Resubm. Rcd to B Vaidya
via large file transfer
7/22/2010.
DLF

05/12/2010

Rich:

The purpose of this electronic submittal is to provide the attached evaluation of Susquehanna SES Unit 1 steam dryer performance based on the data collected at the 107% power test plateau as requested by NRC reviewers.

Summary:

This report provides a summary of the SSES Unit 1 replacement steam dryer monitoring instrumentation (Main Steam Line Strain Gage) measurements at the 107% CLTP test plateau. This data was collected at a power level of 3726 MWth and a core flow of 98.19 M lb_m/hr. Based on the current margin to dryer acceptance limits shown in the report there is adequate projected margin to the dryer acceptance limits for continued ascension to 3952 MWth.

The enclosed information contains proprietary information as defined by 10CFR2.390. PPL, as the owner of the proprietary information, has executed the enclosed affidavit, which identifies that the enclosed proprietary information has been handled and classified as proprietary, is customarily held in confidence, and has been withheld from public disclosure. PPL hereby requests that the enclosed proprietary information be withheld from public disclosure in accordance with the provisions of 10CFR2.390.

The header on each page in this enclosure carries the notation "PPL Proprietary Information". PPL proprietary information is identified inside triple brackets. {{{This sentence is an example.[(2)]}}}. In each case, the superscript notation [(2)] refers to Paragraph (2) of the PPL affidavit, which provides the basis for the proprietary determination. Specific information that is not so marked is not PPL proprietary.

Duane Filchner

Enclosure 1 – SSES Replacement Steam Dryer Report, Unit 1 Start-Up, 107% Power Test Plateau, May 11, 2010 – PPL Proprietary Information.

Enclosure 2 – SSES Replacement Steam Dryer Report, Unit 1 Start-Up, 107% Power Test Plateau, May 11, 2010 – Non-Proprietary Information.

Enclosure 3 – Affidavit

ENCLOSURE 1

SSES Replacement Steam Dryer Report

Unit 1 Start-Up

107% Power Test Plateau

May 11, 2010

PPL Proprietary Information

WITHHELD FROM PUBLIC DISCLOSURE
IN ACCORDANCE WITH 10 CFR 2.390

ENCLOSURE 2

SSES Replacement Steam Dryer Report

Unit 1 Start-Up

107% Power Test Plateau

May 11, 2010

Non-Proprietary Information

SSES Replacement Steam Dryer Report

Unit 1 Start-Up

107 % Power Test Plateau

May 11, 2010

Prepared By: John A. Barton 5-11-2010

Reviewed By: [signature] 5/11/2010

Approved by: John Krais per telecon 5/11/2010
JAS

This report provides a summary of the SSES Unit 1 replacement steam dryer monitoring instrumentation (Main Steam Line Strain Gage) measurements at the 107% CLTP test plateau. This data was collected at a power level of 3726 MWth and a core flow of 98.19 M lb_m/hr. The main steam line (MSL) strain gage locations are documented in Reference 1. The plant data log sheet for this power plateau is contained in Appendix A. The data log sheets provide a record of plant conditions during at this plateau.

Figures 1 through 8 provide power spectral density (PSD) plots of MSL strain gage readings. The Level 1 and Level 2 limit curves for each strain gage location are also plotted on each figure. The strain values represent average strain values observed over a 180 second test time period. A data sampling rate of 2500 Hz was used in the data processing. The test data was bandpass filtered between 3 and 250 Hz to be consistent with the load definition used in the replacement dryer structural analysis in Reference 2. There is substantial noise from the 60 Hz alternating current and the recirculation pump power supply, thus filtering of this electrical noise was performed. Also the reactor recirculation pump vane passing frequencies were filtered from the data sets. Testing on the instrumented Unit 1 steam dryer {{{

.[2]}}}

Reference 2 documented that the {{{

.[2]}}} The filters applied to the 3726 MWth data are contained in Table 1 below:

Table 1: PSD Notch Filter Specifications

{{{

[2]}}}

A noise peak at approximately 136 HZ was noted during the primary system hydrostatic test prior to plant start-up. This is a condition where systems are pressurized to operating levels but no steam flow exists. As Unit 1 ascended in power, this noise peak did not increase in amplitude. The source of this noise could not be determined but it has been conclusively shown that it is not related to power and/or steam flow and therefore a filter has been applied to eliminate it.

PSDs were calculated on 2 second blocks of data from the test time period (180 seconds). In order to increase the number of spectral averages, the data blocks were overlapped by 50%. The PSDs were calculated using a Hanning window and a 0.5 Hz bin size. The resulting PSDs were

then linearly averaged and are presented as Figures 1 through 8. This method of data processing was used to provide the results in a format consistent with the processing used to develop the monitoring curves.

There are also two monitoring curves included with the PSD plots. The Level 1 monitoring curve represents the response of the SSES dryer finite element (FE) model under the design acoustic load conditions factored by the minimum component analysis margin to the endurance limit. The Level 2 monitoring curve is based on 80% of the Level 1 curve. A more complete description is included in Reference 3 and Reference 4. The Limit Curves were generated in accordance with Reference 3 using a baseline data set from Unit 1 collected at 3733 MWth during the 2008 power ascension. These monitoring curves provide guidance for evaluating the measured dryer response with respect to the structural analysis results and represent the acceptance criteria for the power ascension.

Table 2 below shows the maximum strain gage reading as a percent of acceptance limits generated in accordance with Reference 3 using a baseline data set from Unit 1 collected at 3726 MWth. All values of strain are below the Level 1 and Level 2 acceptance limits.

Table 2: Maximum MSL Strain Gage Readings @ 3726 MW_{th}
Expressed as a Ratio of the Acceptance Limits

{{{

[(2)]}}}

Table 2 above shows a 15 HZ peak approaching the Level 2 limit curve on the MSL C Lower set of strain gages. An examination of the four strain gages that are averaged to determine this reading shows that 15 HZ content comes from primarily one strain gage. Two of the four strain gages have no 15 HZ peaks. This would indicate that this peak is the result of piping vibration in lieu of MSL steam acoustic pressure pulses. The accelerometers mounted on the MSL C were checked and they confirm that there is a 15 HZ vibration peak in C steam line. This MSL strain gage peak was first observed at 65% power and has remained at a relatively constant magnitude over powers from 65% through 94.4%. Therefore, it is concluded that the 15HZ peak on MSL C Lower is not acoustic. Since true acoustic peaks exist on MSL A and MSL D no 15 HZ filters have been applied to the data.

For trending purposes, filtered MSL strain gage PSDs for powers up to 107% of CLTP (3726 MW_{th}) have been plotted in a waterfall format and are presented in Figures 9 through 16. Figure 17 is a trend plot of the RMS value of the sample time histories plotted against total steam flow.

Figures 9 through 17 shows that MSL stresses are {{{
.[2]}}}

MSL strain gages mounted on the A and D steam lines have the highest magnitude readings. This is attributed to the large 15 HZ peak being generated by the SRV dead-legs on these two steam lines. The magnitude and frequency of the MSL strain gage PSDs is similar to the PSDs measured on Unit 1 in 2008 in both frequency content and magnitude. The Level 1 and Level 2 limit curves, Figures through 8, are based on Unit 1 strain gage PSD's recorded at 3733 MWth during the 2008 start-up.

Summary

Based on the current margin to dryer acceptance limits shown in Table 1 and in Figures 1 through 8, there is adequate projected margin to the dryer acceptance limits for continued power ascension to 3952 MW_{th}.

References:

1. PPL Letter To USNRC, PLA-6176 (Figure 31-1), "Susquehanna Steam Electric Station Proposed License Amendment No. 285 For Unit 1 Operating License No. NPF-14 And Proposed License Amendment No. 253 For Unit 2 Operating License No. NPF-22 Extended Power Update Application Regarding Steam Dryer And Flow Effects Request For Additional Information Responses", dated 4/27/2007

2. GE-Hitachi Nuclear Energy Engineering Report 0000-0095-2113-P-R0, "Susquehanna Replacement Steam Dryer Updated Stress Analysis At Extended Power Uprate Conditions", Class III, February 2009 (Provided via PPL Letter To USNRC, PLA-6484, dated 2/27/09)

3. GE-Hitachi Nuclear Energy Engineering Report 0000-0096-5766-P-R1, "Revised Susquehanna Replacement Steam Dryer Limit Curves - Main Steam Line Mounted Instrumentation", Class III, February 2009 (Provided via PPL Letter To USNRC, PLA-6484, dated 2/27/09)

4. GE-Hitachi Nuclear Energy Engineering Report 0000-0101-0766-P-R0, "Main Steam Line Limit Curve Adjustment During Power Ascension", Class III, April 2009 (Provided via PPL Letter To USNRC, PLA-6510, dated 5/12/09)

{{{

[(2)]}}}

Figure 1: MSL A Upper Strain Gage PSD Plot

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[(2)]}}}

Figure 2: MSL A Lower Strain Gage PSD Plot

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{{{[2]}}}

Figure 3: MSL B Upper Strain Gage Plot PSD Plot

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{{{[2]}}}

Figure 4: MSL B Lower Strain Gage PSD Plot

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[2]}}}

Figure 5: MSL C Upper Strain Gage PSD Plot

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[2]}}}

Figure 6: MSL C Lower Strain Gage PSD Plot

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Figure 7: MSL D Upper Strain Gage PSD Plot

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Figure 8: MSL D Lower Strain Gage PSD Plot

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{{{

Figure 9: MSL A Upper Strain Gage PSD Waterfall Plot

[2]}}}

{{{

Figure 10: MSL A Lower Strain Gage PSD Waterfall Plot

[2]}}}

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Figure 11: MSL B Upper Strain Gage PSD Waterfall Plot

{{{

Figure 12: MSL B Lower Strain Gage PSD Waterfall Plot

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Figure 13: MSL C Upper Strain Gage PSD Waterfall Plot

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Figure 14: MSL C Lower Strain Gage PSD Waterfall Plot

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[(2)]}}}

Figure 15: MSL D Upper Strain Gage PSD Waterfall Plot

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[(2)]}}}

Figure 16: MSL D Lower Strain Gage PSD Waterfall Plot

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[(2)]}}}

Figure 17: MSL Strain Gage Time History RMS Trends

Appendix A

Plant Data Log Sheets

Steam Dryer Data Log Sheets

Start

Date/Time	5/11/2010 7:49	(Start)

	Computer ID	Value	Units
Thermal Power (Instantaneous)	u01.nba01	3726.42	MWth
Thermal Power (15 min Ave.)	u01.nba101	3721.46	MWth
Electrical Power	u01.tra178	1274.76	Mwe
Total Core Flow	u01.tra026	98.19	M lbm/hr
Recirc Loop Flow A	u01.tra028	49.55	M lbm/hr
Recirc Loop Flow B	u01.tra029	48.26	M lbm/hr
Recirc Loop A Suction Temperature	u01.nrt01	524.51	°F
Recirc Loop B Suction Temperature	u01.nrt02	524.90	°F
Core Plate D/P	u01.tra027	14.99	PSI
Indicated Steam Flow Line A	u01.nff01	4.00	M lbm/hr
Indicated Steam Flow Line B	u01.nff02	4.09	M lbm/hr
Indicated Steam Flow Line C	u01.nff03	4.12	M lbm/hr
Indicated Steam Flow Line D	u01.nff04	3.98	M lbm/hr
Indicated Total Steam Flow	u01.tra097	16.15	M lbm/hr
Indicated Feedwater Flow	u01.tra098	15.72	M lbm/hr
Feedwater Temperature Line A	u01.tra102	396.49	°F
Feedwater Temperature Line B	u01.tra103	397.96	°F
Feedwater Temperature Line C	u01.tra104	398.67	°F
Rx Dome Pressure Narrow Range	u01.tra208	1023.29	PSIG
Rx Dome Pressure Wide Range	u01.tra209	1021.62	PSIG
Steam Dome Temperature	u01.nfa05	548.89	°F
Recirculation Pump A Speed	vm.1p401a/1a_rrp_tac	1424.00	RPM
Recirculation Pump B Speed	vm.1p401b/1b_rrp_tac	1432.00	RPM
Recirculation Pump A Power	u01.nrj51	3.67	MWe
Recirculation Pump B Power	u01.nrj52	3.69	MWe
CRD Cooling Header Flow	u01.nef03	64.29	GPM
CRD System Flow	u01.nef01	63.23	GPM
CRD System Temperature	u01.ndt05	123.18	°F
Bottom Head Drain Temp	u01.tra206	529.71	°F
Reactor Water Level Narrow Range	u01.tra142	35.81	Inches H2O
Reactor Water Level Narrow Range	u01.nfl02	35.56	Inches H2O
Reactor Water Level Narrow Range	u01.nfl03	33.61	Inches H2O
Reactor Water Level Wide Range	u01.tra143	36.31	Inches H2O
Recirculation Pump A Vane Passing Freq.	n/a	118.67	Hz
Recirculation Pump B Vane Passing Freq.	n/a	119.33	Hz
Recirculation Pump A Motor Frequency	n/a	47.95	Hz
Recirculation Pump B Motor Frequency	n/a	48.22	Hz

Enhanced Steam Flow Calculations

Feed Flow Line A (LEFM)	u01.nff77	5.14	M lbm/hr
Feed Flow Line B (LEFM)	u01.nff78	5.20	M lbm/hr
Feed Flow Line C (LEFM)	u01.nff79	5.16	M lbm/hr
CRD Flow	u01.ndf01	0.03	M lbm/hr
Total Feedwater Flow	n/a	15.53	M lbm/hr
Steam Flow Line A	n/a	*3.84*	M lbm/hr
Steam Flow Line B	n/a	*3.93*	M lbm/hr
Steam Flow Line C	n/a	*3.95*	M lbm/hr
Steam Flow Line D	n/a	*3.82*	M lbm/hr
Total Steam Flow	n/a	*15.53*	M lbm/hr

Steam Dryer Data Log Sheets
Finish

Date/Time	5/11/2010 7:52	(Finish)

	Computer ID	Value	Units
Thermal Power (Instantaneous)	u01.nba01	3726.03	MWth
Thermal Power (15 min Ave.)	u01.nba101	3722.97	MWth
Electrical Power	u01.tra178	1287.19	Mwe
Total Core Flow	u01.tra026	97.95	M lbm/hr
Recirc Loop Flow A	u01.tra028	49.58	M lbm/hr
Recirc Loop Flow B	u01.tra029	48.29	M lbm/hr
Recirc Loop A Suction Temperature	u01.nrt01	524.52	°F
Recirc Loop B Suction Temperature	u01.nrt02	524.91	°F
Core Plate D/P	u01.tra027	15.01	PSI
Steam Flow Line A	u01.nff01	4.00	M lbm/hr
Steam Flow Line B	u01.nff02	4.10	M lbm/hr
Steam Flow Line C	u01.nff03	4.12	M lbm/hr
Steam Flow Line D	u01.nff04	3.98	M lbm/hr
Total Steam Flow	u01.tra097	16.14	M lbm/hr
Feedwater Flow	u01.tra098	15.74	M lbm/hr
Feedwater Temperature Line A	u01.tra102	396.48	°F
Feedwater Temperature Line B	u01.tra103	397.96	°F
Feedwater Temperature Line C	u01.tra104	398.65	°F
Rx Dome Pressure Narrow Range	u01.tra208	1023.19	PSIG
Rx Dome Pressure Wide Range	u01.tra209	1021.62	PSIG
Steam Dome Temperature	u01.nfa05	548.89	°F
Recirculation Pump A Speed	vm.1p401a/1a_rrp_tac	1424.00	RPM
Recirculation Pump B Speed	vm.1p401b/1b_rrp_tac	1433.00	RPM
Recirculation Pump A Power	u01.nrj51	3.66	MWe
Recirculation Pump B Power	u01.nrj52	3.69	MWe
CRD Cooling Header Flow	u01.nef03	64.29	GPM
CRD System Flow	u01.nef01	63.22	GPM
CRD System Temperature	u01.ndt05	123.18	°F
Bottom Head Drain Temp	u01.tra206	529.83	°F
Reactor Water Level Narrow Range	u01.tra142	34.19	Inches H2O
Reactor Water Level Narrow Range	u01.nfl02	36.28	Inches H2O
Reactor Water Level Narrow Range	u01.nfl03	35.37	Inches H2O
Reactor Water Level Wide Range	u01.tra143	36.34	Inches H2O
Recirculation Pump A Vane Passing Freq.	n/a	118.67	Hz
Recirculation Pump B Vane Passing Freq.	n/a	119.42	Hz
Recirculation Pump A Motor Frequency	n/a	47.95	Hz
Recirculation Pump B Motor Frequency	n/a	48.25	Hz

Enhanced Steam Flow Calculations

Feed Flow Line A (LEFM)	u01.nff77	5.13	M lbm/hr
Feed Flow Line B (LEFM)	u01.nff78	5.20	M lbm/hr
Feed Flow Line C (LEFM)	u01.nff79	5.16	M lbm/hr
CRD Flow	u01.ndf01	0.03	M lbm/hr
Total Feedwater Flow	n/a	15.53	M lbm/hr
Steam Flow Line A	n/a	*3.83*	M lbm/hr
Steam Flow Line B	n/a	*3.93*	M lbm/hr
Steam Flow Line C	n/a	*3.95*	M lbm/hr
Steam Flow Line D	n/a	*3.81*	M lbm/hr
Total Steam Flow	n/a	*15.53*	M lbm/hr

ENCLOSURE 3

Affidavit

CONFIDENTIAL INFORMATION
SUBMITTED UNDER 10 C.F.R. §2.390

AFFIDAVIT OF RICHARD D. PAGODIN

I, Richard D. Pagodin General Manager-Nuclear Engineering PPL Susquehanna, LLC, do hereby affirm and state:

1. I am authorized to execute this affidavit on behalf of PPL Susquehanna, LLC (hereinafter referred to as "PPL").

2. PPL requests that the information attached and identified by text inside triple brackets {{{This sentence is an example.}}} be withheld from public disclosure under the provisions of 10 C.F.R. 2.390(a)(4).

3. The PPL Documents contain confidential commercial information, the disclosure of which would adversely affect PPL.

4. This information has been held in confidence by PPL. To the extent that PPL has shared this information with others, it has done so on a confidential basis.

5. PPL customarily keeps such information in confidence and there is a rational basis for holding such information in confidence. The information is not available from public sources and could not be gathered readily from other publicly available information.

6. Public disclosure of this information would cause substantial harm to the competitive position of PPL, because such information has significant commercial value to PPL.

7. The information identified in paragraph (2) above is classified as proprietary because it details the results of test data derived from test instrumentation installed specifically to collect this data. This instrumentation was installed at a significant cost to PPL. The data and the conditions under which it was collected constitute a major PPL asset.

8. Public disclosure of the information sought to be withheld is likely to cause substantial harm to PPL by foreclosing or reducing the availability of profit-making opportunities. The information is of value to other BWR Licensee's and would support evaluations and analyses associated with extended power uprate license amendment submittals. Making this information available to other BWR Licensee's would represent a windfall and deprive PPL the opportunity to recover a portion of its large investment in the test instrumentation from which this data is derived.

PPL SUSQUEHANNA, LLC

Richard D. Pagodin

Commonwealth of Pennsylvania
County of Luzerne

Subscribed and sworn before me,
a Notary Public in and for the
Commonwealth of Pennsylvania
This 11th day of May, 2010

Pamela M Vincent

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Pamela M. Vincent, Notary Public
Sugarloaf Twp., Columbia County
My Commission Expires May 31, 2010
Member, Pennsylvania Association of Notaries