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CORE OPERATING LIMITS REPORT - CYCLE 14
HOPE CREEK GENERATING STATION
FACILITY OPERATING LICENSE NPF-57
DOCKET NO. 50-354

In accordance with section 6.9.1.9 of the Hope Creek Technical Specifications, PSEG Nuclear, LLC submits Revision 0 of the Core Operating Limits Report (COLR) for Hope Creek Cycle 14 (NFS-0253, Rev. 0) in Attachment 1 of this letter.

Should you have any questions, please contact James Barstow at (856) 339-1384.

Sincerely,

Michael Jesse
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Attachment

A001

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NFS-0253, Rev. 0

NFS-0253
Revision 0

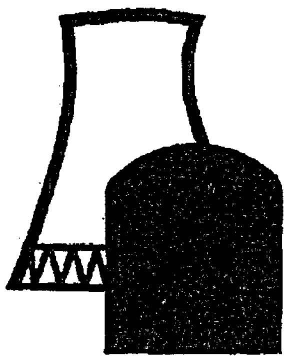
Hope Creek Generating Station

Unit 1

Core Operating Limits Report

Cycle 14 / Reload 13

Effective Date: 5/1/06



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1.0 INTRODUCTION

The purpose of this report is to provide the Core Operating Limits for Hope Creek Generation Station Unit 1 Cycle 14/ Reload 13 operation. This report provides the core thermal limits for Average Planar Linear Heat Generation Rate (APLHGR), Minimum Critical Power Ratio (MCPR), and Linear Heat Generation Rate (LHGR), as well as power and flow dependent adjustments to these limits that support off-rated operation and Single recirculation Loop Operation (SLO). Additionally, this report provides the Allowable Value for the Oscillation Power Range Monitor (OPRM) trip setpoint, and the method of average scram speed determination. Finally, this report provides a reference to the most recent revision of the implemented approved licensing methodology.

These operating limit LCO values have been determined using NRC approved methods contained in GESTAR-II, NEDE-24011-P-A (Revision 15) and are established such that all applicable fuel thermal-mechanical, core thermal-hydraulic, ECCS, and nuclear limits such as shutdown margin, and transient and accident analysis limits are met.

Hope Creek Technical Specifications Section 3.2 references this report as the source for certain LIMITING CONDITIONS FOR OPERATION. These are included in Section 2 of this document. Hope Creek Technical Specification 6.9.1.9 also requires that this report, including any mid cycle revisions, shall be provided, upon issuance, to the NRC.

This document is specific to Hope Creek Generating Station Unit 1 Cycle 14 / Reload 13 and shall not be applicable to any other core or cycle design. The thermal limits contained in this report are applicable whether the Crossflow™ correction factor is applied or not applied. This report is applicable for Cycle 14 operation from the date of issuance through the end of effective full power capability or a cycle exposure of 12070 *MWd/MTU* (10950 *MWd/STU*), whichever occurs first. End of effective full power capability is reached when 100% rated power can no longer be maintained by increasing core flow (up to 105% of rated core flow), at rated feedwater temperatures, in the all-rods-out configuration.

2.0 TECHNICAL SPECIFICATIONS THAT REFERENCE THE COLR

The TECHNICAL SPECIFICATIONS THAT REFERENCE THE COLR presented in this section are referenced by the Hope Creek Technical Specifications.

Tech. Spec.	Title
2.1 Bases	Safety Limit Bases
3/4.2.1	Average Planar Linear Generation Rate
3/4.2.3	Minimum Critical Power Ratio
3/4.2.4	Linear Heat Generation Rate
3/4.3.11	Oscillation Power Range Monitor
3/4.4.1	Recirculation System Recirculation Loops
3/4.2.1 Bases	Average Planar Linear Heat Generation Rate
3/4.2.4 Bases	Linear Heat Generation Rate
3/4.3.11 Bases	Oscillation Power Range Monitor (OPRM)
3/4.4.1 Bases	Recirculation System
6.9.1.9	Administrative Controls, Core Operating Limits Report

2.1 AVERAGE PLANAR LINEAR HEAT GENERATION RATE

LIMITING CONDITION FOR OPERATION:

All AVERAGE PLANAR LINEAR HEAT GENERATION RATES (APLHGRs) shall be less than or equal to the limits specified in Table 2.1-1 and Table 2.1-2 for Two recirculation Loop Operation (TLO).

When the Technical Specification Section 3/4.4.1 ACTION statement a.1.d is entered from that section's Limiting Condition for Operation, reduce the APLHGR limits to the values specified in Tables 2.1-1 and 2.1-2 for Single recirculation Loop Operation (SLO).

Linear interpolation shall be used to determine APLHGR limits as a function of exposure for intermediate values in Table 2.1-1 and Table 2.1-2.

Table 2.1-1: APLHGR Data for GE14 Fuel

Average Planar Exposure		APLHGR Limit kW/ft	
MWD/MTU	MWD/STU	Two Loop Operation	Single Loop Operation
0.00	0.00	12.82	10.26
21090	19130	12.82	10.26
63500	57610	8.00	6.40
70000	63500	5.00	4.00

Table 2.1-2: APLHGR Data for SVEA-96+ Fuel

Average Planar Exposure		APLHGR Limit kW/ft	
MWD/MTU	MWD/STU	Two Loop Operation	Single Loop Operation
0.00	0.00	12.85	10.28
3680	3340	12.85	10.28
16000	14510	10.97	8.78
65000	58970	7.24	5.79

2.2 MINIMUM CRITICAL POWER RATIO

LIMITING CONDITION FOR OPERATION

The MINIMUM CRITICAL POWER RATIO (MCPR) shall be equal to or greater than the MCPR limit computed from the following steps:

1. Determine τ as defined in Appendix A.

NOTE
The SLO operating condition MCPR values in Tables 2.2-1, 2.2-2, 2.2-3 and 2.2-4 implement the increase in the MCPR Safety Limit to meet the requirements of Technical Specification Section 3/4.4.1 ACTION statement a.1.c.

2. Linearly interpolate a MCPR value as a function of τ from the MCPR value at $\tau = 0$ and the MCPR value at $\tau = 1$ as specified in Table 2.2-1 and Table 2.2-2 for the appropriate operating condition.

3. For the power dependent MCPR adjustment, when thermal power is ≥ 30% rated core thermal power, determine a K_p value by linearly interpolating a K_p value as a function of core rated thermal power from Table 2.2-3. Multiply the MCPR value obtained from Step 2 by the K_p value to determine the power dependent MCPR limit.

   When core thermal power is ≥ 25% rated and < 30% rated thermal power, determine the appropriate power dependent MCPR limit by linearly interpolating between the MCPR limits as a function of rated core thermal power for the appropriate core flow condition using the information in Table 2.2-3.

4. For the flow dependent MCPR adjustment, determine the appropriate flow dependent MCPR limit by linearly interpolating between the MCPR limits as a function of rated core flow using the information in Table 2.2-4.

5. Choose the most limiting (highest value) of the power and flow dependent MCPR limits determined in steps 2 and 3 as the value for the MCPR limit for the Limiting Condition For Operation.

Note that the MCPR limit is a function of core average scram speed (τ), cycle exposure, core thermal power, total core flow, EOC-RPT operability, the number of reactor coolant recirculation loops in operation, and main turbine bypass operability.

EOC-RPT system operability is defined by Hope Creek Technical Specification 3.3.4.2.

2.2 MINIMUM CRITICAL POWER RATIO (Continued)

Reactor coolant recirculation loop operation is defined by Hope Creek Technical Specification 3.4.1.1.

Main Turbine Bypass operability is defined by Hope Creek Technical Specification 3.7.7.

Table 2.2-1: Cycle 14 MCPR Operating Limits:
Cycle Exposure ≤ 9755 MWD/MTU *(≤8850 MWD/STU)*

Main Turbine Bypass Operable			
Operating Condition	Scram Speed Option	GE14	SVEA-96+
TLO-EOC-RPT Operable	A	1.45	1.48
	B	1.34	1.37
TLO-EOC-RPT Inoperable	A	1.48	1.49
	B	1.37	1.38
SLO-EOC-RPT Operable	A	1.47	1.50
	B	1.36	1.39
SLO-EOC-RPT Inoperable	A	1.50	1.51
	B	1.39	1.40

Scram Speed Option A $\tau = 1$, Scram Speed Option B $\tau = 0$, TLO = Two recirculation Loop Operation, SLO = Single recirculation Loop Operation

Table 2.2-2: Cycle 14 MCPR Operating Limits:
Cycle Exposure > 9755 MWD/MTU *(> 8850 MWD/STU)*

Main Turbine Bypass Operable			
Operating Condition	Scram Speed Option	GE14	SVEA-96+
TLO-EOC-RPT Operable	A	1.57	1.59
	B	1.40	1.42
TLO-EOC-RPT Inoperable	A	1.61	1.62
	B	1.44	1.45
SLO-EOC-RPT Operable	A	1.59	1.61
	B	1.42	1.44
SLO-EOC-RPT Inoperable	A	1.63	1.64
	B	1.46	1.47

Scram Speed Option A $\tau = 1$, Scram Speed Option B $\tau = 0$, TLO = Two recirculation Loop Operation, SLO = Single recirculation Loop Operation

Table 2.2-3: Power Dependent MCPR Adjustments and Multiplier (K_p) Data

Operating Condition	Core Flow (% of rated)	Core Thermal Power (% of rated)					
		≥ 25	< 30	≥ 30	45	60	≥ 100
		MCPR Limit		MCPR Multiplier, Kp			
TLO	≤ 60	2.25	2.12	1.481	1.280	1.150	1.000
	> 60	2.93	2.70				
SLO	≤ 60	2.27	2.14	1.481	1.280	1.150	1.000
	> 60	2.95	2.72				

TLO = Two recirculation Loop Operation, SLO = Single recirculation Loop Operation

Table 2.2-4: Flow Dependent MCPR Limit ($MCPR_f$)

Operating Condition	Core Flow (% of rated)			
	30	60	77	105
	MCPR Limit			
TLO	1.53		1.25	1.25
SLO	1.55	1.35		

2.3 LINEAR HEAT GENERATION RATE

LIMITING CONDITION FOR OPERATION

The LINEAR HEAT GENERATION RATE (LHGR) shall not exceed the limit computed from the following steps:

1. Determine the exposure dependent LHGR limit for the appropriate fuel design using linear interpolation between the values in Table 2.3-1 and Table 2.3-2.

> **NOTE**
>
> For Two recirculation Loop Operation utilize steps 1, 2, 3 and 6 to determine the LCO LHGR limits for Two recirculation Loop Operation (TLO).
>
> When the Technical Specification Section 3/4.4.1 ACTION statement a.1.e is entered from that section's Limiting Condition for Operation (LCO), utilize steps 1, 4, 5 and 6 to determine the LCO LHGR limits for Single recirculation Loop Operation (SLO).

2. For the power dependent LHGR adjustment for TLO, determine a $LHGRFAC_p$ value by linearly interpolating a $LHGRFAC_p$ value as a function of rated core thermal power for the core flow condition being evaluated from the TLO entries in Table 2.3-3. Multiply the LHGR values obtained from Step 1 by the $LHGRFAC_p$ value to determine the power dependent LHGR limits for each fuel design.

3. For the flow dependent LHGR adjustment for TLO, determine a $LHGRFAC_f$ value by linearly interpolating a $LHGRFAC_f$ value as a function of rated core flow from the TLO entries in Table 2.3-4. Multiply the LHGR values obtained from Step 1 by the $LHGRFAC_f$ value to determine the flow dependent LHGR limits for each fuel design.

4. For the power dependent LHGR adjustment for SLO, determine a $LHGRFAC_p$ value by linearly interpolating a $LHGRFAC_p$ value as a function of rated core thermal power for the core flow condition being evaluated from the SLO entries in Table 2.3-3. Multiply the LHGR values obtained from Step 1 by the $LHGRFAC_p$ value to determine the power dependent LHGR limits for each fuel design.

5. For the flow dependent LHGR adjustment for SLO, determine a $LHGRFAC_f$ value by linearly interpolating a $LHGRFAC_f$ value as a function of rated core flow from the SLO entries in Table 2.3-4. Multiply the LHGR values obtained from Step 1 by the $LHGRFAC_f$ value to determine the flow dependent LHGR limits for each fuel design.

2.3 LINEAR HEAT GENERATION RATE (Continued)

6. Choose the most limiting (lowest value) of the power and flow dependent LHGR limits determined in steps 2 and 3 (TLO) or 4 and 5 (SLO) as the value for the LHGR limit for the Limiting Condition For Operation.

Table 2.3-1: LHGR Limit for GE14

Peak Pellet Exposure		LHGR Limit
MWD/MTU	MWD/STU	kW/ft
0.0	0.0	13.40
16000	14510	13.40
63500	57610	8.00
70000	63500	5.00

Table 2.3-2: LHGR Limit for SVEA-96+

Peak Pellet Exposure		LHGR Limit
MWD/MTU	MWD/STU	kW/ft
0.0	0.0	13.41
16000	14510	10.97
65000	58970	7.24

Table 2.3-3: Power Dependent Linear Heat Generation Rate Multiplier ($LHGRFAC_p$)

Operating Condition	Core Flow (% of rated)	Core Thermal Power (% of rated)					
		≥ 25	< 30	≥ 30	61.7	70	≥ 100
		$LHGRFAC_p$ Multiplier					
TLO	≤ 60	0.577	0.590	0.634			1.000
	> 60	0.476	0.502				
SLO	≤ 60	0.577	0.590	0.634	0.800	0.800	
	> 60	0.476	0.502				

Table 2.3-4: Flow Dependent Linear Heat Generation Rate Multiplier ($LHGRFAC_f$)

Operating Condition	Core Flow (% of rated)					
	30	50	52.7	60	82.2	105
	$LHGRFAC_f$ Multiplier					
TLO	0.500	0.782			1.000	1.000
SLO	0.500	0.782	0.800	0.800		

2.4 OPRM TRIP SETPOINT

LIMITING CONDITION FOR OPERATION

Four channels of the OPRM instrumentation shall be OPERABLE. Each OPRM channel period based algorithm amplitude trip setpoint (Sp) shall be less than or equal to the Allowable Value of 1.08.

3.0 REFERENCES

1. Nuclear Fuel Section Design Input File HCG.5-0002,"General Electric Standard Application for Reactor Fuel," General Electric Company, NEDE-24011-P-A-15, and the U.S. Supplement NEDE-24011-P-A-15-US.

2. Nuclear Fuel Section Design Input File, HCG.5-0041, "Supplemental Reload Licensing Report for Hope Creek Unit 1 Reload 13 Cycle 14" GE Nuclear Energy 0000-0041-6021-SRLR, Rev. 1, March 2006.

3. Nuclear Fuel Section Design Input File HCG.5-0041, "Fuel Bundle Information Report for Hope Creek Unit 1 Reload 13 Cycle 14," 0000-0041-6021-FBIR, Rev. 0 February 2006.

Appendix A: Method of Core Average Scram Speed Calculation

Method of Core Average Scram Speed, τ, Calculation

τ is defined as

$$\tau = \frac{(\tau_{ave} - \tau_B)}{\tau_A - \tau_B}$$

where:

$\tau_A = 0.86$ seconds, control rod average scram insertion time limit to notch 39 per Specification 3.1.3.3

$$\tau_B = 0.672 + 1.65\left[\frac{N_1}{\sum_{i=1}^{n} N_i}\right]^{1/2} (0.016)$$

$$\tau_{ave} = \frac{\sum_{i=1}^{n} N_i \tau_i}{\sum_{i=1}^{n} N_i}$$

n = number of surveillance tests performed to date in cycle,
N_i = number of active control rods measured in the i^{th} surveillance test,
τ_i = average scram time to notch 39 of all rods measured in the i^{th} surveillance test, and
N_1 = total number of active rods measured in Specification 4.1.3.2.a.

If $\tau_{ave} \le \tau_B$, set $\tau = 0$ to apply Option B OLMCPR.
τ shall be 1.0 ($\tau = 1.0$) prior to performance of the initial scram time measurements for the cycle in accordance with Specification 4.1.3.2.