July 12, 2007

Mr. Britt T. McKinney
Sr. Vice President
and Chief Nuclear Officer
PPL Susquehanna, LLC
769 Salem Blvd., NUCSB3
Berwick, PA 18603-0467

SUBJECT: SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2 - STEAM DRYER INFORMATION AND ANALYSES SUPPORTING THE EXTENDED POWER UPRATE (EPU) AMENDMENT REQUESTS (TAC NOS. MD3309 AND MD3310)

Dear Mr. McKinney:

By letter dated October 11, 2006 (Agencywide Documents Access and Management System Accession No. ML043270480), PPL Susquehanna, LLC (PPL, the licensee) submitted its request to amend the operating license for Susquehanna Steam Electric Station, Units 1 and 2 (SSES 1 and 2) to increase the maximum authorized power level from 3489 megawatts thermal (MWt) to 3952 MWt, an increase of approximately 13 percent in thermal power.

The purpose of this letter is to request supplemental information regarding steam dryer information and analyses supporting the ongoing EPU amendment request review. In support of the EPU review, you have met with the Nuclear Regulatory Commission (NRC) staff and submitted information regarding the steam dryer analyses. Most recently, on June 29, 2007, you met with the NRC staff and provided an overview of the steam dryer licensing and design approach, corrective action status, replacement steam dryer design overview, steam dryer instrumentation plan, and power ascension test plan/startup limits. In addition, on July 6, 2007, you submitted the updated stress analysis report for the SSES 1 and 2 replacement steam dryers.

During the public meeting on June 29, 2007, the NRC staff indicated that additional information is needed by the end of July 2007 for the staff to complete its review in a manner commensurate with its review schedule. The additional information to be submitted to the NRC staff are included in the enclosures to this letter. These questions were discussed with your staff during a teleconference on June 26, 2007, and during the June 29, 2007, meeting. As agreed to by your staff, we request you respond by July 31, 2007. Enclosure 1 includes proprietary information which is indicated in brackets and underlines. We have prepared a non-proprietary version of the questions (Enclosure 2) that does not contain the proprietary information of Enclosure 1.

Should any information needed for this review be received after July 31, the NRC staff notes that the scheduled EPU presentations to the Advisory Committee on Reactor Safeguards could be delayed from the current schedule of September-October 2007. The NRC staff requests that you inform us at the earliest opportunity of your plans to provide the information discussed above.

If you have any questions, please contact me at 301-415-1030.

Sincerely,

/ra/

Richard V. Guzman, Senior Project Manager
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-387 and 50-388

Enclosures:
1. Request for Supplemental Information (Proprietary)
2. Request for Supplemental Information (Non-Proprietary)

cc: See next page (w/o Enclosure 1)

If you have any questions, please contact me at 301-415-1030.

Sincerely,

/ra/

Richard V. Guzman, Senior Project Manager
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cc: See next page (w/o Enclosure 1)

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Susquehanna Steam Electric Station, Units 1 and 2

cc: w/o Enclosure 1

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SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2 (SSES 1 AND 2)

EXTENDED POWER UPRATE APPLICATION

REQUEST FOR SUPPLEMENTAL INFORMATION

PPL SUSQUEHANNA, LLC

DOCKET NOS. 50-387 AND 50-388

The Nuclear Regulatory Commission (NRC) staff has identified the following deficiencies which have not been adequately addressed in PPL's application for the NRC staff to complete its technical review:

1. In reference to the response to NRC staff's request for additional Information (RAI) 3 in letter PLA-6167 dated April 27, 2007, PPL is requested to clarify the following:

   (a) PPL is requested to specify as to which dryer stress analysis will be used for developing the Unit 1 dryer instrumentation limit curves - those based on current licensed thermal power (CLTP) conditions with all four main steam lines (MSLs) open, or those based on slowly closing a single MSL. Although MSL strain gages will not be used to set limits for Unit 1 until 110.5% CLTP, PPL should submit interim limit curves for the MSLs prior to EPU approval, and compare the curves to current levels measured in the plant at original licensed thermal power (OLTP) conditions in order to review the approximate proposed increase in loading levels between CLTP and the extended power uprate (EPU).

   (b) For Unit 1, PPL proposes to use the dryer instrumentation to check pressure, strain, and acceleration levels at 103.5% and 107% CLTP conditions, and then rely solely on MSL strain gage limit curves at 110.5 and 114% CLTP conditions. Since the dryer in Unit 2 is not instrumented, MSL strain gages will be monitored at all four steps (103.5, 107, 110.5, and 114% CLTP conditions), and not until the benchmarking of the stress analysis procedure is completed based on Unit 1 instrumentation at 107% CLTP. The benchmarked dryer stress analysis procedures and updated MSL limit curves shall be reviewed by the NRC prior to PPL proceeding to power levels higher than 107% CLTP in either Unit 1 or Unit 2. As such, PPL should provide a sufficient hold period at 107% CLTP.

   (c) PPL is requested to explain how it plans to use the Unit 1 steam dryer measurements in benchmarking of the stress analysis procedure.

   (d) PPL is requested to explain the rationale for not using the Unit 1 steam dryer instrumentation to monitor stresses in the steam dryer for all four steps of power ascension to 114% CLTP. Operating experience shows that previous applications of an acoustic circuit analyses have determined pressure loads on steam dryers based on pressure fluctuation measurements in the MSLs caused by downstream sources in the steam lines. The licensee indicates in Attachment 10, Section 4.2.5.1 of their submittal, that the pressure pulses measured in the MSLs are generated by hydrodynamic sources.

The licensee's application does not provide the technical justification to show that the acoustic circuit analysis is reliable in determining SSES steam dryer pressure loads caused by such hydrodynamic sources.

(e) The benchmarking of dryer stress analysis as discussed in (b) may not be adequate because it may not include loading due to significant acoustic resonance that might only take place at power greater than 107% CLTP. Discuss the benchmarking of the dryer stress analysis for loading above 107% CLTP.

2. (a) In the response to NRC staff's RAI 4 in letter PLA-6167 dated April 27, 2007, PPL supplies pressure time signals measured during the scale model testing (SMT) and inside the dead leg attached to line A (or D). The signals appear to be in phase, which supports the supposition of a standing quarter wavelength inside the dead leg. However, PPL does not comment on why the normalized power spectral density (PSD) is lower at the end cap than at the midpoint of the dead leg (Figs A.19 to A. 29 of Continuum Dynamics Inc. (CDI) Report No. 05-32, March 2006). These results contradict those shown in Fig. 8.2 of the same report, which shows higher root mean-square (RMS) pressure at the end cap. PPL is requested to explain this disagreement in the reported results.

(b) PPL also refers to the turbulent eddies at the inlets of MSLs as the excitation source of the low frequency components (16 and 32 Hz). While this is a plausible excitation source, PPL neglects the possibility of flow excitation at the mouth of the dead leg. Simple calculations based on f =16 Hertz (Hz), V = 153 fps, and 24" diameter pipe, gives a Strouhal number of about 0.21. This is close to the critical value for this geometry (see Figs. 12 & 13 of paper by Peters & Bokhorst 2000, "Flow-excited pulsations in pipe systems with closed branches, impact of flow direction," in Flow-Induced Vibration, Balkema 2000). However, the geometry of the T-junction edge is crucial. PPL is requested to (1) evaluate this possible excitation source; (2) provide information on the geometry of the T-junction edge (sharp or rounded and at what radius); and (3) explain whether the geometrical details of the T-junction edges and the length of MSLA were properly modeled in the SMT study.

(c) In its response to RAI 4 (and RAI 31), PPL supplied more details on the MSL geometry. It seems that the lower strain gages on steam lines A and D are very close to (1) the T-junction at the mouth of the dead leg and (2) to a pressure node of the 16 Hz component. Concerning Item (1), PPL is requested to explain how it accounts for the effect of the pipe stiffening (being close to a T-junction) when relating the pipe strains to acoustic pressure. Regarding Item 2, the lower strain gages on Lines A and D are nearly "blind" to the 16 Hz component, which is the strongest dynamic loading on the dryer. Since PPL is planning to use MSL measurements to evaluate the dryer stresses for the last two steps of power ascension to EPU of Unit 1, the measurement accuracy and uncertainties of the lower strain gages should be reassessed. First, the lower strain gages are blind to the 16 Hz component and they are also close to the T-junction which influences the conversion factor. PPL is requested to explain whether the lower strain gages will be repositioned (away from the pressure node) or if additional strain gages will be installed on lines A and D (i.e., use a three-location measurement method for MSL pressures).

3. With regard to its response to NRC staff's RAI 9 in letter PLA-6167 dated April 27, 2007, PPL is requested to provide plots for each MSL at CLTP conditions which compare the PSDs of the unfiltered and filtered (where coherence between upper and lower MSL locations is used to compute coherent PSDs) conditions. The comparison should be on a common plot, with the two curves clearly distinguishable from each other or can be presented as 8 total plots - unfiltered data and filtered data at each strain gauge (8). The unfiltered data should be shown prior to the removal of any "exclusion" frequencies.

4. In the response to NRC staff's RAI 10 in letter PLA-6167 dated April 27, 2007, [

].

PPL addresses the [

].

5. (a) In its response to NRC staff's RAI 13 in letter PLA-6167 dated April 27, 2007, PPL states that "the ACM model used computes only the acoustic loads on the dryer. The loads acting on the Susquehanna dryer are primarily hydrodynamic in nature. In order to obtain a true representative load definition, the acoustic and hydrodynamic loads should be combined." This statement contradicts the foundation of CDI Report No. 06-22, Revision 0, September 2006. In this report, "Hydrodynamic loads at OLTP, CLTP, …", CDI uses ACM to predict the "hydrodynamic" loads on the dryer. The first item in the conclusion section of this report, Page 40, states that "the acoustic circuit analysis determines that steam dryer peak differential hydrodynamic loads at 113% OLTP power are less than 0.37psid." PPL should explain this apparent contradiction and, if necessary, revise CDI Report No. 06-22 so that it reflects what is measured. In addition, if the ACM methodology will be used to monitor dryer loads during power ascension from 107% to 114% CLTP, PPL should explain how the hydrodynamic loads will be assessed.

(b) In response to RAI 13(b), PPL refers to Section 6.3 of General Electric (GE) report GENE-0057-4166-R1-P for incorporation of the stress underprediction factor in the fatigue analysis of Susquehanna steam dryer. However, during the February 27, 2007, meeting, PPL informed the NRC staff that it does not plan to use GENE-0057-4166-R1-P in the design development of the SSES replacement dryers. PPL is requested to clarify its use of the mentioned GE report in response to RAI 13(b).

6. (a) In its response to NRC staff's RAI 24(a) in letter PLA-6167 dated April 27, 2007, PPL is requested to provide a summary of the stress analysis report (bounding licensing case), for the replacement steam dryer. The summary should discuss the overall model, analysis assumptions, results, deviations from final geometry/as-designed finite element evaluation, and identification of relevant locations of high stress with respect to the allowable American Society of Mechanical Engineers code limit of 13,600 pounds per square-inch (psi). The summary should include specific discussion of the weld factors used in estimating the alternating stresses at the toes of the fillet welds when joining plates of equal and unequal thicknesses. The proposed bounding (or 'licensing') stress report should also identify as-built features which are not included in the interim finite element solution, and explain how those features are expected to decrease dryer stresses.

   (b) In addition to toes of the fillet welds, the roots of the fillet welds are also susceptible to stress concentration and fatigue cracking. According to Hechmer and Kuhn, "Fatigue Strength Reduction Factors for Welds Based on Nondestructive Examination," Journal of Pressure Vessel Technology, 1999, Vol. 121, pages 6-10, the fatigue strength reduction factor (FSRF) for the root of a fillet weld varies between 3 and 4. PPL is requested to explain how it accounts for the FSRF for the roots of the fillet welds in the fatigue analysis of the replacement steam dryer for Susquehanna Units 1 and 2.

   (c) In its response to RAI 24(b) regarding stress underprediction factor, PPL refers to scale model testing. However, during the February 27, 2007, meeting PPL informed the staff that it does not plan to use the GE report [GENE-0000-0054-2552-01-P ((1/17th SMT)] or CDI report [05-32, Rev. 0 9 (1/6th SMT)] in the design development of the SSES 1 and 2 replacement dryers. PPL is requested to clarify its use of the mentioned GE and CDI report in response to RAI 24(b).

7. With regard to the response to NRC staff's RAI 26 in letter PLA-6167 dated April 27, 2007, confirm whether the visual dryer inspections at refueling outages will be performed following EPU approval to ensure pump vane passing frequency tones do not cause fatigue damage to the dryer.

8. From the review of PPL's responses presented in PLA-6176, it is not clear which dryer stress analysis will be used to define limit curves during power ascension: (1) analysis based on CLTP conditions, or (2) analysis based on slow closure of a single MSL. Please clarify.

9. PPL is requested to submit limit curves for the replacement dryer and/or MSL instrumentation that will be monitored during power ascension for NRC review prior to constant pressure power uprate approval. The limit curves need to be substantiated by an updated dryer stress analysis report.

10. In the response to NRC staff's RAI 18 in Attachment 1 to PLA-6200, PPL notes that: "The interaction formula is a commonly used relationship of forces and moments that are applied to rotating equipment." Please specify the standard.

11. The NRC staff is considering license conditions and regulatory commitments for monitoring, evaluating, and taking prompt action in response to potential adverse flow effects as a result of EPU operation on plant structures, systems, and components (including verifying continued structural integrity of the steam dryer), and interacting with the NRC staff during power ascension, for SSES 1 and 2 if an EPU license amendment is approved. The staff considers license conditions and regulatory commitments similar to those placed on the Vermont Yankee nuclear power plant in the EPU license amendment issued on March 2, 2006, to also be appropriate for a Susquehanna EPU license amendment. PPL is requested to propose license conditions and/or regulatory commitments and indicate where those license conditions and regulatory commitments should be modified to reflect power ascension plans for SSES 1 and 2.