December 15, 2006

Mr. William Levis
Senior Vice President & Chief Nuclear Officer
PSEG Nuclear LLC - N09
Post Office Box 236
Hancocks Bridge, NJ 08038

SUBJECT: HOPE CREEK GENERATING STATION - FINAL ACCIDENT SEQUENCE PRECURSOR ANALYSIS OF OCTOBER 10, 2004, OPERATIONAL EVENT

Dear Mr. Levis:

The enclosure provides the final results of the Accident Sequence Precursor (ASP) analysis of an event which occurred at the Hope Creek Generating Station (Hope Creek) as documented in Licensee Event Report 354/04-010. The subject event occurred on October 10, 2004, when a pipe failure occurred in a moisture separator reheater drain line, leading to a manual reactor scram and plant cooldown. The ASP analysis calculated a mean conditional core damage probability of $3.4 \times 10^{-6}$.

The Nuclear Regulatory Commission (NRC) established the ASP Program in 1979 in response to the Risk Assessment Review Group Report (see NUREG/CR-0400, dated September 1978). The ASP Program systematically evaluates U.S. nuclear power plant operating experience to identify, document, and rank the operating events that were most likely to have led to inadequate core cooling and severe core damage (precursors), accounting for the likelihood of additional failures.

The ASP Program has the following objectives:

- Provide a measure for trending nuclear power plant core damage risk.
- Provide a partial check on dominant core damage scenarios predicted by probabilistic risk assessments (PRAs).
- Provide feedback to regulatory activities.
- Evaluate the adequacy of NRC programs.

The NRC also uses the ASP Program to monitor performance against the safety goal established in the agency's Strategic Plan (see NUREG-1100, Vol. 21, dated February 2005).

For more information about the ASP program, see the annual ASP program report at http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2005/secy2005-0192/2005-0192scy.pdf.

The enclosure is provided for your information and no response is requested. If you have any questions about the analyses, please contact me at (301) 415-1321 or at snb@nrc.gov.

Sincerely,

**/RA/**

Stewart N. Bailey, Senior Project Manager
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-354

Enclosure:
Final ASP Analysis

cc w/encl: See next page

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Hope Creek Generating Station

cc:

Mr. Dennis Winchester
Vice President - Nuclear Assessments
PSEG Nuclear
P.O. Box 236
Hancocks Bridge, NJ 08038

Mr. George P. Barnes
Site Vice President - Hope Creek
PSEG Nuclear
P.O. Box 236
Hancocks Bridge, NJ 08038

Mr. George H. Gellrich
Plant Support Manager
PSEG Nuclear
P.O. Box 236
Hancocks Bridge, NJ 08038

Mr. Michael J. Massaro
Plant Manager - Hope Creek
PSEG Nuclear
P.O. Box 236
Hancocks Bridge, NJ 08038

Mr. James Mallon
Manager - Licensing
200 Exelon Way - KSA 3-E
Kennett Square, PA 19348

Jeffrie J. Keenan, Esquire
PSEG Nuclear - N21
P.O. Box 236
Hancocks Bridge, NJ 08038

Mr. Michael Jesse
Manager - Regulatory Assurance
P.O. Box 236
Hancocks Bridge, NJ 08038

Township Clerk
Lower Alloways Creek Township
Municipal Building, P.O. Box 157
Hancocks Bridge, NJ 08038

Mr. Paul Bauldauf, P.E., Asst. Director
Radiation Protection Programs
NJ Department of Environmental
Protection and Energy
CN 415
Trenton, NJ 08625-0415

Mr. Brian Beam
Board of Public Utilities
2 Gateway Center, Tenth Floor
Newark, NJ 07102

Regional Administrator, Region I
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Senior Resident Inspector
Hope Creek Generating Station
U.S. Nuclear Regulatory Commission
Drawer 0509
Hancocks Bridge, NJ 08038

## SUMMARY OF FINAL ACCIDENT SEQUENCE PRECURSOR ANALYSIS

## PIPE FAILURE AND SCRAM ON OCTOBER 10, 2004

## HOPE CREEK GENERATING STATION

## PSEG NUCLEAR LLC

**Manual reactor scram due to moisture separator reheater drain line failure at Hope Creek (October 2004).** This event is documented in Licensee Event Report LER 354/04-010, dated December 9, 2004.

The Region I office of the Nuclear Regulatory Commission conducted a Special Inspection and issued Inspection Report (IR) 05000354/2004013 on February 4, 2005. A Notice of Violation was issued for this event under EA-05-001 on February 28, 2005.

***Event summary.*** On October 10, 2004, at 17:39 hours, a pipe failure occurred in a moisture separator reheater drain line of the Hope Creek Nuclear Generating Station. A power reduction to 80-percent power was initiated at 17:59 hours due to reports of a steam leak in the turbine building. At 18:14 hours, the reactor recirculation pumps were reduced to minimum speed and the reactor was manually scrammed. Operators initially began to reduce the reactor pressure vessel (RPV) pressure using the turbine bypass valves to allow for use of the condensate and feedwater pumps for RPV makeup. Due to the continued degradation of condenser vacuum, the reactor feedwater pumps all tripped. At this point, RPV makeup and pressure control was provided by manually initiating the high pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) systems. At 18:17 hours, the control room supervisor directed the reactor operator to close the turbine bypass valves. As the bypass valves closed, RPV level decreased causing an isolation signal.

With the RCIC system injecting into the RPV and water levels trending upwards, HPCI injection was terminated. Condenser vacuum continued to degrade and operators manually closed the main steam isolation valves (MSIVs) and main steam line drain valves prior to automatic closure on low condenser vacuum. Following MSIV closure, HPCI was placed in the pressure control mode. While placing HPCI in the pressure control mode, operators were initially unable to open the HPCI full-flow test line motor-operated valve. At 18:31 hours, the A and B residual heat removal trains were placed in the suppression pool cooling mode. At 18:46 hours, RPV level dropped and the RPV Level 3 scram setpoint was again actuated. RCIC flow was manually increased to restore water levels above the RPV Level 3 scram setpoint. Following this, at approximately 18:50 hours, the feedwater system was restarted (with flow being provided by the condensate pumps) with the startup feedwater level control valve set in the automatic mode.

At 20:48 hours, the operators commenced a plant cooldown using HPCI, RCIC, and safety/relief valves (SRVs). This effort was complicated by repeated trips of the HPCI barometric vacuum pump, a non-safety support system which maintains a slight vacuum on the HPCI steam discharge line. This led operators to secure the HPCI system and rely on a combination of SRVs and RCIC to maintain RPV level and depressurize the system. At approximately 22:03 hours, the Level 3 setpoint was again reset and feedwater startup level control valve setpoint raised from 25 inches to 35 inches (with flow being provided by the condensate pumps). The plant reached cold shutdown conditions at 05:09 hours on October 12, 2004.

***Results.*** This initiating event resulted in a conditional core damage probability (CCDP) of $3.4 \times 10^{-6}$. An uncertainty analysis for this operating condition resulted in a mean CCDP of $3.4 \times 10^{-6}$ with 5% and 95% uncertainty bounds of $4.7 \times 10^{-8}$ and $1.2 \times 10^{-5}$, respectively.

***SDP/ASP comparison.*** The result of the Significance Determination Process (SDP) analysis was a White finding. The White finding was based on a SDP Phase 3 assessment assuming an unavailability of 25 days and an estimated increase in core damage frequency (ΔCDF) of $1.8 \times 10^{-6}$ for internal events. Since the SDP did a ΔCDF calculation and the Accident Sequence Precursor (ASP) analysis did an initiating event assessment (i.e., calculated the CCDP), the two analytic results are not numerically comparable. The analytic assumptions and dominant risk contributors are similar in the two analyses.

The ASP analysis can be found in the Agencywide Documents Access and Management System at Accession number ML062710037. If you have any questions about the analysis, please contact Gary DeMoss (301-415-6225).