PSEG Nuclear LLC
P.O. Box 236, Hancocks Bridge, New Jersey 08038-0236

PSEG
Nuclear LLC

10 CFR 50.73

LR-N23-0067
October 20, 2023

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington DC 20555-001

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

Subject: Licensee Event Report 2023-002-00
Shutdown Margin Less Than Expected Resulting in a Condition Prohibited by Technical Specifications

In accordance with 10 CFR 50.73(a)(2)(i)(B), PSEG Nuclear LLC is submitting Licensee Event Report (LER) number 2023-002-00.

There are no regulatory commitments contained in this letter.

If you have any questions or require additional information, please contact Mr. Harry Balian at (856) 339-2173.

Sincerely,

Thomas R. Agster
Plant Manager
Hope Creek Generating Station

Attachment: Licensee Event Report 2023-002-00

cc: USNRC Regional Administrator – Region 1
USNRC NRR Project Manager – Hope Creek
USNRC Senior Resident Inspector – Hope Creek
NJ Department of Environmental Protection, Bureau of Nuclear Engineering

President & Chief Nuclear Officer, PSEG Nuclear
Site Vice President, Hope Creek
Plant Manager, Hope Creek
Vice President, PSEG Nuclear Engineering
Executive Director Regulatory Affairs & Nuclear Oversight
Director Site Regulatory Compliance
Manager, Nuclear Oversight
Corporate Commitment Coordinator, PSEG Nuclear
Records Management (Record Type 3E.111)

NRC FORM 366 (10-01-2023) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 03/31/2024

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Library, and Information Collections Branch (T-6 A10M), U. S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by email to Infocollects.Resource@nrc.gov, and the OMB reviewer at: OMB Office of Information and Regulatory Affairs, (3150-0104), Attn: Desk Officer for the Nuclear Regulatory Commission, 725 17th Street NW, Washington, DC 20503; email: oira_submission@omb.eop.gov. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

1. Facility Name		2. Docket Number	3. Page
Hope Creek Generating Station	■ 050 ☐ 052	00354	1 OF 3

4. Title

Shutdown Margin Less than Expected Resulting in a Condition Prohibited by Technical Specifications

5. Event Date			6. LER Number			7. Report Date			8. Other Facilities Involved		
Month	Day	Year	Year	Sequential Number	Revision No.	Month	Day	Year	Facility Name	☐ 050	Docket Number
05	04	2023	2023	- 002 -	00	10	20	2023	Facility Name	☐ 052	Docket Number

9. Operating Mode	10. Power Level
2 – Start-up	0%

11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: *(Check all that apply)*

10 CFR Part 20	☐ 20.2203(a)(2)(vi)	**10 CFR Part 50**	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)	☐ 73.1200(a)
☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)	☐ 73.1200(b)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)	☐ 73.1200(c)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)	☐ 73.1200(d)
☐ 20.2203(a)(2)(i)	**10 CFR Part 21**	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(A)	**10 CFR Part 73**	☐ 73.1200(e)
☐ 20.2203(a)(2)(ii)	☐ 21.2(c)	☐ 50.69(g)	☐ 50.73(a)(2)(v)(B)	☐ 73.77(a)(1)	☐ 73.1200(f)
☐ 20.2203(a)(2)(iii)		☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(2)(i)	☐ 73.1200(g)
☐ 20.2203(a)(2)(iv)		☑ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(ii)	☐ 73.1200(h)
☐ 20.2203(a)(2)(v)		☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)		

☐ **OTHER** (Specify here, in abstract, or NRC 366A).

12. Licensee Contact for this LER

Licensee Contact	Phone Number (Include area code)
Harry Balian	(856) - 339 - 2173

13. Complete One Line for each Component Failure Described in this Report

Cause	System	Component	Manufacturer	Reportable to IRIS		Cause	System	Component	Manufacturer	Reportable to IRIS
D	AA	ROD	W351	Y						

14. Supplemental Report Expected		15. Expected Submission Date	Month	Day	Year
☑ No	☐ Yes (If yes, complete 15. Expected Submission Date)				

16. Abstract (Limit to 1326 spaces, i.e., approximately 13 single-spaced typewritten lines)

On May 4, 2023, during reactor start-up following a maintenance outage, nuclear instrumentation readings (Source Range Monitor (SRM)) were observed to be rapidly rising during withdrawal of a control rod blade (CRB). The Reactor Operator was directed to re-insert the CRB. Nuclear instrumentation readings stabilized and began to lower when the CRB was re-inserted. The Operating Crew subsequently performed a reactor shutdown by fully inserting all CRBs.

The start-up was re-commenced on May 5, 2023 with an adjusted start-up sequence. The start-up was successfully completed with normal responses from nuclear instrumentation. Subsequent collection of data determined that there had been a loss of reactivity worth in two CRBs.

On August 21, 2023, Hope Creek Generating Station received the results of a Shutdown Margin (SDM) Analysis performed by Global Nuclear Fuel (GNF). The analysis determined that with the reduced reactivity worth of the two CRBs, the calculated SDM for the current fuel cycle was lower than expected, and less than required by Technical Specification 3.1.1, Shutdown Margin, during the early portion of the fuel cycle. This condition is reportable under 10 CFR 50.73(a)(2)(i)(B).

LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

1. FACILITY NAME		2. DOCKET NUMBER	3. LER NUMBER		
			YEAR	SEQUENTIAL NUMBER	REV NO.
Hope Creek Generating Station	X 050	00354	2023	- 002	- 00
	052				

NARRATIVE

IDENTIFICATION OF OCCURRENCE

Event Date: May 4, 2023
Discovery Date: August 21, 2023

CONDITIONS PRIOR TO OCCURRENCE

At the time of the unexpected increase in SRM readings, May 4, 2023, Hope Creek was in Operational Condition (OPCON) 2, Start-up, 0 percent power, with the reactor subcritical. No other structures, systems or components that could have contributed to the event were inoperable at the time of the event.

When the analysis from Global Nuclear Fuel (GNF) was accepted, August 21, 2023, Hope Creek was in OPCON 1, Power Operation, at 100 percent rated thermal power.

DESCRIPTION OF OCCURRENCE

During reactor start-up following a maintenance outage, nuclear instrumentation readings (Source Range Monitor (SRM)) were observed by the Reactor Operator to be rapidly rising during continuous withdrawal of a CRB. The Reactor Operator was directed to re-insert the CRB. Nuclear instrumentation readings stabilized and began to lower when the CRB was re-inserted. The Operating Crew subsequently performed a reactor shutdown by fully inserting all CRBs.

An initial investigation did not reveal any errors in sequence development, Estimated Critical Positions (ECP), or CRB reactivity worth calculations. These items were independently checked by the fuel vendor. However, the start-up sequence was revised and a second start-up proceeded without any issue.

Evaluation of Local Power Range Monitor (LPRM) responses and Traversing Incore Probe (TIP) data later determined that there was a loss of reactivity worth in two CRBs. Initially four CRBs were inserted to ensure shutdown margin requirements were met. After a calculation performed by GNF, three of the CRBs were withdrawn, leaving one inserted.

GNF was engaged to perform a Shutdown Margin (SDM) analysis of the Cycle 25 reactor core. The analysis concluded that the minimum SDM at Beginning of Cycle (BOC) 25 was below the Technical Specification limit of 0.38% delta k/k. Cycle 25 began on October 28, 2022 with reactor start-up from refuel outage R24. This condition existed until core average exposure reached approximately 500 Megawatt-Days per Short Ton (MWD/ST) on November 21, 2022. At that time, the SDM was determined to have been greater than 0.38% delta k/k and therefore compliance with Technical Specifications was restored.

CAUSE OF EVENT

A Root Cause Evaluation (RCE) was conducted. The Direct Cause of the event was determined to be a reduction of boron-10 in two (2) CRBs, reducing the reactivity worth of these two CRBs. The Root Cause was determined to be that established procedural and administrative criteria for CRB management was ineffective at identifying mechanical end of life.

As part of the Extent of Condition review, PSEG identified indications of reduced reactivity worth for two CRBs discharged during the last refueling outage, R24. This was documented in the Corrective Action Program. Visual inspection of the two CRBs was completed and assessment is on-going as part of the Corrective Actions for this event.

LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

3. FACILITY NAME		4. DOCKET NUMBER	3. LER NUMBER		
			YEAR	SEQUENTIAL NUMBER	REV NO.
Hope Creek Generating Station	X 050	00354	2023	002	00
	052				

NARRATIVE

SAFETY CONSEQUENCES AND IMPLICATIONS

Shutdown Margin (SDM) is defined in Hope Creek Technical Specifications (HCTS) as the amount of reactivity by which the reactor is subcritical or would be subcritical throughout the cycle assuming that:
a. The reactor is xenon free;
b. The moderator temperature is greater than or equal to 68 degrees F, corresponding to the most reactive state; and
c. All CRBs are fully inserted except for the single CRB of highest reactivity worth, which is assumed to be fully withdrawn.
With CRBs not capable of being fully inserted, the reactivity worth of these CRBs must be accounted for in the determination of SDM.

HCTS 3.1.1 requires that the SDM be equal to or greater than 0.38% delta k/k with the highest worth CRB analytically determined. The GNF analysis determined that the actual SDM due to the reduction in boron concentration in the two CRBs was less than required. The Technical Specification minimum SDM was restored when the core average exposure reached 500 Megawatt-Days per Standard Ton (MWD/ST) on November 21, 2022, approximately 24 days into the fuel cycle. At that time, the SDM was above 0.38% delta k/k.

Although the SDM was determined to be less than required by HCTS, it was calculated as positive (greater than zero) throughout the period of non-compliance. While there is inherent uncertainty in SDM calculations, a positive value for SDM indicates that the reactor would have been able to be shutdown under all operating conditions, including transients and postulated accidents, during the time of non-compliance. A Technical Evaluation was performed to assess the conditions that existed during the first part of fuel cycle 25 and determined that conditions were sufficient to ensure the reactor could have been shutdown.

On April 30, 2023, a reactor shutdown was conducted in order to perform maintenance activities. During that shutdown all CRBs fully inserted demonstrating the capability to insert all CRBs during the affected period of time.

Based on the analysis conducted by GNF and the Technical Evaluation performed by the station, there were no Safety Consequences as a result of the condition.

PREVIOUS EVENTS

A review of Hope Creek LERs for the past three years was conducted. No previous LERs for Shutdown Margin were identified during that period.

CORRECTIVE ACTIONS

1. The affected CRBs will be replaced during the next refueling outage.
2. Visual inspection of the affected CRBs will be performed.
3. Extent of condition testing was performed on similar CRBs.
4. The associated procedures will be revised to include appropriate end of life criteria based on internal and external OE for CRBs currently installed at Hope Creek.
5. A recurring task will be created to perform visual inspection of this model of CRB to confirm no indications of cracking and verify that appropriate criteria have been developed.

COMMITMENTS

There are no regulatory commitments contained in this LER.