CORE OPERATING LIMITS REPORT.

PALO VERDE NUCLEAR GENERATING STATION (PVNGS)

- UNIT 3 CYCLE 6

Revision 3



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This Report has been prepared in accordance with the requirements of Technical Specification 6.9.1. The Core Operating Limits have been developed using the NRC approved methodologies specified in Section 6.9.1.10 of the Palo Verde Unit 3 Technical Specifications.

AFFECTED PVNGS TECHNICAL SPECIFICATIONS

- 3.1.1.1 Shutdown Margin Reactor Trip Breakers Open
- 3.1.1.2 Shutdown Margin Reactor Trip Breakers Closed
- 3.1.1.3 Moderator Temperature Coefficient
- 3.1.2.7 Boron Dilution Alarms
- 3.1.3.1 Movable Control Assemblies CEA Position
- 3.1.3.6 Regulating CEA Insertion Limits
- 3.1.3.7 Part Length CEA Insertion Limits
- 3.2.1 Linear Heat Rate
- 3.2.3 Azimuthal Power Tilt T_q
- 3.2.4 DNBR Margin
- 3.2.7 Axial Shape Index
- 3.9.1 Boron Concentration (Mode 6) --

CORE OPERATING LIMITS

The cycle-specific operating limits for the specifications listed are presented below.

3.1.1.1 - Shutdown Margin - Reactor Trip Breakers Open

The Shutdown Margin shall be greater than or equal to that shown in Figure 3.1.1.1-1.

3.1.1.2 - Shutdown Margin - Reactor Trip Breakers Closed

The Shutdown Margin shall be greater than or equal to that shown in Figure 3.1.1.2-1.

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CORE OPERATING LIMITS - CONTINUED

3.1.1.3 - Moderator Temperature Coefficient

The moderator temperature coefficient (MTC) shall be within the area of Acceptable Operation shown in Figure 3.1.1.3-1.

3.1.2.7 - Boron Dilution Alarms

With one or both start-up channel high neutron flux alarms inoperable, the RCS boron concentration shall be determined at the applicable monitoring frequency specified in Tables 3.1.2.7-1 through 3.1.2.7-5.

3.1.3.1 - Movable Control Assemblies - CEA Position

With one or more full-length or part-length CEAs misaligned from any other CEAs in its group by more than 6.6 inches, the minimum required MODES 1 and 2 core power reduction is specified in Figure 3.1.3.1-1.

<u>3.1.3.6 - Regulating CEA Insertion Limits</u>

One or more CEAC's <u>OPERABLE</u>: With COLSS IN SERVICE, regulation CEA groups shall be limited to the withdrawal sequence and to the insertion limits shown in Figure 3.1.3.6-1; with COLSS <u>OUT</u> OF SERVICE, regulation CEA groups shall be limited to the withdrawal sequence and to the insertion limits shown in Figure 3.1.3.6-2.

3.1.3-7 - Part Length CEA Insertion Limits

One or more CEAC's OPERABLE: The part length CEA groups shall be limited to the insertion limits shown in Figure 3.1.3.7-1.

<u> 3.2.1 - Linear Heat Rate</u>

The linear heat rate limit of 13.5 kW/ft shall be maintained.

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CORE OPERATING LIMITS - CONTINUED

<u>3.2.3 - Azimuthal Power Tilt - Tg</u>

The AZIMUTHAL POWER TILT (T_q) shall be less than or equal to the limit in Figure 3.2.3-1 with COLSS IN SERVICE.

<u>3.2.4 - DNBR Margin</u>

COLSS IN SERVICE and Both CEAC'S INOPERABLE - Maintaining COLSS calculated core power less than or equal to COLSS calculated core power operation limit based on DNBR decreased by the allowance shown in Figure 3.2.4-1.

COLSS OUT OF SERVICE and Either One or Both CEAC's are OPERABLE - Operating within the region of acceptable operation of Figure 3.2.4-2 using any operable CPC channel.

COLSS OUT OF SERVICE and CEAC's INOPERABLE - Operating within the region of acceptable operation of Figure 3.2.4-3 using any operable CPC channel.

<u>3.2.7 - Axial Shape Index</u>

The core average AXIAL SHAPE INDEX (ASI) shall be maintained within the following limits:

COLSS OPERABLE $-0.28 \le ASI \le 0.26$

COLSS OUT OF SERVICE (CPC) -0.20 \leq ASI \leq 0.20

3.9.1 - Boron Concentration (Mode 6)

The boron concentration of all filled portions of the Reactor Coolant System and the refueling canal shall be maintained at a uniform concentration ≥ 2650 ppm.

LIST OF FIGURES

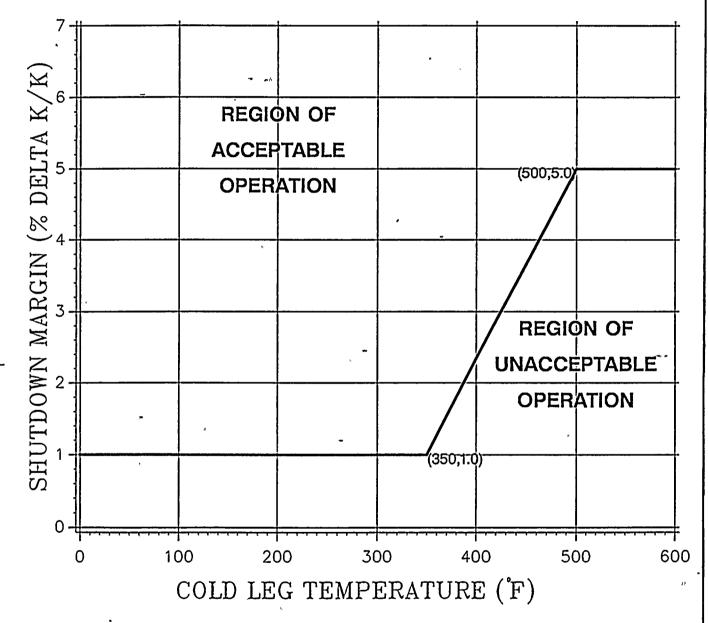
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FIGURE 3.1.1.1-1

SHUTDOWN MARGIN VERSUS COLD LEG TEMPERATURE REACTOR TRIP BREAKERS OPEN



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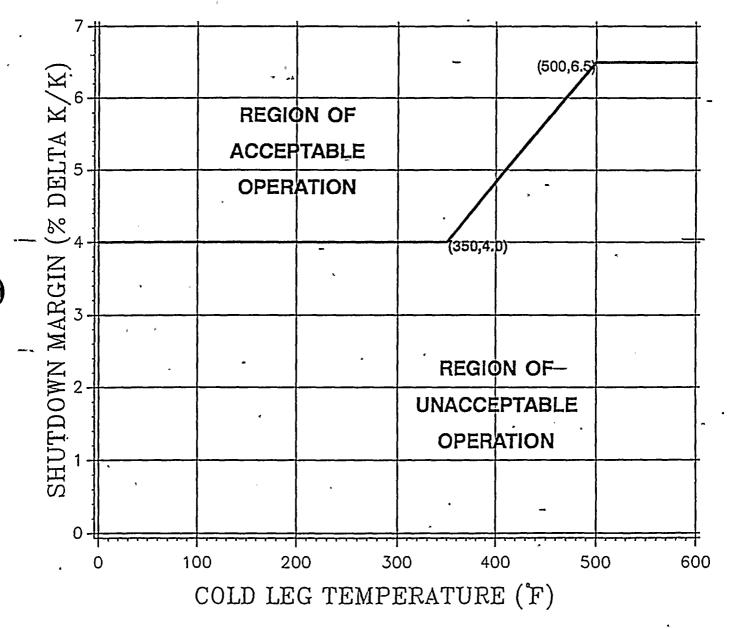
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FIGURE 3.1.1.2-1

SHUTDOWN MARGIN VERSUS COLD LEG TEMPERATURE REACTOR TRIP BREAKERS CLOSED



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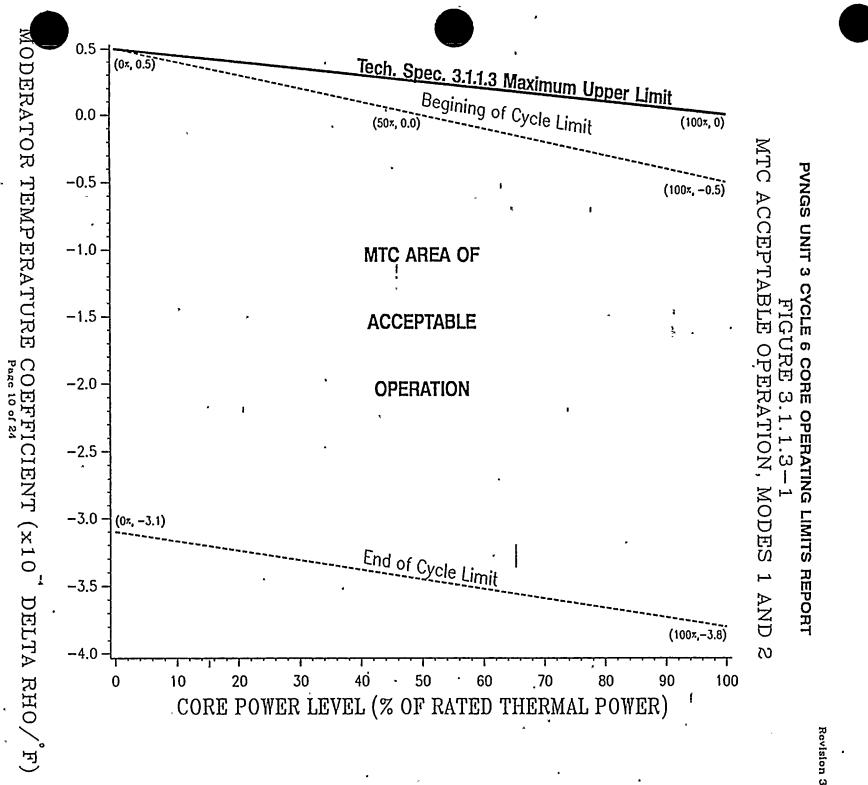


FIGURE 3.1.3.1-1 CORE POWER LIMIT AFTER CEA DEVIATION * 30 UM REQUIRED POWER REDUCTION OF RATED THERMAL POWER) 25 (6<u>) MIN_20.0</u>2 20 LED PC 10 5 IMINI 8 0 0 10 20 30 40 50 60 TIME AFTER DEVIATION, MINUTES

* WHEN CORE POWER IS REDUCED TO 55% OF RATED THERMAL • POWER PER THIS LIMIT CURVE, FURTHER REDUCTION IS NOT REQUIRED

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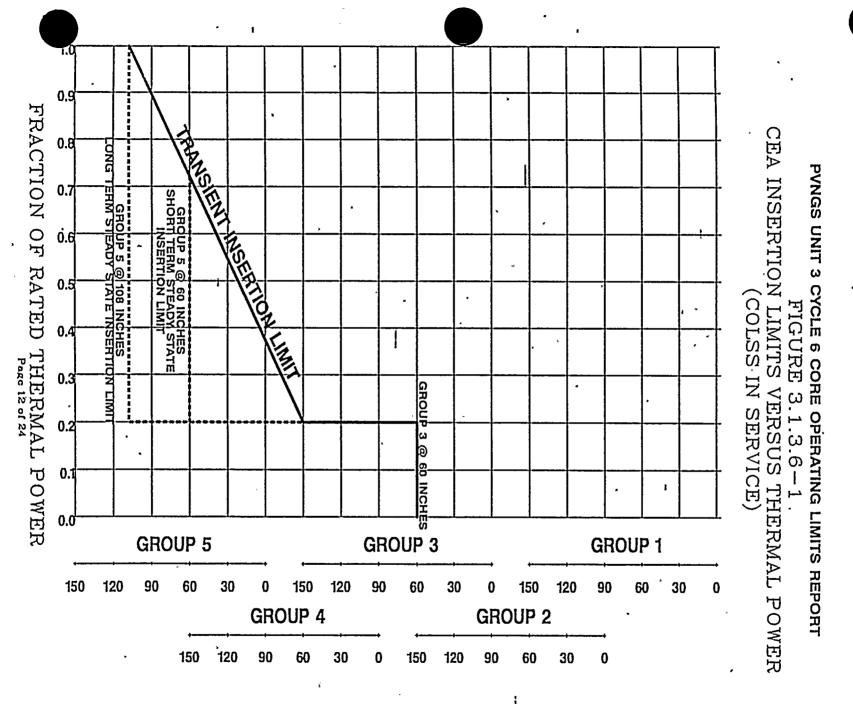
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CEA POSITION (INCHES WITHDRAWN)

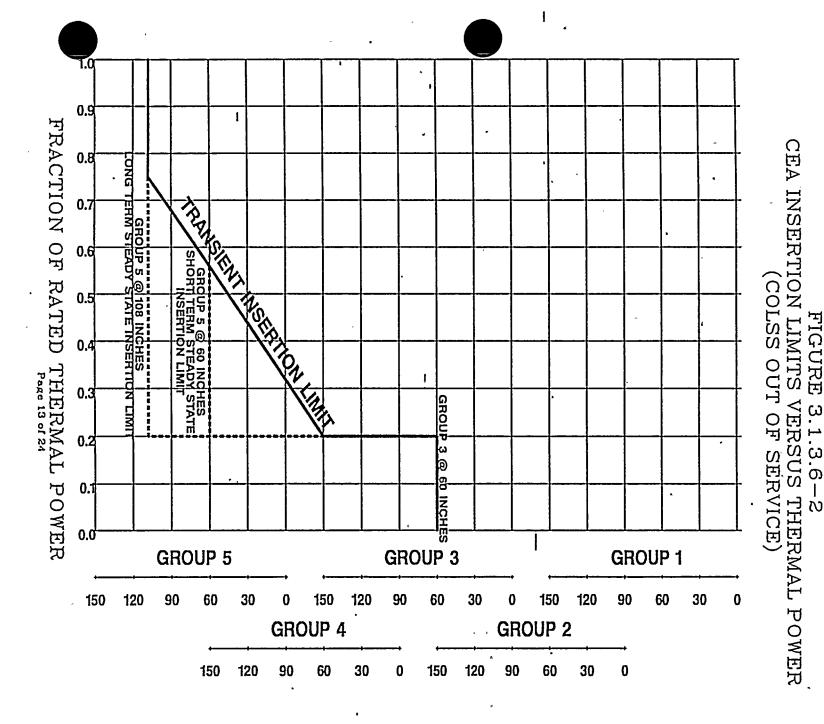
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CEA POSITION (INCHES WITHDRAWN)

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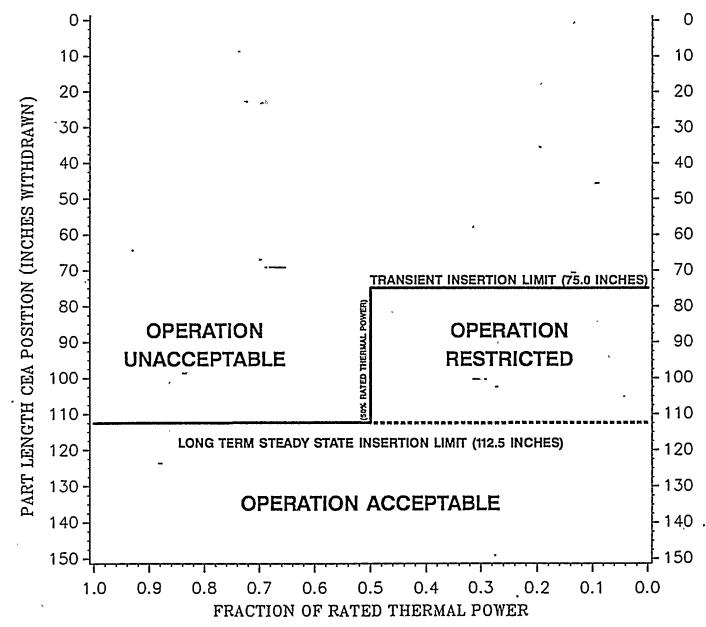
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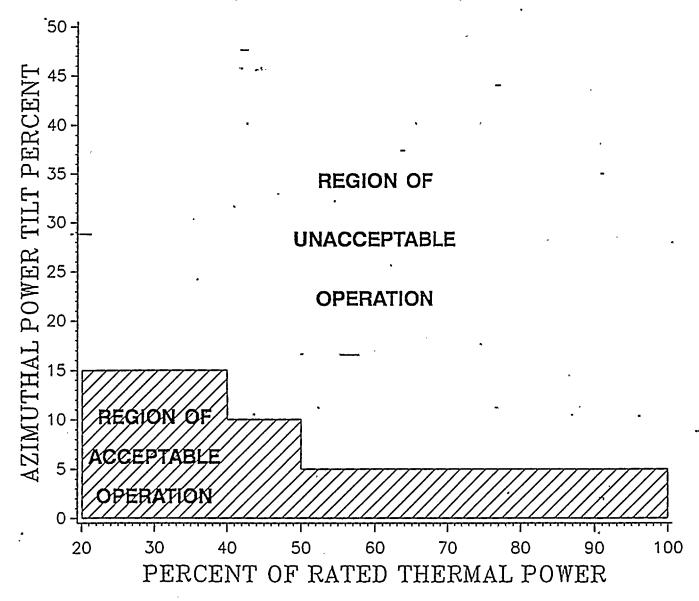
FIGURE 3.1.3.7–1



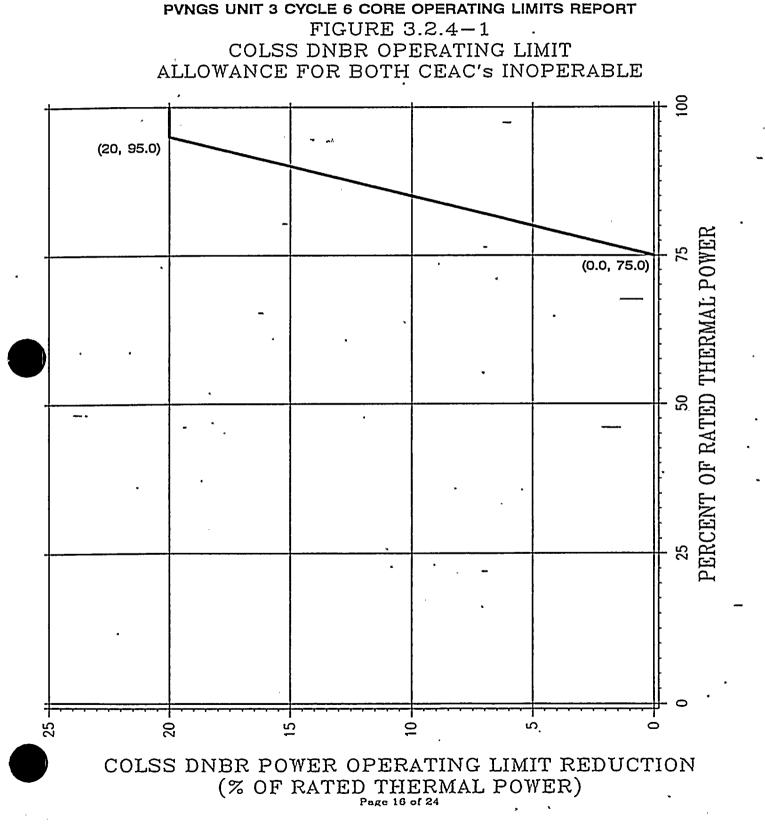


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FIGURE 3.2.3-1 AZIMUTHAL POWER TILT VERSUS THERMAL POWER (COLSS IN SERVICE)



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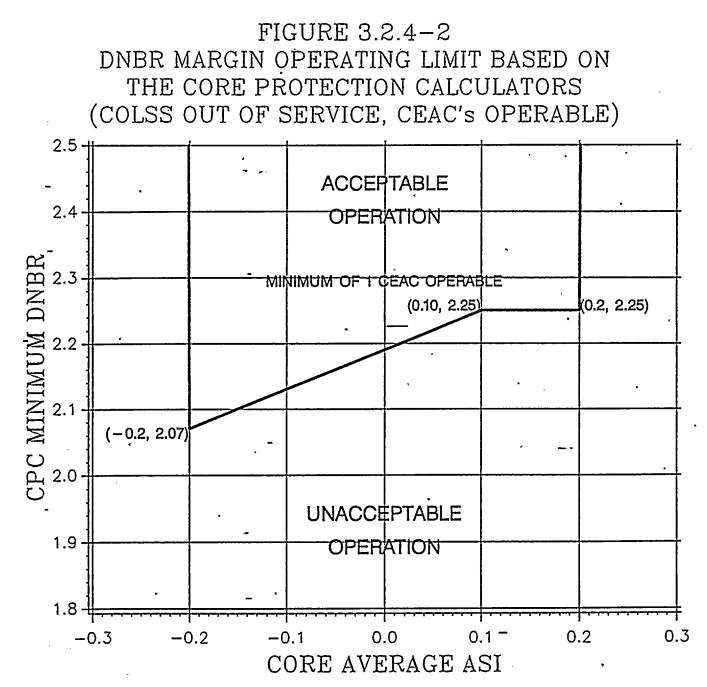
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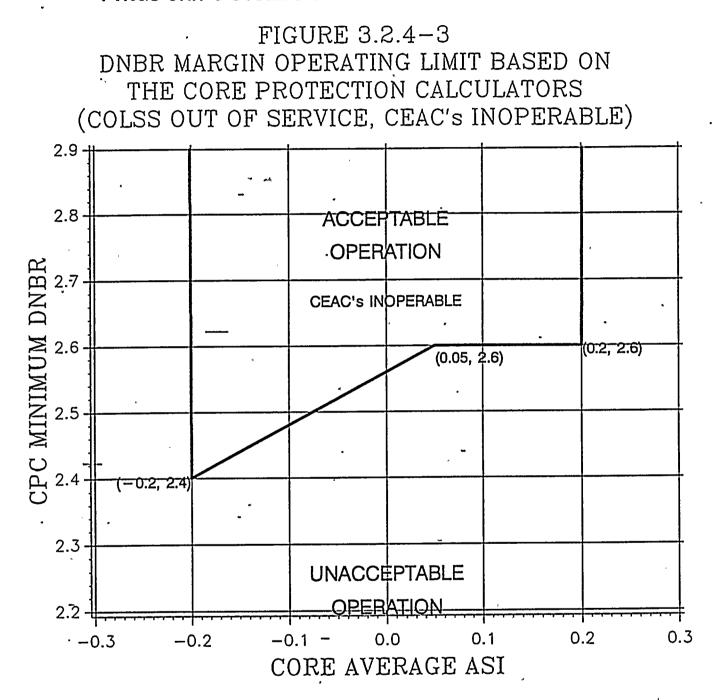
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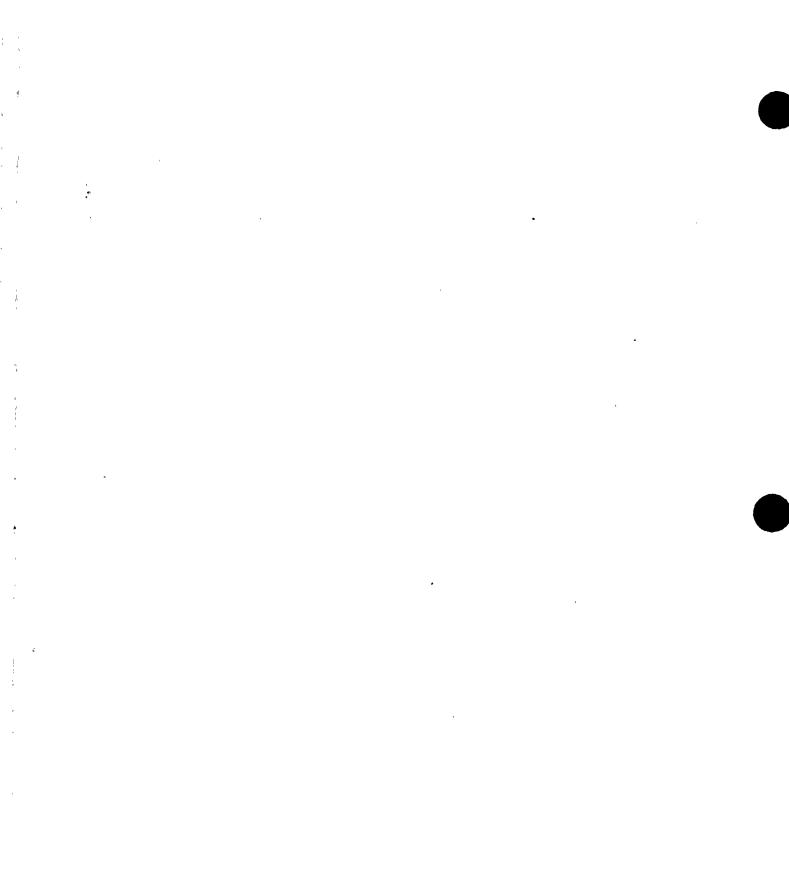
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- 3.1.2.7-4. Required Monitoring Frequencies for Backup Boron Dilution Detection as a Function of Operating Charging Pumps and Plant Operational Modes for 0.96 ≥ K_{eff} > 0.95.
- 3.1.2.7-5. Required Monitoring Frequencies for Backup Boron Dilution Detection as a Function of Operating Charging Pumps and Plant Operational Modes for $K_{eff} \leq 0.95$.



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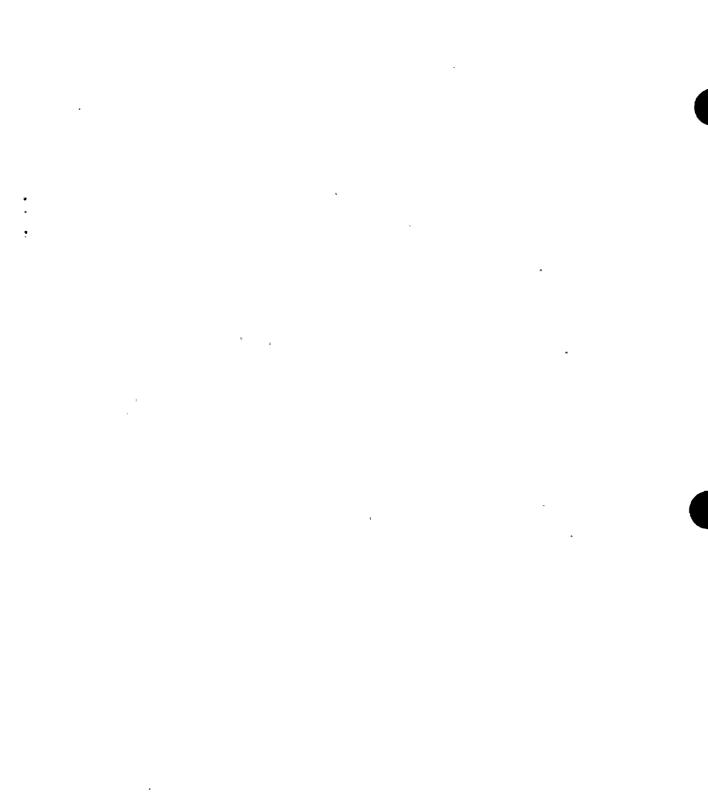
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TABLE 3.1.2.7-1

REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR K_{eff} > 0.98

ÓPERATIONAL	Number	Number of Operating Charging Pumps				
MODE	0	1	2	3		
3	12 hours	0.5 hour	ONA	ONA		
4 not on SCS	12 hours	1 hour_	ONA	ONA		
5 not on SCS	8 hours	1 hour	ONA	ONA		
4 & 5 on SCS	ONA	ONA	ONA	ONA		

Notes: SCS = Shutdown Cooling System ONA = Operation Not Allowed



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TABLE 3.1.2.7-2

REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR 0.98 ≥ K_{eff} > 0.97

OPERATIÓNAL	Number	Number of Operating Charging Pumps				
MODE	0	1	2	3		
3	12 hours	2 hours	0.5 hours	ONA		
4 not on SCS	12 hours	2.5 hours	1 hour	0.5 hours		
5 not on SCS	8 hours	2.5 hours	1 hour ·	0.5 hours		
4 & 5 on SCS	8 hours	0.5 hours	ONA	ONA		

Notes: SCS = Shutdown Cooling System ONA = Operation Not Allowed

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TABLE 3.1.2.7-3

REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR $0.97 \ge K_{eff} > 0.96$

OPERATIONAL	Number of Operating Charging Pumps			
MODE	0	1	2	3
3 .	12 hours	3.5 hours	1.5 hours	0.5 hours
4 not on SCS	12 hours	3.5 hours	1.5 hours	1 hour
5 not on SCS	8 hours	- 3.5 hours	1.5 hours	1 hour
4 & 5 on SCS	8 hours	1 hour	0.5 hours	ONA

Notes: SCS = Shutdown-Cooling System — ONA = Operation Not Allowed

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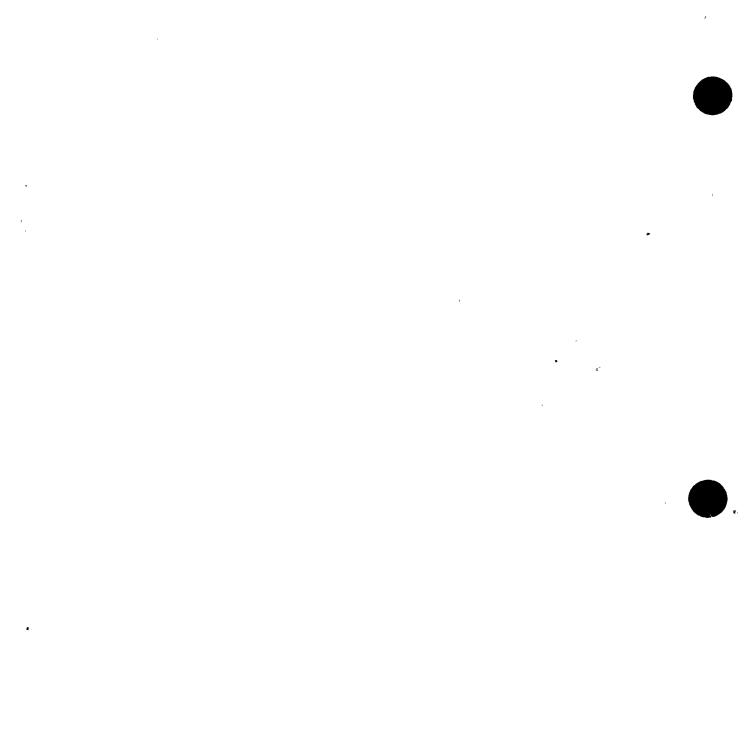
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TABLE 3.1.2.7-4

REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR 0.96 ≥ K_{eff} > 0.95

OPERATIONAL	Number	Number of Operating Charging Pumps				
MODE	0	. 1	2	3		
		-				
3	12 hours	4.5 hours	2 hours	1 hour		
4 not on SCS	12 hours	5 hours	2 hours	1 hour		
5 not on SĊS	8 hours	5 hours	2 hours	1 hour		
4 & 5 on SCS	8 hours	2 hours	0.5 hours	ONA		

Notes: SCS = Shutdown Cooling System ONA = Operation Not Allowed



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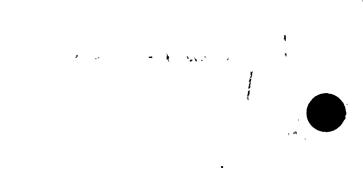
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TABLE 3.1.2.7-5

REQUIRED MONITORING FREQUENCIES FOR BACKUP BORON DILUTION DETECTION AS A FUNCTION OF OPERATING CHARGING PUMPS AND PLANT OPERATIONAL MODES FOR $K_{eff} \le 0.95$

0 12 hours 12 hours	1 6 hours - 6 hours	2 2.5 hours 3 hours	•
		•	•
12 hours	- 6 hours	3 hours	1 <i>m</i> 1
		5 110415	1.5 hours
8 hours	6 hours	3 hours	1.5 hours
8 hours	2 hours	1 hour	0.5 hours
24 hours	8 hours .	3.5 hours	2 hours
24 hours	2 hours	0.5 hours	ONA .
	8 hours 24 hours	8 hours 2 hours 24 hours 8 hours .	8 hours2 hours1 hour24 hours8 hours. 3.5 hours

Notes: SCS = Shutdown Cooling System ONA = Operation not allowed



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