ATTACHMENT 2

Hope Creek Generating Station

Facility Operating License No. NPF-57
NRC Docket No. 50-354

Extended Power Uprate

Non-Proprietary Version of August 17, 2007 Presentation

Hope Creek EPU

NRC/PSEG Nuclear Meeting

Rockville, Maryland

August 17, 2007

Hope Creek
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Introductions

Objectives

PSEG View of Acceptance Criteria

Discussion of Key Points :

- Bias & Uncertainty
- Acoustic Circuit Model (ACM) Rev 4 Methodology
- Loading Definition from ACM
- Finite Element Model (FEM)
- Limit Curves

Final Reports

RAI Responses

Objectives

Demonstrate closure with May 2007 audit concerns as summarized by recent RAIs

- RAI matrix is provided at the end of the presentation
  - Indicates if a report was generated to address RAI response
  - Broken down by category (FEM, ACM, etc)

Summarize the revised reports

- Indicates key reasons for resubmitting

Solicit NRC feedback/observations

PSEG View of Acceptance Criteria

Acoustic Circuit Model Biases and Uncertainties

- Frequency-dependent based on QC2 data
- Applied to loads from in-plant CLTP strain gage data

Finite Element Model

- Frequency shift ±10% to establish peak stresses

Acceptable Margin

- Sufficient to accommodate expected increase in loads proportional to flow^2
- Qualitative Assessment of Acoustic Loads

Bias and Uncertainty (B&U)

The B&U for the load consists of:

- **Strain Gage B&U**
- **Acoustic Circuit Model Rev 4 B&U**
  - Based on QC2 data for dryer hood sensors P1 –P21
  - Calculated for discrete frequency ranges as defined by RAI 14.67 Which States
    - "Frequency ranges are:[[

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  - Averaged 6 pressure sensors in each frequency range
  - [[ ]]
    - Expected Standpipe Resonance for HC is at 118 Hz

Bias and Uncertainty (B&U)

Biases are added algebraically.

Uncertainties are combined by SRSS.

Summarized in CDI Report 07-09P & CDI Technical Note 07-29P Tables 2, 3 & 4

FEM Load shifted in 2.5% intervals between -/+10% to account for frequency uncertainty

Bias and Uncertainty

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Negative bias is ACM over prediction;

Positive bias is ACM under prediction

Total includes strain gage bias and uncertainty

Acoustic Circuit Model Rev 4 Methodology

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Summarized in CDI Report 07-09P

Loading Definition from ACM Rev 4

Input: 2007 in-plant data from all 4 MSLs (RAI 14.109)

- No reliance on previous algorithm to justify data from only 2 MSLs
- No reliance on Scale Model Test (SMT)

The calculated B&U is added to the measured load before it is applied to the FEM

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Summarized in CDI Report 07-18P

Finite Element Model (FEM)

FEM - ANSYS 10 in the Harmonic Domain

- Constant 1% structural damping across frequency range (RAI 14.78)
- Addresses concerns on transient time at low frequencies
- 64 seconds of in-plant data are used vs 2 seconds (RAI 14.96)

Harmonic approach provides much more efficient means of producing accurate data

Based on 2007 in-plant CLTP Loads

Finite Element Model (FEM)

Validation is provided in Appendix B of CDI Report 07-09 (RAI 14.110)

- Compares results of the harmonic domain vs the transient in the time domain
- Stress histories are virtually identical in both Amplitude & Phase
- Comparison is done using the Browns Ferry Unit 1 Dryer FEM
- Two Specific Base Frequencies were Compared

Finite Element Model (FEM)

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FEM Alternating Stress Ratios ≤ 2.50

Locations (All are Welds)	% Frequency Shift	Alternating Stress Ratio
Outer vane bank/perforated inlet plate	-7.5%	1.86
Middle base plate / middle vane bank	-7.5%	1.89
Inlet Perforated Plate / vane bank top vertical plate	-7.5%	2.11
Middle base plate / middle vane bank	-7.5%	2.40
Outer base plate / outer vane bank	-7.5%	2.50

All alternating stress ratios at nominal frequency are > 4

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Limit Curves

Based on 2007 in-plant data

- No reliance on Scale Model Testing

Based on Limiting Frequency shifts in 2.5% intervals between -/+10%

One limit curve for each of the 8 MSL strain gage locations

Summarized in Technical Note No. 07-29P

Limit Curves

Minimum SR-a at CLTP = 1.86

- No further reduction required due to loading B&U

Level 2 is 80% of allowable (10,880 psi)

Level 1 is 100% of allowable (13,600 psi)

Load increase for 15% EPU is factor of 1.32

- Projected stress ratio at EPU is 1.86 / 1.32 = 1.40

Load increase for 11.5% TPU is factor of 1.24

- Projected stress ratio at EPU is 1.86 / 1.24 = 1.50
- Target power in next operating cycle

Load Methodology for ACM R4

- CDI Report 07-09P Revision 1
  - Adds "low frequency hydrodynamic contribution" to increase fidelity at lower frequencies
  - Provides bias and uncertainty information over specified frequency ranges (RAI 14.67)

Load Definition

- CDI Report 07-18P
  - Based solely on 2007 in-plant data and from all 4 MSLs
  - Addresses RAIs on SMT (14.70, 80, 88, 89, 95,105 and 109)
  - Figure 4.7 shows the [[ ]] (RAI 14.73)

Finite Element Analysis

- CDI Report 07-17P
  - Revised FEM based on CLTP 2007 in-plant data
    - Does not rely on scale model tests,
    - Eliminates reliance on using only 2 MS line data (RAI 14.85)
  - Includes frequency variations from –10% to +10%
  - Resolves issues with Rayleigh damping anchors (RAI 14.78)
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  - Adds explanation for model simplification (RAI 14.76)
  - Discusses Mesh Studies (RAI 14.79)
  - Uses 64 seconds of in-plant data (not 2 seconds) (RAI 14.96)

Limit Curves

- CDI Technical Note 07-29P
  - Based solely on in-plant data
  - Based on most conservative frequency shift
  - Provides a limit curve for each of 8 locations
  - Addresses RAI's 14.86, 14.104, and 14.109

Additional RAI's

ACM, RAI 14.75 – Address problems that are prevalent in two- sensors acoustic measurement

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RAI's on benchmarking of SMT, etc

- Responses provided to specific questions, but revised submittal only uses SMT for QC and HC comparisons:
  - Add a 118 Hz peak to the HC predicted PSD curves at EPU for comparison with the QC OLTP PSDs (RAI 14.107)

PSD Comparisons – QC2 vs HC1

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FEM, RAI 14.108, Use of higher factor at the root of a fillet weld

- WRC Bulletin 432 provides the basis for using a weld factor of 1.8 at the root of a fillet weld. The membrane plus-bending stresses and the thermal stresses are normally higher on the surface then at the embedded location and the free surface has less constraint than an embedded location. Low constraint allows the shear plane to be worked, distorted, and separations to be formed. HCGS FEM shows that the bending stresses are much larger then the membrane stresses at all the limiting steam dryer locations.

Additional RAI's (Continued)

FEM, RAI 14.77, different thickness plates

- Provided two simple models
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- Provided component thicknesses at highest stressed locations

Additional RAI's (Continued)

RAI's 14.74 SRV monitoring

PSEG is in the process of developing a finite element model of the SRV's which will allow calculating vibration limits for theses valves.

Vane Passing Frequency Concern on SSES Steam Dryer, RAI 14.83

- Responded with added information about the SSES failure and the subsequent lessons learned applied at HCGS.
- Recirculation pump speed range is not changing with EPU, the Steam dryer would not be exposed to any new vane passing frequencies. The Steam Dryer Inspections performed to date and those that will be performed following EPU implementation are adequate to address the concern on loads imposed by Vane Passing Frequency.

RAI Matrix

#14.	Category	Abridged RAI	Abridged response
67	ACM	Bias and uncertainty calculation does not follow VY method. Calculate bias and uncertainty at frequency bands;	New ACM report and new limit curves provide this information. Load definition includes the revised bias and uncertainty.
73	ACM	[[ ]]	[[ ]] Load Report Figure 4.7 provides the [[ ]]
75	ACM	Concern on ACM definition at only two measurement locations;	Provided as response to the RAI
84	ACM	[[ ]]	[[ ]]
85	ACM	Demonstrate 2006 loads/FEM is conservative with regard to 2007 data;	New load definition/FEM based on 2007 data.
96	ACM	Use of 2-second interval for load definition;	New calculations are over an order of magnitude longer.

RAI Matrix

70 and 80	SMT	Questions on limit curves and stresses based on SMT;	Provided limit curves based on CLTP data
88	SMT	Explain inconsistencies in CDI Report 07-01 between SMT and plant data;	New FEM and limit curves rely only on in-plant data
89	SMT	Explain inconsistencies in CDI Report 07-01 between SMT and plant data ;	New FEM and limit curves rely only on in-plant data
95	SMT	Explain what appears to be errors in the report;	Revised reports not relying on SMT data. Provided as response to the RAI
105	SMT	Questions on old limit curves based on SMT data;	New limit curves provided based solely on in-plant data.
109	SMT	Reliance on SMT for FEM;	New FEM report based solely on in-plant data

RAI Matrix

66	FEM	Accuracy of FEM;	Provided as response to the RAI
76	FEM	Explain FEM modeling simplifications;	Discussed in new FEM report
77	FEM	Impact of different thickness plates on stresses	Provided as response to the RAI
78	FEM	Justify selected Rayleigh damping "hi" anchor point below 150 Hz;	New FEM report uses 1% thru the entire range
79	FEM	Discuss mesh studies;	Discussed in new FEM report
86	FEM/ Limit curves	Do not treat freq shift as uncertainty;	New limit curves generated that do not SRSS the frequency with the load uncertainty
97	FEM	Adjustment on weld factor for complex middle hood to end plates configuration	New FEM does not rely on this adjustment
104	Limit Curves	Base limit curves on limiting frequency and one per MSL s/g location;	New limit curves provided are based on limiting frequency and a curve is provided for each MSL location.
106	TPU FEM	Commit to provide NRC with full FEM for TPU;	Commitment made as response to the RAI
108	FEM	Justify fillet weld stress factor	Provided as response to the RAI
110	FEM	Validate freq versus harmonic based FEM;	New FEM report appendix "B"

RAI Matrix

74	SRV's monitoring guidelines	Discuss the SRV monitoring	Provided as response to the RAI
82	SRV Cantilevered components	Qualitatively compare HC SRV to QC failed relief valve	Provided as response to the RAI
83	Recirc Pump VPF	Concern on VPF impact to SSES failure	Provided as response to the RAI
103	PATP	Provide proposed licensing conditions;	Provided as response to the RAI
107	MSL strain gage readings	Provide MSL PSD comparisons to QC OLTP	Provided as response to the RAI

Summary

- 2007 CLTP In- Plant Data

  Acoustic Circuit Model With Biases and Uncertainties

- Finite Element Model

- Limit Curves

- Acceptable Margin

- Revised reports

  May 2007 RAIs were answered