September 20, 2016

MEMORANDUM TO: Doug A. Broaddus, Chief
Plant Licensing Branch LPL I-1
Division of Licensing Project Management

FROM: Eric R. Oesterle, Chief ***/RA/***
Reactor Systems Branch
Office of Nuclear Reactor Regulation

SUBJECT: SAFETY EVALUATION FOR HOPE CREEK GENERATING STATION LICENSE AMENDMENT REQUEST TO REVISE TECHNICAL SPECIFICATIONS - SAFETY LIMIT MINIMUM CRITICAL POWER RATIO. (TAC NO. MF7793)

By letter dated June 08, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. MF7793), PSEG Nuclear LLC (the licensee) submitted a License Amendment Request (LAR) for the Hope Creek Generating Station (HCGS), Unit 1. The proposed LAR revises Technical Specification (TS) Section 2.1.2 to change Cycle 21 Safety Limit Minimum Critical Power Ratio (SLMCPR) numeric values.

The proposed change would lower the numeric values of SLMCPR from 1.10 to 1.11 for Single Recirculation Loop Operation. The SLMCPR value for Two Recirculation Loop Operation remains unchanged.

The Reactor Systems Branch (SRXB) Staff has reviewed the request and finds that the proposed TS revisions are acceptable. Please find attached Safety Evaluation (SE) pertaining to the HCGS Cycle 21 SLMCPR amendment request. The SRXB input to the final SE is enclosed. This completes our action on TAC No. MF7793.

Docket No: 50-354

Enclosure:
Safety Evaluation

CONTACT: Fred M. Forsaty, NRR/DSS
301-415-8523

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DISTRIBUTION:
SRXB/RF FForsaty RidsNrrPMHopeCreek EOesterle

Accession No.: ML16259A204 NRR-106

OFFICE	NRR/DSS/SRXB	NRR/DSS/SRXB: BC
NAME	FForsaty	EOesterle
DATE	9/17/2016	9/20/2016

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. H16-03 TO FACILITY OPERATING LICENSE NO. NPF-57

PSEG NUCLEAR, LLC

HOPE CREEK GENERATING STATION

DOCKET NO. 50-354

1.0 INTRODUCTION

By letter dated June 08, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. MF7793), PSEG Nuclear LLC (the licensee) submitted a License Amendment Request (LAR) for the Hope Creek Generating Station (HCGS), Unit 1. The proposed LAR revises Technical Specification (TS) Section 2.1.2 to change Cycle 21 Safety Limit Minimum Critical Power Ratio (SLMCPR) numeric values.

The proposed change would lower the numeric values of SLMCPR from 1.10 to 1.11 for Single Recirculation Loop Operation (SLO). The SLMCPR value for Two Recirculation Loop Operation (TLO) remains unchanged.

2.0 REGULATORY EVALUATION

2.1 Proposed Changes

On the basis of the calculations for HCGS core reload analysis for Operating Cycle 21, the calculated SLMCPR would change from ≥ 1.10 to ≥ 1.11 for SLO and SLMCPR value for TLO remains unchanged.

Accordingly, the licensee proposes to revise HCGS TS Section 2.1.2 to read as follows:

MCPR – With the reactor steam dome pressure ≥ 785 psig and core flow ≥ 10% rated core flow:

MCPR shall be ≥ 1.08 for TLO and ≥ 1.11 for SLO.

2.2 Regulations and Guidance

The regulatory requirements and guidance documents that the U.S. Nuclear Regulatory Commission (NRC) staff considered in its review of the proposed amendment included the following:

- Section 182a of the Atomic Energy Act requires applicants for nuclear power plant operating licenses to include TSs as part of the license. The TSs ensure the operational capability of Structures, Systems, and Components that are required to protect the health and safety of the public. The NRC's regulatory requirements related to the

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content of the TSs are contained in Section 50.36, "Technical specifications," of Title 10 of the *Code of Federal Regulations* (10 CFR), which requires that the TSs include items in the following specific categories: (1) safety limits, limiting safety systems settings, and limiting control settings; (2) limiting conditions for operation; (3) surveillance requirements; (4) design features; and (5) administrative controls. However, the regulation does not specify the particular requirements to be included in TSs.

The regulations in 10 CFR 50.36(c)(1)(i)(A) state, in part, that:

> Safety limits for nuclear reactors are limits upon important process variables that are found to be necessary to reasonably protect the integrity of certain of the physical barriers that guard against the uncontrolled release of radioactivity.

- Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Section 50.36(c)(1), "Technical Specifications," requires that power reactor facility TS include safety limits (SLs) for process variables that protect the integrity of certain physical barriers that guard against the uncontrolled release of radioactivity. The fuel cladding is one of the physical barriers that separate the radioactive materials from the environment. The SLMCPR is a SL that is required to be in TS to ensure that fuel design limits are not exceeded. The SLMCPR limit is contained in HCGS TS 2.1.2, and it can vary from cycle to cycle.

- General Design Criterion (GDC) 10, "Reactor Design," of Appendix A to 10 CFR Part 50 states that the reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that Specified Acceptable Fuel Design Limits (SAFDLs) are not exceeded. The purpose of the SLMCPR is to ensure that SAFDLs are not exceeded during steady state operation and analyzed transients.

- Guidance on the acceptability of the reactivity control systems, the reactor core, and fuel system design is provided in NUREG-0800, "Standard Review Plan (SRP) for the Review of Safety Analysis Reports for Nuclear Power Plants." Specifically, Standard Review Plan (SRP) Section 4.2, "Fuel System Design" (Accession No. ML070740002), specifies all fuel damage criteria for evaluation of whether fuel designs meet the SAFDLs. SRP Section 4.4, "Thermal and Hydraulic Design" (Accession No. ML070550060) provides guidance on the review of thermal-hydraulic design in meeting the requirement of GDC 10 and the fuel design criteria established in SRP Section 4.2. It states that the Critical Power Ratio (CPR) is to be established such that at least 99.9 percent of fuel rods in the core would not be expected to experience departure from nucleate boiling or boiling transition during normal operation or anticipated operational occurrences.

3.0 TECHNICAL EVALUATION

The SLMCPR numeric values in HCGS TS 2.1.2 are SLs. The SLMCPR limit is established such that at least 99.9 percent of the fuel rods in the core would not be expected to experience the onset of transition boiling as a result of normal operation and transients, which in turn ensures fuel cladding damage does not occur. The SLMCPR limit is established such that fuel

design limits are not exceeded during steady state operation, normal operational transients, and abnormal operational transients. As such, fuel damage is calculated not to occur if the limit is not violated. However, because fuel damage is not directly observable, a step-back approach is used to establish corresponding operating limits. The Operating Limit Maximum Critical Power Ratio (OLMCPR) is established by summing the cycle-specific core reload transient analyses adders and the calculated SLMCPR values. The OLMCPR is required to be established and documented in the Core Operating Limits Report for each reload cycle.

The absolute value of SLMCPR tends to vary cycle-to-cycle, typically due to the introduction of improved fuel bundle types, changes in fuel vendors or applicable computer codes, and changes in core loading pattern. Following the determination of the cycle-specific SLMCPR values, the OLMCPR values are derived. The cycle-specific SLMCPR numeric values are listed in HCGS TS 2.1.2, and therefore, must be revised using the license amendment process.

Global Nuclear Fuel (GNF) performed the HCGS Cycle 21 SLMCPR calculation consistent with NRC-approved methodologies and uncertainties, as documented in the following topical reports (TRs):

- NEDE-24011-P-A "General Electric Standard Application for Reactor Fuel," Revision 22, November 2015 (GESTAR II) (Accession Nos. ML15324A148 and ML15324A149)

- NEDC-32601P-A, "Methodology and Uncertainties for Safety Limit MCPR Evaluations," August 1999 (Accession No. ML14093A216)

- NEDC-32694P-A, "Power Distribution Uncertainties for Safety Limit MCPR Evaluations," August 1999 (Accession No. ML993140059)

- NEDC-32505P-A, "R-Factor Calculation Method for GE 11, GE 12 and GE 13 Fuel," Revision 1, July 1999 (Accession No. ML060520636)

These methodologies were used for the HCGS Cycle 21 SLMCPR calculations. The NRC staff reviewed the proposed change to ensure that the generic methods were appropriately applied to HCGS. The HCGS Cycle 21 core will be the first full reload of GNF2 fuel assemblies, and no plant hardware or operational changes are required with this proposed change.

NEDC-32505P-A is the generic R-Factor methodology report that describes the changed methodology that was adopted after part length rods were introduced. The NRC staff's Safety Evaluation (SE) for NEDC-32505P-A has a requirement that the applicability of the R-Factor methodology is confirmed when a new fuel type is introduced. The GNF letter designated FLN-2007-011, "GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II), NEDC-33270P, March 2007, and GEXL17 Correlation for GNF2 Fuel, NEDC-33292P, March 2007," was submitted to the NRC on March 14, 2007 (Accession No. ML070780335). FLN-2007-011 confirmed that the R-factor methodology of NEDC-32505P-A is applicable to GNF2, and that all of the criteria defined in NEDE-24011-P-A have been met for the GNF2 fuel design. As part of an NRC audit related to this report, the GNF2 fuel design was verified to have been evaluated in accordance with the TRs listed above. This was documented in an Audit Report dated September 25, 2008 (Accession No. ML081630579).

On the basis of the analysis performed by GNF using the NRC-approved methodologies described above, the licensee has proposed to amend the HCGS TS Section 2.1.2 to revise the SLMCPR for the Operating Cycle 21. This information regarding requested changes to the HCGS TS SLMCPR is based on and is for the core full rated power, and at minimum core flow of 94.80 % at rated power.

The current required SLMCPR values in HCGS TS is 1.08 for TLO and 1.10 for SLO. Calculations performed by GNF for HCGS Cycle 21 resulted in a minimum calculated value of SLMCPR to be stay at 1.08 for TLO, and 1.11 for SLO. For Cycle 21, the minimum core flow SLMCPR calculation performed at 94.8 percent core flow and rated core power condition was limiting as compared to the rated core flow and rated core power condition. GNF's calculation of the revised plant-specific SLMCPR numeric values for HCGS Cycle 21 was performed as part of the reload licensing analysis for HCGS Cycle 21, and is based upon NRC-approved methods, therefore it is acceptable. No departures from NRC-approved methodologies, or deviations from NRC-approved calculational uncertainties, were identified in the HCGS, Cycle 21, SLMCPR calculations.

The NRC staff verified that the proposed changes would continue to meet the applicable regulations and requirements, and that the analysis performed to calculate the HCGS Cycle 21 SLMCPR numeric values was based upon NRC-approved methodologies. The NRC staff concludes that the SLMCPR will continue to provide assurance that 99.9 percent of the fuel rods in the core will not exceed the CPR, and that fuel cladding integrity will be maintained under conditions of normal operation and with appropriate margin for anticipated operational occurrences.

4.0 CONCLUSION

The NRC staff finds that the licensee’s proposed amendment to update the TSs to include cycle-specific SLMCPR numeric values is based on NRC-approved methodologies that have been approved for use with GNF2 fuel. The amendment is consistent with the regulatory requirements and guidance as discussed in Section 2.0 of this SE, and therefore, is acceptable. The NRC staff determined that the changes do not require any exemptions or relief from regulatory requirements. Defense-in-depth and sufficient safety margins will continue to be maintained. Therefore, based on the above considerations, the proposed changes to revise the SLMCPR values are acceptable. The licensee is authorized to change the SLMCPR in TS 2.1.2 from 1.10 to 1.11 for SLO, at steam dome pressures greater than 785 psig and at core flows greater than 10 percent of rated core flow.