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

FEB 1 0 2006

PSEG
Nuclear LLC

LR-N06-0052
LCR H05-01

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

WITHDRAWAL OF REQUEST FOR LICENSE AMENDMENT
EXTENDED POWER UPRATE
HOPE CREEK GENERATING STATION
FACILITY OPERATING LICENSE NPF-57
DOCKET NO. 50-354

Reference: 1) PSEG letter LR-N05-0258, Request for License Amendment: Extended Power Uprate, November 7, 2005

By the Reference 1 letter, PSEG Nuclear LLC (PSEG) requested an amendment to Facility Operating License NPF-57 and the Technical Specifications (TS) for the Hope Creek Generating Station to increase the maximum authorized power level to 3840 megawatts thermal (MWt).

In a telephone conference call on January 12, 2006, PSEG discussed issues identified by the NRC technical staff during the acceptance review of the amendment request. Attachment 1 to this letter documents information discussed with the staff during the January 12, 2006 conference call.

In a telephone conference call on February 2, 2006, the NRC staff stated that the submittal lacks sufficient information in some areas to allow the staff to proceed with its detailed technical review. Therefore, PSEG is withdrawing the referenced request for license amendment with plans to resubmit at a later date. The revised request for license amendment may refer to information previously submitted.

PSEG understands that, in response to this request for withdrawal, the NRC will document the results of the staff's acceptance review, indicating those areas for which additional detail is required for acceptance.

A001

If you have any questions or require additional information, please contact Mr. Paul Duke at (856) 339-1466.

George P. Barnes
Site Vice President
Hope Creek Generating Station

Attachment

C Mr. S. Collins, Administrator – Region I
U. S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Mr. S. Bailey, Project Manager - Hope Creek
U. S. Nuclear Regulatory Commission
Mail Stop O8B1
Washington, DC 20555-0001

USNRC Senior Resident Inspector - Hope Creek (X24)

Mr. K. Tosch, Manager IV
Bureau of Nuclear Engineering
PO Box 415
Trenton, NJ 08625

HOPE CREEK GENERATING STATION
FACILITY OPERATING LICENSE NPF-57
DOCKET NO. 50-354
WITHDRAWAL OF REQUEST FOR LICENSE AMENDMENT
EXTENDED POWER UPRATE

By letter dated November 7, 2005, PSEG Nuclear LLC (PSEG) requested an amendment to Facility Operating License NPF-57 and the Technical Specifications (TS) for the Hope Creek Generating Station to increase the maximum authorized power level to 3840 megawatts thermal (MWt).

In a communication from Mr. S. Bailey, Licensing Project Manager - Hope Creek, on December 20, 2005, and in a telephone conference on January 12, 2006, the NRC staff identified issues that need to be addressed before the NRC can accept the Hope Creek EPU application. Information discussed with the staff during the January 12, 2006 conference call is documented below.

NRC Acceptance Review Comments on Hope Creek EPU License Amendment Dated November 7, 2005

The submittal dated November 7, 2005, from PSEG Nuclear requested a license amendment to increase the maximum power level authorized for the Hope Creek Nuclear Power Plant from 3339 MWt to 3840 MWt (15% power uprate). The submittal describes the licensee's effort to address the lessons learned from extended power uprate (EPU) operation at other BWRs. There are several issues that need to be addressed before the NRC can accept the Hope Creek EPU application. These issues have the potential to cause the review schedule to be exceeded. These issues include:

1. In Attachment 7 to its EPU license amendment request, PSEG Nuclear states the uncertainty of its steam dryer stress analysis has been determined to be 43% based on its "square root of the sum of the squares" combination of the main steam line (MSL) strain gage uncertainty (42%) and the Acoustic Circuit Model (ACM) uncertainty (8%). Significant questions exist regarding the validity of this uncertainty determination for the Hope Creek steam dryer stress analysis. For example, the assumed 8% uncertainty for the ACM has not been justified in stress analyses performed for steam dryers at other nuclear power plants. Further, the uncertainty of the finite element model in terms of amplitude and frequency of the load definition spectra used to determine the stress in individual steam dryer components has not been incorporated.

   PSEG Response:
   In Attachment 7 to the license amendment request, PSEG stated that consideration was being given to reduce the uncertainty of the strain gage input to the ACM. PSEG currently plans to install additional strain gages in the configuration that replicates the benchmarked Quad Cities configuration in the

Spring 2006 outage (RF13), one outage before the planned EPU implementation outage. The strain gages will be located on the MSL vertical run between the outlet of the RPV and the SRV standpipe. All four MSLs will be instrumented at two elevations with greater than 30 feet separation. Each location will have four strain gages at 90 degrees apart on the circumference.

During the start-up from RF13, PSEG plans to record strain gage readings at various powers. The strain gage readings for the previous limiting case, 96% of the current licensed thermal power (CLTP), and for 100% CLTP will be converted to steam dryer hydrodynamic loads, using the revised ACM load transfer model described in the following paragraph. The revised loads will be compared to the loads used for the steam dryer stress analysis described in Attachment 19 to the license amendment request. If the loads are significantly higher, PSEG will rerun the CLTP baseline stress analysis. PSEG expects to complete the load comparison in June 2006.

The ACM methodology for the revised CLTP case is described in "Bounding Methodology to Predict Full Scale Steam Dryer loads From In-Plant Measurements (CDI Proprietary)," Report 05-28, which is being prepared at this time. The bounding methodology increases the conservatism of the ACM so that uncertainty need not be added. This revised ACM methodology will also discuss measurements of loads below 20 Hz.

The uncertainty of the finite element model in terms of amplitude and frequency is addressed in response to NRC Question No. 8.

2. In Attachment 7 to its EPU license amendment request, PSEG Nuclear describes the installation of strain gages at only one circumferential position on each MSL at Hope Creek. The potential for significant error in the determination of pressure fluctuations within each MSL from this installation arrangement could cause difficulty in reaching a decision regarding an acceptable margin to the structural limit for steam dryer components.

   PSEG Response:
   PSEG plans to install four strain gages at locations 90 degrees apart on the circumference in the Spring 2006 outage. Comparison of single strain gage data to the average of 4 strain gages in the optimal arrangement shows the single gage reading bounds the average of the 4 strain gages. In spite of this, the present CLTP stress analysis demonstrates significant margin. The increased number of strain gages, everything else being equal, is expected to further improve the margin.

3. In its EPU license amendment request, PSEG Nuclear does not indicate that the Hope Creek steam dryer stress analysis (including the ACM and finite element model) has received a detailed quality assurance verification to provide confidence in its results.

PSEG Response:
PSEG employed Continuum Dynamics Inc. (CDI) to develop the ACM and steam dryer stress analysis for Hope Creek in accordance with CDI's Nuclear Quality Assurance Program. PSEG provided engineering oversight for CDI's work. Specifically, PSEG verified the appropriateness of the inputs, reviewed the consistency of these tasks with those done for other utilities, and provided technical reviews on final draft reports.

The ACM analytical program was developed by CDI and benchmarked against the Quad Cities Unit 2 instrumented dryer. PSEG retained the services of Structural Integrity Associates (SIA), and consulted other utilities, on strain gage data collection and reduction.

With respect to the steam dryer modeling input to the finite element model (FEM), PSEG verified that the Hope Creek Unit 1 dryer and the abandoned Hope Creek Unit 2 dryer were identical in design and fabrication prior to on-site, field modifications (described in Attachment 7 to the license amendment request), which were only done for the Unit 1 dryer. CDI performed the field measurements of the abandoned Unit 2 steam dryer under their QA program using two individuals who independently verified all the measurements. CDI as part of their QA program documented all input sources. A PSEG engineer experienced with GE reactor vessel internals and GE documentation assembled the original documentation and drawings on the field modifications done for the Unit 1 dryer. A second PSEG engineer reviewed the information and then maintained oversight of the dryer information inputted into the FEM. CDI utilized a widely used, commercially available program, ANSYS (Rev 10.0, July 2005), for the FEM analysis. The source code is proprietary and cannot be modified by the user.

4. In Attachment 7 to its EPU license amendment request, PSEG Nuclear states that computational fluid dynamics (CFD) analyses are being performed to evaluate the hydrodynamic loads on the Hope Creek steam dryer. The licensee does not discuss the uncertainties associated with this analysis and its plans to address those uncertainties.

PSEG Response:
The CFD analyses were performed at 100% CLTP and 115% CLTP. One objective was to qualitatively determine if any new flow phenomena are expected at the higher power. The conclusion of the CFD evaluations was that there is vortexing at both CLTP and EPU at the outlet of the steam dome that extends well into the MSL nozzles. The flow separation at the top edge of the hood was not significant because of the better rounded design.

A second objective was to understand loading on the outer hood area. PSEG requested loading information only on the outer hood area since this was the only

area exposed to any significant steam velocities. Specifically, data was collected at the top of the outer hood, bottom of the outer hood, and on the cover plate. The CLTP CFD analysis calculated a transient pressure loading at these areas primarily between 30 and 40 Hz. The EPU CFD analysis was similar except that the frequency range became smaller, essentially concentrated at 40 Hz, which increased the 40 Hz peak. Since this loading is at all recorded points in the outer hood, this suggests that the loading is acoustic rather than hydrodynamic.

PSEG will use the CFD information as part of the interim EPU FEM (described below) to determine margins for the EPU power ascension testing. However, PSEG does not plan to use the CFD results as a separate, additional input to the final EPU FEM since an acoustic loading at 40 Hz is detectable by strain gages in the MSL and it will be accurately calculated in the ACM loadings. This will prevent duplication of CFD and ACM loads that would unnecessarily reduce the margins. In addition, the CFD results are susceptible to minor changes in modeling and results have not been benchmarked.

PSEG plans to use the revised ACM methodology to detect loads on the steam dryer below the previous 20 Hz threshold. Refer to the response to NRC Question No. 1.

5. In Attachment 7 to its EPU license amendment request, PSEG Nuclear briefly describes its power ascension test plan. However, the licensee did not discuss the establishment of a limiting curve for power uprate operation, margin between the current load definition and the limit curve, interaction at hold points with the NRC staff for any identified safety concerns regarding continued power ascension, and performance of inspections and walkdowns.

PSEG Response:

Limiting Loads:

Regardless of the margins demonstrated at CLTP, PSEG recognizes that EPU loading remains a potential concern because the only known source of significant loading, relief valve acoustic resonance, cannot at this time be quantified or ruled out. PSEG has concluded that generic load assumptions are not appropriate given the large variations among BWRs in the relief valve load magnitude, frequency, and the MSL velocity that causes the phenomenon. For example, relief valve acoustic resonance does not occur until the onset steam velocity is reached, and based on a review of available literature, the loading can increase significantly with further power increases.

Accordingly, in order to provide a more meaningful stress analysis well in advance of the EPU power ascension, PSEG has contracted CDI to perform analyses and testing to predict the HCGS relief valve acoustic frequency and the reactor power at which the onset of this phenomenon occurs. This effort is based upon recent experience gained by CDI on relief valve load attenuation for Quad Cities. The CDI effort for Quad Cities included small scale testing that

replicated the relief valve loading and frequency for their three different design relief valves. The HCGS relief valve load definition effort is underway and PSEG anticipates completing this effort by end of April 2006. This task is somewhat simplified by the fact that all fourteen (14) HCGS relief valves, including standpipes, are identical.

PSEG anticipates completing an additional steam dryer FEM stress analysis by the end of July 2006. This is referred to as the "interim EPU FEM". The loading used for this FEM will include CLTP loading extrapolated to EPU and best estimates of relief valve loads (including frequency). The assumed loadings for the interim EPU FEM will evaluate the ~ 40 Hz loadings predicted by the CFD model for EPU. This interim EPU FEM will be used to determine the limiting loadings for power uprate operation. Refer to the response to NRC Question No. 8 for further FEM discussion. Using this information, PSEG will determine if steam dryer modifications are required to maintain adequate structural margins. Based upon the analyses and testing currently being performed to predict the HCGS relief valve acoustic frequency, PSEG will determine if mitigation of this phenomenon is required before EPU implementation. This approach improves upon previous EPU power ascensions.

The acceptable margin between the EPU measured loading and the calculated limiting loading is based in part on the confidence in the accuracy of the individual pieces that are used to calculate the actual stress. This includes strain gage data acquisition, ACM, and the FEM. As discussed elsewhere in our responses, PSEG plans to improve each of these items.

Power Ascension Testing

The detailed power ascension plan and procedures will be developed after completion of the design change package for the power uprate. The plan will include specific hold points and their duration during power ascension above CLTP; activities to be accomplished during hold points; plant parameters to be monitored; required inspections and walkdowns; data evaluation methods; acceptance criteria for monitoring and trending plant parameters; and actions to be taken, including interactions with NRC staff, if acceptance criteria are not satisfied. PSEG will provide the detailed power ascension test plan to the NRC staff before increasing power above CLTP.

The steam dryer power ascension plan will include hold points at 5% power increments for collection and evaluation of MSL strain gage data. The interim EPU FEM analysis will facilitate comparison of the measured loads against pre-established limit curves. At the completion of the power ascension, PSEG will record the loads and provide a final EPU FEM to document the as-left condition.

Since the steam dryer and MS drywell piping are not accessible during power operation for inspections or walkdowns, PSEG will use accelerometers on the

MS piping and SRVs to complement the MS strain gage information. These are discussed in response to NRC Question No. 6.

Steam Dryer Inspections Following Power Uprate
As noted in Attachment 7 to the EPU license amendment request, PSEG plans to follow the inspection recommendations in General Electric Service Information Letter 644, Revision 1, "BWR Steam Dryer Integrity." PSEG is also evaluating the inspection recommendations in EPRI Technical Report (TR) 1011463, "BWR Vessel and Internals Project, Steam Dryer Inspection and Flaw Evaluation Guidelines (BWRVIP-139)" currently under NRC review, for incorporation into planned dryer inspections.

6. In Attachment 8 to its EPU license amendment request, PSEG Nuclear summarizes completed and planned actions to address the potential for flow-induced vibration during EPU operation at Hope Creek. The licensee has not described a susceptibility review of plant systems and components that might be adversely affected by flow-induced vibration under EPU conditions, including feedwater sample probes.

PSEG Response:
The susceptibility reviews done to date included screening of Operating Experience (OE) to identify flow induced concerns. EPU system evaluations for individual systems and components have been an additional input. Key concerns - sampling probes, main steam line (MSL) vibration, and heat exchanger tube vibration - are discussed below.

A more comprehensive and systematic susceptibility review remains to be completed and will focus on those systems that will have a significant increase in flow. The effort will identify (a) in-line components within the flow stream that will see higher flow, (b) piping that may vibrate at higher levels and thus experience increased piping fatigue stress, and (c) components attached to piping that would experience higher vibration. The screening for susceptible components will be supplemented by interviews with plant operators and system engineers, and further review of EPU evaluation results, and plant-specific and industry operating experience.

Sampling Probes:
The OE review identified sample probe failures as a potential concern even at OLTP. The screening effort done in 2004 determined that the original HCGS design effort (prior to plant start-up) rejected the standard GE sample probe design. The original HCGS design criteria either significantly reduced the insertion length for sample probes manufactured from small diameter piping or required a significantly stronger sampling scoop design, which also had a reduced insertion length. The screening effort categorized HC sampling probe failures at EPU as improbable based on engineering judgment, but identified a follow up action to provide a more rigorous evaluation. This screening and

follow up evaluations are not limited to safety-related sampling probes. Non-safety related FW sampling probes are included.

<u>MSL Vibration:</u>
The OE screening also showed that a significant amount of the reported, post EPU flow induced vibration problems occurred at the Quad Cities units, specifically on their main steam lines (MSL). PSEG's present understanding of the reason for high vibration levels is that Quad Cities already operated at their pre-EPU power with acoustic resonance vibration at their four (4) power actuated relief valves. At EPU, the acoustic resonance on these valves increased and they also experienced acoustic resonance vibration on eight (8) safety relief valves. Their data strongly indicates that relief valve acoustic vibration is a significant contributor to high vibration on MSLs. Thus, the potential for this phenomenon should be included in an effective MSL vibration evaluation program.

To assess MSL vibration, PSEG installed a number of accelerometers on MS lines "A" and "B" in the drywell and in February 2005 recorded vibration data at 10 power levels between 23% and 100% CLTP. The accelerometers are described in Attachment 8 to the license amendment request. The accelerometers on the SRVs or on MSL locations near the SRVs include the following:

- M/S line A, on vertical run after the first elbow on the RPV outlet
- M/S line B, on vertical run after the first elbow on the RPV outlet
- M/S line A, on SRV "J" discharge line
- M/S line B, on SRV "P" discharge line
- M/S line A, at 4" RCIC branch connection line
- M/S line B, between SRV "K" and SRV "B"

This allowed PSEG to determine the actual MSL vibration trend between 23% and 100% CLTP. At each power level, the recorded HCGS data for each monitored location includes a graph showing the g value recorded for frequencies between 0 and 200 Hz and a composite g value expressed as the root mean square (RMS) across the recorded frequencies. The expectation was that in the absence of acoustic valve resonance or other flow instability phenomenon, pipe vibration would increase proportionally with the dynamic pressure term (fluid density times the flow velocity squared). The actual, averaged recorded values between 23% and 100% CLTP show a fairly consistent increase in vibration with power, which generally followed the trend predicted by the dynamic pressure term. The maximum vibration at 100% CLTP in any of the three orthogonal directions at any monitored MSL location was 0.0838 g rms. The average vibration was 0.0466 g rms. Acceleration magnitudes at or below 0.1 g rms are considered very low. The HCGS MSL vibration includes recirculation system vibration transferred mechanically through common structural supports. The above reported MSL vibration values are for

the more limiting of the two 100% CLTP cases (i.e., higher recirculation pump speed).

The HCGS consistent vibration trend with power suggests that there is no flow instability phenomenon (including acoustic resonance) occurring at or below CLTP. This is supported by other recorded data. PSEG determined that the HCGS SRV standpipe acoustic resonance frequency is approximately 133 Hz. This is based on analysis and approximately one-sixth scale testing performed by CDI. None of the MSL vibration data showed any indication of vibration at or near 133 Hz with the exception of very small peaks (maximum of 0.003 g) at approximately 65% power on some but not all accelerometers. Furthermore as described in Attachment 7, PSEG analyzed strain gage data (used in the ACM) at 7 power levels. None showed any pressure pulsations at or near 133 Hz.

PSEG is evaluating by small scale testing with CDI the potential for relief valve acoustical resonance vibration to occur at EPU as opposed to simply relying on EPU power ascension monitoring to determine at power ascension if it happens. As a minimum, if any significant acoustic resonance vibration is anticipated, this will allow PSEG to be more effective in evaluating the susceptibility by knowing the frequency of the loading. It will also allow PSEG to determine if mitigation of relief valve acoustic resonance is required. In any event, vibration limits will be established prior to EPU power ascension.

Heat Exchanger Tubing:
As part of the engineering analysis to rerate feedwater heaters (FWHs) and drain coolers for EPU conditions, the original FWH manufacturer performed vibration analysis to confirm vibration problems are not expected at EPU conditions.

7. In Attachment 18 to its EPU license amendment request, PSEG Nuclear provides its contractor's report on hydrodynamic loads experienced by the Hope Creek steam dryer. The licensee does not justify the uncertainties associated with this analysis in terms of amplitude and frequency of the load definition spectra.

PSEG Response:
Refer to the response to NRC Question No. 1 for discussion on the uncertainties on the magnitude. With regard to frequency, the uncertainties on the hydrodynamic loads are small in comparison with those associated with a steam dryer finite element model, and will be included as part of the frequency uncertainty for the EPU FEM (Refer to the response on NRC Question No. 8).

8. In Attachment 19 to its EPU license amendment request, PSEG Nuclear provides its contractor's report on the stress analysis of the Hope Creek steam dryer for current licensed thermal power (CLTP) conditions. The licensee does not address the uncertainties of this analysis in terms of amplitude and frequency of the load definition spectra in evaluating the margin from the stress limits for individual steam dryer components.

PSEG Response:
The CLTP stress analysis did not evaluate uncertainties in frequency primarily because, as described in Attachment 7 to the license amendment request, no flow induced damage has been detected during steam dryer inspections performed to date. In addition, all available data indicates that Hope Creek does not experience relief valve acoustic resonance loads at or below CLTP. This supports that the existing stress analysis conclusion that steam dryer loads at CLTP are not significant.

Additional FEM analyses will be performed in 2006 once the best estimate information for relief valve acoustic resonance, including frequency and magnitudes, are available. Uncertainties in the relief valve acoustic frequency as well as uncertainties inherent in the FEM for calculating the resonance frequency of key components will be addressed by altering the frequency of the inputted loads by up to ±10% unless a different range is justified. This effort will also determine the limiting loads that can be accepted during EPU power ascension. This effort will allow PSEG to determine if steam dryer modifications are required to maintain adequate structural margins before EPU.