



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 13, 2007

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

SUBJECT: HOPE CREEK GENERATING STATION - REQUEST FOR ADDITIONAL
INFORMATION REGARDING REQUEST FOR EXTENDED POWER UPRATE
(TAC NO. MD3002)

Dear Mr. Levis:

By letter dated September 18, 2006, as supplemented on October 10 and October 20, 2006, February 14, February 16, February 28, March 13 (2 letters), March 22, March 30 (2 letters), April 13, April 18, April 30, May 10, May 18 (3 letters), June 22, August 3, August 17, August 31, September 11, October 10, and October 23, 2007, PSEG Nuclear, LLC (PSEG or licensee) submitted an amendment request for an extended power uprate (EPU) for Hope Creek Generating Station (Hope Creek). The proposed amendment would increase the authorized maximum power level by approximately 15 percent, from 3339 megawatts thermal (MWt) to 3840 MWt.

The Nuclear Regulatory Commission (NRC) staff has been reviewing the submittal and has determined that additional information is needed to complete its review. The specific questions are found in the enclosed request for additional information (RAI). The questions were sent by e-mail to you to ensure that the questions were understandable, the regulatory basis was clear and to determine if the information was previously docketed. The NRC staff has determined that the RAI contains proprietary information pursuant to Section 2.390 of Title 10 of the *Code of Federal Regulations*. As such, we have enclosed non-proprietary and proprietary versions of the RAI (Enclosures 1 and 2 respectively).

In the PSEG letter (LR-N07-0274) dated October 23, 2007, your staff agreed to respond by November 30, 2007, to the enclosed questions except for RAI 14.66 follow-up. Based on discussions with your staff, it is our understanding that PSEG is developing a plan to test a previously purchased, spare steam dryer to address the issues in RAI 14.66 follow-up. In a phone call on November 2, 2007, your staff stated that the test results for the spare dryer would be provided to the NRC staff by December 31, 2007.

Enclosure 2 transmitted herewith
contains Official Use Only - Proprietary
Information. When separated from
Enclosure 2, this document is
decontrolled.

W. Levis

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Please note that if you do not respond to this letter within the prescribed response times or provide an acceptable alternate date in writing, we may reject your application for amendment under the provisions of Title 10 of the *Code of Federal Regulations*, Section 2.108. If you have any questions, I can be reached at (301) 415-3100.

Sincerely,


for

John G. Lamb, Senior Project Manager
Project Directorate I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-354

Enclosures:
As stated

cc w/ Enclosure 1 only: See next page

Hope Creek Generating Station

cc:

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REQUEST FOR ADDITIONAL INFORMATION (NON-PROPRIETARY VERSION)

REGARDING TECHNICAL SPECIFICATION CHANGES FOR

EXTENDED POWER UPRATE

HOPE CREEK GENERATING STATION

DOCKET NO. 50-354

By letter dated September 18, 2006, as supplemented on October 10 and October 20, 2006, February 14, February 16, February 28, March 13 (2 letters), March 22, March 30 (2 letters), April 13, April 18, April 30, May 10, May 18 (3 letters), June 22, August 3, August 17, August 31, September 11, and October 10, 2007, PSEG Nuclear, LLC (PSEG or licensee) submitted an amendment request for an extended power uprate (EPU) for Hope Creek Generating Station (Hope Creek). The proposed amendment would increase the authorized maximum power level by approximately 15 percent, from 3339 megawatts thermal (MWt) to 3840 MWt.

The Nuclear Regulatory Commission (NRC) staff has been reviewing the submittal and has determined that additional information is needed to complete its review.

14. Mechanical & Civil Engineering Branch

Request for Additional Information (RAI) 14.66 Follow-up

In RAI 14.66, the staff noted that shifting the frequency of the Hope Creek steam dryer loading will account for uncertainty and bias in the finite element (FE) model resonance frequencies. However, it does not account for errors in the mean and peak frequency response amplitudes due to uncertainty or bias in plate dimensions, boundary conditions (joints between plates and other members), pre-stresses within members, and friction between internal vanes and other components.

As a clarification of RAI 14.66, PSEG is requested to discuss its consideration of the uncertainty and bias in the dryer FE model frequency response function amplitudes (not in the modal frequencies, the uncertainties of which are already handled by frequency shifting the loads). For example, the assessment of the uncertainties should consider dryer component geometries (length and width, as well as thickness), boundary conditions, and pre-stresses that might occur during welding and assembly.

ENCLOSURE 1
(NON-PROPRIETARY)

RAI 14.74 Follow-up

In RAI 14.74, PSEG was requested to provide acceptance vibration limits for the safety relief valves (SRVs) on the Hope Creek main steam lines (MSLs). In its response to RAI 14.74, PSEG refers to the FE analysis of the SRVs conducted by MPR Associates. PSEG states that the results of this analysis will be incorporated into the power ascension plan. PSEG is requested to provide a summary of the MPR analysis including the results and conclusions.

NOTE: This RAI was answered in PSEG letter LR-N07-0266, dated October 10, 2007.

RAI 14.77 Follow-up

In RAI 14.77, PSEG was requested to provide the following information for the seven weld locations, identified in Table 7b of CDI Report No. 06-27 (Rev. 2), having minimum alternate stress ratio (SR-a) at 115 percent current licensed thermal power (CLTP) conditions with frequency shifts: (1) thickness of the plates at a weld location, (2) if thicknesses are different, identify the nominal stresses in the weld leg attached to the thicker plate, (3) identify the type of loading (normal or bending) acting on the weld during EPU operation, (4) estimate the undersize weld factors, and (5) estimate the minimum alternate stress ratio at the seven weld locations taking into account the undersize weld factors. PSEG has provided part of the requested information in a table for six weld locations where components of different thicknesses are connected.

As a follow-up to RAI 14.77, the licensee is requested to provide the following missing information for each of the six weld locations: (1) identify the alternating stress intensity in both thick and thin components; (2) identify the type of loading (normal and/or bending) acting on the weld; (3) estimate the corresponding undersize weld factors; and (4) estimate the alternate stress ratio for both thick and thin plates.

RAI 14.79 Follow-up

In response to RAI 14.79 and in Section 3.8, *Mesh Details and Element Types*, of CDI Report No. 07-17P, PSEG describes numerical experiments carried out using the ANSYS code applied to simple analytically tractable structures with dimensions and mesh spacing similar to the ones used for the steam dryer, confirming that the natural frequencies are accurately recovered (less than 1 percent errors for the first modes). The staff noted that establishing convergence of resonance frequencies is not sufficient to establish convergence of strain and stress fields. Also, frequency shifting loading functions does not account for lack of convergence in strain and stress fields. Therefore, as a follow-up to RAI 14.79, PSEG is requested to provide pertinent parametric evaluations related to mesh convergence in high strain and stress regions in the Hope Creek steam dryer to assess whether the dimensions and mesh spacing used for the model are adequate. In particular, plots of stresses near high stress regions for coarse and dense FE meshes could be used to confirm that the dryer model used to establish the Hope Creek limit curves are converged.

RAI 14.107 Follow-up

The projected Hope Creek MSL pressure spectra provided in response to RAI 14.107 show that tones may appear near 120 Hz. Since PSEG currently filters 120 Hz signals from the MSL measurements, explain the monitoring and calculation of stress effects of any valve singing tone that occurs near 120 Hz.

RAI 14.110 Follow-up

The stress analysis of the Hope Creek steam dryer represents the first application of the frequency based approach as presented in CDI Report 07-17P for [[

]]. Therefore, a comprehensive verification of this approach is necessary for the reliable prediction of stresses in the Hope Creek steam dryer. The [[

]]. To validate the approach, a rigorous calculation that includes (1) a complex structural dynamic FE model, and (2) a complex spatial and temporal surface loading, is necessary. Item (1) has been met by the existing calculation, but item (2) has not. PSEG notes that [[

]] when analyzing a full steam dryer model. PSEG could consider an alternative analysis to verify the new approach. For example, a small section of a steam dryer could be analyzed, such as one of the outer hoods, using actual plant loads (such as those from CDI report 07-17P) over all frequencies. The outer hood boundaries could be constrained with pins or clamps. The model should retain the dynamic characteristics of the larger steam dryer model, such as having closely spaced natural frequencies. The analysis should include the following aspects:

- (a) One percent Rayleigh damping would be used for the transient simulations. Estimate the actual damping value at each natural frequency of the simplified model (i.e., small section of dryer) and use them in performing new frequency based simulations. Stress and displacement time histories at high stress locations from both approaches would be compared [[

]]. Maximum stresses and displacements for both approaches would then be compared at several locations on the hood.

- (b) Along with comparing time series computed using the transient and frequency based simulations for a model like the one described in part (a), PSEG should provide comparisons of Fast Fourier Transforms, as specified in the original RAI, and explain any differences between peak levels.
- (c) Reevaluate the frequency simulations considered in Part (a) of this RAI with 1 percent of the critical damping for all the frequencies and the compare the results for high stresses, displacements and alternating stress ratios with those for the transient simulations presented in Part (a). Provide justification for the differences in the results.

Additional RAI 14.111

[[

]]. PSEG is requested to explain why such large differences exist in the source strengths.

Additional RAI 14.112

[[

]]. PSEG is requested to provide this report for evaluation of the new methodology.

Additional RAI 14.113

In CDI Report No. 07-09P, a new ACM Rev. 4 is developed to improve prediction of the dryer load at low frequencies. [[

]]

Additional RAI 14.114

In the development of the hydrodynamic load contribution on page 8 of CDI Report No. 07-09P, reference is made to pressure fluctuations $p = 0.1 \rho U^2$. It is not clear whether this estimate is used in equation 4.1 for the [[]]. The other parameters used in equation 4.1 are also not clear. PSEG is requested to:

- (a) if the estimate $p = 0.1 \rho U^2$ is used in equation 4.1, validate this estimate from [[]] on the dryer, e.g. from Quad Cities 2 (QC2) dryer measurements; and
- (b) [[]].

Additional RAI 14.115

On page 4 of CDI Report No. 07-09P, CDI develops a new ACM code to improve the prediction of dryer load at low frequency. The report states that the Helmholtz and Acoustic Circuit Model (ACM) analyses are driven by [[]]. In the new ACM Rev. 4, it appears that [[]]. PSEG is requested to

provide the [[]].

Additional RAI 14.116

The pressure fluctuations measured by the strain gages on the MSLs contain noise signals that are not acoustic in nature. In CDI Report No. 07-09P, the [[

]]. In particular, PSEG should provide:

(a) [[]];

(b) [[]]; and

(c) more detailed explanation of step 3.

Additional RAI 14.117

Referring to CDI Report No. 07-09P, the predictions of ACM Rev. [[]]

PSEG is requested to explain [[]].

Additional RAI 14.118

Benchmarking of the new ACM Rev. 4 against the data of QC2 dryer is presented in CDI Report No. 07-09. PSEG has not demonstrated that this benchmarking is an adequate validation of the new methodology. For example, the low frequency loading on the dryer of QC2 is relatively small, and the [[]]. The new version of ACM Rev. 4 needs to be validated against data from additional dryers exposed to strong low frequency loading. PSEG is requested to provide validation of this new methodology against additional dryer data.

Additional RAI 14.119

In CDI Report no. 07-18, ACM Rev. 4 is used to predict the dryer load of HC1 from strain gage measurements on MSLs. No details however are given regarding the [[]]. PSEG is requested to provide the following:

(a) [[]].

(b) [[]].

(c) [[]].

(d) [[]].

Additional RAI 14.120

In CDI Report No. 07-18P, the [[

]] In CDI Report No. 07-17P, 90 percent of this signal is filtered out based on the determination that this component is not present in the pressure measurements taken from the steam dome (see page 79 of CDI Report No. 07-17P). However, the absence of the [[

]].

Although consideration of the full strength of the [[

]] (i.e. still results in a positive stress ratio), PSEG is requested to provide additional information to [[

]].

Additional RAI 14.121

The following questions are intended for clarification of CDI Report 07-17P:

- (a) In Equation (6), why is the right-hand side multiplied by $(1 + \lambda)$?
- (b) In Section 2.3, first paragraph, it is stated, "Off-surface loads are required by ANSYS to ensure proper interpolation of forces." What are off-surface loads? Please explain the statement.
- (c) In Section 2.3, second paragraph, first sentence states, [[
]] Please explain this sentence. The last sentence of this paragraph states, "Linear interpolation is sufficient since the pressure load varies slowly over [[
]] Please explain why the [[
]].
- (d) Section 3.3, fourth bullet: Please explain the statement, [[
]].
- (e) Please explain the connections of shell edges to solid faces and shell edges to solids as used in the steam dryer model and discussed in Section 3.9.
- (f) In Section 4.4, the factor f_{sw} is used to reflect different weld types. Please explain the meaning of this factor and how it is used in the report.

Additional RAI 14.122

According to the stress analysis using frequency based approach as documented in CDI Report 07-17P (Section 6: Conclusions), the minimum alternating stress ratio at 115 percent CLTP is 2.71 when 10 percent of the 80 Hz signal is included in the analysis. In contrast, according to the stress analysis using direct time history method as documented in CDI Report 06-27, the minimum alternating stress ratio at 115 percent CLTP is 1.33 (Table 7b). Please explain why the

minimum alternating stress ratio as determined by the frequency based approach is more than twice the corresponding ratio determined using the direct time history analysis despite the inclusion of the 10 percent of the 80 Hz signal only with the frequency based approach.

Additional RAI 14.123

The weld locations having the lowest alternating stress ratios as reported in Tables 7b and 8b in CDI Report 07-17P (frequency based approach) appear to be different than those reported in Table 7b in CDI Report 06-27 (direct time history analysis). Please provide justification for these differences.