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	Pages TRM / 3.6-6 through TRM / 3.6-8	12/31/2002
3.7	PLANT SYSTEMS	
	Pages 3.7-1 through 3.7-3	08/31/1998
	Pages TRM / 3.7-4 through TRM / 3.7-10	08/02/1999
	Page TRM / 3.7-11	12/29/1999
	Pages TRM / 3.7-12 through TRM / 3.7-27	08/02/1999
	Pages TRM / 3.7-28 through TRM / 3.7-32	11/16/2001
	Page TRM / 3.7-33	01/09/2004
	Page TRM / 3.7-34	11/16/2001
	Page TRM / 3.7-34a	10/05/2002
	Pages TRM / 3.7-35 through TRM / 3.7-37	02/01/1999
	Pages 3.7-38 through 3.7-40	08/31/1998
	Pages TRM / 3.7-41 and TRM / 3.7-41a	08/11/2000
	Pages 3.7-42 and 3.7-43	08/31/1998
	Pages 3.7-44 through 3.7-48	10/13/1998
	Page TRM / 3.7-49	03/08/2003
	Pages TRM / 3.7-50 and TRM / 3.7-51	03/09/2001
	Pages TRM / 3.7-52 and TRM / 3.7-53	04/15/2003
	Page TRM / 3.7-54	07/29/1999
3.8	ELECTRICAL POWER	
	Pages TRM / 3.8-1 and TRM / 3.8-2	04/02/2002
	Page 3.8-3	08/31/1998
	Page TRM / 3.8-4	12/31/2002
	Pages TRM / 3.8-5 and TRM / 3.8-6	04/02/2002
	Pages TRM / 3.8-7 through TRM / 3.8-9	08/31/1998
	Page TRM / 3.8-10	07/19/2001
	Page TRM / 3.8-11	08/10/2004
	Pages 3.8-12 through 3.8-14	08/31/1998
	Pages TRM / 3.8-15 through TRM / 3.8-17	04/02/2002

Section	Title	Effective Date
	Page TRM / B 3.6-5	01/07/2002
	Pages TRM / B 3.6-6 through TRM / B 3.6-11	12/31/2002
B 3.7	PLANT SYSTEMS BASES	
	Pages B 3.7-1 and B 3.7-2	08/31/1998
	Pages TRM / B 3.7-3 through TRM / B 3.7-7	08/02/1999
	Page TRM / B 3.7-7a	08/02/1999
	Pages TRM / B 3.7-8 through TRM / B 3.7-10	08/02/1999
	Page TRM / B 3.7-10a	08/02/1999
	Pages TRM / B 3.7-11 and TRM / B 3.7-11a	08/02/1999
	Pages TRM / B 3.7-12 through TRM / B 3.7-14	08/02/1999
	Page TRM / B 3.7-14a	08/02/1999
	Page TRM / B 3.7-14b	01/09/2004
	Pages TRM / B 3.7-15 and TRM / B 3.7-16	02/01/1999
	Pages B 3.7-17 through B 3.7-20	08/31/1998
	Page TRM/B 3.7-21 through TRM/B 3.7-21a	05/11/2001
	Pages TRM/B 3.7-22 and TRM/B 3.7-23	04/07/2000
	Pages B 3.7-24 through B 3.7-30	08/31/1998
	Pages TRM / B 3.7-31 and TRM / B 3.7-32	03/09/2001
	Page TRM / B 3.7-33	04/15/2003
	Pages TRM / B 3.7-34 and TRM / B 3.7-35	07/05/2000
B 3.8	ELECTRICAL POWER BASES	
	Pages TRM / B 3.8-1 and TRM / B 3.8-2	04/02/2002
	Page TRM / B 3.8-2a	04/02/2002
	Page TRM / B 3.8-3	04/02/2002
	Page TRM / B 3.8-3a	04/02/2002
	Page TRM / B 3.8-4	08/10/2004
	Page TRM / B 3.8-4a	04/02/2002
	Page TRM / B 3.8-5	08/31/1998
	Pages TRM / B 3.8-6 through TRM / B 3.8-17	04/02/2002
B.3.9	REFUELING OPERATIONS BASES	
	Pages B 3.9-1 through B 3.9-7	08/31/1998
B 3.10	MISCELLANEOUS BASES	
	Pages B 3.10-1 through B 3.10-2	08/31/1998
	Page TRM / B 3.10-3	03/08/2003
	Pages TRM / B 3.10-4 and TRM / B 3.10-5	08/23/1999
	Pages TRM / B 3.10-6 and TRM / B 3.10-7	04/17/2002
B 3.11	RADIOACTIVE EFFLUENTS BASES	
	Pages B 3.11-1 through B 3.11-9	08/30/1998
	Page TRM / B 3.11-10	02/01/1999
	Pages TRM/B 3.11-11 and TRM/B 3.11-11a	04/07/2000

TRM1 text LOES
11/11/04

TRM1 text TOC
11/11/04

2.0 PLANT PROGRAMS AND SETPOINTS

2.2 Instrument Trip Setpoint Table

The Instrument Trip Setpoint Limits in Table 2.2-1 are the Trip Setpoint value limits that were contained in the Instrumentation Setpoint tables for protection systems and other functions important to safety that were included in the scope of the original Standard Technical Specifications. Actual instrument setpoints are established utilizing the Allowable Values specified in the Technical Specifications and Technical Requirements. Allowable Values are established in the Reference LCOs and TROs identified in this Table. TRO references are enclosed in square brackets.

Instrumentation process setpoints for the listed subsystems and trip functions are set consistent with the Trip Setpoint Limit Column of Table 2.2-1. Actual setpoints are established in accordance with engineering procedures.

Alarm setpoints and other non-protection system trip settings as may be found in the Technical Specifications or in the Technical Requirements are not included in this table.

Reference NDAP-QA-1104 Setpoint Change Control

TABLE 2.2-1 (Page 1 of 8)
INSTRUMENTATION SETPOINTS

	SYSTEM/REFERENCE LCO [TRO]	TRIP FUNCTION	TRIP SETPOINT
2.2.1	Reactor Protection		
2.2.1.1	3.3.1.1	Intermediate Range Monitor, Neutron Flux - High	≤ 120/125 divisions of full scale
2.2.1.2	3.3.1.1	Average Power Range Monitor, Neutron Flux - High Setdown	≤ 15% of RATED THERMAL POWER
2.2.1.3	3.3.1.1	Average Power Range Monitor, Flow Biased Simulated Thermal Power - High Two Loop Operation	See COLR - TRO 3.2
2.2.1.4	3.3.1.1	Average Power Range Monitor, Flow Biased Simulated Thermal Power - High Single Loop Operation	See COLR - TRO 3.2
2.2.1.5	3.3.1.1	Average Power Range Monitor, Flow Biased Simulated Thermal Power - High Flow Clamped	≤ 113.5% of RATED THERMAL POWER
2.2.1.6	3.3.1.1	Average Power Range Monitor, Fixed Neutron Flux - High	≤ 118% of RATED THERMAL POWER
2.2.1.7	3.3.1.1	Reactor Vessel Steam Dome Pressure - High	≤ 1087 psig
2.2.1.8	3.3.1.1	Reactor Vessel Water Level - Low, Level 3	≥ 13.0 inches [(a)]
2.2.1.9	3.3.1.1	Main Steam Isolation Valve - Closure	≤ 10% closed
2.2.1.10		This Section Not Used	
2.2.1.11	3.3.1.1	Drywell Pressure - High	≤ 1.72 psig
2.2.1.12	3.3.1.1	Scram Discharge Volume Water Level - High - Level Transmitter	≤ 65 gallons
2.2.1.13	3.3.1.1	Scram Discharge Volume Water Level - High - Float Switch	≤ 61 gallons
2.2.1.14	3.3.1.1	Turbine Stop Valve - Closure	≤ 5.5% closed
2.2.1.15	3.3.1.1	Turbine Control Valve Fast Closure, Trip Oil Pressure - Low	≥ 500 psig

(continued)

(a) See Figure 2.2-1

TABLE 2.2-1 (Page 2 of 8)
INSTRUMENTATION SETPOINTS

	SYSTEM/REFERENCE LCO [TRO]	TRIP FUNCTION	TRIP SETPOINT
2.2.1.16 OPRM Instrumentation			
2.2.1.16.1	3.3.1.3	Sp Cell Signal Amplitude	See COLR – TRO 3.2
2.2.1.16.2	3.3.1.3	N2 Confirmation Count Permissive	See COLR – TRO 3.2
2.2.1.16.3	[3.3.9]	TOL Period Confirmation Tolerance	0.10 sec
2.2.1.16.4	[3.3.9]	Ta Averaging Filter	5 sec
2.2.1.16.5	[3.3.9]	Fc Conditioning Filter Cutoff Frequency	1.5 Hz
2.2.1.16.6	[3.3.9]	Tmin Minimum Oscillation Period	1.0 sec
2.2.1.16.7	[3.3.9]	Tmax Maximum Oscillation Period	3.5 sec
2.2.1.16.8	[3.3.9]	Noise Floor Peak Discrimination Threshold	1
2.2.1.16.9	[3.3.9]	Minimum LPRM/Cell Cell Operability Requirement	2
2.2.1.16.10	[3.3.9]	S1 Peak Threshold Setpoint	1.20
2.2.1.16.11	[3.3.9]	S2 Valley Threshold Setpoint	0.85
2.2.1.16.12	[3.3.9]	Smax Max. Amplitude Trip Setpoint	1.50
2.2.1.16.13	[3.3.9]	DR3 Growth Rate Factor Setpoint	1.60
2.2.1.16.14	[3.3.9]	T1 lo S1 to S2 Timer Range	0.5 sec
2.2.1.16.15	[3.3.9]	T1 hi S1 to S2 Timer Range	1.75 sec
2.2.1.16.16	[3.3.9]	T2 lo S2 to (S3 or Smax) Timer Range	0.5 sec
2.2.1.16.17	[3.3.9]	T2 hi S2 to (S3 or Smax) Timer Range	1.75 sec
2.2.2 Isolation Actuation Instrumentation			
2.2.2.1 Primary Containment Isolation			
2.2.2.1.1	3.3.6.1	Reactor Vessel Water Level Low, Level 3	≥ 13.0 inches[(a)]
2.2.2.1.2	3.3.6.1	Reactor Vessel Water Level Low Low, Level 2	≥ -38.0 inches[(a)]
2.2.2.1.3	3.3.6.1	Reactor Vessel Water Level Low Low Low, Level 1	≥ -129 inches[(a)]
2.2.2.1.4	3.3.6.1	Drywell Pressure - High	≤ 1.72 psig
2.2.2.1.5	3.3.6.1/[3.3.6]	SGTS Exhaust Radiation - High	≤ 23.0 mR/hr
2.2.2.1.6	[3.3.6]	Main Steam Line Radiation – High High	≤ 15 x full power background without hydrogen injection

(continued)

TABLE 2.2-1 (Page 3 of 8)
INSTRUMENTATION SETPOINTS

	SYSTEM/REFERENCE LCO [TRO]	TRIP FUNCTION	TRIP SETPOINT
2.2.2.2	Secondary Containment Isolation		
2.2.2.2.1	3.3.6.2	Reactor Vessel Water Level - Low Low, Level 2	≥ -38.0 inches[a]
2.2.2.2.2	3.3.6.2	Drywell Pressure - High	≤ 1.72 psig
2.2.2.2.3	3.3.6.2	Refuel Floor High Exhaust Duct Radiation - High	≤ 18 mR/hr
2.2.2.2.4	3.3.6.2	Railroad Access Shaft Exhaust Duct Radiation - High	≤ 5 mR/hr
2.2.2.2.5	3.3.6.2	Refuel Floor Wall Exhaust Duct Radiation - High	≤ 21 mR/hr
2.2.2.3	Main Steam Line Isolation		
2.2.2.3.1	3.3.6.1	Reactor Vessel Water Level - Low Low Low, Level 1	≥ -129 inches[a]
2.2.2.3.2	3.3.6.1	Main Steam Line Pressure - Low	≥ 861 psig
2.2.2.3.3	3.3.6.1	Main Steam Line Flow - High	≤ 113 psid
2.2.2.3.4	3.3.6.1	Condenser Vacuum - Low	≥ 9.0 inches Hg vacuum
2.2.2.3.5	3.3.6.1	Reactor Building Main Steam Line Tunnel Temperature - High	≤ 177°F
2.2.2.3.6		This Section Not Used	
2.2.2.3.7	[3.3.6]	Reactor Building Main Steam Line Tunnel Δ Temperature - High	≤ 99°F
2.2.2.3.8	[3.3.6.1]	Turbine Building Main Steam Tunnel Temperature - High	≤ 197°F
2.2.2.4	Reactor Water Cleanup System Isolation		
2.2.2.4.1	3.3.6.1	Reactor Vessel Water Level - Low Low, Level 2	≥ -38 inches[a]
2.2.2.4.2	3.3.6.1	RWCU Δ Flow - High	≤ 59 gpm
2.2.2.4.3	3.3.6.1	RWCU Flow - High	≤ 462 gpm
2.2.2.4.4	3.3.6.1	RWCU Penetration Area Temperature - High	≤ 131°F
2.2.2.4.5	[3.3.6]	RWCU Penetration Room Area Δ Temperature - High	≤ 69°F
2.2.2.4.6	3.3.6.1	RWCU Pump Area Temperature - High	≤ 147°F
2.2.2.4.7	[3.3.6]	RWCU Pump Room Area Δ Temperature - High	≤ 69°F
2.2.2.4.8	3.3.6.1	RWCU Heat Exchanger Area Temperature - High	≤ 147°F
2.2.2.4.9	[3.3.6]	RWCU Heat Exchanger Room Area Δ Temperature – High	≤ 69°F

(continued)

[a] See Figure 2.2-1

TABLE 2.2-1 (Page 4 of 8)
INSTRUMENTATION SETPOINTS

	SYSTEM/REFERENCE LCO [TRO]	TRIP FUNCTION	TRIP SETPOINT
2.2.2.5	Reactor Core Isolation Cooling System Isolation		
2.2.2.5.1	3.3.6.1	RCIC Steam Line Δ Pressure - High	≤ 188 inches H_2O
2.2.2.5.2	3.3.6.1	RCIC Steam Supply Line Pressure - Low	≥ 60 psig
2.2.2.5.3	3.3.6.1	RCIC Turbine Exhaust Diaphragm Pressure - High	≤ 10.0 psig
2.2.2.5.4	3.3.6.1	RCIC Equipment Room Temperature - High	≤ 167°F
2.2.2.5.5	3.3.6.1	RCIC Pipe Routing Area Temperature - High	≤ 167°F
2.2.2.5.6	3.3.6.1	RCIC Emergency Area Cooler Temperature - High	≤ 167°F
2.2.2.5.7	3.3.6.1	Drywell Pressure - High	≤ 1.72 psig
2.2.2.5.8	[3.3.6]	RCIC Equipment Room Δ Temperature - High	≤ 89°F
2.2.2.5.9	[3.3.6]	RCIC Pipe Routing Area Δ Temperature - High	≤ 89°F
2.2.2.6	High Pressure Coolant Injection System Isolation		
2.2.2.6.1	3.3.6.1	HPCI Steam Line Δ Pressure - High	≤ 370 inches H_2O
2.2.2.6.2	3.3.6.1	HPCI Steam Supply Line Pressure - Low	≥ 104 psig
2.2.2.6.3	3.3.6.1	HPCI Turbine Exhaust Diaphragm Pressure - High	≤ 10 psig
2.2.2.6.4	3.3.6.1	HPCI Equipment Room Temperature - High	≤ 167°F
2.2.2.6.5	3.3.6.1	HPCI Emergency Area Cooler Temperature - High	≤ 167°F
2.2.2.6.6	3.3.6.1	HPCI Pipe Routing Area Temperature - High	≤ 167°F
2.2.2.6.7	3.3.6.1	Drywell Pressure - High	≤ 1.72 psig
2.2.2.6.8	[3.3.6]	HPCI Equipment Room Δ Temperature - High	≤ 89°F
2.2.2.6.9	[3.3.6]	HPCI Pipe Routing Area Δ Temperature - High	≤ 89°F
2.2.2.7	Shutdown Cooling/System Isolation		
2.2.2.7.1	3.3.6.1	Reactor Vessel Water Level - Low, Level 3	≥ 13.0 inches[(a)]
2.2.2.7.2	3.3.6.1	Reactor Vessel Steam Dome Pressure - High	≤ 98 psig
2.2.2.7.3	[3.3.6]	RHR Flow - High	≤ 25,000 gpm
2.2.3	ECCS Actuation		
2.2.3.1	Core Spray System		
2.2.3.1.1	3.3.5.1	Reactor Vessel Water Level - Low Low Low, Level 1	≥ -129 inches[(a)]
2.2.3.1.2	3.3.5.1	Drywell Pressure - High	≤ 1.72 psig
2.2.3.1.3	3.3.5.1	Reactor Vessel Steam Dome Pressure - Low injection permissive	≥ 413, ≤ 427 psig

(continued)

(a) See Figure 2.2-1

TABLE 2.2-1 (Page 5 of 8)
INSTRUMENTATION SETPOINTS

	SYSTEM/REFERENCE LCO [TRO]	TRIP FUNCTION	TRIP SETPOINT
2.2.3.2	LPCI Mode of RHR System		
2.2.3.2.1	3.3.5.1	Reactor Vessel Water Level - Low Low Low, Level 1	≥ -129 inches[a]
2.2.3.2.2	3.3.5.1	Drywell Pressure - High	≤ 1.72 psig
2.2.3.2.3	3.3.5.1	Reactor Vessel Steam Dome Pressure - Low, injection permissive	≥ 413, ≤ 427 psig
2.2.3.2.4	3.3.5.1	Reactor Vessel Steam Dome Pressure - Low, Recirculation Discharge Valve permissive	≥ 236 psig, decreasing
2.2.3.3	HPCI System		
2.2.3.3.1	3.3.5.1	Reactor Vessel Water Level - Low Low, Level 2	≥ -38 inches[a]
2.2.3.3.2	3.3.5.1	Drywell Pressure - High	≤ 1.72 psig
2.2.3.3.3	3.3.5.1	Condensate Storage Tank Level - Low	≥ 36.0 inches above tank bottom
2.2.3.3.4	3.3.5.1	Reactor Vessel Water Level - High, Level 8	≤ 54 inches
2.2.3.4	Automatic Depressurization System (ADS)		
2.2.3.4.1	3.3.5.1	Reactor Vessel Water Level - Low Low Low, Level 1	≥ -129 inches
2.2.3.4.2	3.3.5.1	Drywell Pressure - High	≤ 1.72 psig
2.2.3.4.3	3.3.5.1	ADS Timer	≤ 102 seconds
2.2.3.4.4	3.3.5.1	Core Spray Pump Discharge Pressure - High	≥ 135, ≤ 155 psig
2.2.3.4.5	3.3.5.1	Low Pressure Coolant Injection Pump Discharge Pressure - High	≥ 121, ≤ 129 psig
2.2.3.4.6	3.3.5.1	Reactor Vessel Water Level - Low, Level 3 Confirmatory	≥ 13 inches
2.2.3.4.7	3.3.5.1	ADS Drywell Pressure Bypass Timer	≤ 420 seconds
2.2.3.5	Loss of Power - ECCS Actuation		
2.2.3.5.1	4.16kv ESS Bus Undervoltage (Loss of Voltage < 20%)		
2.2.3.5.1.1	3.3.8.1	Bus Undervoltage	≥ 823.2, ≤ 856.8 Volts
2.2.3.5.1.2	3.3.8.1	Time delay	≥ 0.4, ≤ 0.6 seconds

(continued)

[a] See Figure 2.2-1

TABLE 2.2-1 (Page 6 of 8)
INSTRUMENTATION SETPOINTS

	SYSTEM/REFERENCE LCO [TRO]	TRIP FUNCTION	TRIP SETPOINT
2.2.3.5.2	4.16kV ESS Bus Undervoltage (Degraded Voltage < 65%)		
2.2.3.5.2.1	3.3.8.1	Bus Undervoltage	≥ 2641.1, ≤ 2748.9 Volts
2.2.3.5.2.2	3.3.8.1	Time delay	≥ 2.7, ≤ 3.3 seconds
2.2.3.5.3	4.16kV ESS Bus Undervoltage (Degraded Voltage, < 93%)		
2.2.3.5.3.1	3.3.8.1	Bus Undervoltage	≥ 3829.3, ≤ 3906.7 Volts
2.2.3.5.3.2	3.3.8.1	Time Delay (Non-LOCA)	≥ 4 minute, 30 seconds ≤ 5 minute, 30 seconds
2.2.3.5.3.4	3.3.8.1	Time Delay (LOCA)	≥ 9, ≤ 11 seconds
2.2.3.5.4	480V ESS Bus 0B565 Undervoltage (Degraded Voltage, < 65%)		
2.2.3.5.4.1	[3.8.5]	480V Basis	≥ 308.9, ≤ 315.1 Volts
2.2.3.5.4.2	[3.8.5]	Time Delay	≥ 4.5, ≤ 5.5 seconds
2.2.3.5.5	480V ESS Bus 0B565 Undervoltage (Degraded Voltage, < 92%)		
2.2.3.5.5.1	[3.8.5]	480V Basis	≥ 437.6, ≤ 446.4 Volts
2.2.3.5.5.2	[3.8.5]	Time Delay	≥ 9, ≤ 11 seconds
2.2.4	ATWS Alternate Rod Injection and Recirculation Pump Trip		
2.2.4.1	3.3.4.2/[3.1.1]	Reactor Vessel, Water Level - Low Low, Level 2	≥ -38 inches[a]
2.2.4.1	3.3.4.2/[3.1.1]	Reactor Vessel Steam Dome Pressure – High	≤ 1135 psig
2.2.5	End of Cycle Recirculation Pump Trip		
2.2.5.1	3.3.4.1	Turbine Stop Valve-Closure	≤ 5.5% closed
2.2.5.2	3.3.4.1	Turbine Control Valve - Fast Closure	≥ 500 psig
2.2.6	Reactor Core Isolation Cooling System Actuation		
2.2.6.1	3.3.5.2	Reactor Vessel Water Level - Low Low, Level 2	≥ -38 inches[a]
2.2.6.2	3.3.5.2	Reactor Vessel Water Level - High, Level 8	≤ 54 inches[a]
2.2.6.3	3.3.5.2	Condensate Storage Tank Level – Low	≥ 36.0 inches above tank bottom

(continued)

[a] See Figure 2.2-1

TABLE 2.2-1 (Page 7 of 8)
INSTRUMENTATION SETPOINTS

	SYSTEM/REFERENCE LCO [TRO]	TRIP FUNCTION	TRIP SETPOINT
2.2.7	Control Rod Block		
2.2.7.1	Rod Block Monitor		
2.2.7.1.1	3.3.2	Low Power Range Upscale - Two Loop Operation	≤ 0.58W + 52%
2.2.7.1.2	3.3.2	Low Power Range Upscale - Single Loop Operation	≤ 0.58W + 47%
2.2.7.1.3		Downscale	5%
2.2.7.2	APRM		
2.2.7.2.1	[3.1.3]	Flow Biased Simulated Thermal Power-High - Two Loop Operation	See COLR - TRO 3.2
2.2.7.2.2	[3.1.3]	Flow Biased Simulated Thermal Power High - Single Loop Operation	See COLR - TRO 3.2
2.2.7.2.3	[3.1.3]	Flow Biased Simulated Thermal Power High - High Flow Clamped	≤ 108% of RATED THERMAL POWER
2.2.7.2.4	[3.1.3]	Downscale	≥ 5% of RATED THERMAL POWER
2.2.7.2.5	[3.1.3]	Neutron Flux - High Setdown	≤ 12% of RATED THERMAL POWER
2.2.7.3	Source Range Monitors		
2.2.7.3.1	[3.1.3]	Upscale	≤ 2E5 cps
2.2.7.3.2	[3.1.3]	Downscale	≥ 0.7 cps[(b)]
2.2.7.4	Intermediate Range Monitors		
2.2.7.4.1	[3.1.3]	Upscale	≤ 108/125 divisions of full scale
2.2.7.4.2	[3.1.3]	Downscale	≥ 5/125 divisions of full scale
2.2.7.5	Scram Discharge Volume		
2.2.7.5.1	[3.1.3]	Water Level – High	≤ 35.9 gallons
2.2.7.6	Reactor Coolant System Recirculation Flow		
2.2.7.6.1	[3.1.3]	Upscale	114%
2.2.7.6.2	[3.1.3]	Comparator	≤ 10% flow deviation

(continued)

(b) Provided signal-to-noise ratio is ≥ 2. Otherwise, ≥ 3 cps.

TABLE 2.2-1 (Page 8 of 8)
INSTRUMENTATION SETPOINTS

	SYSTEM/REFERENCE LCO [TRO]	TRIP FUNCTION	TRIP SETPOINT
2.2.8	CREOASS		
2.2.8.1	3.3.7.1	Main Control Room Outside Air Intake Radiation Monitor	≤ 5 mR/hr
2.2.8.1.1	3.3.7.1	Reactor Vessel Water Level - Low Low, Level 2	≥ -38.0 inches[a]
2.2.8.1.2	3.3.7.1	Drywell Pressure – High	≤ 1.72 psig
2.2.8.1.3	3.3.7.1	Refuel Floor High Exhaust Duct Radiation - High	≤ 18 mR/hr
2.2.8.1.4	3.3.7.1	Railroad Access Shaft Exhaust Duct Radiation – High	≤ 5 mR/hr
2.2.8.1.5	3.3.7.1	Refuel Floor Wall Exhaust Duct Radiation - High	≤ 21 mR/hr
2.2.9	Feedwater/Main Turbine Trip System Actuation		
2.2.9.1	3.3.2.2	Reactor Vessel Level – High	≤ 54.0 inches[a]
2.2.10	MVP Isolation		
2.2.10.1	[3.3.11]	Main Steam Line Radiation – High High	≤ 15 x full power background without hydrogen injection

[a] See Figure 2.2-1

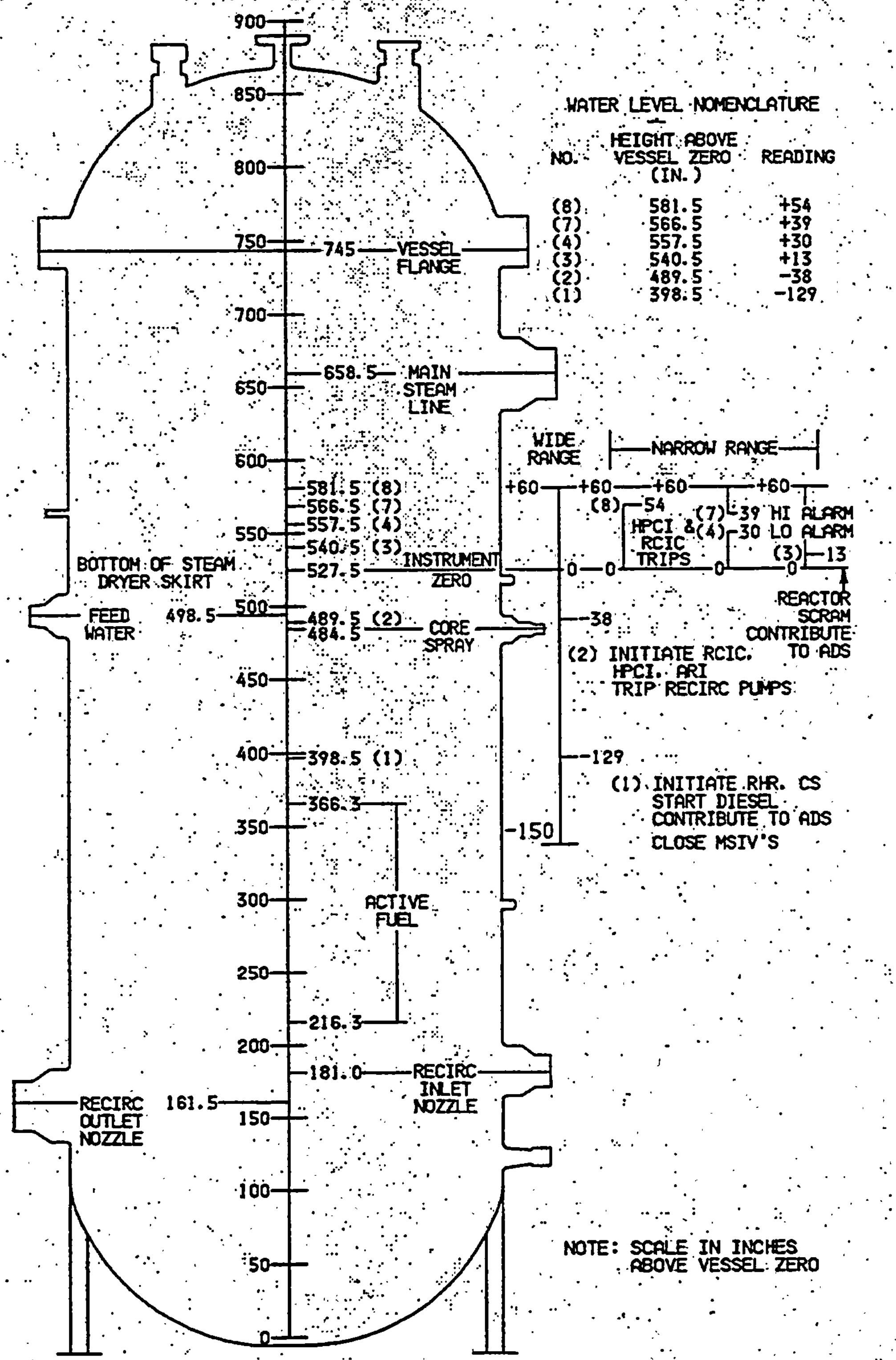


FIGURE 2.2-1
REACTOR VESSEL WATER LEVEL

CADAM ID: FIG2..2.1 . . .A

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 14

CORE OPERATING LIMITS REPORT

Nuclear Fuels Engineering

November 2004

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 14 operation.
1	TOC 1.0 2.0 9.0 10.0 11.0	This revision changes the Power / Flow map and adds setpoints for the OPRM system. The change to the Power / Flow map provides direction when the OPRM system is OPERABLE and inoperable. The setpoints for the OPRM system are set to reliably detect and suppress anticipated stability related power oscillations while providing a high degree of confidence that the MCPR safety limit is not violated.

SUSQUEHANNA STEAM ELECTRIC STATION
Unit 1 Cycle 14
CORE OPERATING LIMITS REPORT

Table of Contents

1.0 INTRODUCTION

This CORE OPERATING LIMITS REPORT (COLR) for Susquehanna Unit 1 Cycle 14 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, APRM 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 BUNDLE EXPOSURE shall be equal to the total energy produced by the bundle divided by the total initial weight of uranium in the fuel bundle.

2.2 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.

2.3 The FRACTION OF LIMITING POWER DENSITY (FLPD) shall be the LHGR existing at a given height divided by the applicable LHGR for APRM Setpoint Limit for that bundle type.

2.4 The FRACTION OF RATED THERMAL POWER (FRTP) shall be the measured THERMAL POWER divided by the RATED THERMAL POWER.

2.5 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.

2.6 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 APLGHR limit for the applicable fuel bundle type.

2.8 FDLRC is the ratio of the maximum LHGR calculated by the core monitoring system for each fuel bundle divided by the LHGR for APRM Setpoint Limit for the applicable fuel bundle type.

2.9 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

2.10 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.

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

2.12 F_P is the core flow below which the OPRM RPS trip is activated.

3.0 SHUTDOWN MARGIN

3.1 Technical Specification Reference

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 Technical Specification Reference

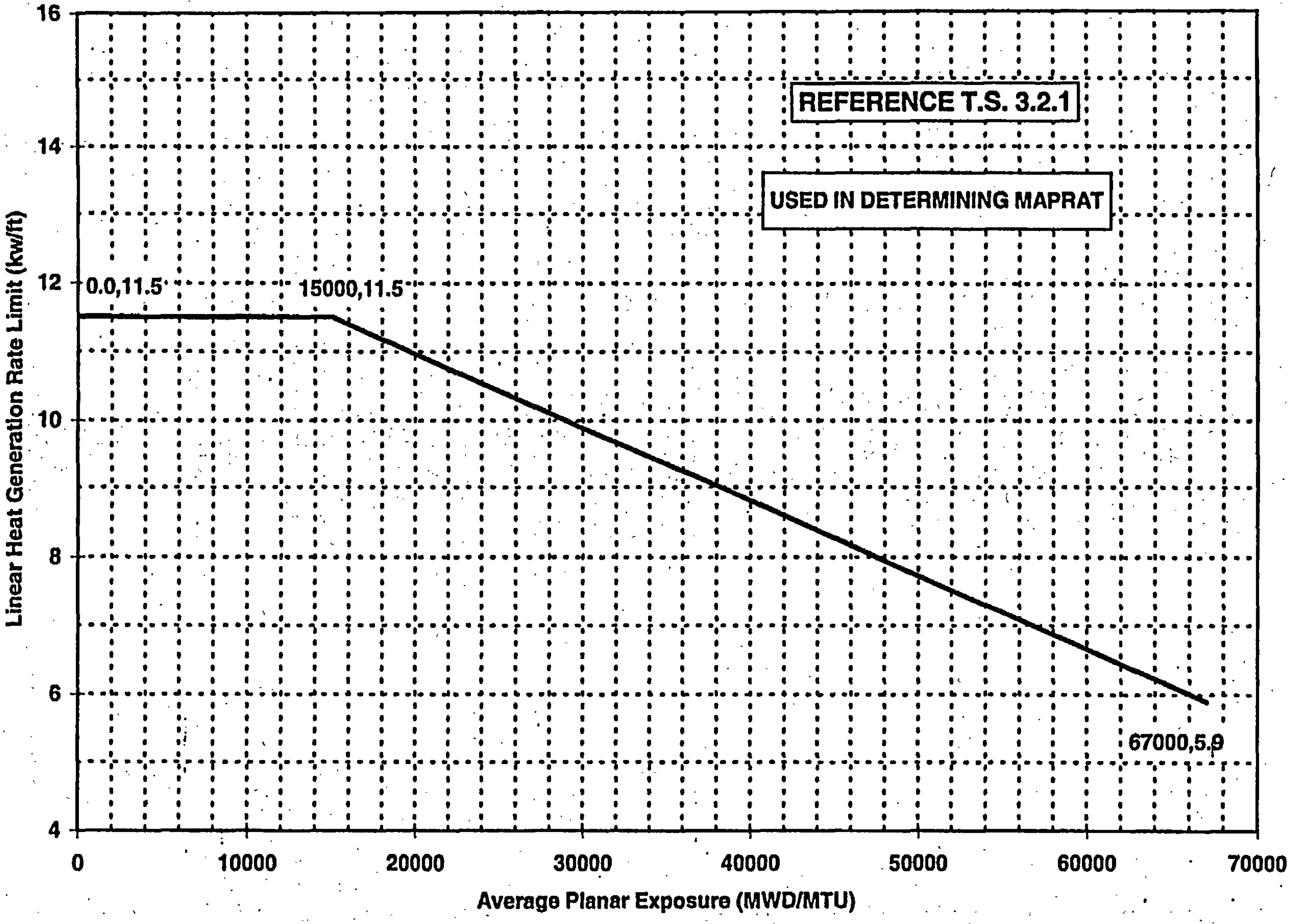
Technical Specification 3.2.1

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 for Main Turbine Bypass Operable and Inoperable and EOC-RPT Operable and Inoperable in Two Loop operation. The APLHGR limits for Single Loop operation are provided in Section 8.0.

SSES UNIT 1 CYCLE 14



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 Technical Specification Reference

Technical Specification 3.2.2, 3.7.6, and 3.3.4.1

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) EOC-RPT and Main Turbine Bypass 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 / EOC-RPT Operable

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 / Main Turbine Bypass Operable

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

The MCPR limits in Figures 5.2-1 through 5.2-6 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

Table 5.3-1 provides the relationship between average scram time to control rod position and scram time fraction. The evaluation of scram insertion time data, as it relates to the attached table should be performed per Reactor Engineering procedures.

EOC-RPT and Main Turbine Bypass Operable

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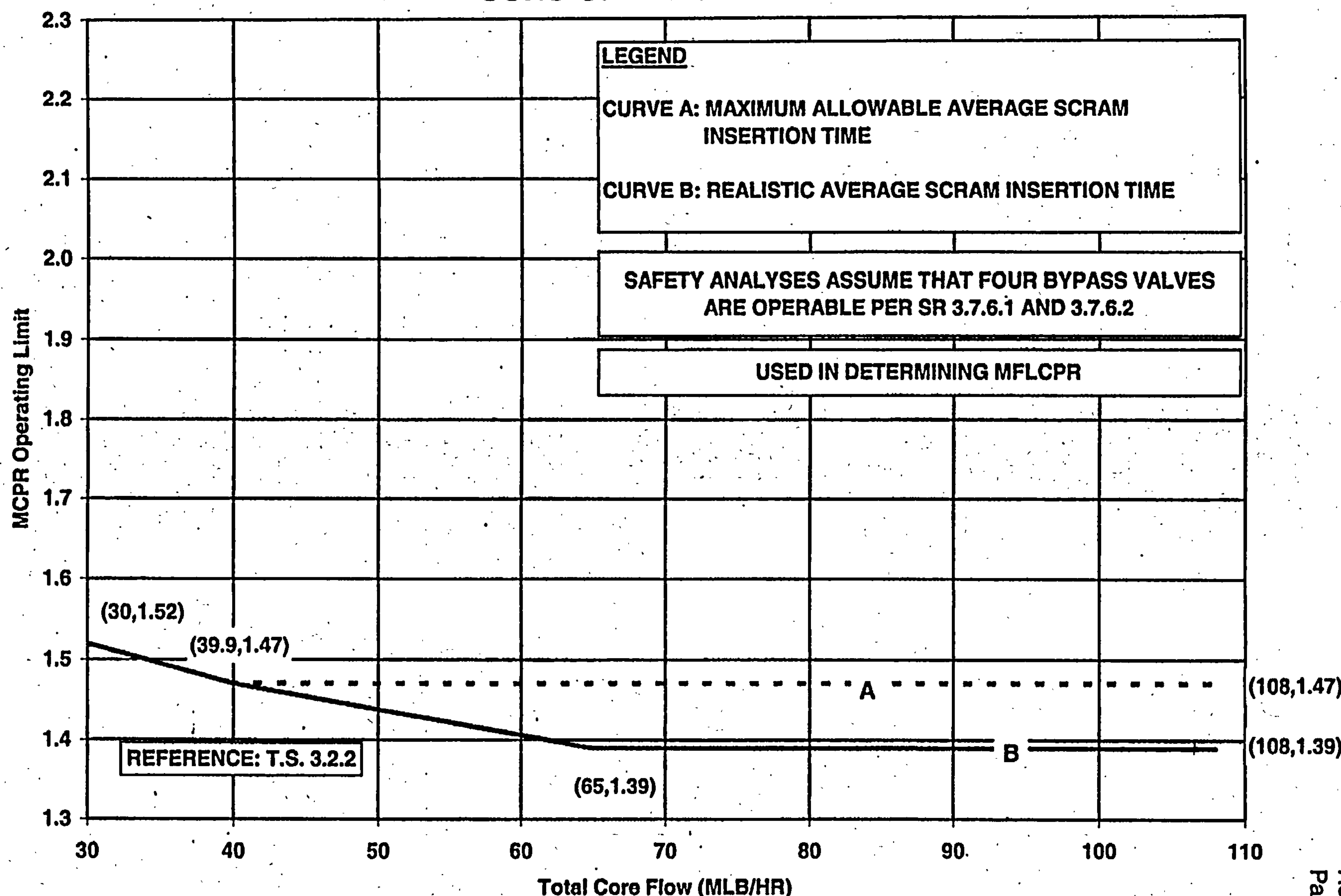
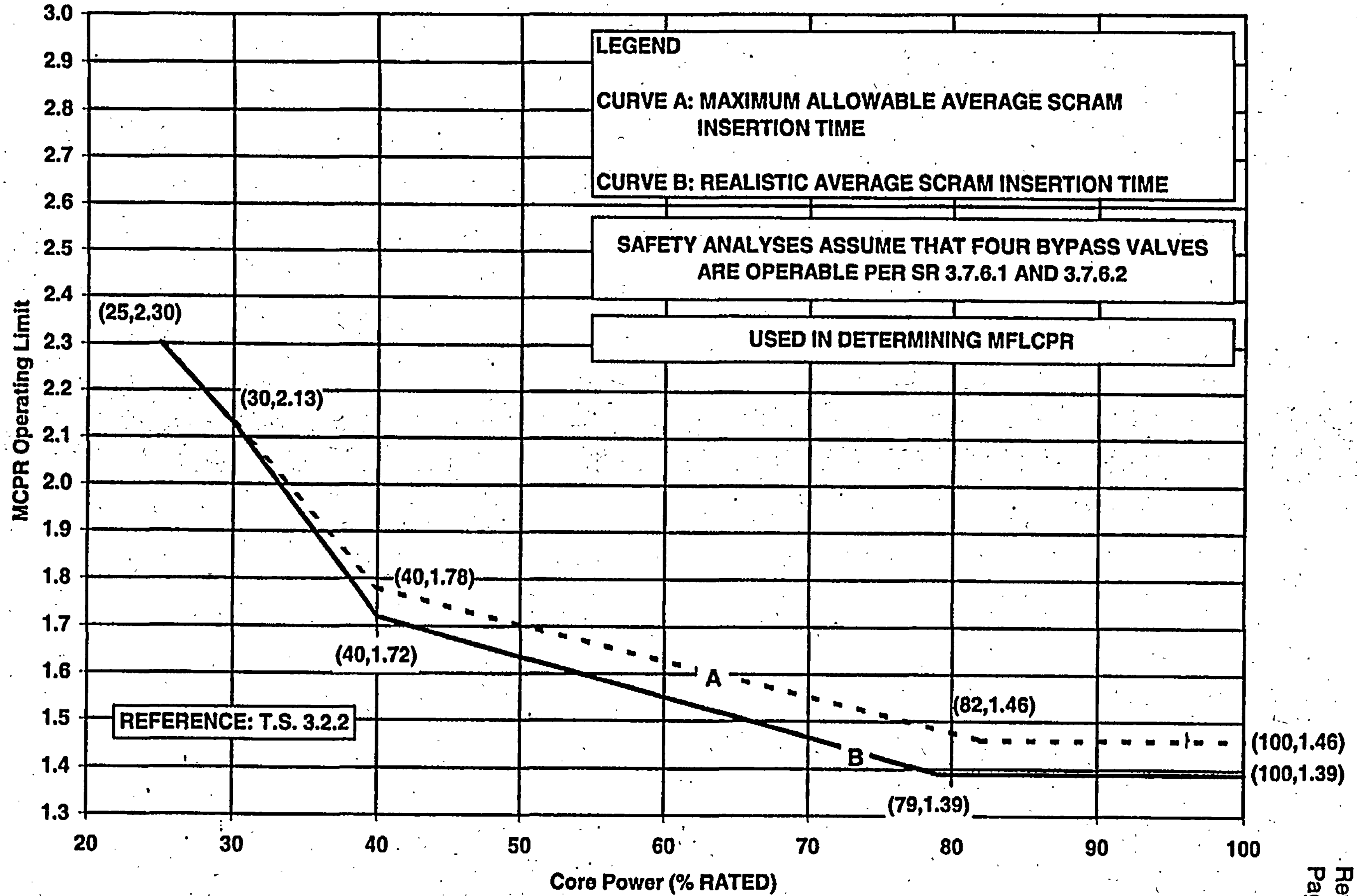


MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
EOC-RPT AND MAIN TURBINE BYPASS OPERABLE
TWO LOOP OPERATION (BOC TO EOC)
FIGURE 5.2-1

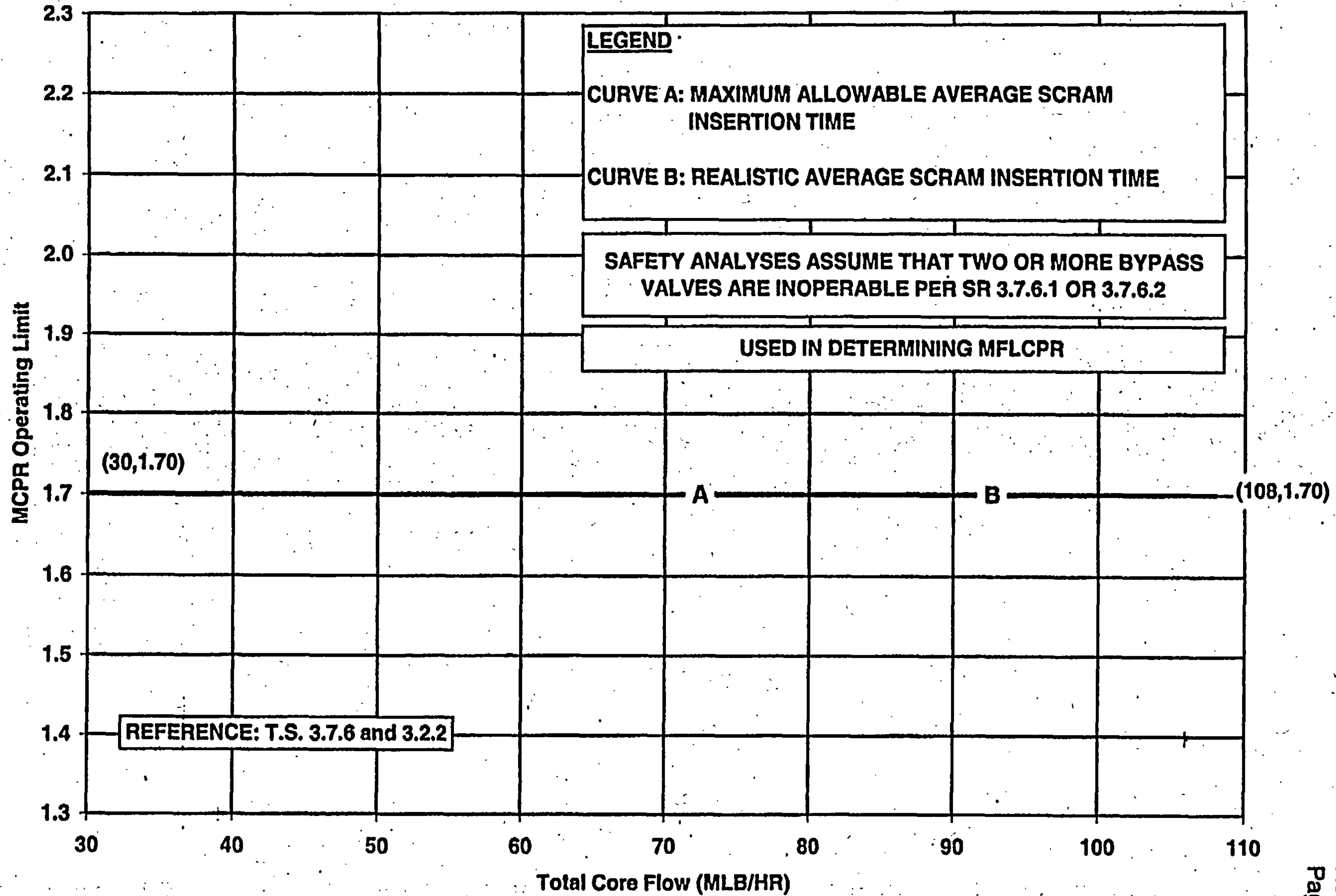
SSES UNIT 1 CYCLE 14



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

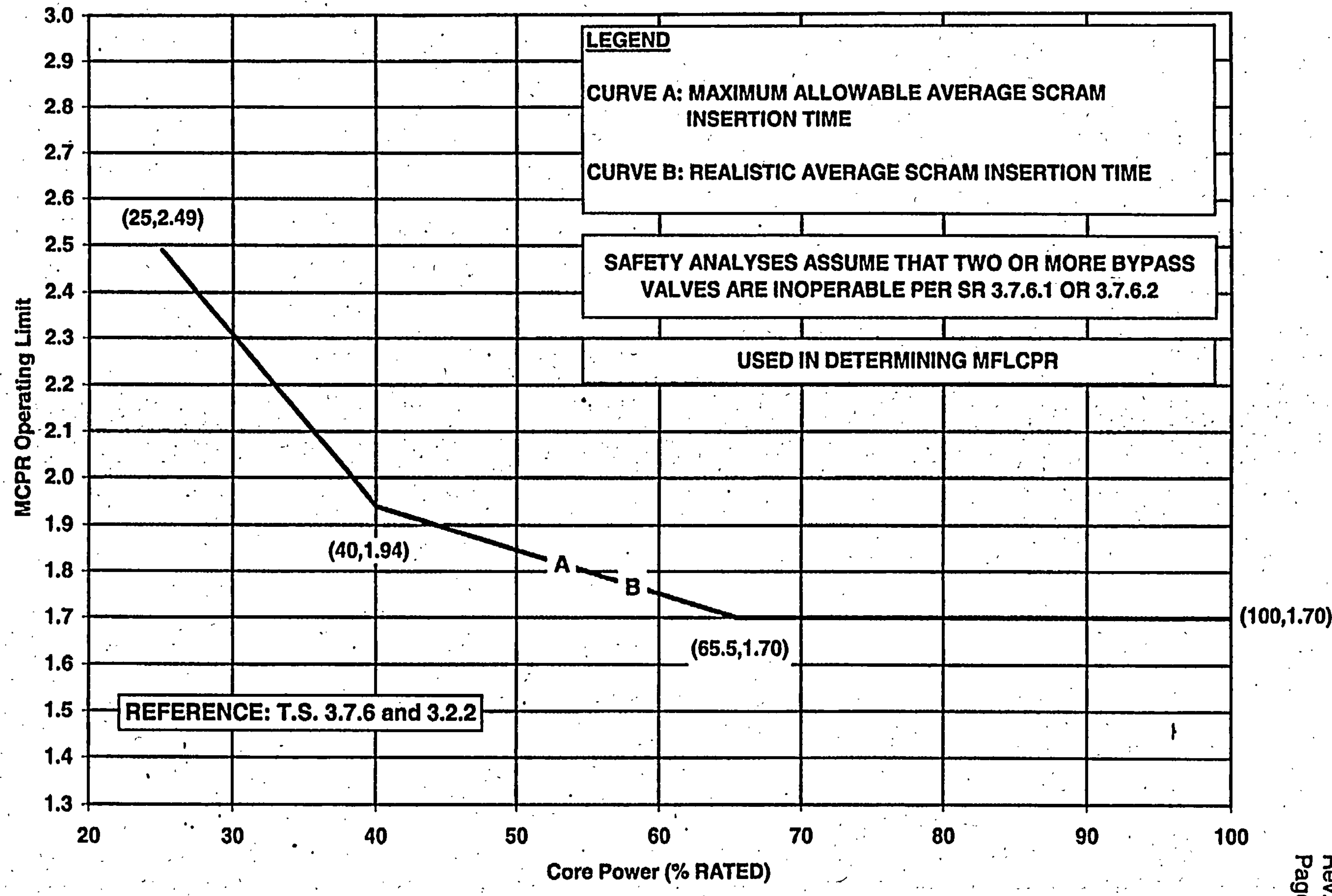
Main Turbine Bypass Inoperable / EOC-RPT Operable

SSES UNIT 1 CYCLE 14



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

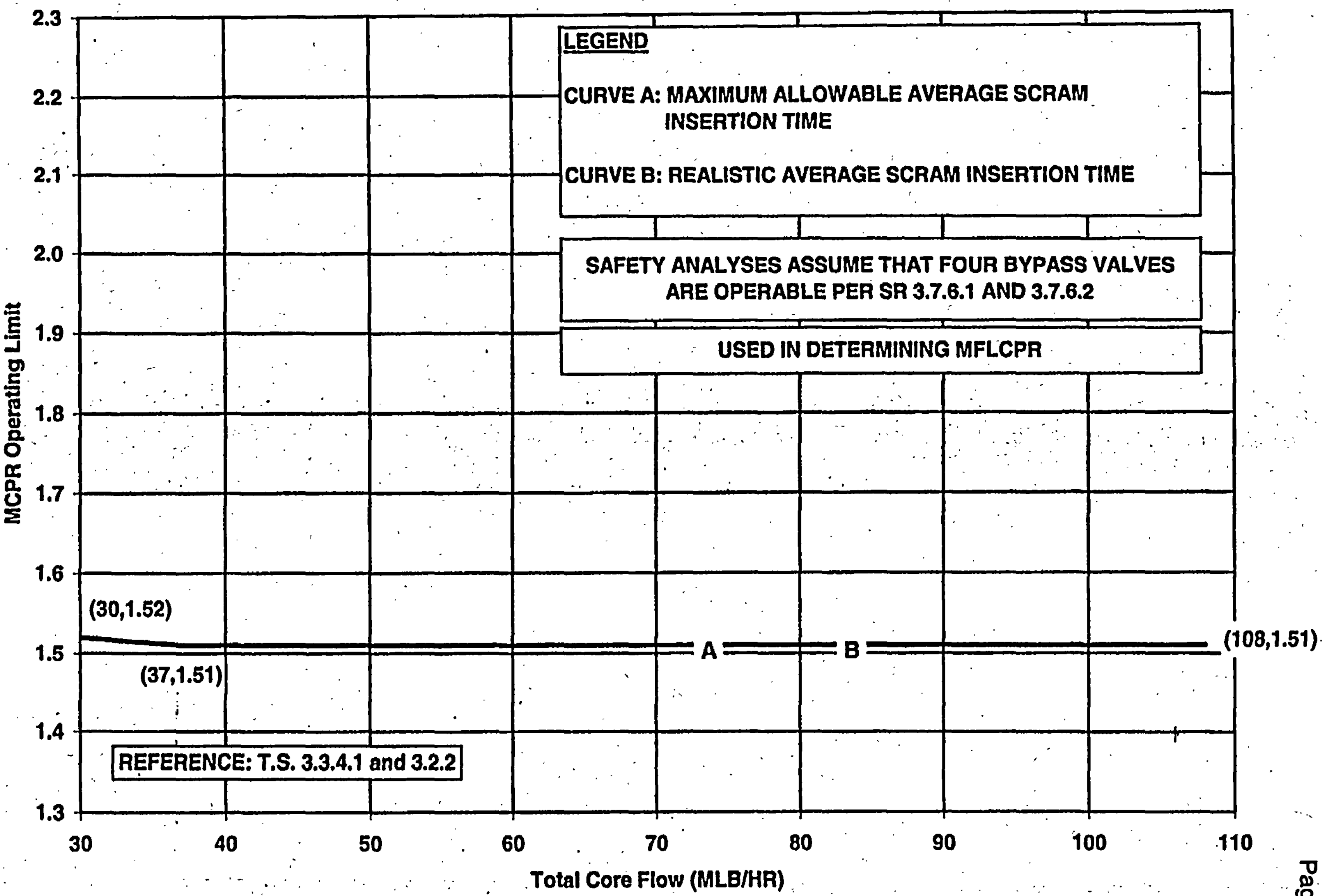
SSES UNIT 1 CYCLE 14



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

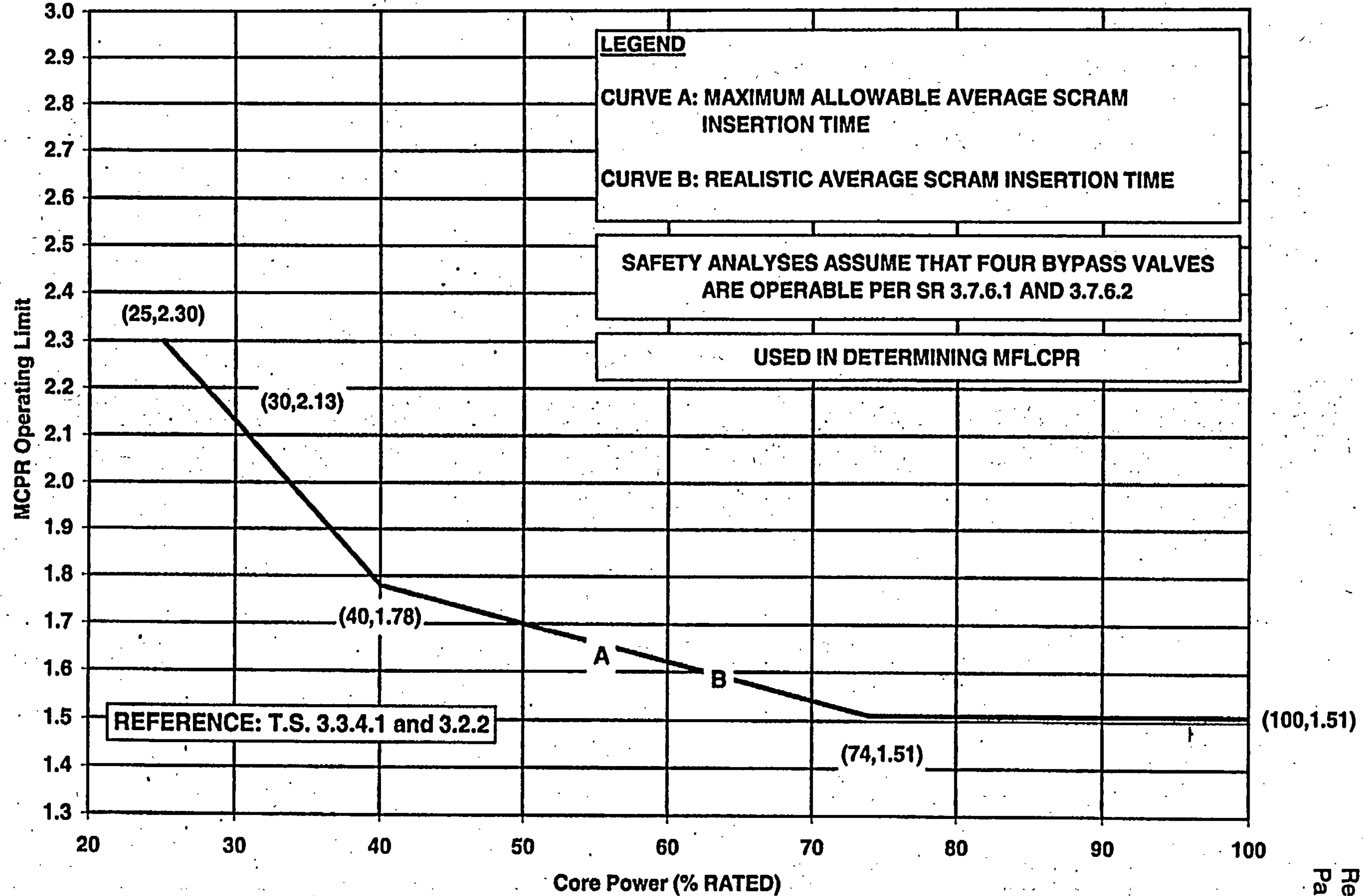
EOC-RPT Inoperable / Main Turbine Bypass Operable

SSES UNIT 1 CYCLE 14



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

SSES UNIT 1 CYCLE 14



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

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	0.480	0.490	0.500	0.510	0.520
39	0.630	0.676	0.722	0.768	0.814	0.860
25	1.500	1.582	1.664	1.746	1.828	1.910
5	2.700	2.848	2.996	3.144	3.292	3.440
Scram Time Fraction	0.000	0.200	0.400	0.600	0.800	1.000
Average Scram Insertion Time	Realistic					Maximum Allowable

6.0 LINEAR HEAT GENERATION RATE (LHGR)

6.1 Technical Specification Reference

Technical Specification 3.2.3 and 3.7.6

6.2 Description

The LHGR limits are specified below as a function of Main Turbine Bypass operability for each fuel type as follows:

Main Turbine Bypass Operable

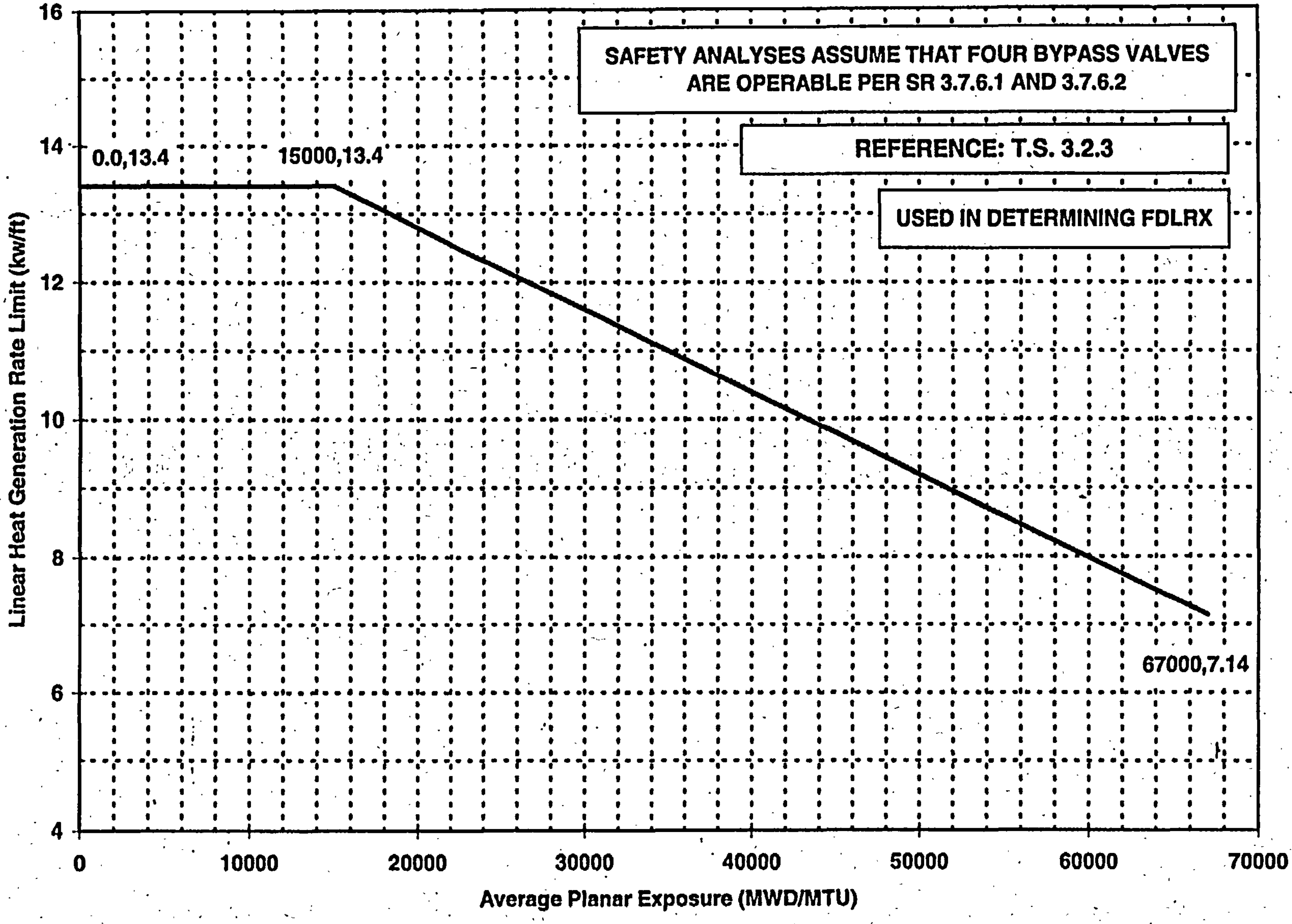
The LHGR for ATRIUM™-10 fuel shall not exceed the LHGR limit determined from Figure 6.2-1.

Main Turbine Bypass Inoperable

The LHGR for ATRIUM™-10 fuel shall not exceed the LHGR limit determined from Figure 6.2-2.

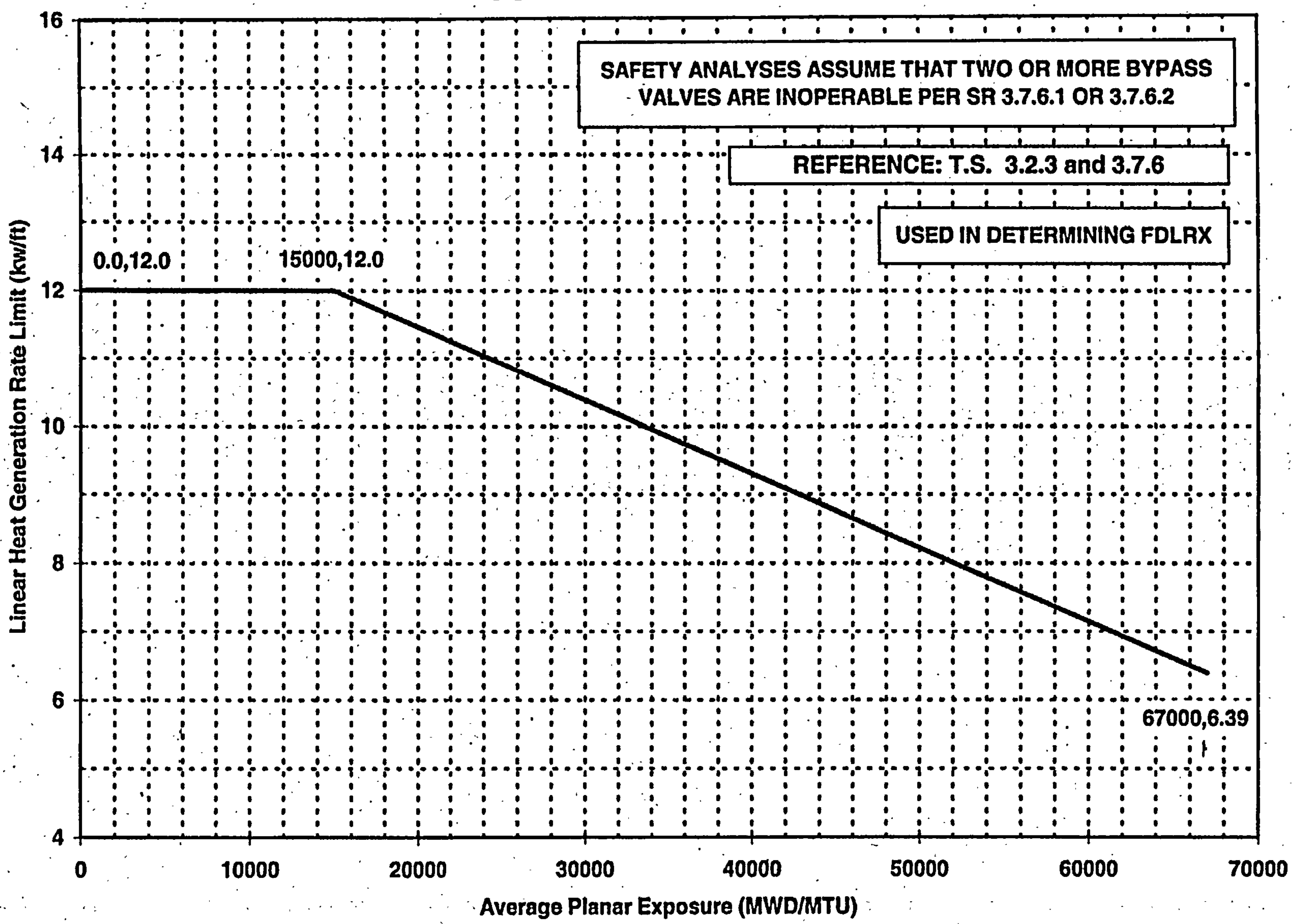
The LHGR limits in Figures 6.2-1 and 6.2-2 are valid for Two Loop and Single Loop operation.

SSES UNIT 1 CYCLE 14



LINEAR HEAT GENERATION RATE LIMIT VERSUS AVERAGE PLANAR EXPOSURE
MAIN TURBINE BYPASS OPERABLE
ATRIUM™-10 FUEL
FIGURE 6.2-1

SSES UNIT 1 CYCLE 14



LINEAR HEAT GENERATION RATE LIMIT VERSUS AVERAGE PLANAR EXPOSURE
MAIN TURBINE BYPASS INOPERABLE
ATRIUM™-10 FUEL
FIGURE 6.2-2

7.0 AVERAGE POWER RANGE MONITOR (APRM) GAIN AND SETPOINTS

7.1 Technical Specification Reference

Technical Specification 3.2.4 and 3.3.1.1

7.2 Description

The APRM flow biased simulated thermal power-upscale scram trip setpoint (S) and flow biased neutron flux-upscale control rod block trip setpoint (S_{RB}) shall be established as specified in Table 7.2-1 and Table 7.2-2, including any adjustments per Technical Specification LCO 3.2.4.

Technical Specification LCO 3.2.4 provides an option to adjust the APRM setpoints when MFLPD is greater than FRACTION OF RATED THERMAL POWER (FRTP). The adjustment applies to both the APRM flow biased simulated thermal power-upscale scram trip setpoint and flow biased neutron flux-upscale control rod block trip setpoint for Two Loop and Single Loop operation. The APRM setpoints for Specification 3.2.4 are established in Tables 7.2-1 and 7.2-2.

Table 7.2-1
APRM Setpoint for
Two Loop Operation

Trip Setpoint	Allowable Value
$S \leq (0.58W + 59\%)\ T$	$S \leq (0.58W + 62\%)\ T$[1]
$S_{RB} \leq (0.58W + 50\%)\ T$	$S_{RB} \leq (0.58W + 53\%)\ T$

Table 7.2-2
APRM Setpoint for
Single Loop Operation

Trip Setpoint	Allowable Value
$S \leq (0.58W + 54\%)\ T$	$S \leq (0.58W + 57\%)\ T$[1]
$S_{RB} \leq (0.58W + 45\%)\ T$	$S_{RB} \leq (0.58W + 48\%)\ T$

where: S and S_{RB} are in percent of RATED THERMAL POWER

W = Loop recirculation flow as a percentage of the loop recirculation flow which produces a core flow of 100 million lbs/hr

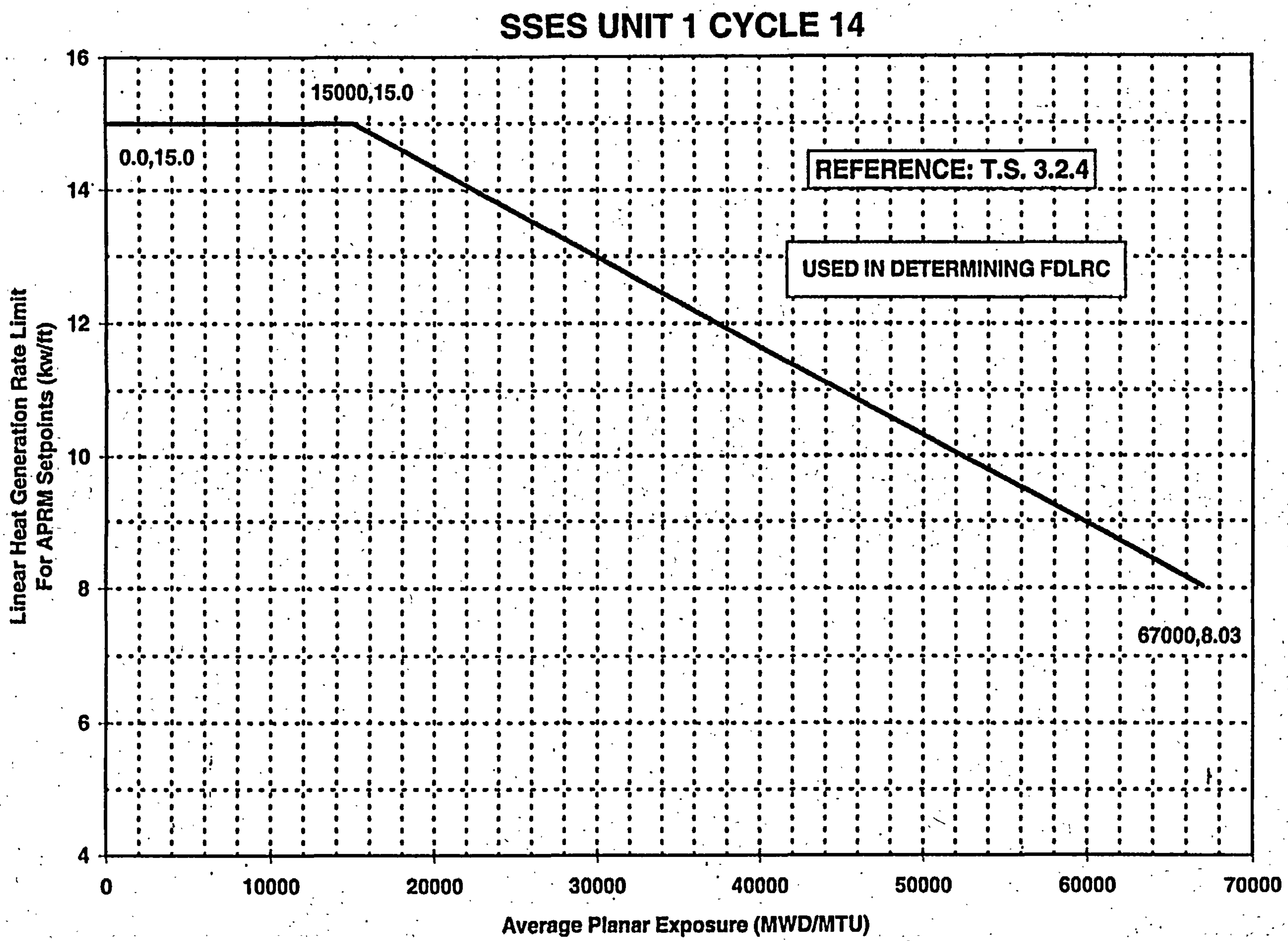
T = Lowest value of the ratio of FRTP divided by the MFLPD.[2] The FLPD is the actual LHGR divided by the applicable LHGR limit for APRM Setpoints. The LHGR limit for APRM setpoints for ATRIUM™-10 fuel shall be taken from Figure 7.2-1.

The LHGR for APRM setpoint limits in Figure 7.2-1 are valid for Main Turbine Bypass Operable and Inoperable and EOC-RPT Operable and Inoperable for both Two and Single Loop operation.

For calculated T-values greater than 1.0, a ratio of 1.0 is used in the above equations.

[1] APRM flow biased simulated thermal power-upscale scram allowable value in this table is equal to the value established in Technical Specification 3.3.1.1.

[2] For the calculation of T, the value of MFLPD shall be the maximum value of FDLRC.



LINEAR HEAT GENERATION RATE LIMIT FOR APRM SETPOINTS VERSUS AVERAGE PLANAR EXPOSURE
ATRIUM™ -10 FUEL
FIGURE 7.2-1

8.0 RECIRCULATION LOOPS - SINGLE LOOP OPERATION

8.1 Technical Specification Reference

Technical Specification 3.2.1, 3.2.2, 3.2.3, 3.2.4, 3.3.4.1, 3.4.1, and 3.7.6

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 for Main Turbine Bypass Operable and Inoperable and EOC-RPT Operable and Inoperable in Single Loop operation.

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 limit for all fuel types (ATRIUM™-10) shall be the greater of:

a) Flow-Dependent MCPR value determined from Figure 8.2-2

OR

b) The Power-Dependent MCPR value determined from one of the following figures, as appropriate:

Figure 8.2-3 : EOC-RPT and Main Turbine Bypass Operable from BOC to EOC

Figure 8.2-4 : Main Turbine Bypass Inoperable / EOC-RPT Operable from BOC to EOC

Figure 8.2-5 : EOC-RPT Inoperable / Main Turbine Bypass Operable from BOC to EOC

The MCPR limits in Figures 8.2-2 through 8.2-5 are valid only for Single Loop operation.

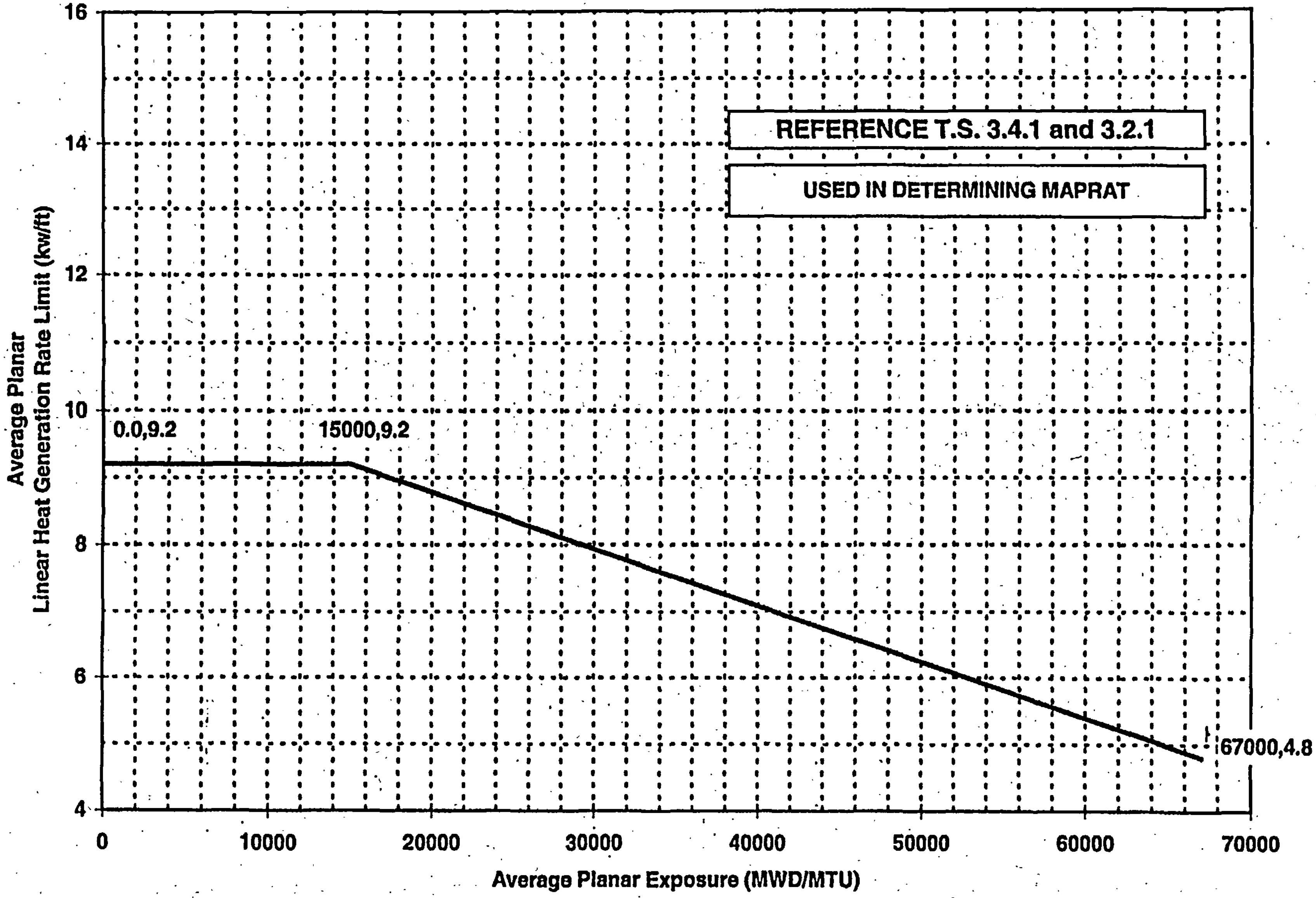
Linear Heat Generation Rate Limit

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

Average Power Range Monitor (APRM) Gain And Setpoints

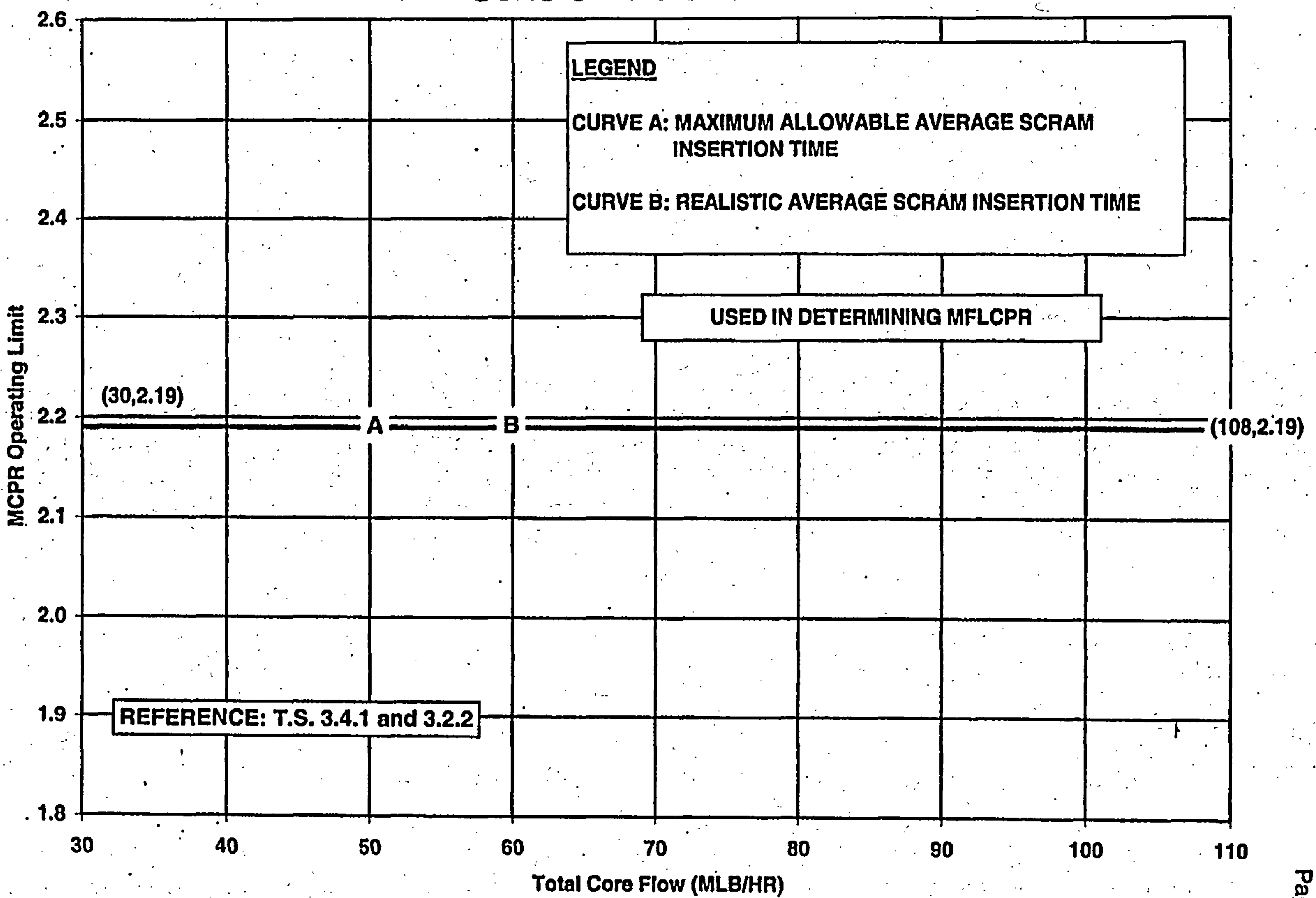
APRM setpoints and the LHGR limit for APRM setpoints for Single Loop operation are defined in Section 7.0.

SSES UNIT 1 CYCLE 14



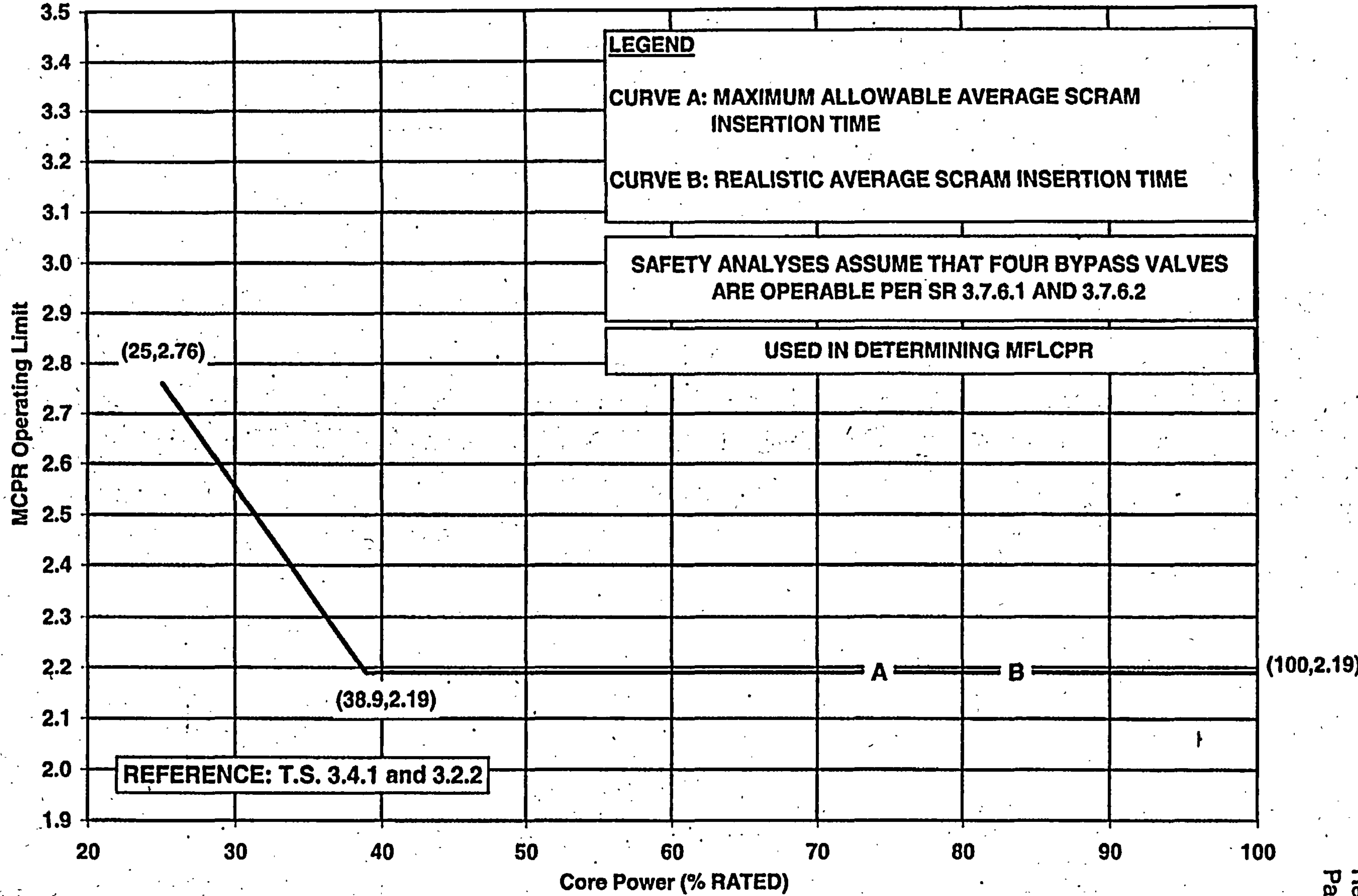
AVERAGE PLANAR LINEAR HEAT GENERATION RATE LIMIT VERSUS AVERAGE PLANAR EXPOSURE
SINGLE LOOP OPERATION
ATRIUM™-10 FUEL
FIGURE 8.2-1

SSES UNIT 1 CYCLE 14



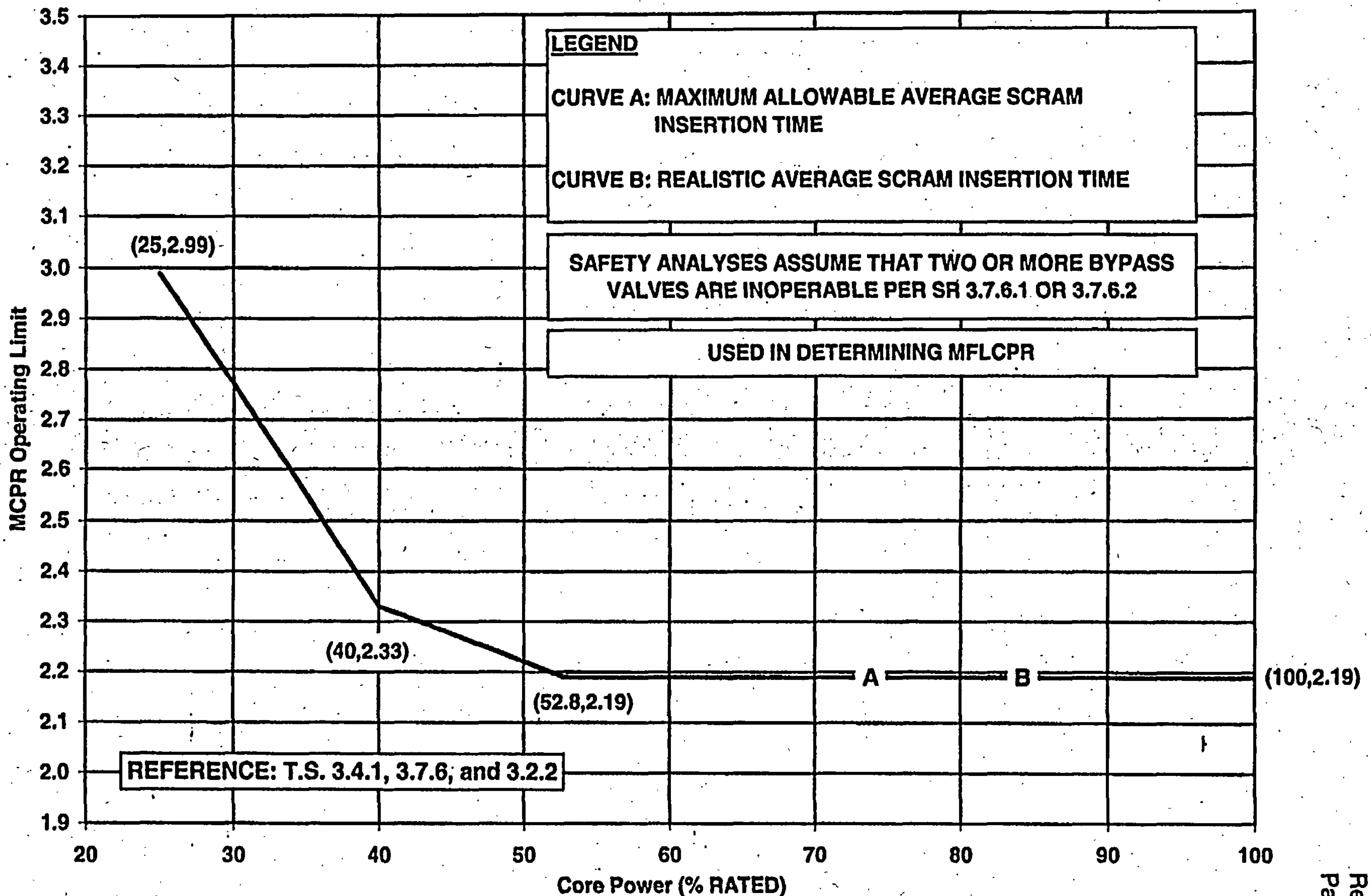
MCPR OPERATING LIMIT VERSUS TOTAL CORE FLOW
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-2

SSES UNIT 1 CYCLE 14



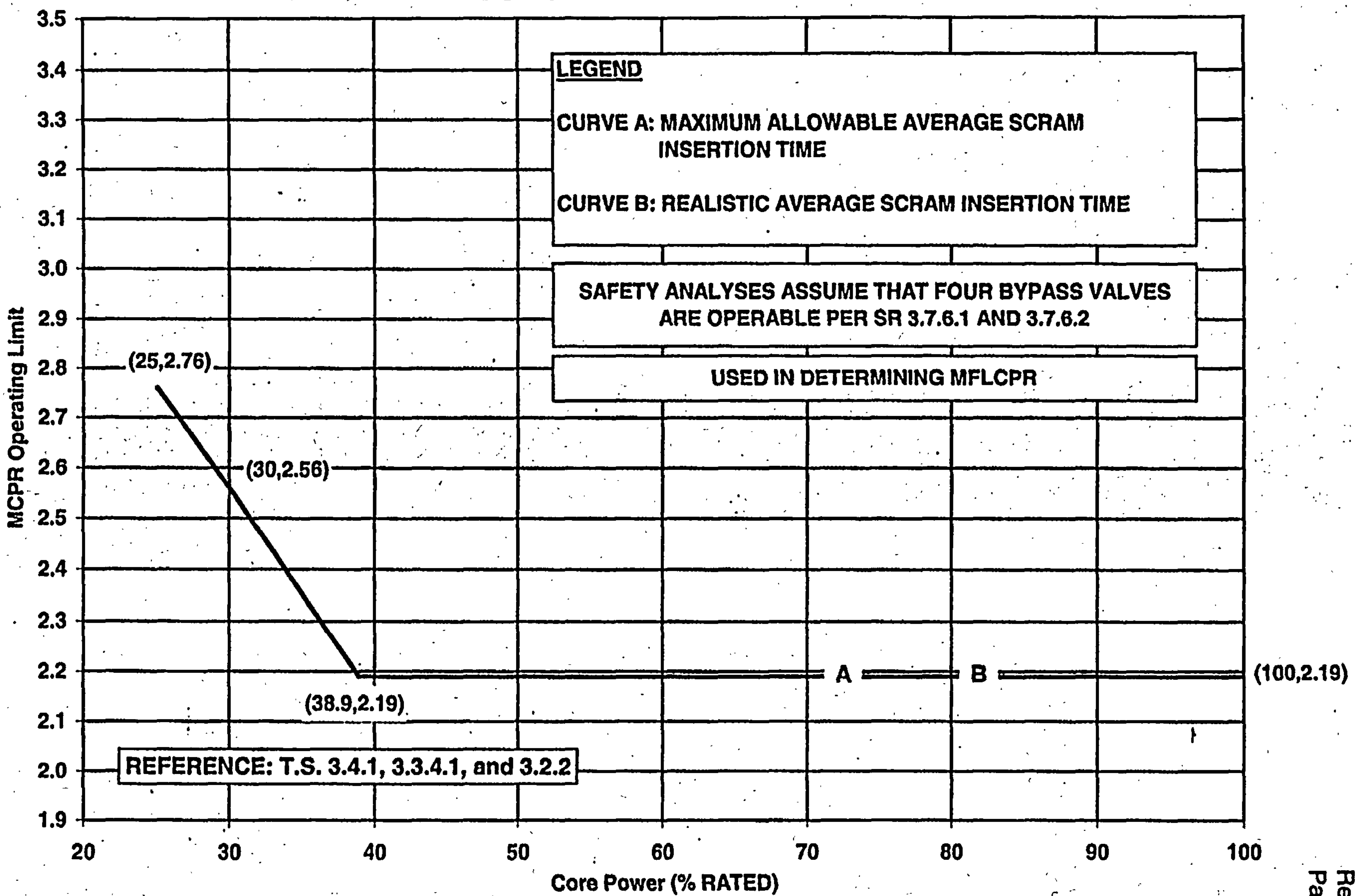
MCPR OPERATING LIMIT VERSUS CORE POWER
EOC-RPT AND MAIN TURBINE BYPASS OPERABLE
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-3

SSES UNIT 1 CYCLE 14



MCPR OPERATING LIMIT VERSUS CORE POWER
MAIN TURBINE BYPASS INOPERABLE / EOC-RPT OPERABLE
SINGLE LOOP OPERATION (BOC to EOC)
FIGURE 8.2-4

SSES UNIT 1 CYCLE 14



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

9.0 POWER / FLOW MAP

9.1 Technical Specification Reference

Technical Specification 3.3.1.3

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 3.3.1.3, Region I of the Power / Flow map is considered an immediate exit region.

If the OPRM Instrumentation is inoperable per TS 3.3.1.3, 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.

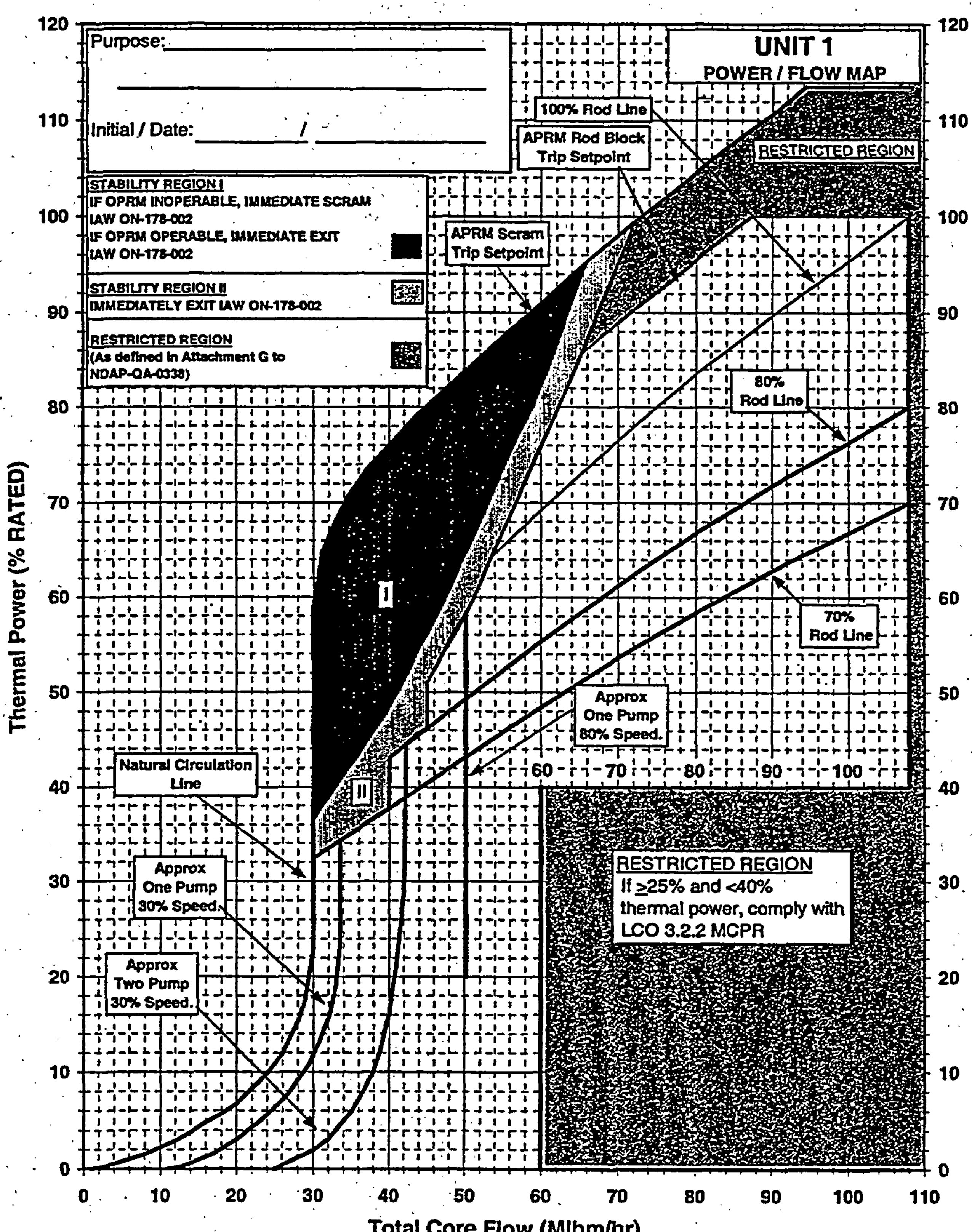


Figure 9.1
Power / Flow Map

10.0 OPRM SETPOINTS

10.1 Technical Specification Reference

Technical Specification 3.3.1.3

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 1.0 and are listed below:

S_P = 1.11

N_P = 14

F_P = 65 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. PL-NF-90-001-A, "Application of Reactor Analysis Methods for BWR Design and Analysis," July 1992.

2. PL-NF-90-001, Supplement 1-A, "Application of Reactor Analysis Methods for BWR Design and Analysis: Loss of Feedwater Heating Changes and Use of RETRAN MOD 5.1," August 1995.

3. PL-NF-90-001, Supplement 2-A, "Application of Reactor Analysis Methods for BWR Design and Analysis: CASMO-3G Code and ANFB Critical Power Correlation," July 1996.

4. PL-NF-90-001, Supplement 3-A, "Application of Reactor Analysis Methods for BWR Design and Analysis: Application Enhancements," March 2001.

5. XN-NF-80-19(A), Volume 1, and Volume 1 Supplements 1 and 2 (March 1983), and Volume 1 Supplement 3 (November 1990), "Exxon Nuclear Methodology for Boiling Water Reactors: Neutronic Methods for Design and Analysis," Exxon Nuclear Company, Inc.

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," 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," 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, Inc. 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 Supplement 1, Revision 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 Revision 1 Supplement 1, "Generic Mechanical Design Criteria for BWR Fuel Designs," Advanced Nuclear Fuels Corporation, May 1995.

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

14. XN-NF-79-71(P)(A) Revision 2, Supplements 1, 2, and 3, "Exxon Nuclear Plant Transient Methodology for Boiling Water Reactors," March 1986.

15. EMF-1997(P)(A) Revision 0, "ANFB-10 Critical Power Correlation," July 1998, and EMF-1997(P)(A) Supplement 1 Revision 0, "ANFB-10 Critical Power Correlation : High Local Peaking Results," July 1998.

16. Caldon, Inc., "TOPICAL REPORT: Improving Thermal Power Accuracy and Plant Safety While Increasing Operating Power Level Using the LEFM✓™ System," Engineering Report - 80P, March 1997.

17. Caldon, Inc., "Supplement to Topical Report ER-80P: Basis for a Power Uprate with the LEFM✓™ or LEFM CheckPlus™ System," Revision 0, Engineering Report ER-160P, May 2000.

18. EMF-85-74(P)(A), "RODEX2A (BWR) Fuel Rod Thermal-Mechanical Evaluation Model," Revision 0, Supplements 1 and 2, February 1998.

19. 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.

20. EMF-CC-074(P)(A), Volume 4, Revision 0, "BWR Stability Analysis: Assessment of STAIF with Input from MICROBURN-B2," November 1999.

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

3.3 Instrumentation

3.3.9 OPRM Instrumentation Configuration

TRO 3.3.9 Oscillation Power Range Monitor (OPRM) supporting setpoints and settings shall be within the specified limits.

APPLICABILITY: Thermal POWER ≥25% RTP

ACTIONS

-----NOTE-----

1. Separate Condition entry is allowed for each channel

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. OPRM Setpoints and Settings not in accordance with Table 3.3.9-1	A.1 Enter the condition referenced in Table 3.3.9-1 for the parameter	Immediately
B. As required by Required Action A.1 and referenced in Table 3.3.9.1	B.1 Declare affected OPRM module inoperable.	Immediately
C. As required by Required Action A.1 and referenced in Table 3.3.9-1	C.1 Restore the OPRM Setpoints and Settings to within the specified limits.	120 days
D. Alternate method to detect and suppress thermal hydraulic instability oscillations required by LCO 3.3.1.3 Required Action A.3 or Required Action B.1	D.1 Initiate Action in accordance with Conditions E, F, or G	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. ----------NOTE---------- Only applicable as required by Required Action D.1 -------------------------- Total core flow as a function of THERMAL POWER within Region I of the Power Flow map as specified in the COLR. <u>OR</u> Total core flow as a function of THERMAL POWER within Region II of the Power Flow map as specified in the COLR and less than 50% of required LPRM upscale alarms OPERABLE	E.1 Place reactor mode switch in the shutdown position.	Immediately
F. ---------NOTE---------- Only applicable as required by Required Action D.1 and when in Region II of the Power Flow map as specified in the COLR. -------------------------- Two or more APRM readings oscillating with one or more oscillating ≥10% of RTP peak-to-peak <u>OR</u>	F.1 Place the reactor mode switch in the shutdown position.	Immediately

(continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. (continued) Two or more LPRM upscale alarms activating and deactivating with a period ≥1 second and ≤5 seconds. <u>OR</u> Sustained LPRM oscillations >10 W/cm^2 peak-to-peak with a period ≥1 second and ≤5 seconds.		
G. --------NOTE--------- Only applicable as required by Required Action D.1. -------------------------- Total core flow as a function of THERMAL POWER within Region II of the Power Flow map as specified in the COLR.	G.1 Initiate action to restore total core flow as a function of THERMAL POWER outside of Region II.	Immediately
H. Less than 50% of the required LPRM Upscale Alarms are OPERABLE	H.1 Post sign on the reactor control panel that less than 50% of the LPRM Upscale Alarms are OPERABLE.	1 hour

TECHNICAL REQUIREMENT SURVEILLANCE

SURVEILLANCE		FREQUENCY
TRS 3.3.9.1	-----NOTE----- Only required to be met when an alternate method to detect and suppress thermal hydraulic instability oscillations is required by LCO 3.3.1.3 Required Action A.3 or Required Action B.1. ---------- Verify total core flow as a function of THERMAL POWER is outside of Region I and II of the Power Flow map as specified in the COLR.	24 hours
TRS 3.3.9.2	Perform CHANNEL CALIBRATION on each LPRM Upscale alarm	24 months
TRS 3.3.9.3	Verify OPRM parameter setpoints and settings are within limits	24 months

Table 3.3.9-1
OPRM SETPOINTS AND SETTINGS

OPRM PARAMETER	DESCRIPTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	VALUE
1. TOL	Period Confirmation Tolerance	B	≥ 0.10 and ≤ 0.30 sec
2. Ta	Averaging Filter	B	5 sec
3. Fc	Conditioning Filter Cutoff Frequency	B	1.5 Hz
4. Tmin	Minimum Oscillation Period	B	≥ 1.0 and ≤ 1.2 sec
5. Tmax	Maximum Oscillation Period	B	≥ 3.0 and ≤ 3.5 sec
6. Noise Floor	Peak Discrimination Threshold	B	1
7. Minimum LPRM/Cell	Cell Operability Requirement	B	≥ 2
8. S1	Peak Threshold Setpoint	C[(a)]	≥ 1.10 and ≤ 1.20
9. S2	Valley Threshold Setpoint	C[(a)]	≥ 0.85 and ≤ 0.95
10. Smax	Max. Amplitude Trip Setpoint	C[(a)]	≥ 1.30 and ≤ 1.50
11. DR3	Growth Rate Factor Setpoint	C[(a)]	≥ 1.30 and ≤ 1.60
12. T1 lo	S1 to S2 Timer Range	C[(a)]	≥ 0.3 sec
13. T1 hi	S1 to S2 Timer Range	C[(a)]	≤ 2.5 sec
14. T2 lo	S2 to (S3 or Smax) Timer Range	C[(a)]	≥ 0.3 sec
15. T2 hi	S2 to (S3 or Smax) Timer Range	C[(a)]	≤ 2.5 sec

(a) Applicable only when two channels in the same trip system not in accordance with Table

B 3.3.9 OPRM Instrumentation

BASES

TRO

The OPRM system configuration governs its operation in accordance with the licensing analysis. Several configuration parameters are intrinsic to the trip function safety setpoint bases or provide settings for defense-in-depth algorithm features that are not assumed in the basis for the protection system safety analysis (Reference 2, Reference 3).

Each of the setting values may be used as the process setpoint or device setting without further adjustment for uncertainties.

Setpoints and Settings Bases

TOL Period Confirmation Tolerance

The specified range of values for the period tolerance has been demonstrated to provide continuous confirmations upon transition from stable reactor operation to a growing reactor instability. A range of values is provided to allow system tuning to avoid spurious alarms on period confirmations. Limiting the setpoint adjustment range provides assurance that the Period Based Detection Algorithm will provide sufficient confirmations for a growing instability.

Ta Averaging Filter

The averaging filter is used to provide a normalization of the input signal such that the average signal value is 1.0. The filter time constant is chosen to approximate the fuel thermal time constant. Setting optimizes system response during fast power transients.

Fc Conditioning Filter Cutoff Frequency

The specified value for the Conditioning Filter Cutoff Frequency has been demonstrated to provide continuous confirmations upon transition from stable reactor operation to a growing reactor instability. Setting minimizes impact on signal amplitude and provides assurance that the Period Based Detection Algorithm will provide sufficient confirmations for a growing instability.

Tmin Minimum Oscillation Period

Tmax Maximum Oscillation Period

The Minimum and Maximum Oscillation Period parameters establish the range of detectable oscillation periods of OPRM cell signals for signal oscillations associated with reactor core thermal-hydraulic instability.

(continued)

B 3.3.9 OPRM Instrumentation

BASES

TRO (continued)

Noise Floor

The period based algorithm uses a peak detection algorithm to determine the peaks and valleys of an OPRM cell signal. The Noise Floor setting assures that peaks and valleys are effectively detected for low amplitude cell signal resonances.

Minimum LPRM/Cell

This value determines the availability and resulting sensitivity of cells in the reactor core in the event of LPRM channel failures. The minimum LPRM/cell is an assumption of the OPRM trip setpoint (Sp) basis calculation.

Amplitude and Growth Rate Algorithm Parameters

S1	Peak Threshold Setpoint
S2	Valley Threshold Setpoint
Smax	Max. Amplitude Trip Setpoint
DR3	Growth Rate Factor Setpoint
T1 lo	S1 to S2 Timer Range
T1 hi	S1 to S2 Timer Range
T2 lo	S2 to (S3 or Smax) Timer Range
T2 hi	S2 to (S3 or Smax) Timer Range

These parameters calibrate the Amplitude and Growth Rate Algorithm, described in References 2 and 3, which provides an OPRM trip output to the Reactor Protection System. The OPRM design and licensing basis takes no credit for the Amplitude and Growth Rate Algorithm. The algorithm is provided as a defense-in-depth feature in the event of unanticipated power oscillations. These Amplitude and Growth Rate Algorithm Parameters are considered sufficient to provide backup protection and to avoid spurious trips by maximizing margin to expected operating conditions and transients.

ACTIONS

The required actions assure that the system settings that support the Period Based Algorithm setpoint analysis, and those parameters that define the Amplitude and Growth Rate Algorithm are returned in a timely manner to the values assumed in the analysis (Reference 2, Reference 3) or that the affected channel module is declared inoperable and the applicable Required Action of LCO 3.3.1.3 is then entered, or an alternate method to detect and suppress thermal hydraulic instability oscillations is employed.

(continued)

B 3.3.9 OPRM Instrumentation

BASES

ACTIONS (continued)

Note 1 has been provided to modify the ACTIONS related to affected OPRM channels. Technical Specification Section 1.3, Completion Times, specifies that once a Condition has been entered, subsequent divisions, subsystems, components, or variables expressed in the Condition discovered to be inoperable or not within limits will not result in separate entry into the Condition. Technical Specification Section 1.3 also specifies that Required Actions of the Condition continue to apply for each additional failure, with Completion Times based on initial entry into the Condition. However, the Required Actions for affected OPRM modules and channels provide appropriate compensatory measures for separate modules and channels. As such, a Note has been provided that allows separate Condition entry for each affected OPRM channel.

B.1

Several parameter settings are essential for the proper operation of the OPRM period-based trip algorithm. The permissible values of Period Confirmation Tolerance, Averaging Filter time constant, Conditioning Filter Cutoff Frequency, and minimum operable LPRM per cell parameters are limited by the setpoint basis calculations and system transient response analysis. The Minimum and Maximum Oscillation Period settings limit the algorithm window to the cell signal resonances that can be associated with unstable thermal-hydraulic conditions. The Noise Floor setting assures that the cell signal peak detection algorithm is sufficiently responsive to low frequency and low amplitude cell signal resonances.

Because the ability of the OPRM module to perform its safety function is affected by these parameter settings, the affected module must be considered inoperable when these conditions are not met. The cell signal processing parameters within each module affects the response and operability of only that module.

Channel operability is evaluated for each inoperable module and Required Actions taken in accordance with LCO 3.3.1.3.

C.1

The design objective for the growth rate and amplitude algorithms is to provide automatic action to limit the size of these unanticipated oscillations, thereby preventing fuel cladding damage. Several parameter settings define the function of the Amplitude and Growth Rate Algorithm. The OPRM design and licensing basis takes no credit for the Amplitude and Growth Rate Algorithm, which is provided as a defense-in-depth feature in the event of unanticipated oscillations.

(continued)

B 3.3.9 OPRM Instrumentation

BASES

ACTIONS

C.1 (continued)

Because the ability of the OPRM module to perform its safety function is not affected by these parameter settings, the affected module need not be immediately considered inoperable when these conditions are not met. These parameters are to be maintained for conformance with the licensing requirement of a defense-in-depth feature in addition to the licensed OPRM trip function. This is corrected by returning the parameters to conformance within 120 days of identification.

Since the Amplitude and Growth Rate parameters within each module affect only the defense-in-depth response within each channel module, failure to maintain the proper parameters in either module in the channel affects only the operability of that module. The trip channel requires only one operable module function, and the trip system requires only one channel for this backup function to be operable.

D.1

This Action is to be taken if the Period Based Detection Algorithm trip function is not available in accordance with LCO 3.3.1.3, and initiation of an alternate method to Detect and Suppress thermal hydraulic instability oscillations is required by the referenced LCO Required Actions. The applicable Conditions are entered as required.

E.1

As directed from Required Action D.1, this Action provides preemptive protection through Power/Flow Map operating restrictions

When operating in Region I of the Power / Flow map specified in the COLR, or when operating in Region II of the Power / Flow map specified in the COLR with less than 50% of the required LPRM upscale alarms are OPERABLE, the potential for thermal-hydraulic oscillations is greatly increased and sufficient margin may not be available for operator response to suppress potential thermal-hydraulic oscillations. Therefore, the reactor mode switch must be immediately placed in the shutdown position. Action is taken immediately to place the plant in a condition where any potential for thermal-hydraulic instabilities will be terminated.

(continued)

B 3.3.9 OPRM Instrumentation

BASES

ACTIONS (continued)

F.1

As directed from Required Action D.1, this Action provides guidance for Operator action in response to thermal-hydraulic instability oscillations.

When operating in Region II of the Power/Flow map specified in the COLR immediate response is necessary when there are indications that thermal hydraulic oscillations are occurring as defined in the CONDITION.

LPRM upscale alarms are required to detect reactor core thermal-hydraulic instability events. The criteria for determining which LPRM upscale alarms are required is based on assignment of these alarms to designated core zones. These core zones consist of the level A, B, and C alarms in 4 or 5 adjacent LPRM strings. The number and location of LPRM strings in each zone assure that with 50% or more of the associated LPRM upscale alarms OPERABLE sufficient monitoring capability is available to detect core wide and regional oscillations. Operating plant instability data is used to determine the specific LPRM strings assigned to each zone.

G.1

As directed from Required Action D.1, this Action provides guidance for Operator action in response to operation in conditions that may lead to thermal-hydraulic instability oscillations.

When operating in Region II of the Power/Flow map specified in the COLR, the potential for thermal-hydraulic oscillations is increased and sufficient margin may not be available for operator response to suppress potential thermal-hydraulic oscillations. Therefore, action must be initiated immediately to restore operation outside of Regions II of the Power/Flow map specified in the COLR. This can be accomplished by either decreasing THERMAL POWER with control rod insertion or increasing core flow by increasing recirculation pump speed. The starting of a recirculation pump will not be used as a means to exit the excluded Regions because the starting of a recirculation pump with the plant operating above the 80% rod line is prohibited due to potential instability problems.

(continued)

B 3.3.9 OPRM Instrumentation

BASES

ACTIONS (continued)

H.1

The LPRMs provide a capability to monitor power in selected locations of the reactor core. The LPRM Upscale Alarm Instrumentation provides information concerning local power oscillations. Condition G requires a reactor scram when operating in Region II of the Power/Flow map specified in the COLR with indications that thermal hydraulic oscillations are occurring. The number and location of LPRM strings in each zone assures that with 50% or more of the associated LPRM upscale alarms OPERABLE any power oscillations which could occur would be detected and proper actions can be taken.

A sign is posted in the Control Room to ensure that plant operators are aware of the system condition if a plant transient results in the plant entering into the instability region.

TRS

TRS 3.3.9.1

Required only when the OPRM trip function is not available, this TRS ensures the combination of core flow and THERMAL POWER are within required limits to prevent uncontrolled thermal hydraulic oscillations by ensuring the recirculation loops are within the limits established by the Power / Flow map specified in the COLR. At low recirculation flows and high reactor power, the reactor exhibits increased susceptibility to thermal-hydraulic instability. The Power / Flow map specified in the COLR is based on guidance provided in References 7, 8, and 9 which also provided the guidance on how to respond to operation in these conditions. The 24 hour Frequency is based on operating experience and the operator's inherent knowledge of the current reactor status, including significant changes in THERMAL POWER and core flow to ensure the requirements are constantly met.

TRS 3.3.9.2

This TRS is to be performed at the specified Frequency to ensure that the LPRM Upscale Alarm Instrumentation are maintained OPERABLE.

(continued)

B 3.3.9 OPRM Instrumentation

BASES

TRS (continued)

TRS 3.3.9.3

The parameter setpoint verification surveillance compares the desired settings and setpoints to the values contained in the processor memory. This surveillance is required to assure that the settings are maintained in accordance with the setpoint analysis. The frequency is based on the OPRM CALIBRATION frequency per SR 3.3.1.3.3.

REFERENCES

1. NEDO-31960-A, BWROG Long Term Solution Licensing Methodology
2. NEDO-31960-A, Supp. 1, BWROG Long Term Solution Licensing Methodology
3. NEDO-32465-A, BWROG Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology and Reload Applications
4. CENPD-400-P-A, Generic Topical Report for the ABB Option III OPRM
5. Generic Letter 94-02, Long-Term Solutions and Upgrade Of Interim Operating Recommendations for Thermal-Hydraulic Instabilities in Boiling Water Reactors
6. LCO 3.3.1.3, OPRM Instrumentation
7. GE Service Information Letter No. 380, "BWR Core Thermal Hydraulic Stability," Revision 1, February 10, 1984.
8. Letter, L. A. England to M. J. Virgilio, "BWR Owner's Group Guidelines for Stability Interim Corrective Action," June 6, 1994.
9. EMF-CC-074(P)(A), Volume 4, Revision 0, "BWR Stability Analysis: Assessment of STAIF with Input from MICROBURN-B2," November 1999.