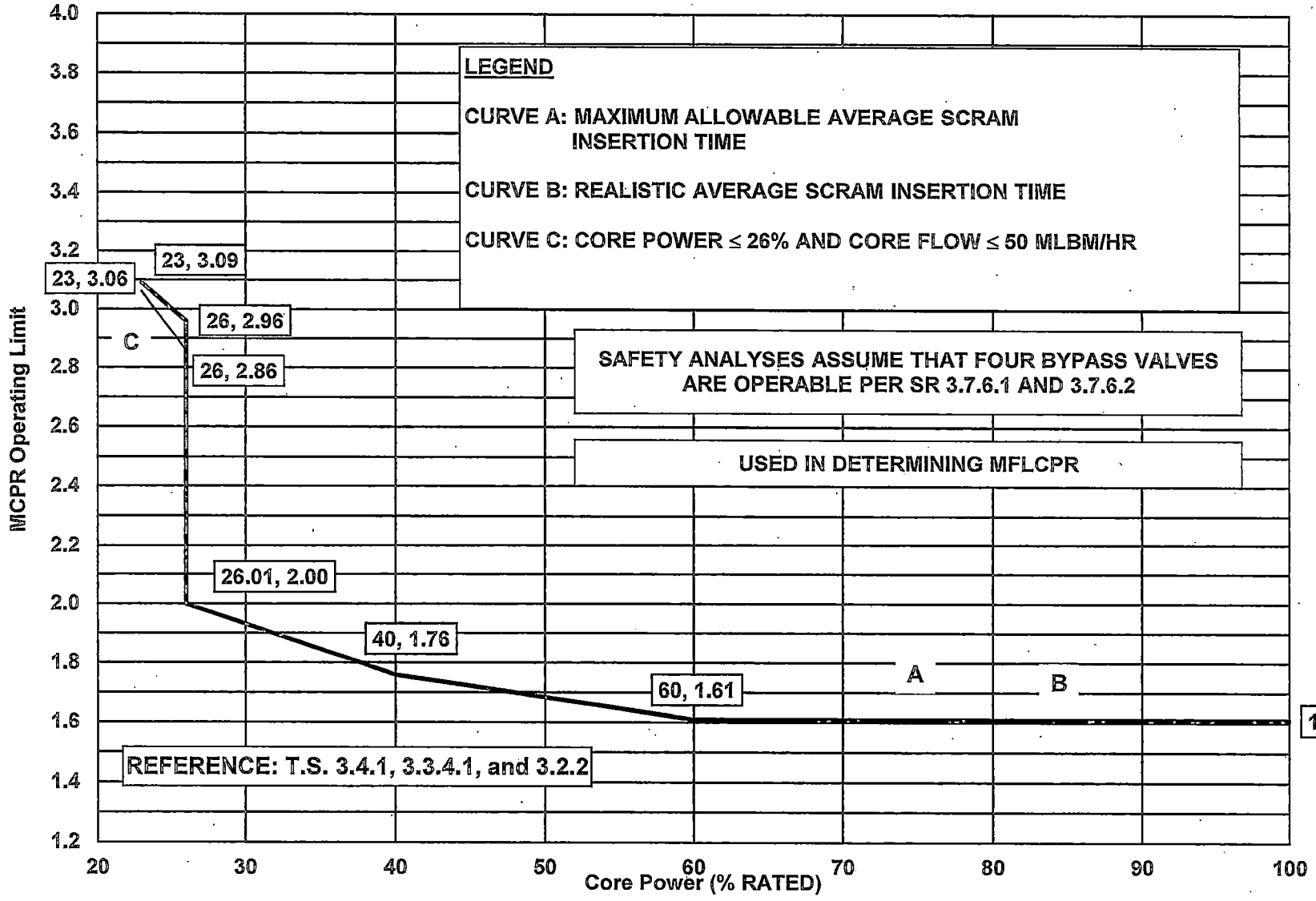
MCPR OPERATING LIMIT VERSUS CORE POWER
MAIN TURBINE BYPASS INOPERABLE
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-5

EOC-RPT
Inoperable



MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
EOC-RPT INOPERABLE
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-6

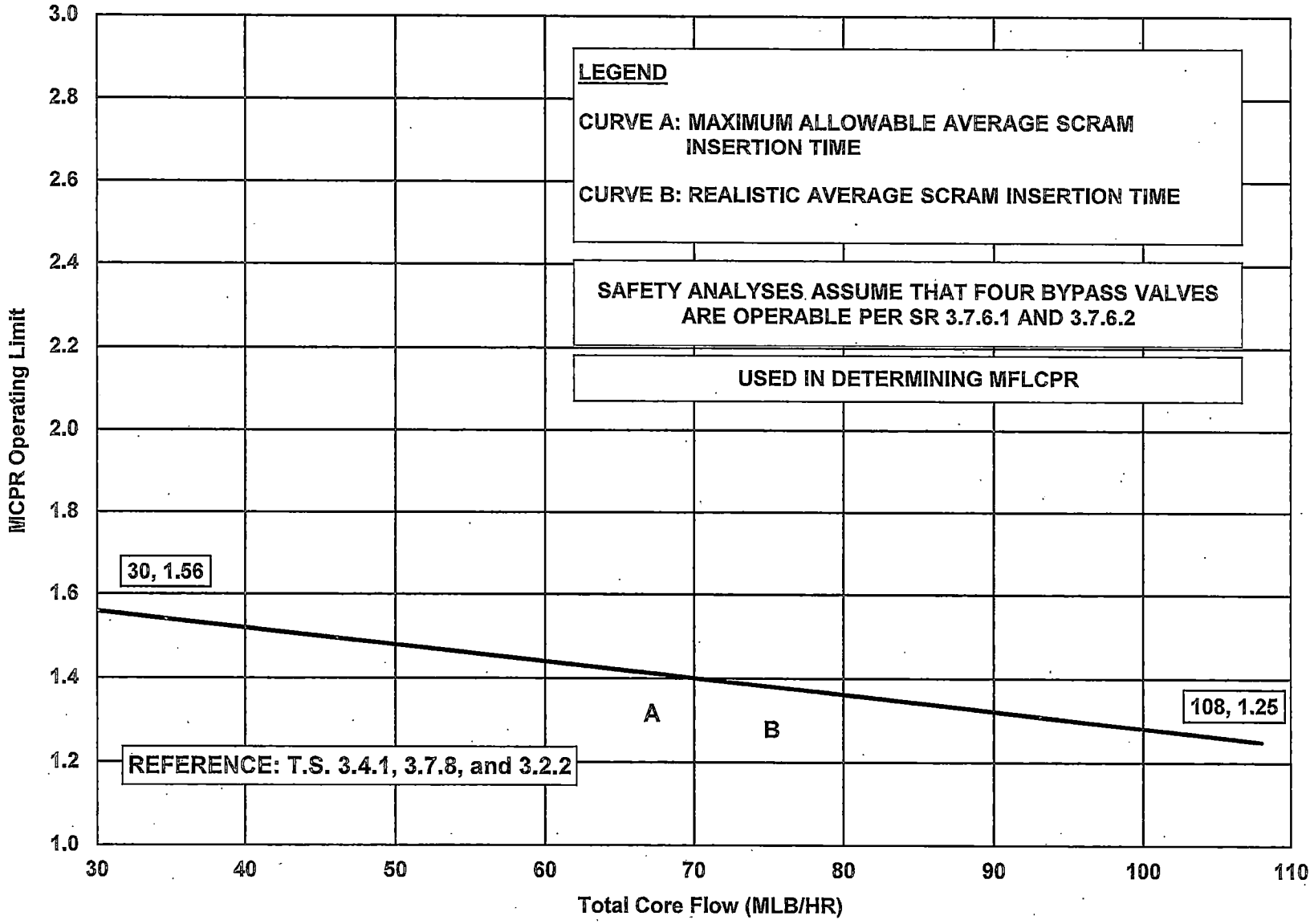
SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS CORE POWER
EOC-RPT INOPERABLE
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-7

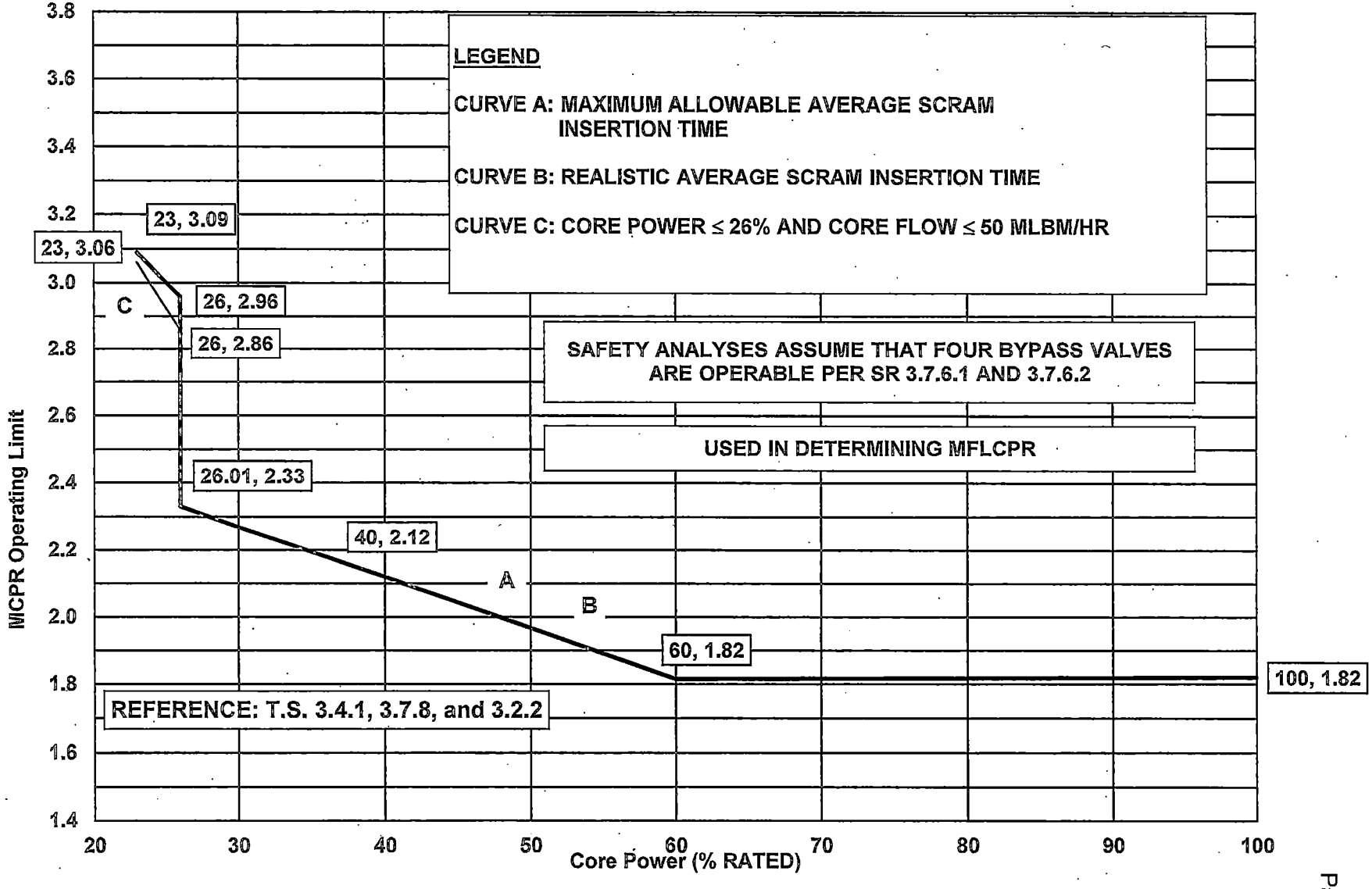
Backup Pressure Regulator Inoperable

SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
BACKUP PRESSURE REGULATOR INOPERABLE
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-8

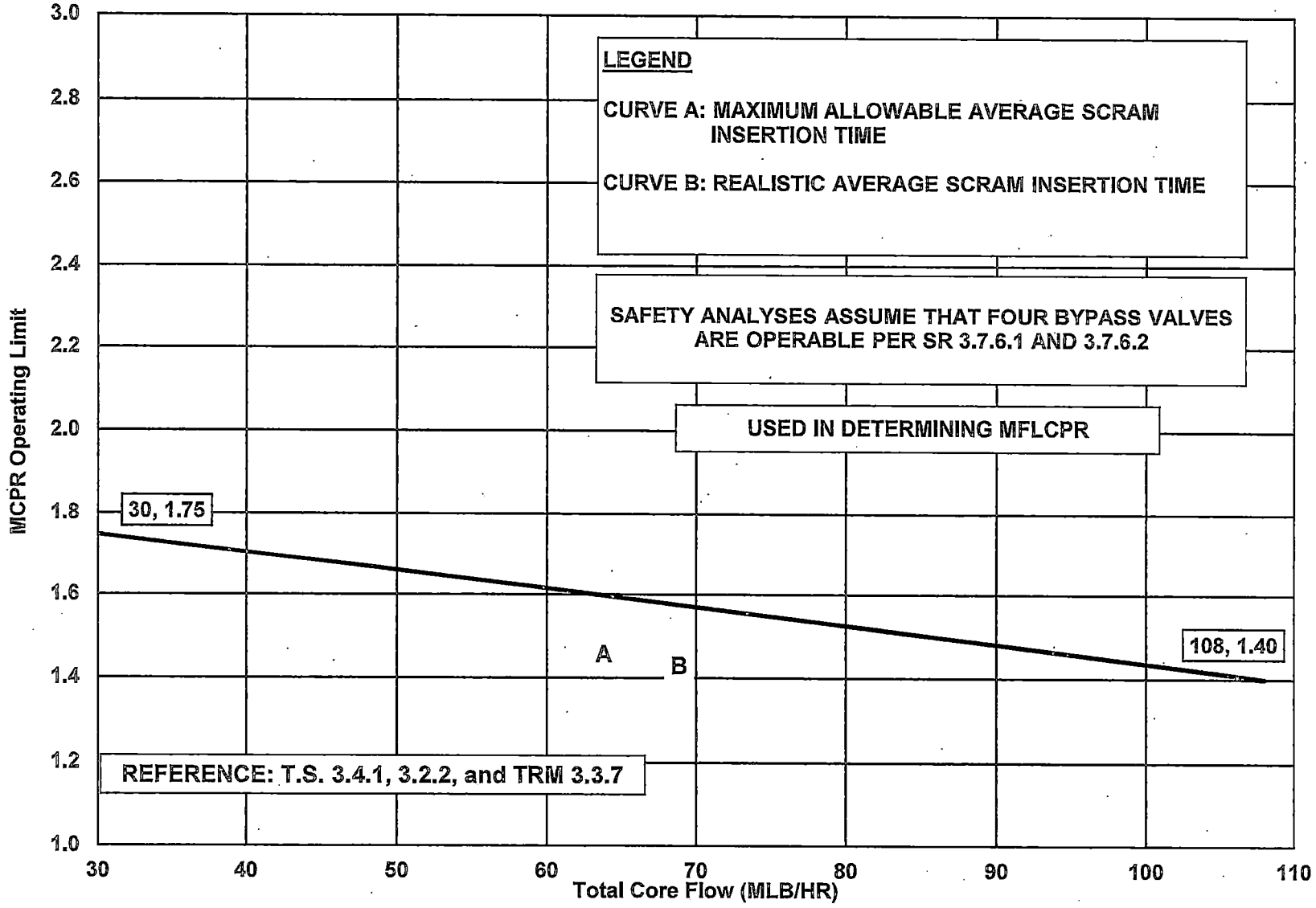
SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS CORE POWER
BACKUP PRESSURE REGULATOR INOPERABLE
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-9

One TSV or TCV Closed

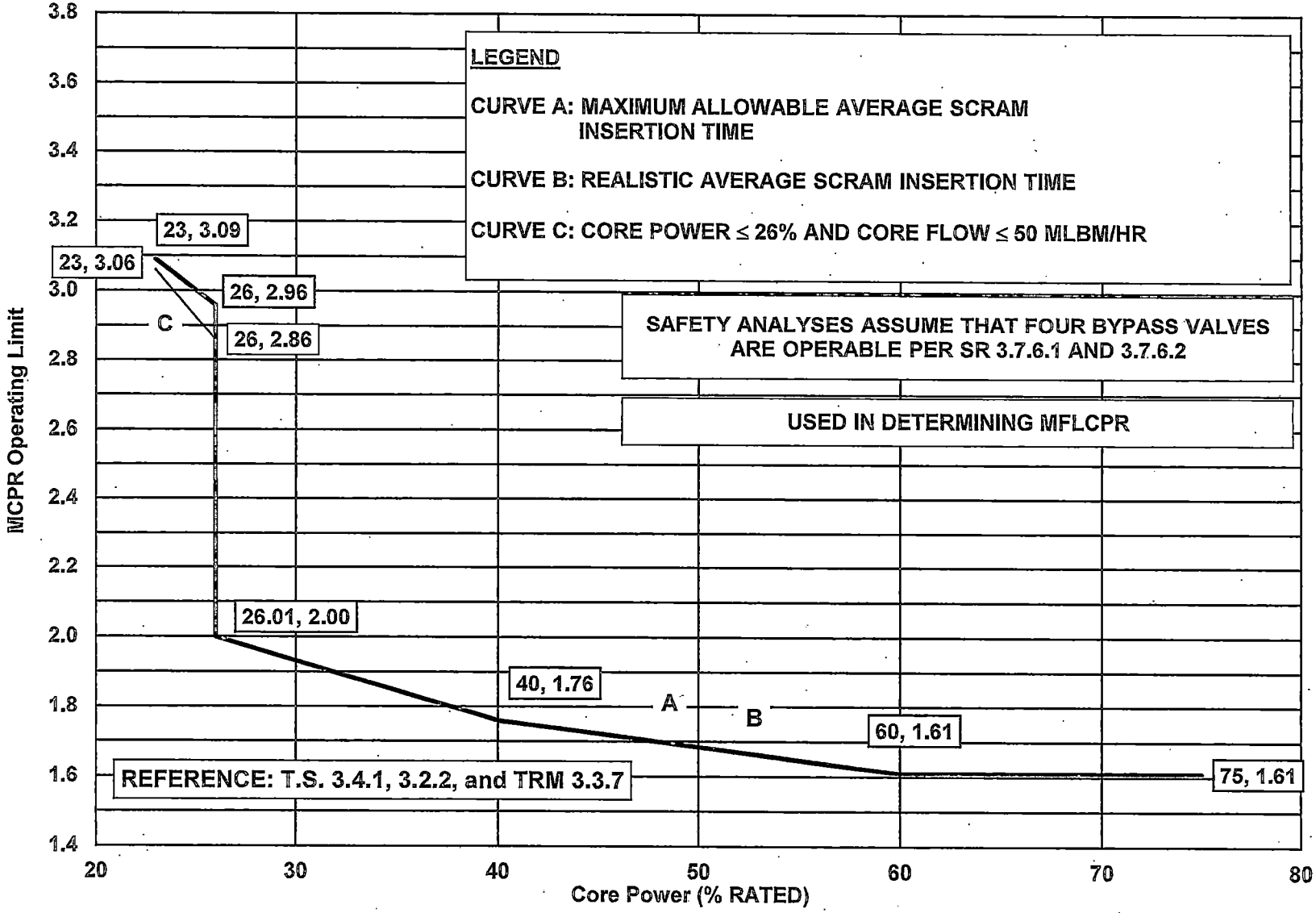
SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
ONE TSV OR TCV CLOSED*
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-10

*Operation with one TSV or TCV closed is only supported at power levels ≤ 75% rated power.

SSES UNIT 1 CYCLE 21



MCPR OPERATING LIMIT VERSUS CORE POWER
ONE TSV OR TCV CLOSED
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-11

9.0 POWER / FLOW MAP

9.1 References

Technical Specification 3.3.1.1

9.2 Description

Monitor reactor conditions to maintain THERMAL POWER / core flow outside of Stability Regions I and II of the Power / Flow map, Figure 9.1.

If the OPRM Instrumentation is OPERABLE per TS 3.3.1.1, Region I of the Power / Flow map is considered an immediate exit region.

If the OPRM Instrumentation is inoperable per TS 3.3.1.1, Region I of the Power / Flow map is considered an immediate scram region.

Region II of the Power / Flow map is considered an immediate exit region regardless of the operability of the OPRM Instrumentation.

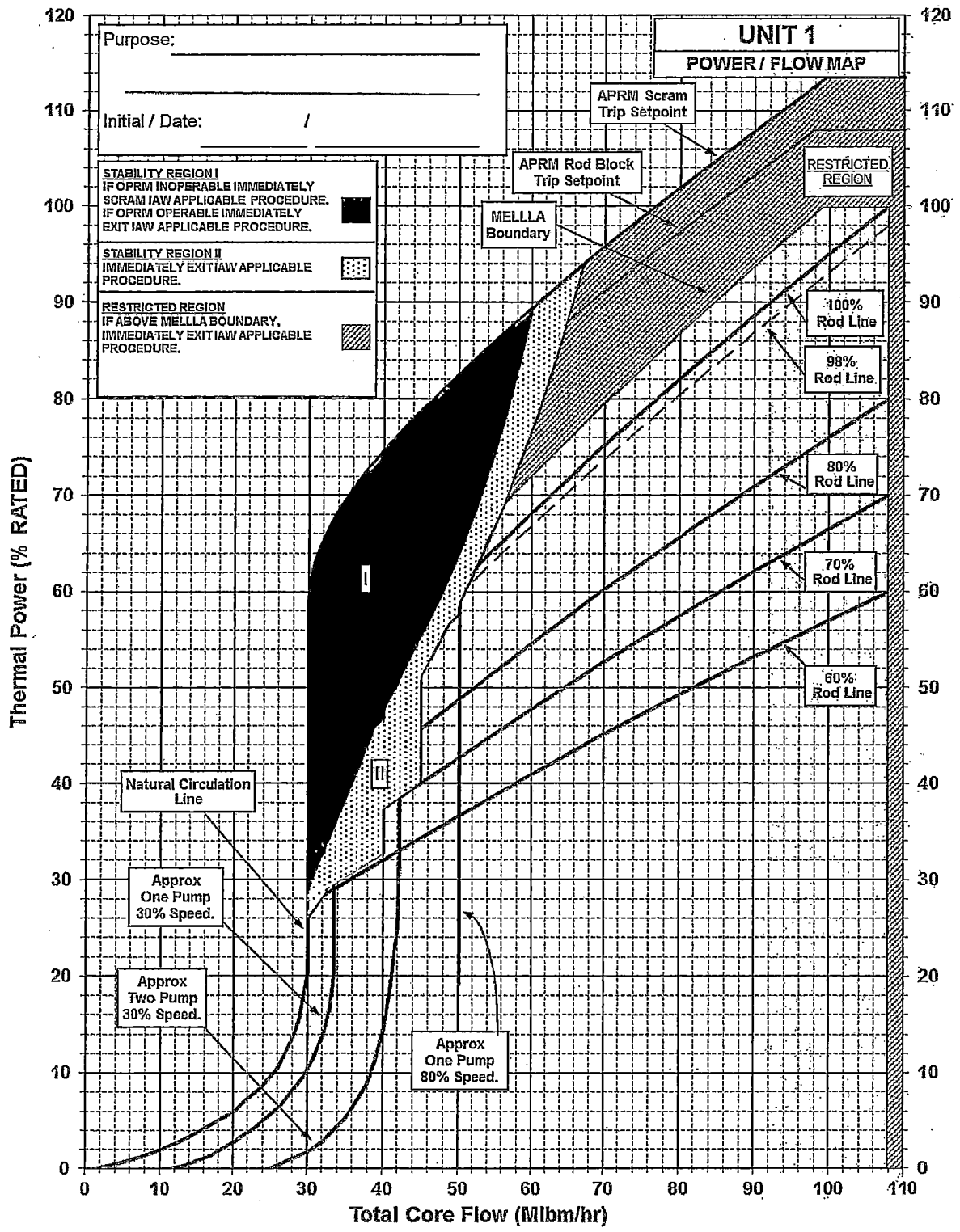


Figure 9.1
SSES Unit 1 Cycle 21 Power / Flow Map

10.0 OPRM SETPOINTS

10.1 References

Technical Specification 3.3.1.1

10.2 Description

Setpoints for the OPRM Instrumentation are established that will reliably detect and suppress anticipated stability related power oscillations while providing a high degree of confidence that the MCPR Safety limit is not violated. The setpoints are described in Section 2.0 and are listed below:

S_P = 1.11

N_P = 15

F_P = 60 Mlbm / hr

11.0 REFERENCES

11.1 The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

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.

2. EMF-2361(P)(A), Revision 0, "EXEM BWR-2000 ECCS Evaluation Model," Framatome ANP, May 2001.

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

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

5. 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.

6. 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.

7. 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.

8. 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.

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

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

11. NE-092-001A, Revision 1, "Licensing Topical Report for Power Uprate With Increased Core Flow," Pennsylvania Power & Light Company, December 1992 and NRC SER (November 30, 1993).

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

13. EMF-2209(P)(A), Revision 3, "SPCB Critical Power Correlation," AREVA NP, September 2009.

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

15. EMF-2158(P)(A), Revision 0, "Siemens Power Corporation Methodology for Boiling Water Reactors: Evaluation and Validation of CASMO-4/Microburn-B2," Siemens Power Corporation, October 1999.

16. 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.

17. NEDO-32465-A, "BWROG Reactor Core Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications," August 1996.

18. 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.

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

B 3.5 Emergency Core Cooling Systems (ECCS), Reactor Pressure Vessel (RPV) Water Inventory Control, and Reactor Core Isolation Cooling (RCIC) System

B 3.5.1 Automatic Depressurization System (ADS) Manual Inhibit

BASES

TRO

The ADS Manual Inhibit function is provided to permit overriding ADS actuation in the event that the actuation signals are due to an Anticipated Transient Without a Scram (ATWS). The function supports operation of the SLCS Function (LCO 3.1.7) (ADS Inhibit) and ADS Function (LCO 3.5.1) (ADS Permissive), and is required to be OPERABLE when those functions are required.

The purpose of the ADS Manual Inhibit Function is to disable the ADS system to prevent a blowdown in the event of an Anticipated Transient Without a Reactor Scram (ATWS), when boron injection is required. ADS Manual Inhibit is required by procedure any time SLCS injection is initiated for reactivity control.

The ADS Manual Inhibit function supports SLCS operation for mitigation of an ATWS event, which ties its Operability requirement to that of SLCS. If the ATWS transient results in a sustained reactor water level below the Level 1 ADS initiation setpoint (-129"), the SLCS Function can be defeated by failure of one ADS Manual Inhibit channel in either the ADS A or B logic control systems. Because its actuation could result in the injection of a large amount of unborated water into the core under ATWS conditions, preventing ADS is appropriate whenever boron injection is required.

The ADS Manual Inhibit "passive" function must be Operable to support actuation of the ADS initiation function, which ties its Operability requirement to that of ADS.

One ADS Manual Inhibit Switch is provided for each Division. (Reference 1)

BASES

ACTIONS

The Actions are defined to ensure proper corrective measures are taken in response to the inoperable components.

The REQUIRED ACTIONS are based on the ATWS mitigation Function and on the need to preserve the ADS ECCS function. The allowed out of service time for the Inhibit function is commensurate with the Function's importance to safety, relative to ATWS functional requirements.

While the ADS Manual Inhibit is a desirable function for the ATWS mitigation scenarios, it is not a necessary function for plant shutdown with Standby Liquid Control injection under the ATWS emergency operating procedures when high pressure injection systems are available. High pressure injection systems are used to control RPV water level above -129" in an ATWS. SSES plant specific analyses do not show RPV level falling below -129" in an MSIV closure ATWS (the limiting water level event) if HPCI and RCIC are available.

Failure of the ADS Manual Inhibit Function to reset to the "permissive" mode when returned to "normal" can affect the ADS system's ability to perform its ECCS safety function. The ADS Manual Inhibit "permissive" function assures there is appropriate switch contact continuity such that the automatic and manual ADS initiation trip channels can function in accordance with the ECCS design basis. Failure of the switch to support the ADS ECCS Function causes the ADS trip channel to become inoperable.

TRS

The TRSs are defined to be performed at the specified Frequency to ensure that the ADS Manual Inhibit Switch is maintained OPERABLE.

REFERENCES

1. FSAR Section 7.3.1.1a