January 7, 2002

Mr. Harold W. Keiser
Chief Nuclear Officer & President
PSEG Nuclear LLC-X04
Post Office Box 236
Hancocks Bridge, NJ 08038

SUBJECT: HOPE CREEK GENERATING STATION - ISSUANCE OF AMENDMENT RE: CORE SPRAY SUBSYSTEM FLOW REQUIREMENTS (TAC NO. MB0955)

Dear Mr. Keiser:

The Commission has issued the enclosed Amendment No. 136 to Facility Operating License No. NPF-57 for the Hope Creek Generating Station. This amendment consists of changes to the Technical Specifications (TSs) in response to your application dated January 8, 2001, as supplemented on February 6, December 7, and December 27, 2001.

The amendment revises TS 4.5.1.b.1 to change the minimum acceptable Core Spray subsystem flow from 6,350 gallons per minute (gpm) to 6,150 gpm.

A copy of our safety evaluation is also enclosed. Notice of Issuance will be included in the Commission's biweekly Federal Register notice.

Sincerely,

/RA/

Richard B. Ennis, Sr. Project Manager, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-354

Enclosures: 1. Amendment No. 136 to License No. NPF-57
2. Safety Evaluation

cc w/encls: See next page

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Accession Number: ML013530219 *See previous concurrence

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PSEG NUCLEAR LLC

DOCKET NO. 50-354

HOPE CREEK GENERATING STATION

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 136
License No. NPF-57

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment filed by PSEG Nuclear LLC dated January 8, 2001, as supplemented on February 6, December 7, and December 27, 2001, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance: (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations set forth in 10 CFR Chapter I;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. NPF-57 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 136, and the Environmental Protection Plan contained in Appendix B, are hereby incorporated into the license. PSEG Nuclear LLC shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. The license amendment is effective as of its date of issuance and shall be implemented within 60 days of the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA E. Adensam for/

James W. Clifford, Chief, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: January 7, 2002

ATTACHMENT TO LICENSE AMENDMENT NO. 136

FACILITY OPERATING LICENSE NO. NPF-57

DOCKET NO. 50-354

Replace the following page of the Appendix A Technical Specifications with the attached revised page. The revised page is identified by amendment number and contains marginal lines indicating the areas of change.

Remove	Insert
3/4 5-4	3/4 5-4

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 136 TO FACILITY OPERATING LICENSE NO. NPF-57

PSEG NUCLEAR LLC

HOPE CREEK GENERATING STATION

DOCKET NO. 50-354

1.0 INTRODUCTION

By letter dated January 8, 2001, as supplemented on February 6, December 7, and December 27, 2001, PSEG Nuclear LLC (PSEG or the licensee) submitted a request for changes to the Hope Creek Generating Station (HCGS) Technical Specifications (TSs). The requested changes would revise TS 4.5.1.b.1 to change the minimum acceptable Core Spray subsystem flow from 6,350 gallons per minute (gpm) to 6,150 gpm.

The letters dated February 6, December 7, and December 27, 2001, provided clarifying information that did not change the initial proposed no significant hazards consideration determination or change the scope of the request dated January 8, 2001.

2.0 BACKGROUND

As discussed in Section 6.3 of the HCGS Updated Final Safety Analysis Report (UFSAR), the Emergency Core Cooling System (ECCS) is designed to provide protection against postulated loss-of-coolant accidents (LOCAs) caused by ruptures in the reactor coolant pressure boundary. The functional requirements of the ECCS (e.g., coolant delivery rates) are such that the system performance under all postulated LOCA conditions satisfies the requirements of Section 50.46 of Title 10 of the *Code of Federal Regulations* (10 CFR 50.46), "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors."

The HCGS ECCS consists of the following systems:

(1) High Pressure Coolant Injection (HPCI) system;

(2) Automatic Depressurization System (ADS);

(3) Core Spray (CS) system; and the

(4) Low Pressure Coolant Injection (LPCI) system.

As discussed in Section 6.3.2.2.3 of the HCGS UFSAR, each of the two redundant CS system loops (subsystems) consists of two 50-percent capacity centrifugal pumps, a spray sparger in the reactor vessel above the core, and piping and valves to convey water from the suppression

pool to the sparger. The CS system is designed to provide cooling to the reactor core only when the reactor vessel pressure is low, as is the case for large-break LOCAs. When the CS system operates in conjunction with the ADS, the effective core cooling capability of the CS system is extended to all break sizes, because the ADS rapidly reduces the reactor vessel pressure to the CS system operating range.

The CS pumps are tested in accordance with TS 4.5.1.b.1 to verify the capability of the CS system to deliver the design-basis flow rate to the reactor vessel as assumed in the UFSAR. The current TS surveillance requirement requires that “the two CS pumps in each subsystem together develop a flow of at least 6350 gpm against a test line pressure corresponding to a reactor vessel pressure of ≥105 psi above suppression pool pressure.”

As discussed in the licensee’s submittal, UFSAR Figure 6.3-9 shows the flow capability of the CS pumps with respect to the differential pressure between the suppression pool and the reactor vessel. This figure is used in the licensee’s 10 CFR Part 50, Appendix K LOCA analysis. The LOCA analysis assumes a CS flow of 6,250 gpm at 105 pounds per square inch differential (psid). The licensee’s submittal stated that a delivered CS flow of 6,350 gpm at 105 psid to the reactor vessel (as per the requirements in TS 4.5.1.b.1) ensures delivery of 6,250 gpm to the fuel in the reactor core, when a value of 100 gpm is assumed for core shroud bypass flow.

The licensee’s submittal stated that the mechanical calculations for HCGS are being upgraded including changes to the CS system analysis. The new analysis includes conservatisms such as instrument uncertainty that were not accounted for in the original calculations. The new analysis identified a situation in which the CS system performance differed from the system performance as described in the UFSAR. Specifically, the CS system may no longer have any operating margin to the flows currently specified in UFSAR Figures 6.3-5, 6.3-8, and 6.3-9 under worst-case conditions, with the CS pumps at their maximum degraded condition as allowed by the TS surveillance acceptance criteria. The licensee’s submittal stated that the CS system remains operable and is capable of delivering sufficient flow to the reactor following a design-basis accident, based on the current pump performance. The licensee has proposed to revise TS 4.5.1.b.1 to change the minimum acceptable Core Spray subsystem flow from 6,350 gpm to 6,150 gpm in order to regain the operating margin. The proposed TS value of 6,150 gpm is based on a revised LOCA analysis value of 6,050 gpm, with 100 gpm assumed for core shroud bypass flow.

3.0 EVALUATION

The acceptance criteria for ECCS performance, as specified in 10 CFR 50.46(b), include the following:

(1) *Peak cladding temperature.* The calculated maximum fuel element cladding temperature shall not exceed 2,200 °F.

(2) *Maximum cladding oxidation.* The calculated total oxidation of the cladding shall nowhere exceed 0.17 times the total cladding thickness before oxidation.

(3) *Maximum hydrogen generation.* The calculated total amount of hydrogen generated from the chemical reaction of the cladding with water or steam shall not exceed 0.01 times the hypothetical amount that would be generated if all the metal in the cladding cylinders surrounding the fuel, excluding the cladding surrounding the plenum volume, were to react.

(4) *Coolable geometry.* Calculated changes in core geometry shall be such that the core remains amenable to cooling.

(5) *Long-term cooling.* After any calculated successful initial operation of the ECCS, the calculated core temperature shall be maintained at an acceptably low value and decay heat shall be removed for the extended period of time required by the long-lived radioactivity remaining in the core.

In addition, 10 CFR 50.46(a)(3)(i) requires licensees to estimate the effect of any change or error in an acceptable evaluation model to determine if the change is significant. The regulation defines a significant change or error as one which results in a calculated peak fuel cladding temperature (PCT) different by more than 50 °F from the temperature calculated for the limiting transient using the last acceptable model, or a cumulation of changes and errors such that the sum of the absolute magnitudes of the respective changes is greater than 50 °F. Appendix K to 10 CFR Part 50 specifies the requirements with respect to acceptable ECCS evaluation models.

As discussed in the licensee's submittal, ECCS performance analyses, in accordance with approved Appendix K models, were performed by both fuel vendors supplying fuel for the current HCGS core (i.e., Westinghouse and General Electric). The purpose of the analyses was to determine the impact of using the proposed CS flow delivery to the fuel of 6,050 gpm in lieu of the value of 6,250 gpm that is used in the existing ECCS-LOCA analysis. The results of the Westinghouse and General Electric evaluations were provided in the submittal dated February 6, 2001.

Westinghouse, the current HCGS fuel vendor, performed the ECCS-LOCA analysis for fuel bundles PA and PB, which were initially loaded into the HCGS core for Cycle 10. Westinghouse determined the portions of the ECCS-LOCA analysis that are sensitive to changes in the CS delivery and generated a revised CS pump curve. As discussed in the licensee's submittal dated December 27, 2001, both fuel vendors generated the revised pump curves using a CS flow value of less than 6000 gpm at 105 psid. This value is conservative for purposes of evaluating the impact on the ECCS performance, since at least 6050 gpm will actually be delivered to the fuel, based on the proposed TS 4.5.1.b.1 CS flow value of 6150 gpm being delivered to the reactor vessel, with 100 gpm assumed for core shroud bypass flow.

Westinghouse assessed the impact of the revised pump curve on the portions of the ECCS-LOCA analysis sensitive to changes in the CS delivery. The HCGS performance analysis included verification of the limiting break size, calculation of the PCT, maximum cladding oxidation, maximum core-wide oxidation, and maximum average planar linear heat generation rate (MAPLHGR) limit for the HCGS PA and PB fuel bundles. Westinghouse stated that the primary impact of degraded CS flow is to increase the PCT results due to delayed core reflood

and diminished CS heat transfer performance, and that the impact on core-wide oxidation, cladding oxidation, and MAPLHGR would be secondary and a function of the increased PCT. As discussed in the licensee's submittal dated January 8, 2001, the analysis determined that a reduction in CS flow to 6,050 gpm would result in less than a 10 °F increase in PCT. Westinghouse also concluded that the corresponding impact on core-wide oxidation, cladding oxidation and MAPLHGR would remain bounded by the values in the current ECCS-LOCA performance analysis. With respect to the adequacy for CS distribution during long-term cooling, Westinghouse concluded that the spray heat transfer coefficients used in the current analysis remain valid with the reduced CS delivery.

Similarly, General Electric also generated a revised pump curve and evaluated the impact of the reduced CS flow on the existing HCGS ECCS-LOCA analysis for the resident General Electric fuel. General Electric concluded that the reduced CS flow would result in no more than a 10 °F increase in PCT, and that peak local oxidation and core-wide metal water reaction would remain unchanged from the existing analysis.

Based on the results of the ECCS performance analyses performed by Westinghouse and General Electric, the licensee's submittal dated January 8, 2001, stated that the reduction in CS flow to 6,050 gpm would result in a very small (less than 10 °F) increase to the PCT in the most limiting case. PSEG concluded that the change to the PCT is not considered significant using the guidance in 10 CFR 50.46(a)(3)(i), and that the resultant PCT would be maintained well below the 2,200 °F limit specified in 10 CFR 50.46(b)(1). In addition, PSEG concluded that the maximum cladding oxidation and maximum hydrogen generation limits, as specified in 10 CFR 50.46(b)(2) and 10 CFR 50.46(b)(3) respectively, would continue to be met.

The staff has reviewed the licensee's submittal and concludes that since the licensee evaluated the impact of the reduced CS delivery on the ECCS-LOCA analysis, in accordance with approved Appendix K models, for all resident fuel types, and determined that the change in PCT is not significant, and that the maximum cladding oxidation and maximum hydrogen generation limits will continue to be met, there is reasonable assurance that the acceptance criteria specified by 10 CFR 50.46 for the HCGS ECCS will continue to be met for a CS flow delivery to the fuel of 6,050 gpm. Therefore, taking the assumed 100 gpm core shroud bypass flow into account, the staff concludes that the proposed revision to TS 4.5.1.b.1 to change the minimum acceptable CS subsystem flow delivery to the reactor vessel to 6,150 gpm is acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the New Jersey State Official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative

occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (66 FR 6701). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: Z. Abdullahi
R. Ennis

Date: January 7, 2001