Attachment 1 Contains Proprietary Information to be Withheld
from Public Disclosure Pursuant to 10 CFR 2.390

PSEG Nuclear LLC
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PSEG
Nuclear LLC

LR-N21-0005

TS 6.9.1.9

January 29, 2021

United States Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Hope Creek Generating Station
Renewed Facility Operating License No. NPF-57
NRC Docket No. 50-354

Subject: Core Operating Limits Report, Reload 22, Cycle 23, Revision 20

PSEG Nuclear, LLC submits the Core Operating Limits Report (COLR) for Hope Creek Generating Station (HCGS) Reload 22, Cycle 23, Revision 20 as required by Hope Creek Technical Specification 6.9.1.9.

Attachment 1 is marked proprietary in its entirety because it contains information proprietary to Global Nuclear Fuel – Americas, LLC (GNF-A). GNF-A requests that Attachment 1 be withheld from public disclosure per 10 CFR 2.390(a)(4) and 10 CFR 9.17(a)(4). Attachment 2 is a non-proprietary version of the COLR. Attachment 3 is the GNF-A affidavit requesting withholding of proprietary information from public disclosure.

There are no commitments contained in this letter.

Should you have any questions, please contact Mr. Harry Balian at (856) 339 - 2173.

Sincerely,

Jean Fleming

Jean A. Fleming
Director – Site Regulatory Compliance

Attachment 1 - Core Operating Limits Report, Reload 22, Cycle 23, Revision 20 – Proprietary
Attachment 2 - Core Operating Limits Report, Reload 22, Cycle 23, Revision 20 – Non-Proprietary
Attachment 3 - Affidavit for Core Operating Limits Report for Hope Creek Generating Station Unit 1

cc: Regional Administrator - NRC Region 1
US NRC NRR Project Manager – Hope Creek
US NRC Senior Resident Inspector - Hope Creek
NJ Department of Environmental Protection, Bureau of Nuclear Engineering
Commitment Coordinator – Hope Creek Generating Station
Corporate Commitment Coordinator – PSEG Nuclear, LLC

LR-N21-0005

Attachment 2

Core Operating Limits Report, Reload 22, Cycle 23, Revision 20
(Non-Proprietary Version)

Attachment 2 to NFS 21-008

CORE OPERATING LIMITS REPORT

FOR

Hope Creek Generating Station Unit 1

RELOAD 22, CYCLE 23

Prepared By: (SAP#80125324/2280) Date: 01/22/2021
Eric S. Scott

Reviewed By: (SAP#80125324/2290) Date: 01/22/2021
Kenneth W. Buckwheat

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Francis J. Safin

COLR HOPE CREEK 1 Rev 20 (Cycle 23)

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COLR HOPE CREEK 1 Rev 20 (Cycle 23)

List of Tables

1.0 Terms and Definitions

ABSP	Automated Backup Stability Protection
APLHGR	Average Planar Linear Heat Generation Rate
ARTS	APRM and RBM Technical Specification Analysis
BSP	Backup Stability Protection
COLR	Core Operating Limits Report
DSS-CD	Detect and Suppress Solution – Confirmation Density
ECCS	Emergency Core Cooling Systems
EOC	End-of-Cycle
EOC-RPT	End-of-Cycle Recirculation Pump Trip
FFWTR	Final Feedwater Temperature Reduction
FWHOOS	Feedwater Heaters Out of Service
GNF	Global Nuclear Fuel
LCO	Limiting Condition for Operation
LHGR	Linear Heat Generation Rate
$LHGRFAC_f$	ARTS LHGR thermal limit flow dependent adjustments and multipliers
$LHGRFAC_p$	ARTS LHGR thermal limit power dependent adjustments and multipliers
MCPR	Minimum Critical Power Ratio
$MCPR_{99.9\%}$	Cycle-specific MCPR that ensures at least 99.9% of fuel rods are not susceptible to boiling transition
MCPRf	ARTS MCPR thermal limit flow dependent adjustments and multipliers
MCPRp	ARTS MCPR thermal limit power dependent adjustments and multipliers
OPRM	Oscillation Power Range Monitor
RBM	Rod Block Monitor
RDF	Recirculation Drive Flow
RTP	Rated Thermal Power
S_{AD}	Amplitude Discriminator Setpoint
SLO	Single Recirculation Loop Operation
TLO	Two Recirculation Loop Operation

2.0 References

Methodology References

1. "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A-28, and the U.S. Supplement NEDE-24011-P-A-28-US, September 2019.

User References

2. "GE Hitachi Boiling Water Reactor Detect and Suppress Solution – Confirmation Density," NEDC-33075P-A, Revision 8, November 2013.

3. Renewed Facility Operating License No. NPF-57, PSEG Nuclear LLC, Hope Creek Generating Station, Docket No. 50-354.

4. "Applicability of GE Methods to Expanded Operating Domains," NEDC-33173P-A, Revision 4, November 2012.

5. "GE14 Compliance with Amendment 22 of NEDE-24011-P-A (GESTAR II)," NEDC-32868P, Revision 6, March 2016.

6. "Supplemental Reload Licensing Report for Hope Creek Reload 22 Cycle 23," Global Nuclear Fuel Document No. 004N8343, Revision 0, September 2019.

7. "Fuel Bundle Information Report for Hope Creek Reload 22 Cycle 23," Global Nuclear Fuel Document No. 004N8344, Revision 0, June 2019.

8. "Option B Licensing Basis & Cycle-Independent Transient Evaluation for Implementation of the Technical Specification Improvement Program (TSIP) Scram Speed," Global Nuclear Fuel Document No. 0000-0119-7785, Revision 0, October 2010.

9. "SRLR Bases Confirmation with Control Rods Inserted at End of Cycle for Hope Creek (KT1)," Global Nuclear Fuel Document No. 002N4856, Revision 0, February 18, 2015.

10. "GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II)," NEDC-33270P, Revision 9, December 2017.

11. "Hope Creek SRLR Bases Confirmation for Control Rods Inserted at the End of Cycle," Global Nuclear Fuel Letter 005N3138, Revision 0, May 31, 2019.

12. "GESTAR II Section 3.4 Compliance Assessment for Hope Creek Cycle 23," Global Nuclear Fuel Document No. 005N5150, Revision 1, October 2019.

13. "Hope Creek Cycle 23 Projection – OLMCPR Breakpoint Adjustment," PSEG Doc. ID HCP.6-0339, Revision 0, August 24, 2020.

User References Continued

14. "Hope Creek Generating Station (KT1) Cycle 23 BSP Revision for FWTR," Global Nuclear Fuel Document No. 006N4004, Revision 0, January 2021.

3.0 General Information

This revision of the Core Operating Limits Report provides the core operating limits for Hope Creek Generating Station Unit 1 Cycle 23 operation. This report provides information relative to OPRM setpoints, backup stability protection regions, RBM setpoints, single recirculation loop operation, and core average scram speed. The power distribution limits presented here correspond to the core thermal limits for Average Planar Linear Heat Generation Rate (APLHGR), Minimum Critical Power Ratio (MCPR), and Linear Heat Generation Rate (LHGR). The $MCPR_{99.9\%}$ values determined for the generation of the MCPR power distribution limits are provided in Appendix D. Finally, this report provides references to the most recent revision of the implemented approved methodology.

These operating limit values have been determined using NRC approved methods contained in GESTAR-II (Reference 1).

These operating limit values also include limitations where required by the NRC Safety Evaluation Report for Hope Creek License Amendment Number 174, Extended Power Uprate (Reference 3) for the use of GE Licensing Topical Report NEDC-33173P, Applicability of GE Methods to Expanded Operating Domains (Reference 4).

The following sections contain operating limit values for both the GE14 fuel design and the GNF2 fuel design. The operating limit values apply to both GE14 and GNF2, unless specific values are provided for a fuel design.

The method of calculating core average scram speed, τ, is provided in Option B Licensing Basis & Cycle-Independent Transient Evaluation for Implementation of the Technical Specification Improvement Program (TSIP) Scram Speed (Reference 8).

These operating limits 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.

Various sections of the Hope Creek Technical Specifications reference this COLR. Those sections are listed in Section 5 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.

Revision 20 updates the limitations associated with FFWTR operation during Cycle 23 to reflect a maximum feedwater temperature reduction of 102°F from the design rated thermal power final feedwater temperature.

4.0 Precautions and Limitations

This document is specific to Hope Creek Generating Station Unit 1 Cycle 23 and shall not be applicable to any other core or cycle design. Revision 20 of the COLR is applicable for Cycle 23 operating from the date of issuance through the end of cycle including consideration of reduced feedwater temperatures for FWHOOS or FFWTR, and a power coastdown to a core thermal power that shall not go below 40% rated core thermal power. End of 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 allowable feedwater temperatures, in the all-rods-out configuration. The term "all-rods-out" excludes control rods that have been inserted to suppress fuel leakers, address cell friction performance, or other circumstances that would require control rod insertion such as, but not limited to, meeting Technical Specification Operability requirements. Inserted rods may be removed at any point of the cycle, including after the end of full power capability (References 9 and 11). Operation beyond the end of full power capability is defined as power coastdown operation which includes an operating assumption that vessel dome pressure will decrease during the power coastdown period as steam flow decreases (maintaining constant vessel dome pressure during the power coastdown period was not generically considered by GESTAR-II for determining the operating limit LCO values described above).

FWHOOS was evaluated for a final feedwater temperature reduction of up to 60°F from the design rated thermal power final feedwater temperature of 433.5°F (433.5°F - 60°F = 373.5°F). Therefore, Cycle 23 FWHOOS operation is limited to feedwater system configurations that result in a final feedwater temperature greater than or equal to 373.5°F at rated thermal power. FWHOOS operation and the associated limitations may be implemented any time during the operating cycle prior to cycle extension utilizing FFWTR.

FFWTR was evaluated for a final feedwater temperature reduction of up to 102°F from the design rated thermal power final feedwater temperature of 433.5°F (433.5°F - 102°F = 331.5°F). Therefore, Cycle 23 FFWTR operation is limited to feedwater system configurations that result in a final feedwater temperature greater than or equal to 331.5°F at rated thermal power which is compliant with Renewed Facility Operating License No. NPF-57 License Condition 2.C.(11): The facility shall not be operated with a rated thermal power feedwater temperature less than 331.5°F for the purpose of extending the normal fuel cycle. FFWTR operation and the associated limitations shall only be implemented for the purposes of cycle extension after rated thermal power cannot be maintained at 100% rated total core flow in the all-rods-out configuration.

5.0 Technical Specifications that Reference the COLR

The following Hope Creek Technical Specifications reference this COLR:

Technical Specification	Title
2.1	Safety Limits
2.2	Reactor Protection System Instrumentation Setpoints
3/4.1.4.3	Rod Block Monitor
3/4.2.1	Average Planar Linear Heat Generation Rate
3/4.2.3	Minimum Critical Power Ratio
3/4.2.4	Linear Heat Generation Rate
3/4.3.1	Reactor Protection System Instrumentation
3/4.3.6	Control Rod Block Instrumentation
3/4.4.1	Recirculation System Recirculation Loops
6.9.1.9	Administrative Controls, Core Operating Limits Report

5.1 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 5.1-1 (GE14) and Table 5.1-2 (GNF2) for two recirculation loop operation (TLO).

When the Technical Specification 3.4.1.1 Action Statement a.1.d is entered from that section's Limiting Condition for Operation, reduce the APLHGR limits to the values specified in Table 5.1-1 and Table 5.1-2 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 5.1-1 and Table 5.1-2.

TABLE 5.1-1 APLHGR Data for GE14

Average Planar Exposure		APLHGR Limit (kW/ft)	
MWd/MTU	MWd/STU	TLO	SLO
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 5.1-2 APLHGR Data for GNF2

Average Planar Exposure		APLHGR Limit (kW/ft)	
MWd/MTU	MWd/STU	TLO	SLO
0.00	0.00	13.78	11.02
18910	17150	13.78	11.02
67000	60780	6.87	5.50
70000	63500	5.50	4.40

5.2 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 5.2-1, 5.2-2, and 5.2-4 implement the increase in the $MCPR_{99.9\%}$ Limit to meet the requirements of Technical Specification 3.4.1.1 Action Statement a.1.c.

2. Linearly interpolate a MCPR value as a function of τ from the MCPR value at τ=0 and MCPR value at τ=1 as specified in Table 5.2-1 and Table 5.2-2 for the appropriate condition. Repeat for each fuel type.

3. For the power dependent MCPR adjustment, when thermal power is ≥ 24% 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 5.2-3. Multiply the MCPR value obtained from Step 2 by the K_p value to determine the power dependent MCPR limit for each fuel type.

   When core thermal power is < 24% rated thermal power, no thermal limits are required.

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 5.2-4.

5. Choose the most limiting (highest value) of the power and flow dependent MCPR limits determined in Steps 3 and 4 as the value for the MCPR limit for the Limiting Condition for Operation for each fuel type.

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.

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 5.2-1 MCPR Operating Limits Cycle Exposure ≤ 8,397 MWd/MTU (≤ 7,618 MWd/STU)

Main Turbine Bypass Operable			
Operating Condition	Scram Speed Option	GE14	GNF2
TLO-EOC-RPT Operable	A	1.49	1.51
	B	1.39	1.41
TLO-EOC-RPT Inoperable	A	1.51	1.53
	B	1.40	1.43
SLO-EOC-RPT Operable	A	1.52	1.54
	B	1.42	1.44
SLO-EOC-RPT Inoperable	A	1.54	1.56
	B	1.43	1.46

Scram Speed Option A τ=1, Scram Speed Option B τ=0
TLO = Two Recirculation Loop Operation
SLO = Single Recirculation Loop Operation

TABLE 5.2-2 MCPR Operating Limits Cycle Exposure > 8,397 MWd/MTU (> 7,618 MWd/STU)

Main Turbine Bypass Operable			
Operating Condition	Scram Speed Option	GE14	GNF2
TLO-EOC-RPT Operable	A	1.60	1.56
	B	1.43	1.46
TLO-EOC-RPT Inoperable	A	1.63	1.58
	B	1.46	1.48
SLO-EOC-RPT Operable	A	1.63	1.59
	B	1.46	1.49
SLO-EOC-RPT Inoperable	A	1.66	1.61
	B	1.49	1.51

Scram Speed Option A τ=1, Scram Speed Option B τ=0
TLO = Two Recirculation Loop Operation
SLO = Single Recirculation Loop Operation

TABLE 5.2-3 Power Dependent MCPR Multiplier (K_p) Data

Operating Condition	Core Thermal Power (%of Rated)			
	24	45	60	≥100
	MCPR Multiplier K_p			
TLO	1.561	1.280	1.150	1.000
SLO	1.561	1.280	1.150	1.000

K_p is linearly interpolated between core thermal power entries.
The K_p multiplier is the same for both GE14 and GNF2.
TLO = Two Recirculation Loop Operation
SLO = Single Recirculation Loop Operation

TABLE 5.2-4 Flow Dependent MCPR Limit ($MCPR_f$)

Operating Condition	Core Flow (% of Rated)			
	30	60	92.9	105
	MCPR Limit			
TLO	1.58	[redacted]	1.20	1.20
SLO	1.61	1.43	[redacted]	

$MCPR_f$ is linearly interpolated between core flow entries.
The $MCPR_f$ value is the same for both GE14 and GNF2.
TLO = Two Recirculation Loop Operation
SLO = Single Recirculation Loop Operation

5.3 Linear Heat Generation Rate

LIMITING CONDITION FOR OPERATION

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

> NOTE
> The steps performed in 1 through 6 below should be repeated for both UO_2 and gadolinia bearing fuel rods in each bundle type.

1. Determine the exposure dependent LHGR limit using linear interpolation between the table values in Appendix B.

> NOTE
> For two recirculation loop operation (TLO) utilize steps 1, 2, 3, and 6 to determine the LCO LHGR limits.
>
> When the Technical Specification 3.4.1.1 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 from the TLO entries in Table 5.3-1. Multiply the LHGR values obtained from Step 1 by the $LHGRFAC_p$ value to determine the power dependent LHGR limit.

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 5.3-2. Multiply the LHGR values obtained from Step 1 by the $LHGRFAC_f$ value to determine the flow dependent LHGR limit.

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 from the SLO entries in Table 5.3-1. Multiply the LHGR values obtained from Step 1 by the $LHGRFAC_p$ value to determine the power dependent LHGR limit.

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 5.3-2. Multiply the LHGR values obtained from Step 1 by the $LHGRFAC_f$ value to determine the flow dependent LHGR limit.

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 5.3-1 Power Dependent Linear Heat Generation Rate Multiplier ($LHGRFAC_p$)

Operating Condition	Core Thermal Power (%of Rated)		
	24	59.89	≥ 100
	$LHGRFAC_p$ Multiplier		
TLO	0.603		1.000
SLO	0.603	0.790	

$LHGRFAC_p$ is linearly interpolated between core thermal power entries.
The $LHGRFAC_p$ multiplier is the same for both GE14 and GNF2.
TLO = Two Recirculation Loop Operation
SLO = Single Recirculation Loop Operation

TABLE 5.3-2 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		

$LHGRFAC_f$ is linearly interpolated between core flow entries.
The $LHGRFAC_f$ multiplier is the same for both GE14 and GNF2.
TLO = Two Recirculation Loop Operation
SLO = Single Recirculation Loop Operation

5.4 OPRM Setpoints

5.4.1 Technical Specifications Table 2.2.1-1, Function 2.f, OPRM Upscale

A DSS-CD evaluation was completed for Hope Creek Cycle 23 in accordance with the licensing methodology described in Reference 2. The DSS-CD evaluation confirms that the DSS-CD solution is applicable to Hope Creek Cycle 23 and confirms S_{AD} = 1.10 for Hope Creek Cycle 23 operation.

The S_{AD} = 1.10 is applicable under all operating conditions within the OPRM Armed Region.

5.5 Rod Block Monitor

5.5.1 Reactivity Control Systems, Rod Block Monitor

Limiting Condition For Operation

Technical Specifications 3.1.4.3 Both rod block monitor (RBM) channels shall be OPERABLE.

APPLICABILITY: OPERATIONAL CONDITION 1, when THERMAL POWER is greater than or equal to 30% of RATED THERMAL POWER and less than 90% of RATED THERMAL POWER with MCPR less than 1.75, or THERMAL POWER greater than or equal to 90% of RATED THERMAL POWER with MCPR less than 1.44.

5.5.2 Technical Specifications Table 3.3.6-2, Control Rod Block Instrumentation Setpoints, Trip Function 1, Rod Block Monitor

TABLE 5.5.2-1 Control Rod Block Instrumentation Setpoints, Trip Function 1, Rod Block Monitor

Trip Function	Trip Setpoint*	Allowable Value*
a.i) Low Trip Setpoint (LTSP)	123.0	123.4
a.ii) Intermediate Trip Setpoint (ITSP)	118.2	118.6
a.iii) High Trip Setpoint (HTSP)	113.2	113.6
c. Downscale	5	N/A

*** %** RBM Reference Level

Appendix A: Method of Core Average Scram Speed Calculation

Method of Core Average Scram Speed, τ, Calculation

τ is defined as $$\tau = \frac{\left(\tau_{ave} - \tau_B\right)}{\tau_A - \tau_B}$$

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

τ_A= 0.86 seconds, control rod scram insertion time limit to notch 39 per Specification 3.1.3.3,

n = number of surveillance tests performed to date in cycle,

N_i = number of active control rods measured in the ith surveillance test,

τ_i = average scram time to notch 39 of all rods measured in the ith surveillance test, and

N_1 = total number of active rods measured in Specification 4.1.3.3.a or 4.1.3.3.d.

If $\tau_{ave} \leq \tau_B$, set τ = 0 to apply Option B OLMCPR.

τ shall be 1.0 (τ = 1.0) prior to performance of the initial scram time measurements for the cycle in accordance with Specification 4.1.3.3.

Appendix B: Exposure-Dependent Linear Heat Generation Rate Limits

COLR HOPE CREEK 1 Rev 20 (Cycle 23)

Exposure-Dependent Linear Heat Generation Rate Limits

The LHGR limits for all fuel and rod types are considered proprietary information of the vendor. Tables B-1 through B-8 contain exposure-dependent LHGR limits. The tables are presented in pairs since the LHGR limits are presented at separate peak pellet exposures for UO_2 and gadolinia bearing fuel rods. Several of the bundle types have the same exposure-dependent LHGR limits, and the applicable bundle types are noted before each set of tables. The gadolinia fuel rod limits provided for each bundle type reflect the bounding gadolinia LHGR limit for all gadolinium concentrations occurring in that bundle type.

Tables B-1 and B-2 contain limits applicable to the GE14 bundle types that follow.

- GE14-P10CNAB401-9G6.0/6G4.0-100T-150-T6-4343
- GE14-P10CNAB401-9G6.0/6G4.0-100T-150-T6-4238

TABLE B-1: GE14 LHGR Limits – UO_2 Fuel Rods

Peak Pellet Exposure		UO_2 LHGR Limit
MWd/MTU	MWd/STU	kW/ft
[[		
		]]

TABLE B-2: GE14 LHGR Limits – Gadolinia Bearing Rods

Peak Pellet Exposure		Most Limiting Gadolinia LHGR Limit
MWd/MTU	MWd/STU	kW/ft
[[		
		]]

Tables B-3 and B-4 contain limits applicable to the GE14 bundle types that follow.

- GE14-P10CNAB401-17G4.0-100T-150-T6-4342
- GE14-P10CNAB401-17GZ-100T-150-T6-4237

TABLE B-3: GE14 LHGR Limits – UO_2 Fuel Rods

Peak Pellet Exposure		UO_2 LHGR Limit
MWd/MTU	MWd/STU	kW/ft
[[		
		]]

TABLE B-4: GE14 LHGR Limits – Gadolinia Bearing Rods

Peak Pellet Exposure		Most Limiting Gadolinia LHGR Limit
MWd/MTU	MWd/STU	kW/ft
[[		
		]]

Tables B-5 and B-6 contain limits applicable to the GNF2 bundle types that follow.

- GNF2-P10CG2B392-13G4.0-100T2-150-T6-4533
- GNF2-P10CG2B392-14G4.0-100T2-150-T6-4534
- GNF2-P10CG2B370-12GZ-100T2-150-T6-4651
- GNF2-P10CG2B385-14GZ-100T2-150-T6-4653

TABLE B-5: GNF2 LHGR Limits – UO_2 Fuel Rods

Peak Pellet Exposure		**UO_2 LHGR Limit**
MWd/MTU	MWd/STU	kW/ft
[[		
		]]

TABLE B-6: GNF2 LHGR Limits – Gadolinia Bearing Rods

Peak Pellet Exposure		**Most Limiting Gadolinia LHGR Limit**
MWd/MTU	MWd/STU	kW/ft
[[		
		]]

Tables B-7 and B-8 contain limits applicable to the GNF2 bundle types that follow.

- GNF2-P10CG2B382-15GZ-100T2-150-T6-4438
- GNF2-P10CG2B382-6G5.0/7G4.0-100T2-150-T6-4439
- GNF2-P10CG2B377-15GZ-100T2-150-T6-4440
- GNF2-P10CG2B375-6G5.0/7G4.0-100T2-150-T6-4441
- GNF2-P10CG2B392-10G5.0/5G4.0-100T2-150-T6-4442
- GNF2-P10CG2B372-12GZ-100T2-150-T6-4531
- GNF2-P10CG2B383-14GZ-100T2-150-T6-4532
- GNF2-P10CG2B368-14GZ-100T2-150-T6-4650
- GNF2-P10CG2B373-2G5.0/12G4.0-100T2-150-T6-4652
- GNF2-P10CG2B399-15GZ-100T2-150-T6-4654
- GNF2-P10CG2B408-2G5.0/10G4.0-100T2-150-T6-4655

TABLE B-7: GNF2 LHGR Limits – UO_2 Fuel Rods

Peak Pellet Exposure		**UO_2 LHGR Limit**
MWd/MTU	MWd/STU	kW/ft
[[		
		]]

TABLE B-8: GNF2 LHGR Limits – Gadolinia Bearing Rods

Peak Pellet Exposure		**Most Limiting Gadolinia LHGR Limit**
MWd/MTU	MWd/STU	kW/ft
[[		
		]]

Appendix C: Backup Stability Protection

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Backup Stability Protection Region Intercepts

Table C-1 values reflect the cycle-specific BSP region intercepts determined for Cycle 23 considering nominal feedwater temperature operation and FWHOOS (Reference 6).

Table C-2 provides BSP region intercepts for Cycle 23 for the implementation of FFWTR operation (Reference 14).

TABLE C-1: BSP Region Intercepts (Operation Prior to FFWTR)

Region Boundary Intercept	% Power	% Flow
Region 1 High Flow Control Line	62.5	46.4
Region 1 Natural Circulation Line	43.5	35.2
Region 2 High Flow Control Line	67.9	53.2
Region 2 Natural Circulation Line	31.7	36.3

TABLE C-2: BSP Region Intercepts (Required for FFWTR)

Region Boundary Intercept	% Power	% Flow
Region 1 High Flow Control Line	69.6	55.4
Region 1 Natural Circulation Line	40.8	35.5
Region 2 High Flow Control Line	74.2	61.4
Region 2 Natural Circulation Line	31.7	36.3

Region 1 = BSP Scram Region
Region 2 = BSP Controlled Entry Region

Automated Backup Stability Protection (ABSP) Region Setpoints

Table C-3 values reflect the cycle-specific modified Simulated Thermal Power – Upscale scram setpoints for implementation of the ABSP region (Reference 6).

The ABSP region is conservatively constructed to encompass BSP Region 1 and generates an immediate automatic reactor scram upon entry. The ABSP region provided is applicable for Nominal, FWHOOS, and FFWTR conditions.

TABLE C-3: ABSP Region Setpoints

Parameter	Setpoint
Slope for Trip (m_{TRIP})	0.79 (% RTP / % RDF)
Constant Power Line for Trip ($P_{BSP-TRIP}$)	43.5 (% RTP)
Constant Flow Line for Trip ($W_{BSP-TRIP}$)	37.8 (% RDF)
Flow Breakpoint ($W_{BSP-BREAK}$)	16.0 (% RDF)

Appendix D: $MCPR_{99.9\%}$ Value

COLR HOPE CREEK 1 Rev 20 (Cycle 23)

$MCPR_{99.9\%}$ Value

Table D-1 contains the $MCPR_{99.9\%}$ values developed for the determination of the Hope Creek Cycle 23 LCO 3.2.3 MCPR Operating Limits (Reference 6), generated in accordance with Section 5.2. The $MCPR_{99.9\%}$ value is dependent on the number of reactor coolant recirculation loops in operation.

TABLE D-1: $MCPR_{99.9\%}$ Value

Operating Condition	$MCPR_{99.9\%}$ Value
TLO	1.10
SLO	1.13

The $MCPR_{99.9\%}$ value is the same for both GE14 and GNF2.
TLO = Two Recirculation Loop Operation
SLO = Single Recirculation Loop Operation

LR-N21-0005

Attachment 3

Affidavit for Core Operating Limits Report for Hope Creek Generating Station Unit 1

Attachment 3 to NFS 21-008

Global Nuclear Fuel – Americas

AFFIDAVIT

I, **Lukas Trosman,** state as follows:

(1) I am Engineering Manager, Reactor Physics Technology, Global Nuclear Fuel - Americas, LLC ("GNF-A"), and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Appendix B of the Core Operating Limits Report for Hope Creek Generating Station Unit 1, titled "Exposure-Dependent Linear Heat Generation Rate Limits." GNF-A proprietary information in Appendix B of the Core Operating Limits Report for Hope Creek Generating Station Unit 1 is identified by a dotted underline inside double square brackets. [[This sentence is an example.{3}]] In all cases, the superscript notation {3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GNF-A relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for "trade secrets" (Exemption 4). The material for which exemption from disclosure is here sought also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GNF-A's competitors without license from GNF-A constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals aspects of past, present, or future GNF-A customer-funded development plans and programs, resulting in potential products to GNF-A;

d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. above.

(5) To address 10 CFR 2.390 (b) (4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GNF-A, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GNF-A, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or subject to the terms under which it was licensed to GNF-A.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GNF-A are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2) is classified as proprietary because it contains details of GNF-A's fuel design and licensing methodology.

The development of the methods used in these analyses, along with the testing, development and approval of the supporting methodology was achieved at a significant cost to GNF-A or its licensor.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GNF-A's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GNF-A's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical, and NRC review costs comprise a substantial investment of time and money by GNF-A.

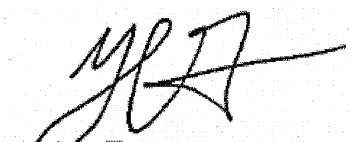
The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GNF-A's competitive advantage will be lost if its competitors are able to use the results of the GNF-A experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GNF-A would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GNF-A of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 28th day of October 2016.



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