Meramec Unit 3 Rollup, June 2008

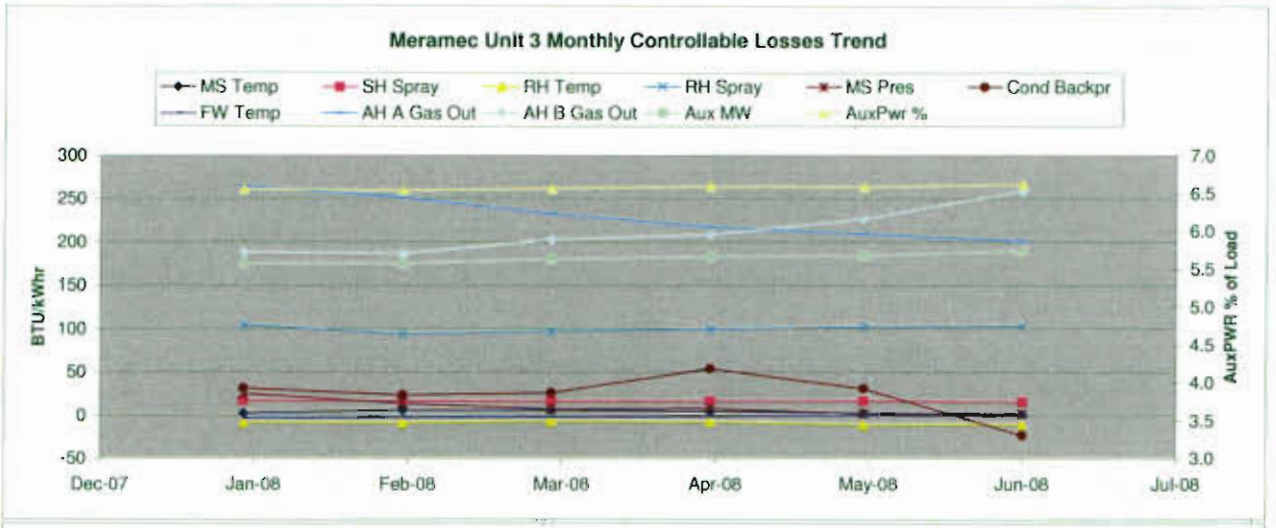
Notable Deviations in Plant Performance Data / Discussion Topics, etc.

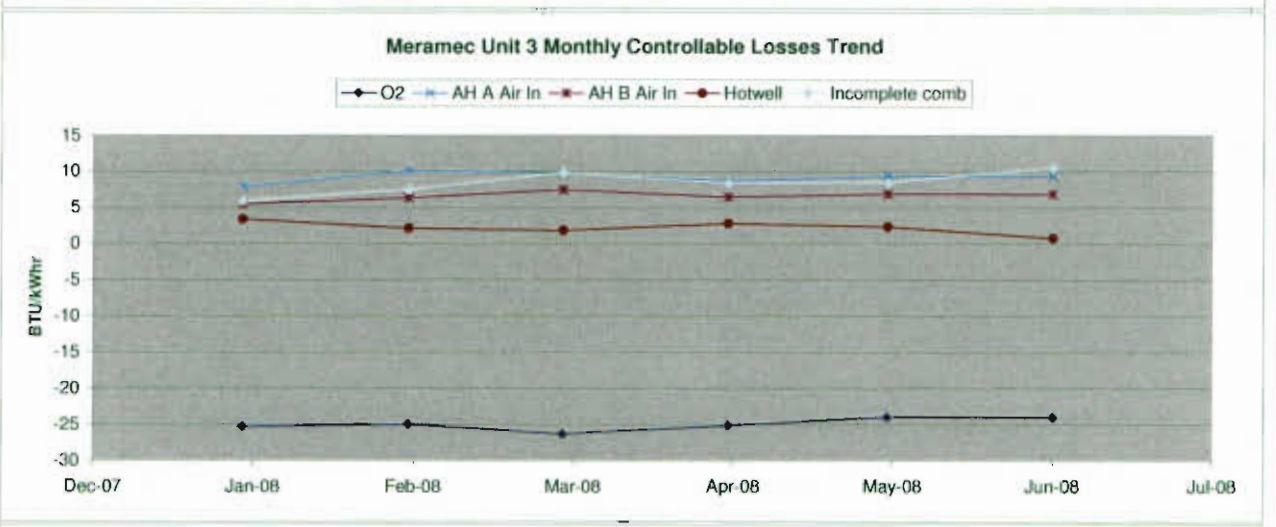
1. The controllable loss parameter target values need to updated to reflect current plant operation. The target values for all controllable loss parameters have been reviewed using actual 2007 unit data.

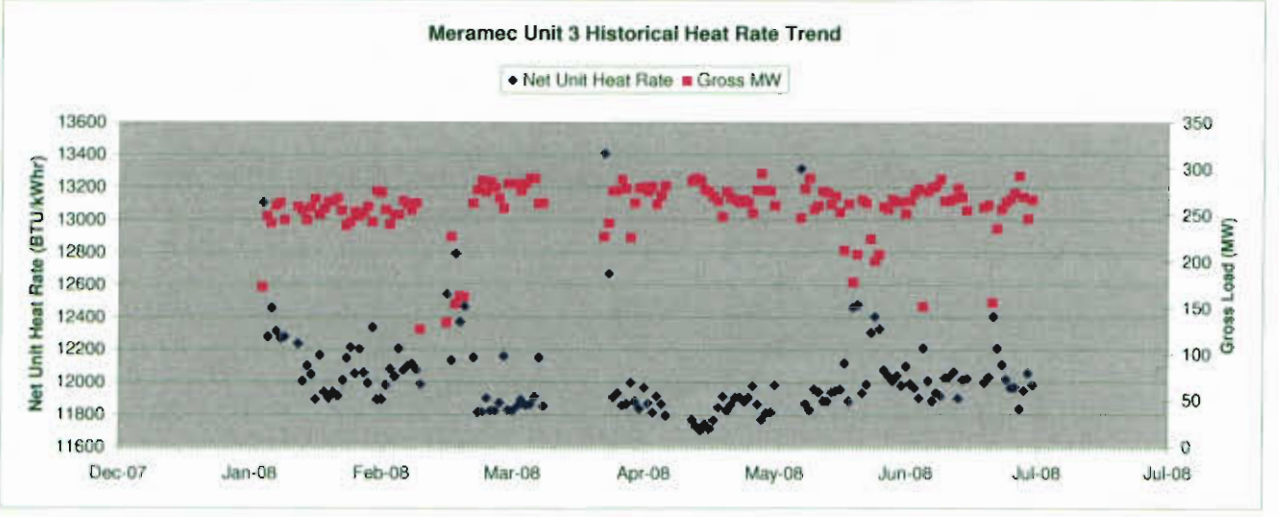
Top Priority Engineering Action Items	JR#	Priority	Resp Pty

Top Instrumentation Deficiencies	Point ID	Actual	Expected	JR#	Priority	Resp Pty

Top Priority OPM/EtaPro Action Items	Priority	Resp Pty
Update target values with agreed upon target values/curves	1	JDS


Meramec Unit 3 Monthly Controllable Losses Trend
MS Temp
SH Spray
RH Temp
RH Spray
MS Pres
Cond Backpr
FW Temp
AH A Gas Out
AH B Gas Out
Aux MW
AuxPwr %
BTU/kWhr
AuxPWR % of Load
300
250
200
150
100
50
0
-50
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08


Meramec Unit 3 Monthly Controllable Losses Trend
O2
AH A Air In
AH B Air In
Hotwell
Incomplete comb
BTU/kWhr
15
10
5
0
-5
-10
-15
-20
-25
-30
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08


Meramec Unit 3 Historical Heat Rate Trend
Net Unit Heat Rate
Gross MW
Net Unit Heat Rate (BTU/kWhr)
Gross Load (MW)
13600
13400
13200
13000
12800
12600
12400
12200
12000
11800
11600
350
300
250
200
150
100
50
0
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Jul-08

Meramec Unit 3 Rollup, June 2008 June-08
Overall Heat Rate & Losses Summary
1. The controllable loss parameter target values need to updated to reflect current plant operation.
Steam Generator Performance Summary:
Steam Turbine Performance Summary:
Condenser Performance Summary:
Feedwater Heater Performance Summary:
Recommended Actions:
Instrumentation or calculation related issues:
The EtaPro target values need to be updated to reflect current plant operation.
Changes made to the system that affects this month's report:

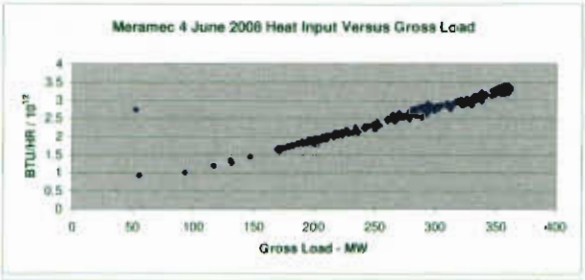
Summary of Performance Report for:

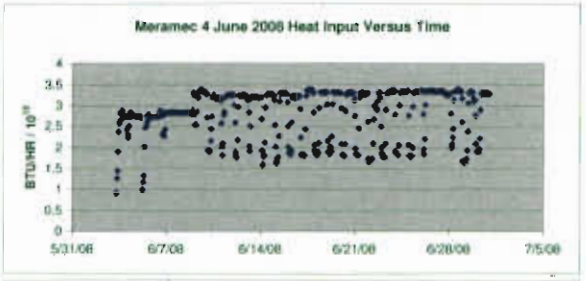
Plant	Meramec		
Unit	4		
Period	6/1/08	to	7/1/08

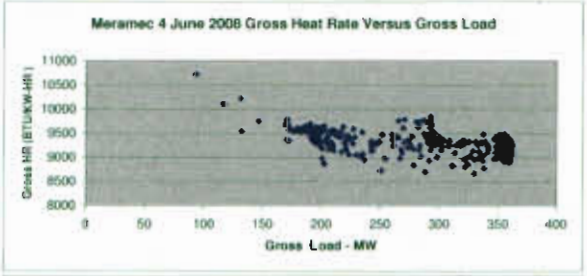
Full Load Performance

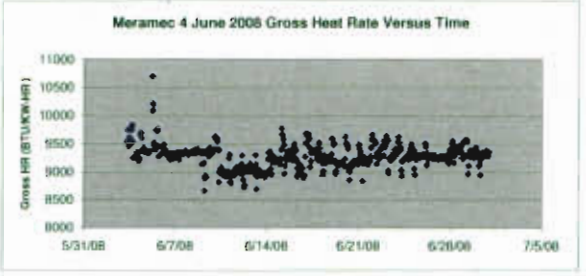
Hours of Data 331

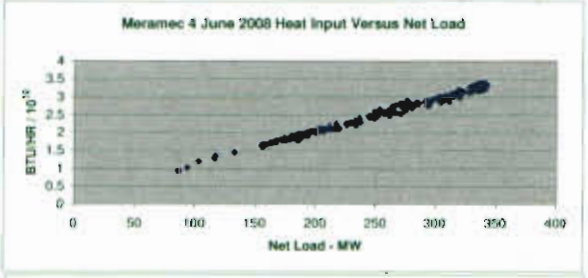
	Averages	
GENERATOR MEGAWATTS	358.3	MW
AUX POWER	20.6	MW
Net Unit Heat Rate Actual (GPHR)	9775.8	BTU/KW-HR
Boiler Efficiency Actual	83.5	%
CONTROL VALVE POSITION LVDT	99.7	%
FEEDWATER TEMP TO ECON	492.8	degF
FEEDWATER TEMP TO HTR 1	390.8	degF
HP Turbine Efficiency Actual	84.7	%
IP Turbine Efficiency Corrected	87.9	%
Condenser Pressure HP	3.6	inHga
AIRHTR-A GAS OUTLET TEMP	341.1	degF
AIRHTR-B GAS OUTLET TEMP	329.9	degF
AMBIENT AIR TEMP	81.0	degF
CIRC WTR TEMP TO LP CONDS	77.0	degF
Minimum River Temperature	77.0	degF
FWH 1 Temperature Rise	101.9	degF
Net Load	337.7	MW
Average Cond Press	3.6	inHga
Average Exit Gas Temperature	335.5	degF
Aux Power	5.7	%
Gross Unit Heat Rate	9214.1	BTU/KW-HR
Gross Turbine Heat Rate	7695.7	BTU/KW-HR

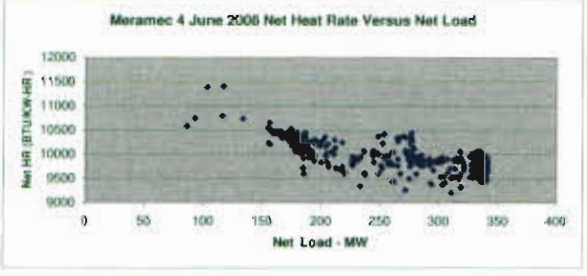


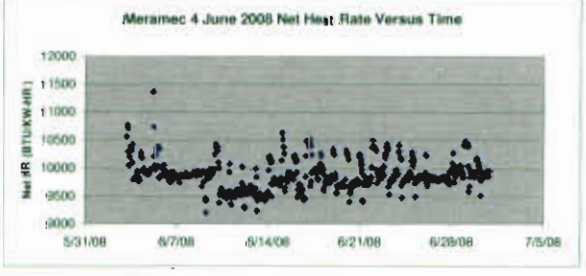












Meramec Unit 4 Rollup, June 2008

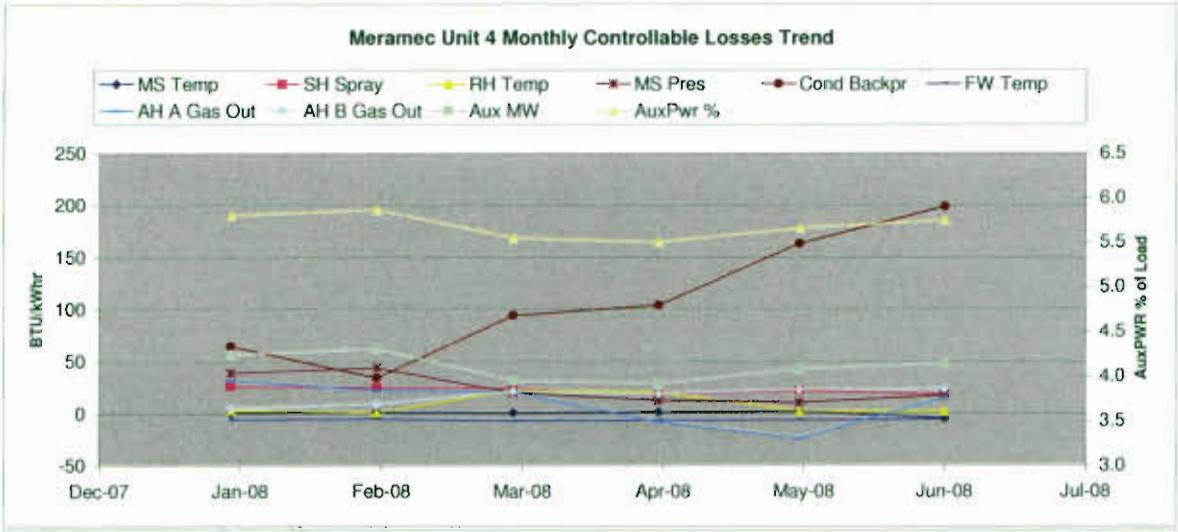
Notable Deviations in Plant Performance Data / Discussion Topics, etc.

1. The controllable loss parameter target values need to updated to reflect current plant operation The target values for all controllable loss parameters have been reviewed using actual 2007 unit data

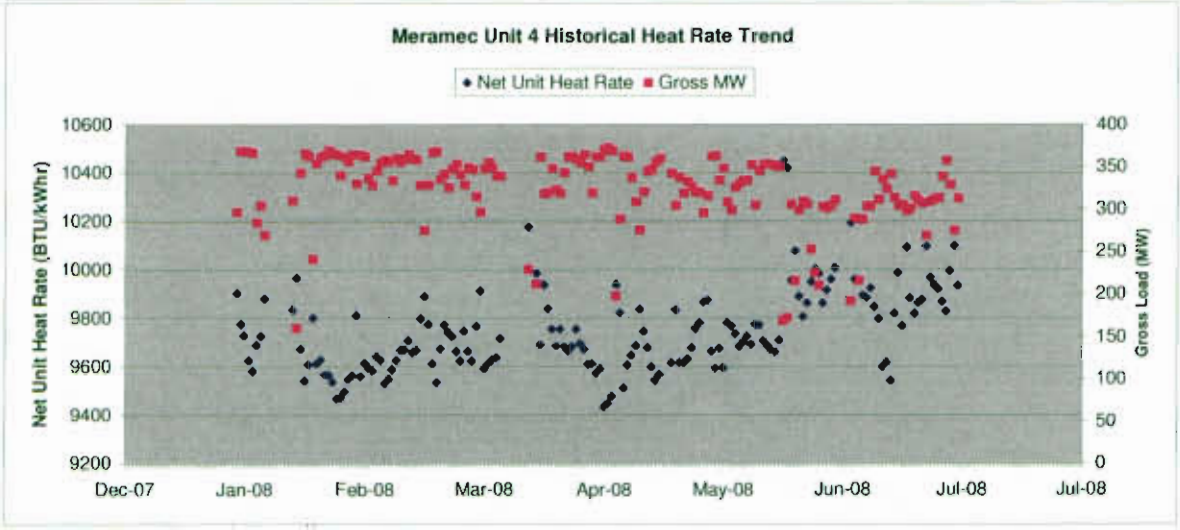
Top Priority Engineering Action Items	JR#	Priority	Resp Pty

Top Instrumentation Deficiencies	Point ID	Actual	Expected	JR#	Priority	Resp Pty

Top Priority OPM/EtaPro Action Items	Priority	Resp Pty
Update target values with agreed upon target values/curves	1	JDS


Meramec Unit 4 Monthly Controllable Losses Trend
MS Temp
SH Spray
RH Temp
MS Pres
Cond Backpr
FW Temp
AH A Gas Out
AH B Gas Out
Aux MW
AuxPwr %
BTU/kWhr
AuxPWR % of Load
250
200
150
100
50
0
-50
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08


Meramec Unit 4 Monthly Controllable Losses Trend
O2
AH A Air In
AH B Air In
Hotwell
Incomplete comb
BTU/kWhr
15
10
5
0
-5
-10
-15
-20
-25
-30
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08


Meramec Unit 4 Historical Heat Rate Trend
Net Unit Heat Rate
Gross MW
Net Unit Heat Rate (BTU/kWhr)
Gross Load (MW)
10600
10400
10200
10000
9800
9600
9400
9200
400
350
300
250
200
150
100
50
0
Dec-07
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Jul-08

Meramec Unit 4 Rollup, June 2008 June-08
Overall Heat Rate & Losses Summary
1. The controllable loss parameter target values need to updated to reflect current plant operation.
Steam Generator Performance Summary:
Steam Turbine Performance Summary:
Condenser Performance Summary:
Feedwater Heater Performance Summary:
Recommended Actions:
Instrumentation or calculation related issues:
The EtaPro target values need to be updated to reflect current plant operation.
Changes made to the system that affects this month's report:

Rush Island

Heat Rate Performance Reports

Attachment D

7/22/2009

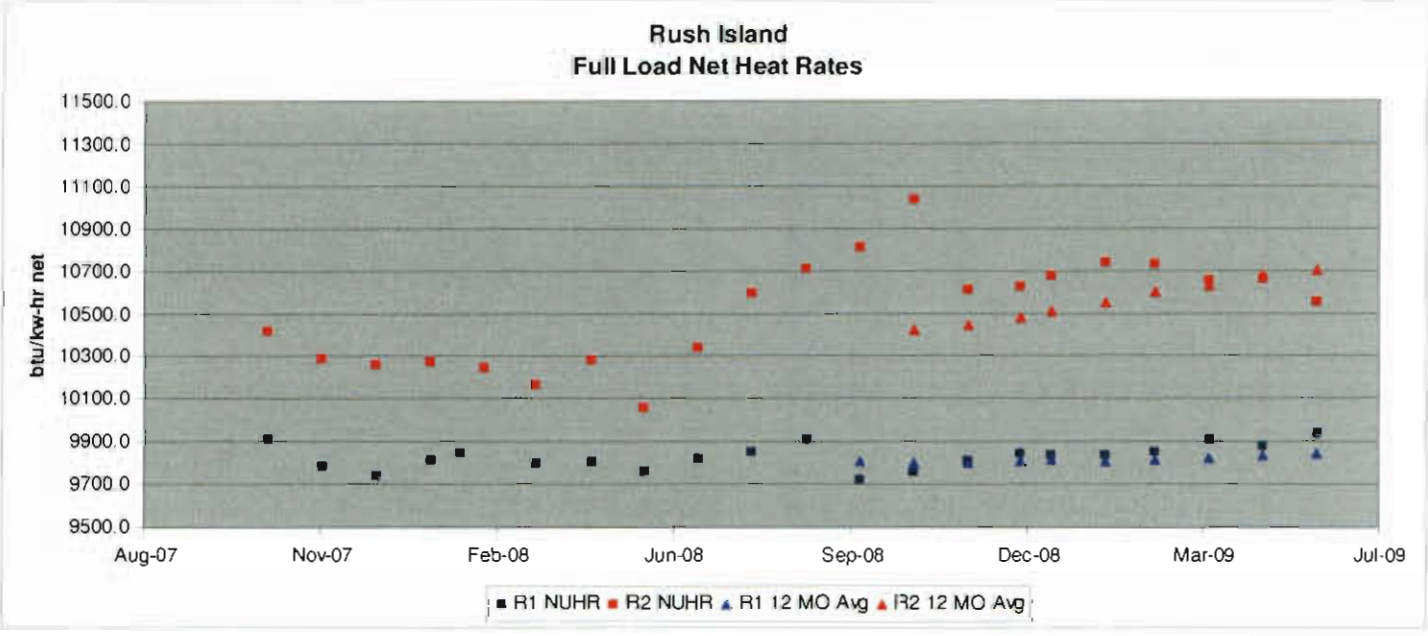
Mr. David Strubberg

From: Jim Barnett

Cc: Bob Meiners, Andy Williamson, Paul Starks, Greg Vasel, Gary Blessing, Mike Clonts, Matt Wallace, Ken Stuckmeyer, Don Clayton, Jeff Shelton, Joe Sind, Jim Barnett, Scott Hixson, Glenn Tiffin, Fred Kutilek, Tom Ziegler, Jeff Colter, Tim Finnell, Scott McCormack, Mike Kobel

Re: Rush Island June 2009 Performance Report

The last report was on June 19, 2009 and covered operation through May 2009. The information provided within this report covers unit operation from the last report through June 2009.



The heat rate KPI data through June is summarized in the table below.

Plant	2009 Actual	Threshold	Target	Stretch
Rush Island	10264	10186	10066	9996

Executive Summary

- Unit 1/Unit 2 Heat Rates remain consistent with what was seen in last month's report.
- As Unit 1 backpressure continues to increase, due to rising river temperatures and condenser cleanliness degradation Gross Load at VWO also continues to decrease because of the cross over pressure limitation.
- Unit 1 Boiler Draft is being operated at -0.75 in H2O instead of -0.5 in H2O which is typical for balanced draft units. Does not impact the Auxiliary power to any noticeable degree.
- The Main Steam Flow Curve on Unit 1 has not been updated in DCS since changing the first stage nozzle block in Fall of 2007, the increased flow area of 3% may explain some of the 4% difference in Feedwater to main steam flow ratio.
- At a first look the 1-3 feedwater heater may appear to have a leak, but after further investigation the DCA is also on the rise which may indicate a level issue.
- Unit 2 Corrected Load appears to be trending downward starting around the June 25th.
- 2-3 Feedwater heater higher than expected DCA, suspect level issue.
- Unit 2 Main Steam Drain valve 2HV-905A is leaking thru. Discussions with other plants indicate typical operation with root valves closed on leaking high energy drains with similar functionality as Rush Island's 1(2)HV-905A/B's.

Action Items

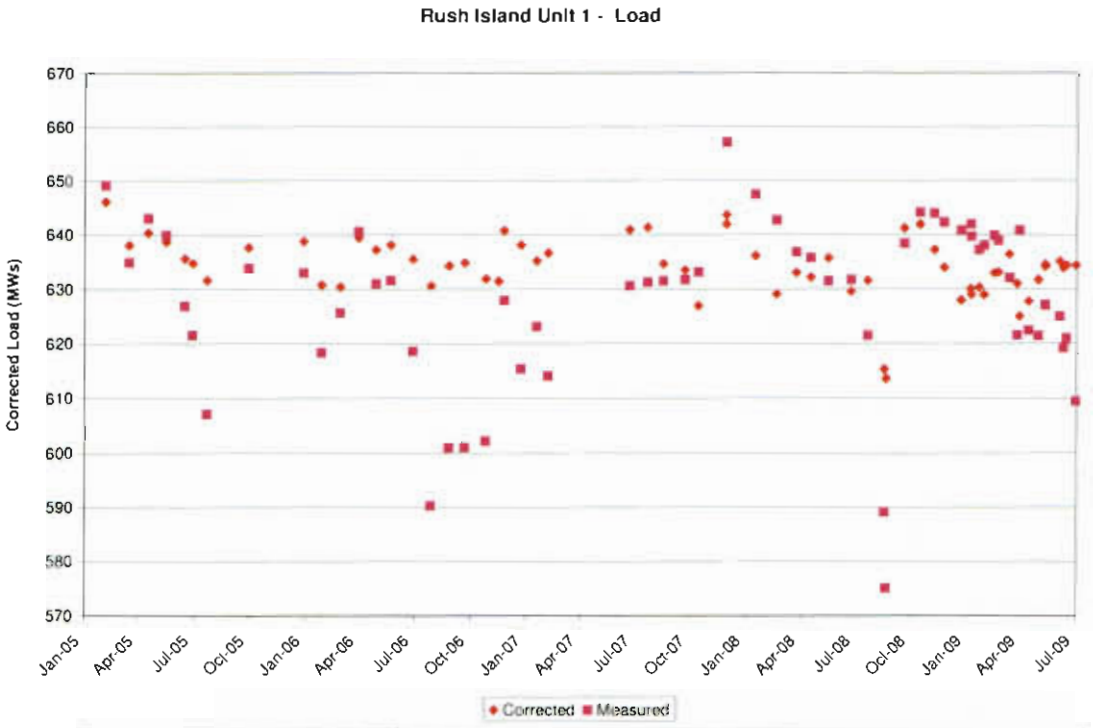
- Performance engineering to analyze operating data, fuel deliveries, and fuel lab analysis and provide a report on the 8800/8400 test burn.
- Performance engineering to work with the plant on JR'ing the correct instrumentation to be calibrated so the U2 FW flow indication can be validated.
- The Instrument & other issue spreadsheet has been updated and JRs initiated for instruments that are not functional. Could the plant please review and comment on if the JRs initiated are OK, or what should be done I:\RUSH\Performance\Instrument & other issues.xls
- Performance engineering would like to be copied on notes from morning meetings.
- Performance engineering working with plant on trouble shooting #5 heater level and high DCA's.
- Performance engineering working with Plant Controls engineer to correct Steam Flow Curve in DCS after the First Stage Nozzle block change out.

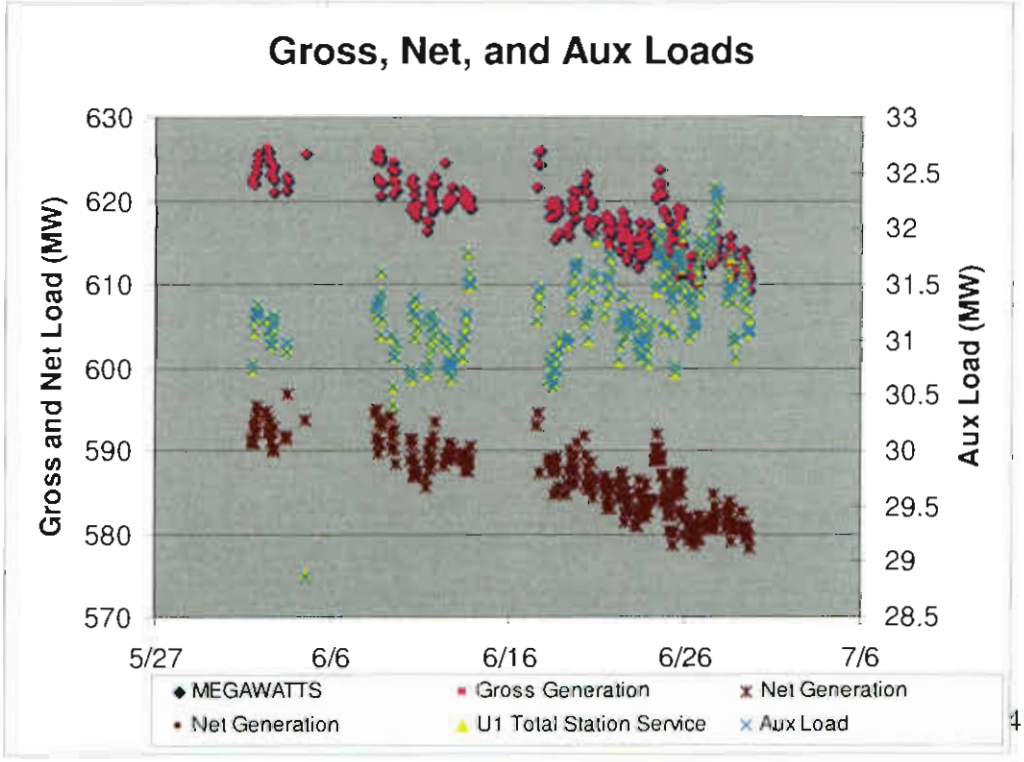
Summary of Performance Report for:

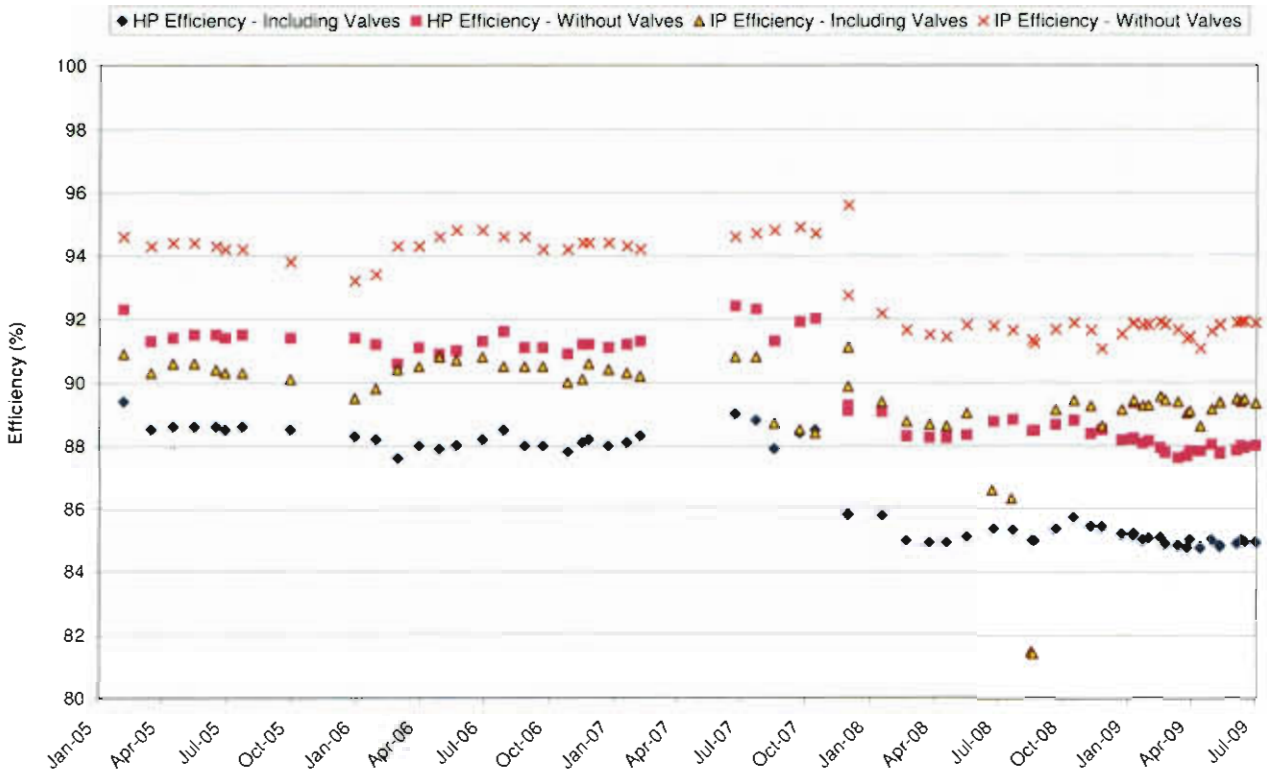
Plant	Rush Island				
Unit	1				
Period	6/1/09	to	7/1/09		
			Jun-09	May-09	Jun-08
Full Load Performance					
Hours of Data			273	193	329
			Averages	**Averages**	**Averages**
GENERATOR MEGAWATTS	MW		617.6	618.5	632.9
AUX POWER	MW		31.3	30.6	30.7
Net Unit Heat Rate Actual (GPHI)	BTU/KW-HR		9934.1	9878.0	9814.4
Boiler Efficiency Actual	%		86.3	86.2	86.5
CONTROL VALVE POSITION LVDT	%		100.6	100.4	99.9
FEEDWATER TEMP TO ECON	degF		493.8	493.4	496.8
FEEDWATER TEMP TO HTR 1	degF		445.1	444.5	446.8
HP Turbine Efficiency Actual	%		85.0	84.9	85.4
IP Turbine Efficiency Corrected	%		89.2	89.3	91.5
Condenser Pressure	inHga		3.2	2.6	2.8
AIRHTR-A GAS OUTLET TEMP	degF		312.2	300.0	300.1
AIRHTR-B GAS OUTLET TEMP	degF		315.2	309.1	304.8
AMBIENT AIR TEMP	degF		84.0	71.8	80.0
CIRC WTR TEMP TO LP CONDB	degF		77.6	66.6	75.3
CIRC WTR TEMP TO LP CONDB	degF		75.9	64.9	73.7
Minimum River Temperature	degF		75.9	64.9	73.7
FWH 1 Temperature Rise	degF		48.8	49.0	50.0
Net Load	MW		586.3	587.9	602.2
Average Exit Gas Temperature	degF		313.7	304.5	302.5
Aux Power	%		5.1	4.9	4.9
Gross Unit Heat Rate	BTU/KW-HR		9431.2	9389.2	9337.9
Gross Turbine Heat Rate	BTU/KW-HR		8142.7	8094.9	8075.6
Measured Feedwater Flow	KPPH		4200.2	4156.2	4339.1
Calc Steam Evaporated	KPPH		4188.4	4150.4	4334.1
Steam Flow From First Stage	KPPH		4042.6	3995.2	4126.2
FW/Steam			1.04	1.04	1.05
Steam/Load			6.55	6.46	6.52
FW/Load			6.80	6.72	6.86

Unit 1 Observations

The following two chart(s) show the continued degradation of the Gross and Net load on Unit 1 due to the cross over limitation and the increase in condenser backpressure. As can be seen below there is basically no significant change in the corrected load, but the gross and net continue to decrease because the decrease in throttle pressure/flow due to the crossover limitation.

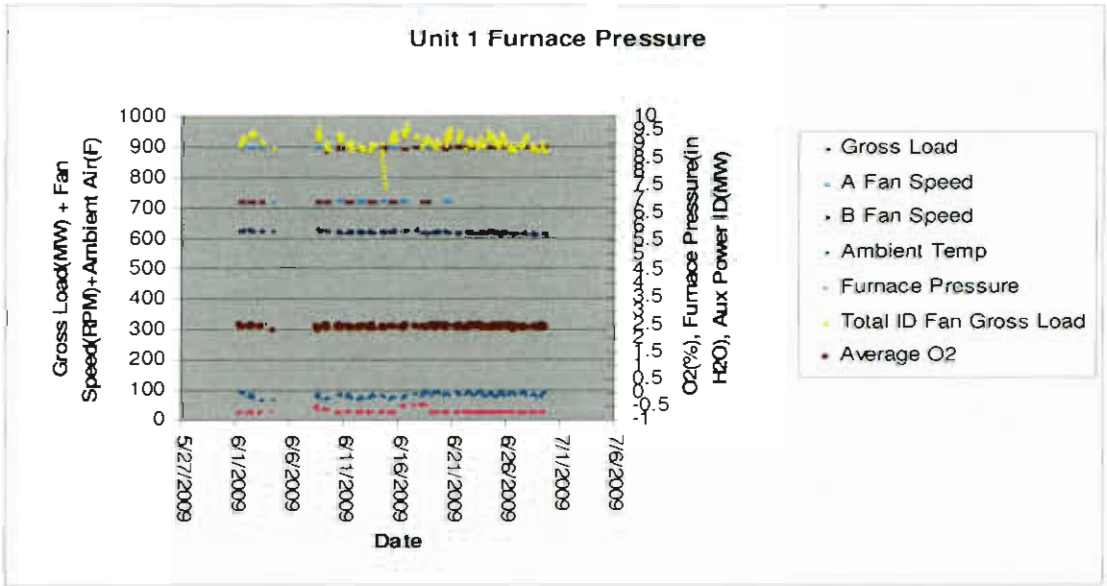




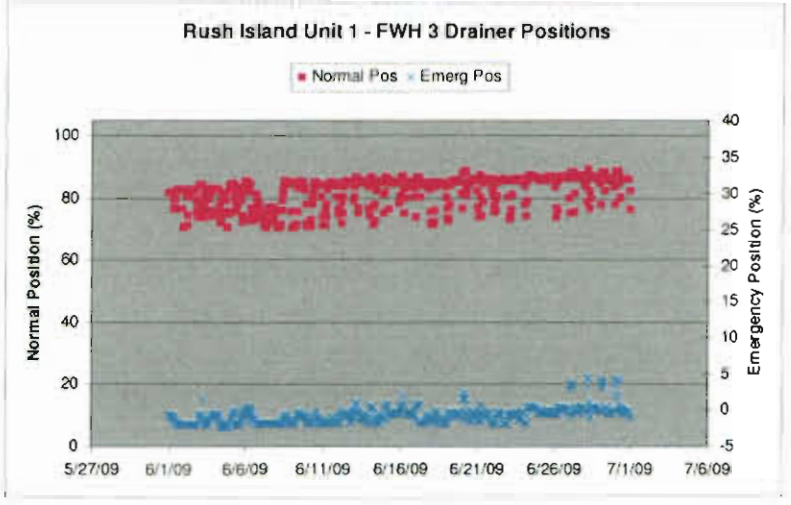


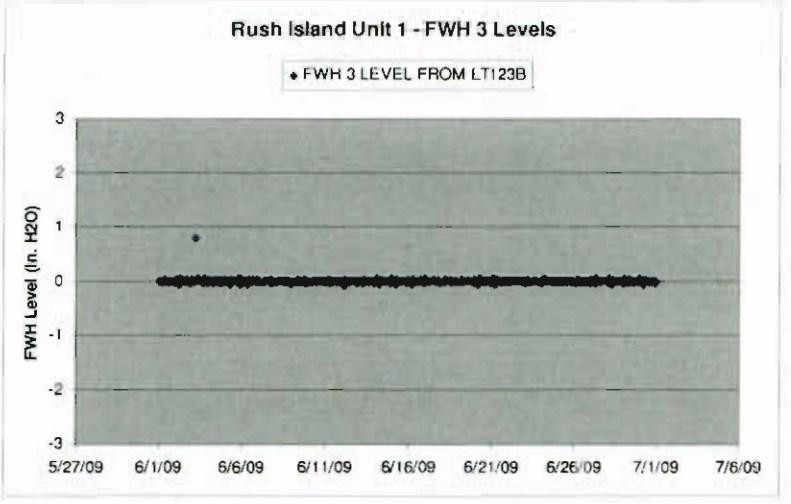
Turbine efficiencies do not seem to be dropping to any significant degree.

The unit 1 boiler furnace draft set-point is being operated at -0.75 in H2O, instead of what is typically seen on balanced draft units -0.5 in H2O. After looking at the auxiliary power for the A/B ID's there is no noticeable change observed depending on whether you are operating at -0.5 in H2O or -0.75 in H2O. After discussion with plant personnel, the plant is operating in this manner for additional personal protection, while working around boiler and maintaining sootblowers.

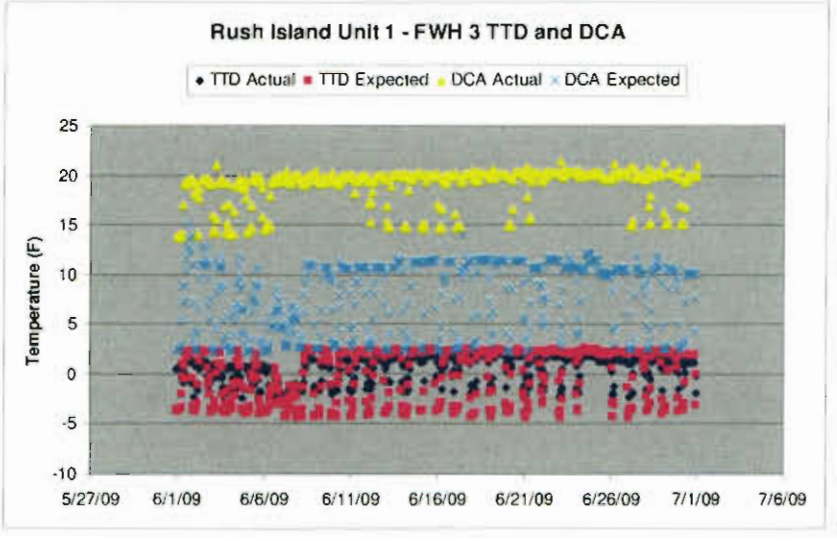


The 1-3 feedwater heater appeared to have a leak, based on the drainer valve position required to maintain the same heater level over the month of June.





In addition to looking at the normal drainer position, if the DCA on 1-3 heater is trended for the month you can see that the DCA is also on the rise which more than likely indicates a drift in the level instrumentation.

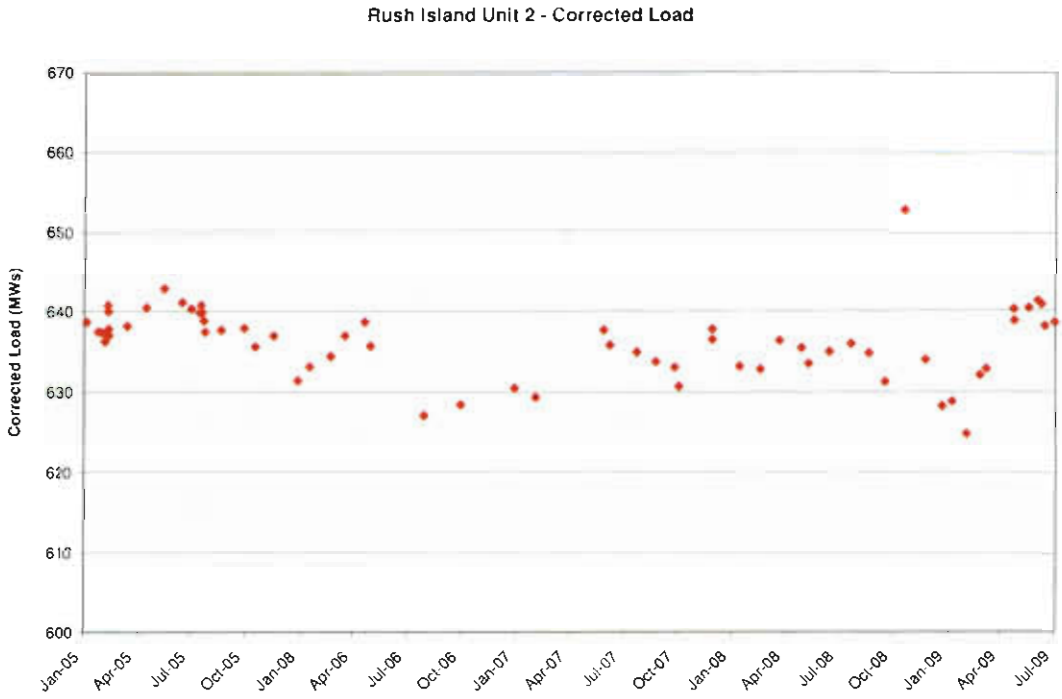


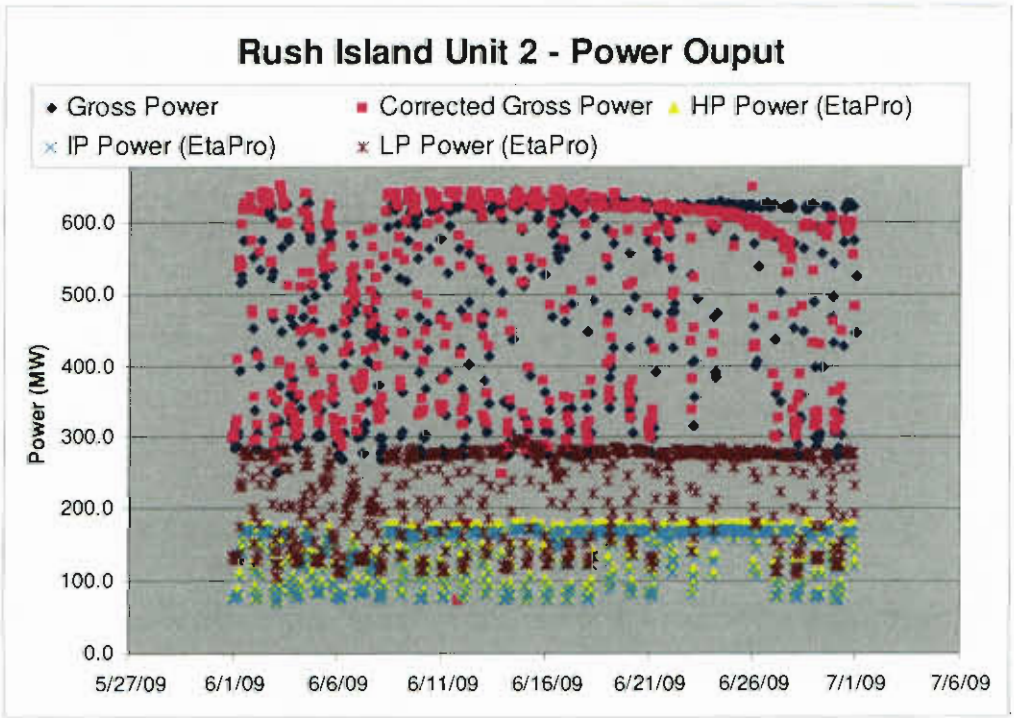
Summary of Performance Report for:

Plant	Rush Island				
Unit	2				
Period	6/1/09	to	7/1/09		
			Jun-09	May-09	Jun-08
Full Load Performance					
Hours of Data			284	178	224
			Averages	**Averages**	**Averages**
GENERATOR MEGAWATTS	MW		622.9	612.9	616.0
AUX POWER	MW		36.2	35.8	35.9
Net Unit Heat Rate Actual (GPHI)	BTU/KW-HR		10554.5	10663.6	10339
Boiler Efficiency Actual	%		86.1	85.9	85.6
CONTROL VALVE POSITION LVDT	%		99.8	99.8	100.2
FEEDWATER TEMP TO ECON	degF		488.1	485.9	490
FEEDWATER TEMP TO HTR 1	degF		443.9	441.7	442
HP Turbine Efficiency Actual	%		87.7	88.0	89.9
IP Turbine Efficiency Corrected	%		92.2	92.5	91.4
Condenser Pressure HP	inHga		2.6	2.0	2.4
AIRHTR-A GAS OUTLET TEMP	degF		312.3	311.4	317
AIRHTR-B GAS OUTLET TEMP	degF		334.6	322.1	329
AMBIENT AIR TEMP	degF		85.5	72.6	80.8
CIRC WTR TEMP TO LP CONDB	degF		77.7	65.3	75.1
CIRC WTR TEMP TO LP CONDB	degF		77.6	65.2	75.1
Minimum River Temperature	degF		77.6	65.2	75.1
FWH 1 Temperature Rise	degF		44.2	44.2	48.2
Net Load	MW		586.6	577.2	580.2
Average Exit Gas Temperature	degF		323.4	316.8	323.0
Aux Power	%		5.8	5.8	5.8
Gross Unit Heat Rate	BTU/KW-HR		9940.5	10041.3	9737
Gross Turbine Heat Rate	BTU/KW-HR		8557.4	8628.0	8333
Measured Feedwater Flow	KPPH		4399.0	4333.3	4239
Calc Steam Evaporated	KPPH		4470.3	4394.9	4294
Steam Flow From First Stage	KPPH		4043.7	3934.5	3982
FW/Steam			1.09	1.10	1.06
Steam/Load			6.49	6.42	6.46
FW/Load			7.06	7.07	6.88

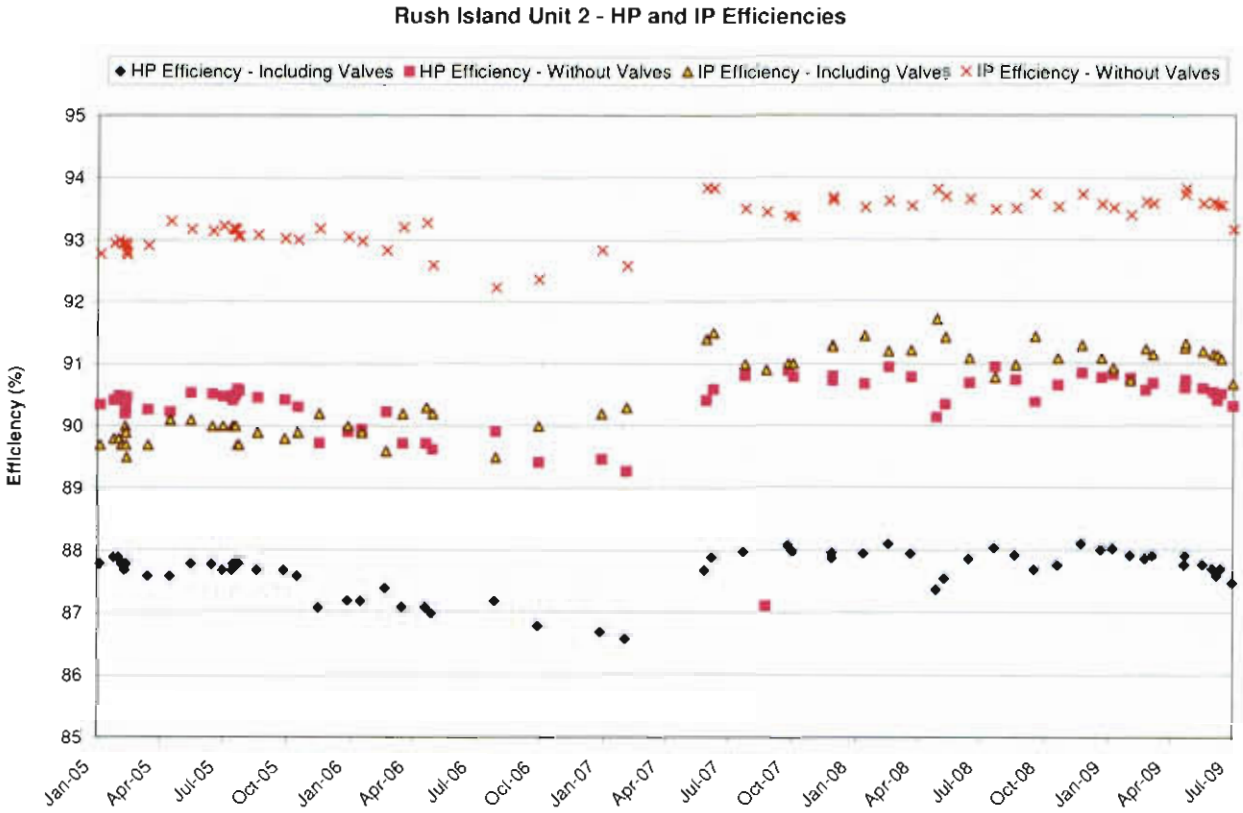
Unit 2 Observations

Corrected load appears to have taken approximate 2 MW drop from when data was obtained last month. Performance engineering has just started to investigate the reason behind this and plans to have more details with in the next couple of reports. The corrected load appears to have started to drop off around the 25th of June. Note that the corrected loads listed below does not make corrections for turbine efficiency degradation so, the degradation of the efficiencies might be the major contributor to the drop in corrected load, but additional analysis is required for validation.

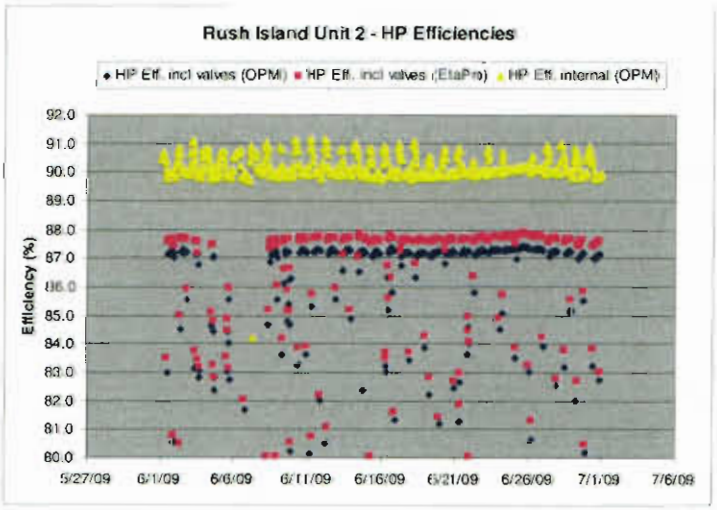


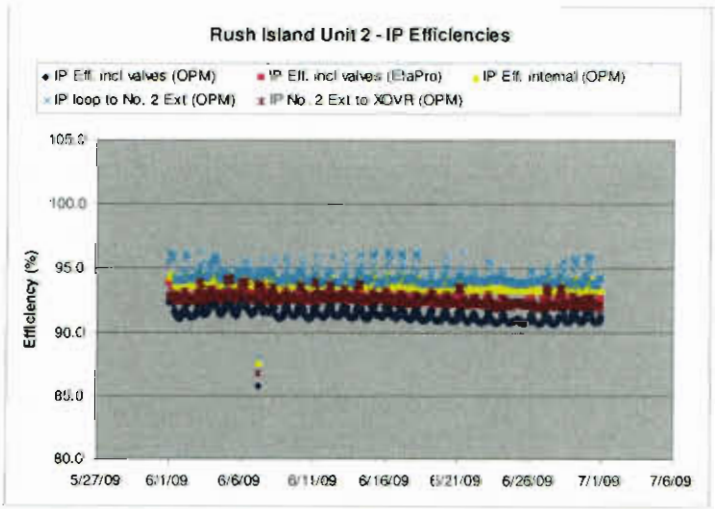


The HP/IP efficiencies seem to continue to drop off. The HP's seem to have held fairly constant until around the 06/26/09, vs. the IP efficiencies continued a slow degradation the entire month.



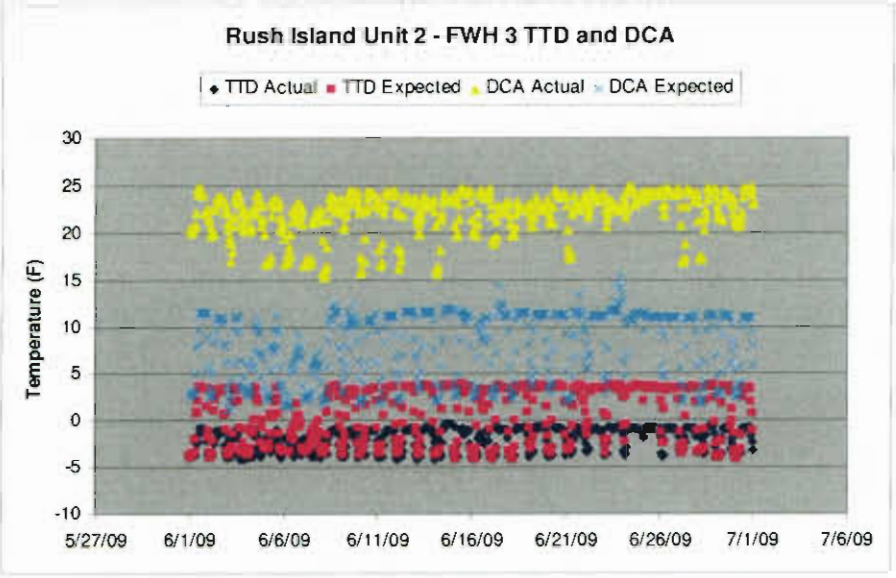
The above chart is a snap shot that is collected on a monthly basis with the turbine at VWO and approximately full load/2400 psig throttle pressure which gives a broader look at the turbine efficiencies.



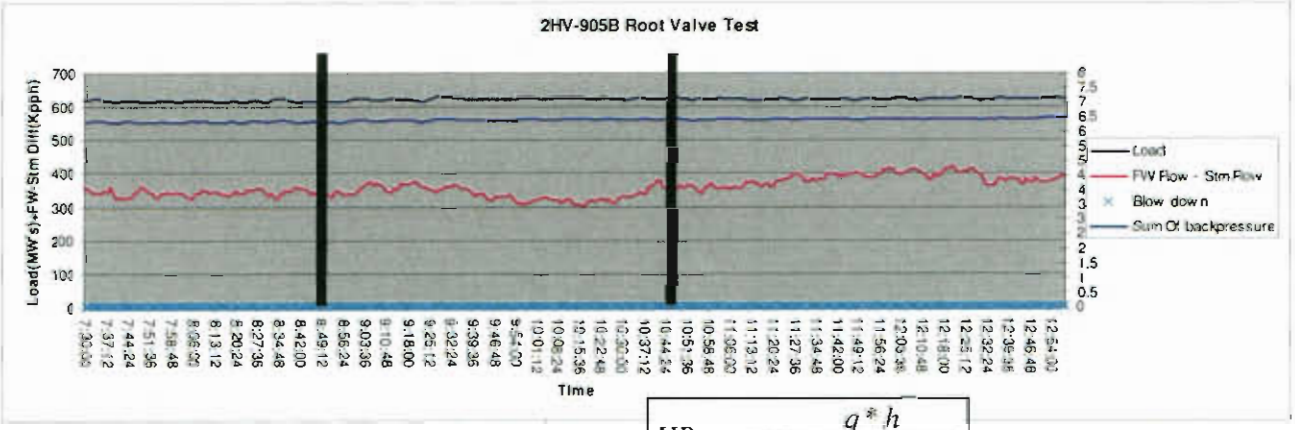


The above two charts include the entire month of June's efficiencies, at all loads, as you can see the HP drops around the 25th of the month and the IP has a more gradual drop thru out the entire month.

The DCA for the 2-3 Feedwater heater is running approximately 10 degrees higher than the expected temperature, which may indicate a level problem. In addition the TTD is running lower than expected which would also indicate a level problem.



Based on testing that was completed on 06/24/09 and 06/25/09 on 2HV-905B/Mainsteam drain valve there appears to be an approximate 42kpph of leakage thru this valve. The high energy drain is estimated at having an enthalpy of 1468 btu/#, so if this valve is leaking to this degree performance engineering would expect an 100.5 btu/kw-hr heat rate impact. Based on recent conversations with other plants that have similar start-up and drain systems on their main steam leads typical operation is to close the root valves when the a motor operated drain valve is found leaking until repairs can be completed on valves with the same functionality as the RI 1(2)HV-905A/B's.



$$HR_{impact} = \frac{q * h}{GrossLoad_{Unit}}$$

	Feedwater to steam mismatch	Gross Load			
During Test	340.5056505	619 05171			
After Test	382.8547258	619.07369	q(#/hr) =	Flow Rate	
			h(BTU/#)		
difference	42.34907525	kpph	=	Enthalpy	
Estimated Enthalpy	1468.293819	Btu/lbm	Gross Load(Kw) =		619051.7
Heat Rate Impact	100.4537729	btu/kw-hr			

6/23/2009

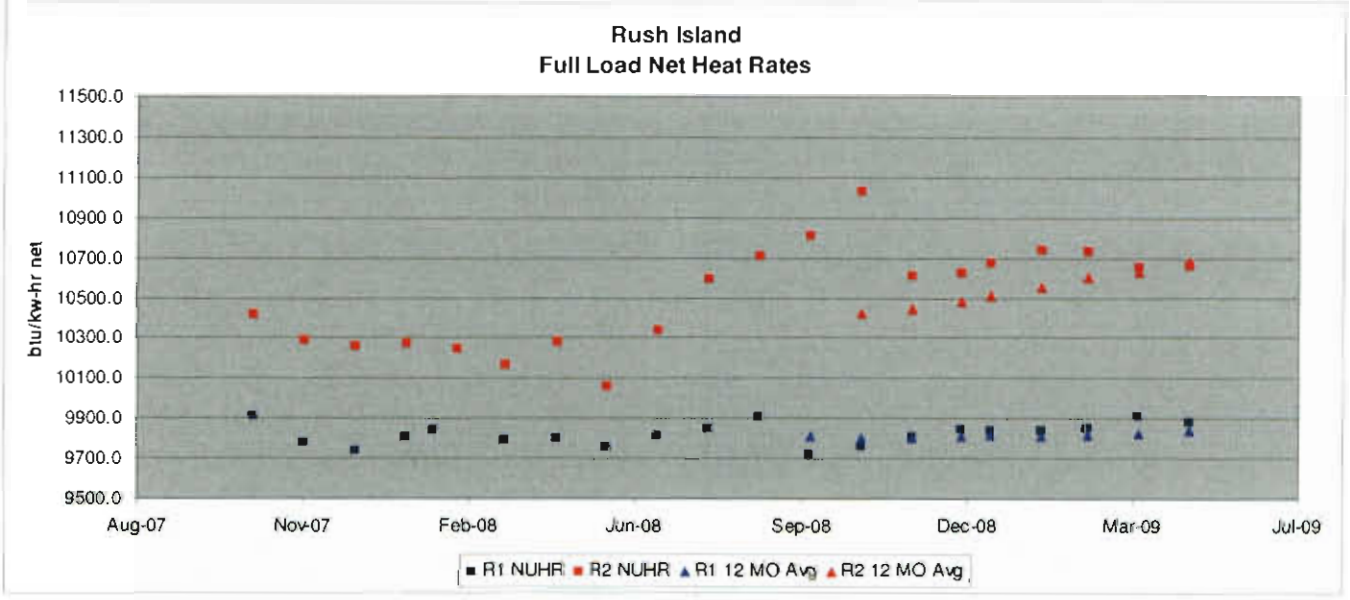
Mr. David Strubberg

From: Jim Barnett

Cc: Bob Meiners, Andy Williamson, Paul Starks, Greg Vasel, Gary Blessing, Mike Clonts, Matt Wallace, Ken Stuckmeyer, Don Clayton, Jeff Shelton, Joe Sind, Jim Barnett, Scott Hixson, Glenn Tiffin, Fred Kutilek, Tom Ziegler, Jeff Colter, Tim Finnell, Scott McCormack, Mike Kobel

Re: Rush Island May 2009 Performance Report

The last report was on May 18, 2009 and covered operation through April 2009. The information provided within this report covers unit operation from the last report through May 2009.



The heat rate KPI data through May is summarized in the table below. The potential feedwater flow indication issue (high indicated flow) is contributing to the plant heat rate being higher than the KPI target.

Plant	2009 Actual	Threshold	Target	Stretch
Rush Island	10270	10186	10066	9996

Executive Summary

- Unit 1 Heat Rate remains consistent with what was seen in last month's report. Unit 2 Heat Rate has decreased by approximately 1% following the recent SBO but remains elevated as compared to last year.
- Valve repairs and replacements during the Unit 2 outage did not result in a significant decrease in the mismatch between MS and FW flow. Performance engineering suspects feedwater flow instrumentation issues on the unit.
- Unit 1 load degradation appears to be due to LP turbine performance. This will be discussed during the upcoming quarterly performance meeting.
- Performance engineering has received the coal analysis from the test burn performed in early April and is in the process of evaluating the results.

Action Items

- Performance engineering to analyze operating data, fuel deliveries, and fuel lab analysis and provide a report on the 8800/8400 test burn.
- Performance engineering to work with the plant on JR'ing the correct instrumentation to be calibrated so that the U2 FW flow indication can be validated.
- The Instrument & other issue spreadsheet has been updated and JRs initiated for instruments that are not functional. Could the plant please review and comment on if the JRs initiated are OK, or what should be done I:\RUSH\Performance\Instrument & other issues.xls
- Performance engineering would like to be copied on notes from morning meetings.

Unit 1 Observations

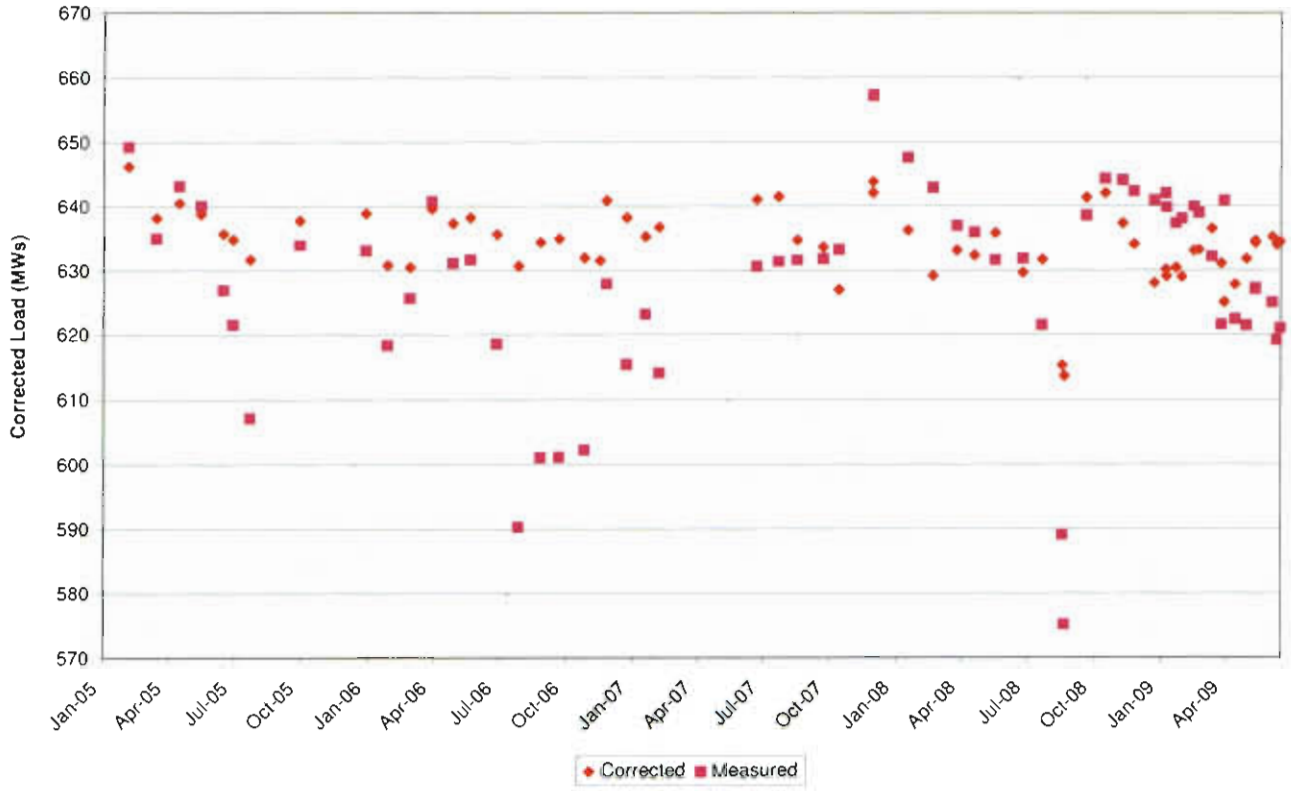
The following observations were noted regarding performance on Unit 1:

- Most performance parameters remained unchanged from April to May.
- Performance engineering has reviewed the performance of the unit in relation to the current crossover pressure limitation. This review indicates potential issues with the first couple of stages of the LP turbine which increases pressure upstream of the LP and hence leads to an elevated crossover pressure. The data points to a loss of efficiency and increased stage pressures in the LP turbine due to turbine deposits. Additional data and prose is provided below. This topic will be discussed at the upcoming performance meeting in late June.
- On average, the condenser pressure on Unit 1 is 0.4 in Hga higher than on Unit 2 (0.3 in HgA by hotwell temperature indication).
- The DCA on both the 5A and 5B FWH are higher than expected (50F actual versus 12F expected). The normal drainer on the 5A is open 100% (and has been for some time (at least 1/1/2008) and the dump valve is open 20%. The normal drainer on the 5B is open about 85% and the dump valve is closed. A level change was made on the 5A heater last August that lowered level to the same as that of the 5B. This coincided with an increase in the dump valve position on the heater. Are these heaters being operated at their design level? It is noted that the calculated extraction flow to these heaters is about 20% higher than those shown on the top load heat balance.

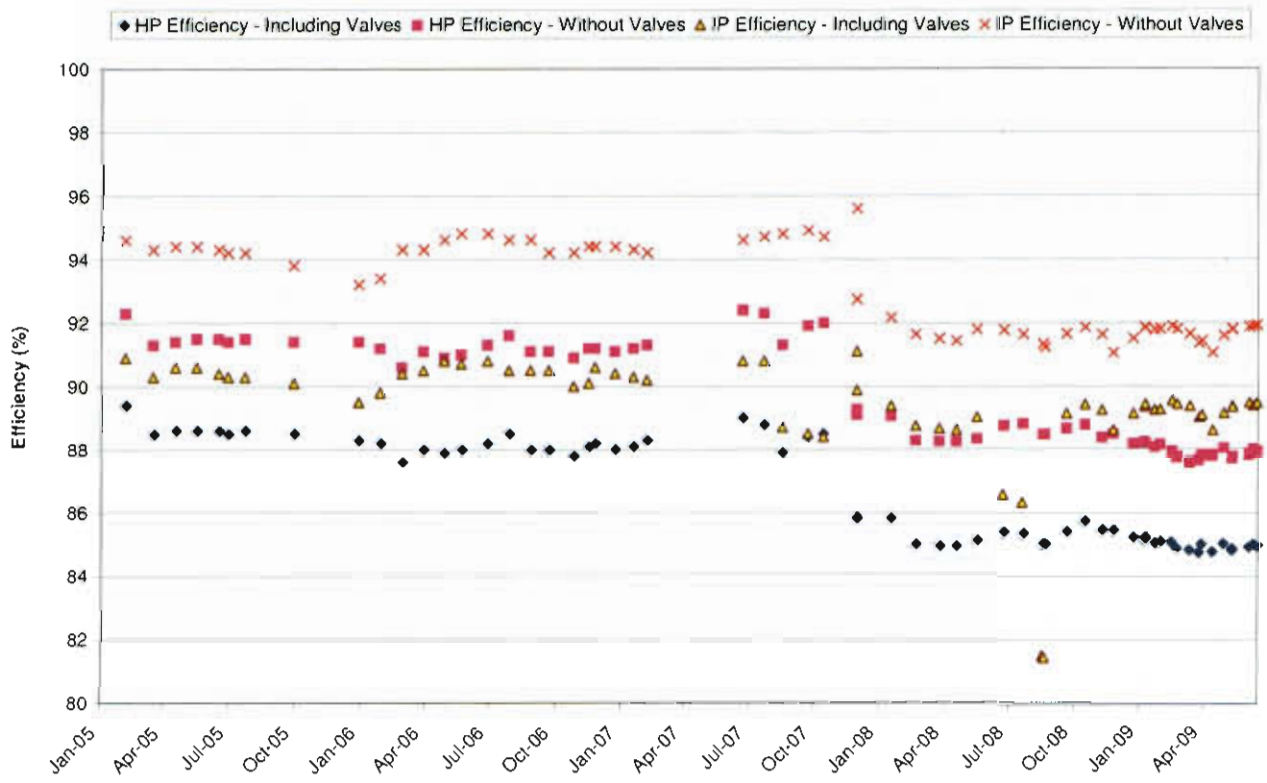
Summary of Performance Report for:

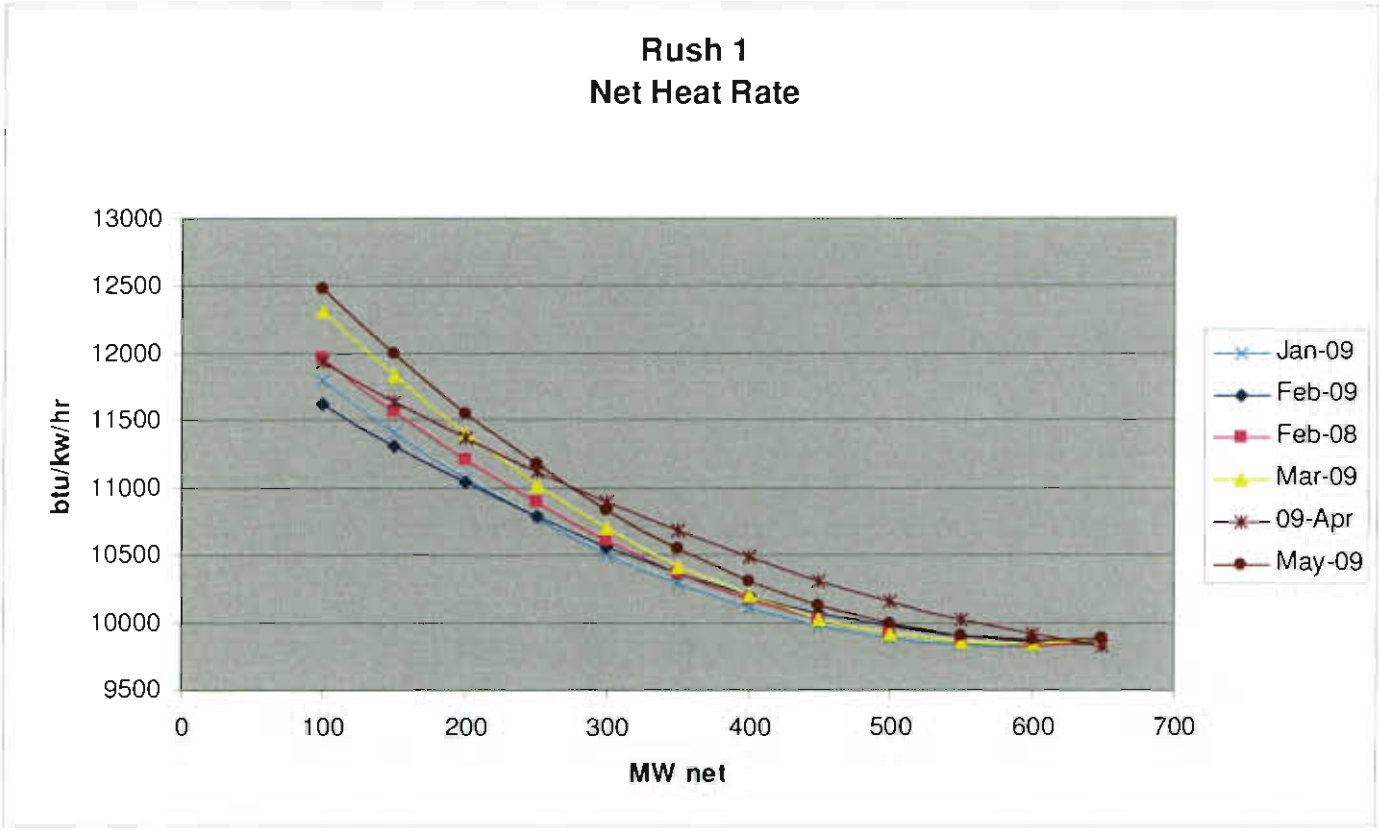
Plant	Rush Island				
Unit	1				
Period	5/1/09	to	6/1/09		
			May-09	Apr-09	May-08
Full Load Performance					
Hours of Data			193	163	231
			Averages	**Averages**	**Averages**
GENERATOR MEGAWATTS	MW		618.5	626.1	634.8
AUX POWER	MW		30.6	32.4	29.6
Net Unit Heat Rate Actual (GPHI)	BTU/KW-HR		9878.0	9906.2	9758.4
Boiler Efficiency Actual	%		86.2	86.5	86.4
CONTROL VALVE POSITION LVDT	%		100.4	99.9	100.1
FEEDWATER TEMP TO ECON	degF		493.4	495.0	496.0
FEEDWATER TEMP TO HTR 1	degF		444.5	446.2	446.6
HP Turbine Efficiency Actual	%		84.9	84.8	84.9
IP Turbine Efficiency Corrected	%		89.3	88.7	92.7
Condenser Pressure	inHga		2.6	2.0	2.1
AIRHTR-A GAS OUTLET TEMP	degF		300.0	292.9	287.1
AIRHTR-B GAS OUTLET TEMP	degF		309.1	309.5	294.8
AMBIENT AIR TEMP	degF		71.8	55.6	65.7
CIRC WTR TEMP TO LP CONDB	degF		66.6	53.2	61.7
CIRC WTR TEMP TO LP CONDB	degF		64.9	51.6	60.1
Minimum River Temperature	degF		64.9	51.6	60.1
FWH 1 Temperature Rise	degF		49.0	48.8	49.3
Net Load	MW		587.9	593.7	605.2
Average Exit Gas Temperature	degF		304.5	301.2	290.9
Aux Power	%		4.9	5.2	4.7
Gross Unit Heat Rate	BTU/KW-HR		9389.2	9393.6	9303.1
Gross Turbine Heat Rate	BTU/KW-HR		8094.9	8121.4	8037.6
Measured Feedwater Flow	KPPH		4156.2	4235.3	4277.1
Calc Steam Evaporated	KPPH		4150.4	4223.5	4271.5
Steam Flow From First Stage	KPPH		3995.2	4054.7	4064.7
FW/Steam			1.0	1.0	1.1
Steam/Load			6.5	6.5	6.4
FW/Load			6.7	6.8	6.7

Rush Island Unit 1 - Load

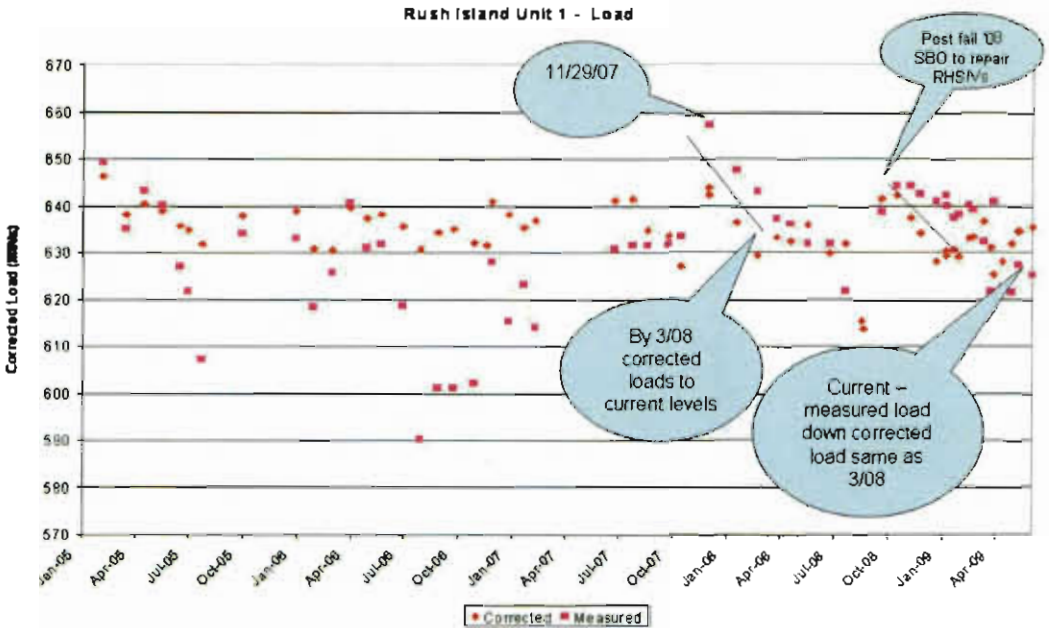


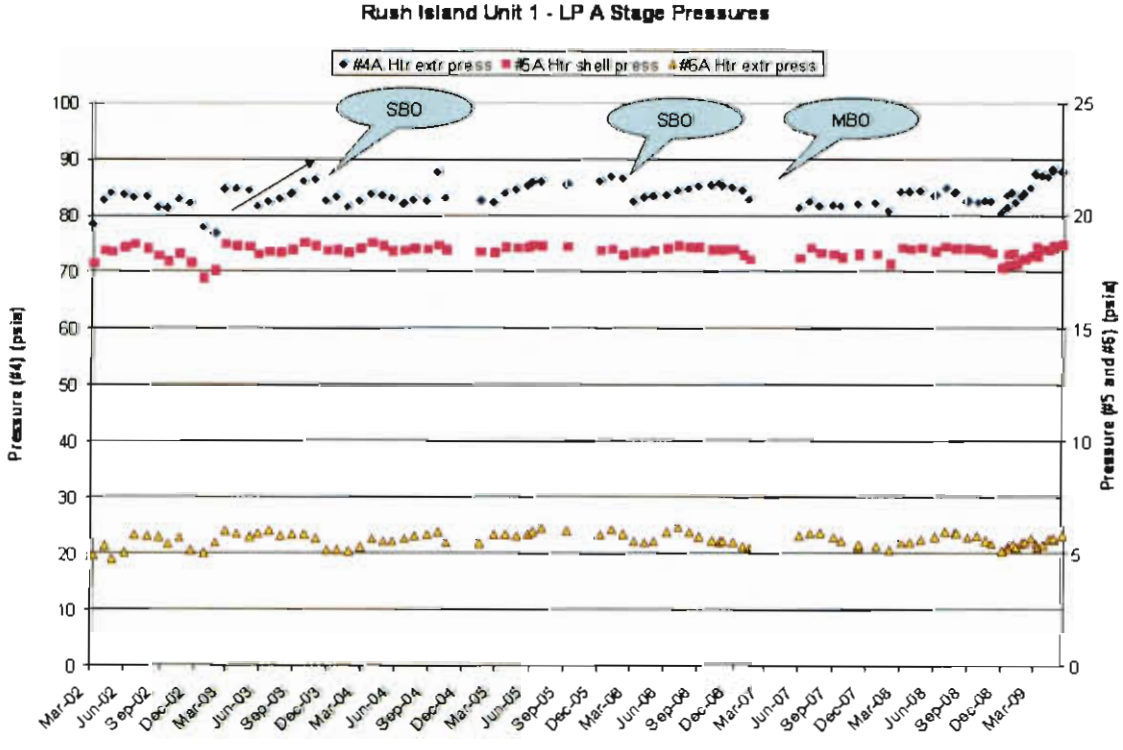
Rush Island Unit 1 - HP and IP Efficiencies





Note that the heat rate on unit 1 has remained fairly consistent at the higher loads in 2009.





These two plots show data relevant to the crossover pressure limitation data review. The top plot shows measured and corrected load over time. Corrected load on the unit was high immediately following the HP/IP outage in the fall of 2007. However, the corrected load dropped off to around 630 MWs fairly quickly (which is about equal to the current corrected load on the unit). The achievable load on the unit has dropped off at in 2009.

The bottom plot shows stage pressures in the A LP turbine. As shown, the stage pressures increase over time (especially at the DA extraction) and seem to recover (lower) during outages. However, the pressures did not drop following the outage in May. Crossover pressure is increasing due to the DA extraction pressure "backing up."

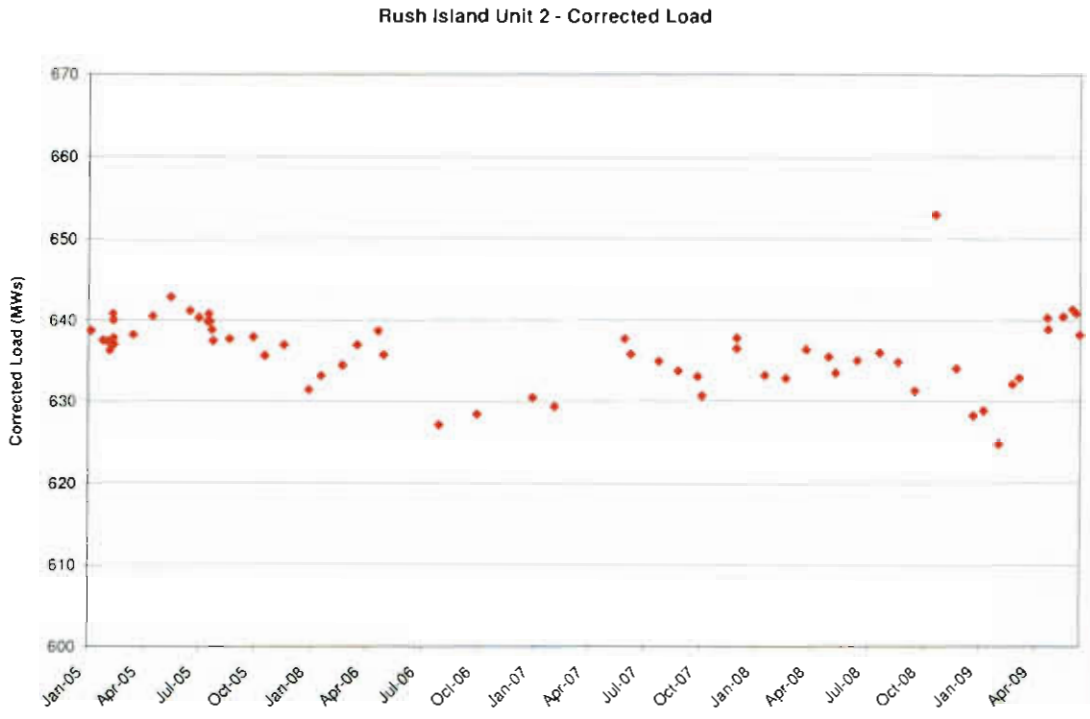
Unit 2 Observations

The following observations were noted regarding performance on Unit 2:

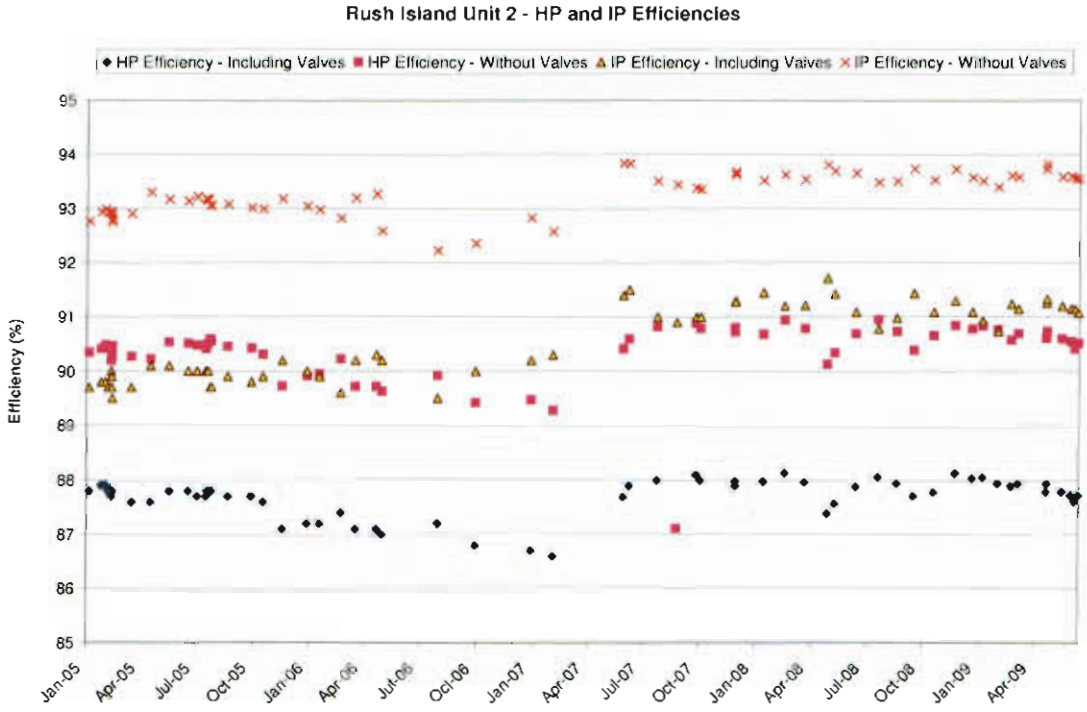
- The heat rate remains elevated with a large mismatch between feedwater and steam flow. Further discussion of a potential issue with the unit's feedwater flow indication is provided below.
- Aux. load on Unit 2 is much higher than on unit 1 (5.8% versus 4.9%), which is typical for Unit 2 since the convective pass modifications that were done on Unit 1 in 2007 have not yet been completed on Unit 2.
- The DCA on both the 5A and 5B FWH are higher than expected (50F actual versus 12F expected). The normal drainer on the 5A is open 100% (and has been for some time (at least 1/1/2008) and the dump valve is open 15%. The normal drainer on the 5B is open 100% (and has been for some time (at least 1/1/2008) and the dump valve is open 35%. Are these heaters being operated at their design level? It is noted that the calculated extraction flow to these heaters is about 30% higher than those shown on the top load heat balance.

Summary of Performance Report for:

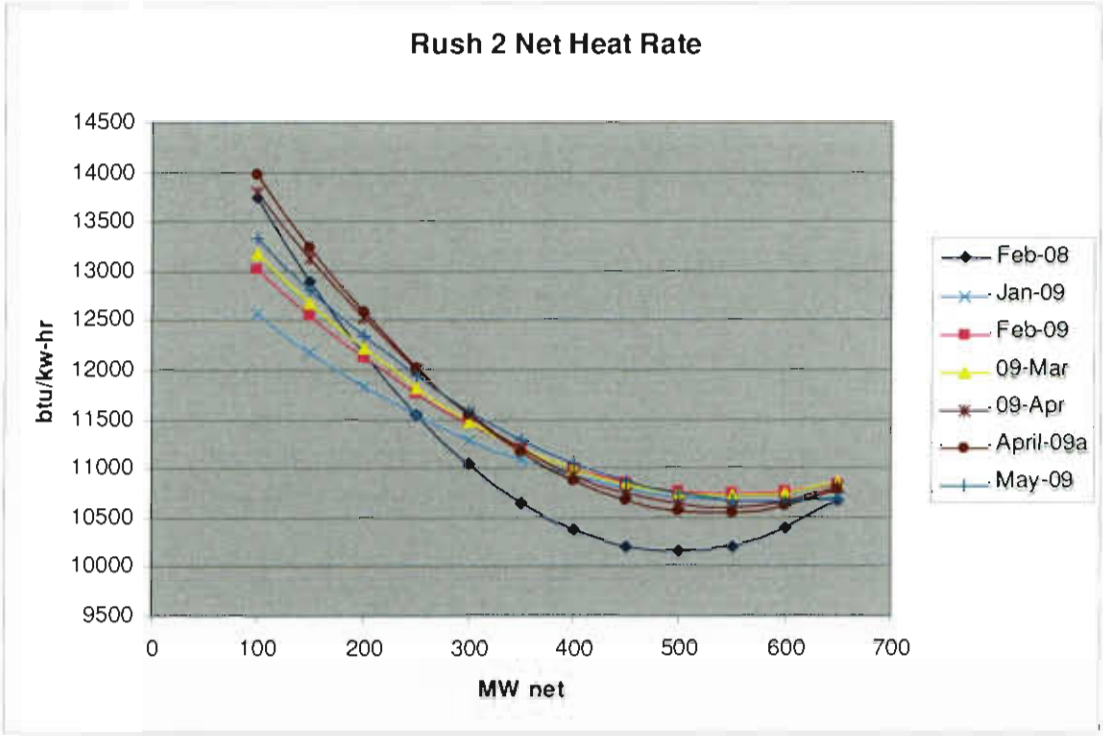
Plant	Rush Island				
Unit	2				
Period	5/1/09 to	6/1/09			
		May-09		Apr-09	May-08
Full Load Performance					
Hours of Data		178		105	36
		Averages		**Averages**	**Averages**
GENERATOR MEGAWATTS	MW	612.9		624.5	611.9
AUX POWER	MW	35.8		36.1	34.6
Net Unit Heat Rate Actual (GPHI)	BTU/KW-HR	10663.6		10652.1	10055.9
Boiler Efficiency Actual	%	85.9		85.6	85.7
CONTROL VALVE POSITION LVDT	%	99.8		99.8	100.1
FEEDWATER TEMP TO ECON	degF	485.9		488.9	489.4
FEEDWATER TEMP TO HTR 1	degF	441.7		443.7	441.5
HP Turbine Efficiency Actual	%	88.0		87.9	89.5
IP Turbine Efficiency Corrected	%	92.5		92.6	91.5
Condenser Pressure HP	inHga	2.0		1.8	1.7
AIRHTR-A GAS OUTLET TEMP	degF	311.4		311.7	295.8
AIRHTR-B GAS OUTLET TEMP	degF	322.1		326.5	307.3
AMBIENT AIR TEMP	degF	72.6		68.1	61.1
CIRC WTR TEMP TO LP CONDB	degF	65.3		58.2	61.3
CIRC WTR TEMP TO LP CONDB	degF	65.2		58.2	61.3
Minimum River Temperature	degF	65.2		58.2	61.3
FWH 1 Temperature Rise	degF	44.2		45.2	47.8
Net Load	MW	577.2		588.4	577.3
Average Exit Gas Temperature	degF	316.8		319.1	301.6
Aux Power	%	5.8		5.8	5.7
Gross Unit Heat Rate	BTU/KW-HR	10041.3		10035.8	9487.0
Gross Turbine Heat Rate	BTU/KW-HR	8628.0		8591.9	8128.8
Measured Feedwater Flow	KPPH	4333.3		4374.3	4113.1
Calc Steam Evaporated	KPPH	4394.9		4484.4	4151.8
Steam Flow From First Stage	KPPH	3934.5		4007.6	3935.7
FW/Steam		1.10		1.1	1.0
Steam/Load		6.42		6.4	6.4
FW/Load		7.07		7.0	6.7



The top plot shows corrected load on Unit 2. As shown, the corrected load increased about 8 MWs following the spring outage. This increase is judged to be partially attributable to the reduction in flow through leaking drain lines on the unit.

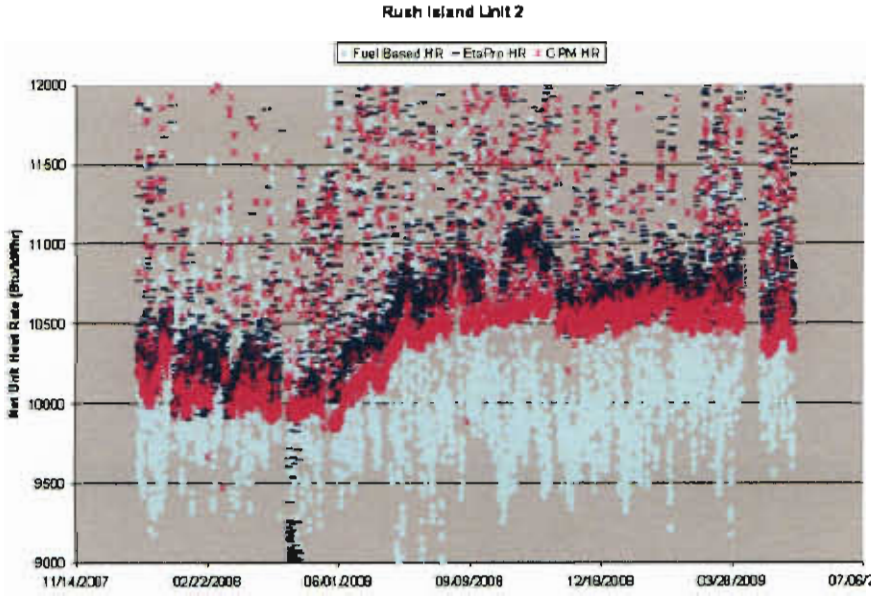


The bottom plot shows turbine efficiencies on Unit 2. As shown, the turbine efficiencies remained about the same following the spring outage.

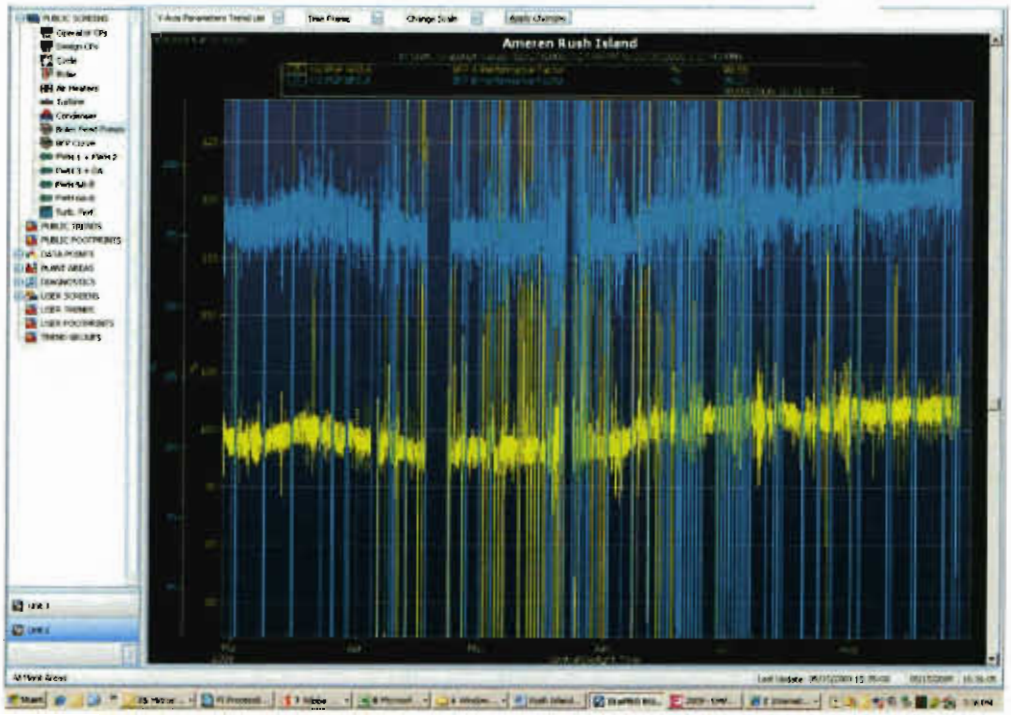


The above chart is a plot of the NUHR vs Net Load. April-09 plotted above is the entire month's data vs load and the April-09a is the April data post-outage. The post-outage data shows a slight decrease in NUHR. The data from May would indicate that the heat rate at high loads has returned to the before-outage levels.

When heat rate reductions were not observed on U2 following the recent outage, Performance Engineering took a look at the Heat Rate based on FW flow versus the heat rate based on fuel flow. Below is a chart of this data. As shown in the chart below, there was an increase in the heat rate based on the indicated FW flow in early June last year, but the fuel flow heat rate slope stays relatively shallow.

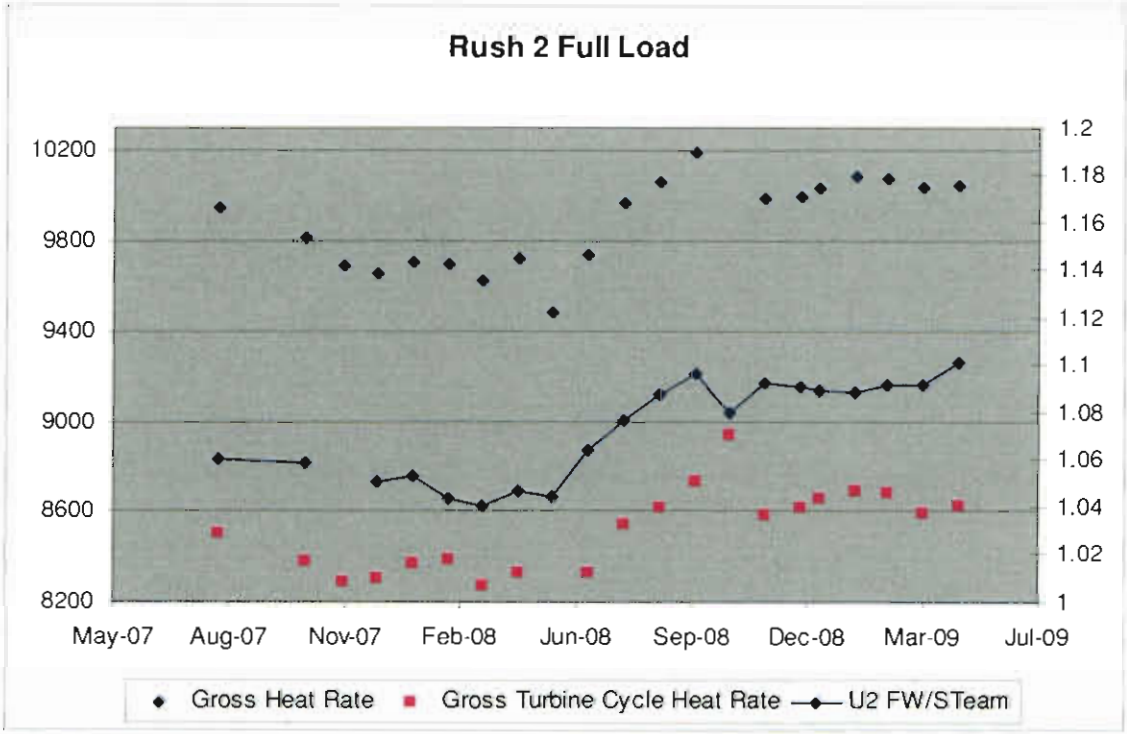


After seeing these results, Performance Engineering suspected an indication error with the feedwater flow measurement. To investigate further, Performance Engineering reviewed some boiler feedpump data. Below is a plot of the A and B boiler feed pump performance factors. Notice around the first part of June an increase in both the A and B pumps.



The pump performance factor is basically a ratio of corrected flow based on the rated speed to the actual speed to the corrected capacity at design head. Since variables involved to make this calculation are flow, pressure, and speed; any one of the field indicated values could be in error, but since the heat rate based on FW flow took a significant jump at approximately the same time that the pump performance factors trended up, performance engineering suspects there is a problem with the FW flow indication on U2 and requests a calibration of the instrumentation associated with feedwater flow. Performance engineering will investigate instruments that provide this indication and work with Rush Island plant to JR accordingly.

The above information was noted in last month's report. Below is a chart of feedwater to steam flow ratio, along with net and gross heat rate, over the last year. The information below shows a gradual trend and not a significant step change which points to either a gradual drift of 2FT-7A(1-3) &7B(1-3) flow transmitters.



5/18/2009

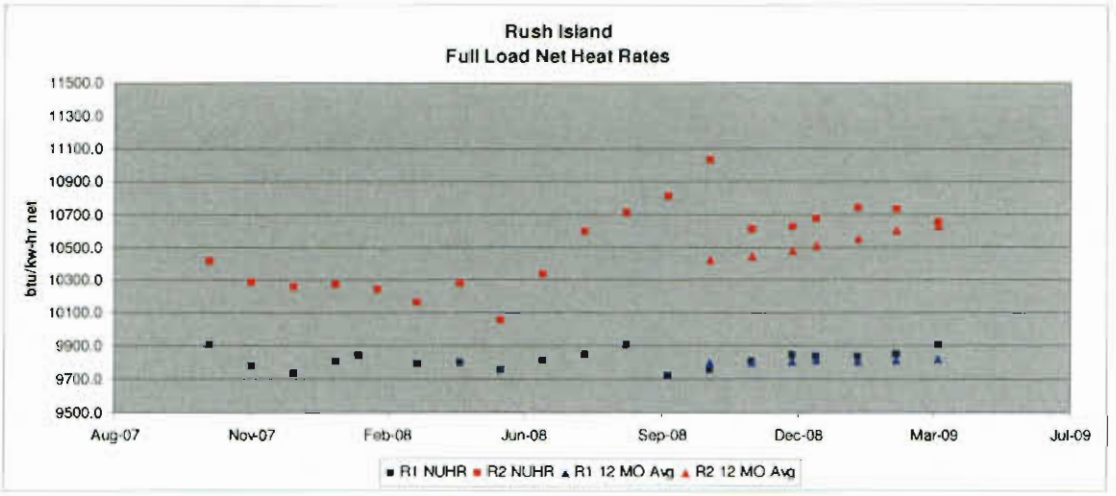
Mr. David Strubberg

From: Jim Barnett

Cc: Bob Meiners, Andy Williamson, Paul Starks, Greg Vasel, Gary Blessing, Mike Clonts, Matt Wallace, Ken Stuckmeyer, Don Clayton, Jeff Shelton, Jim Barnett, Scott Hixson, Glenn Tiffin, Fred Kutilek, Tom Ziegler, Jeff Colter, Tim Finnell, Scott McCormack, Mike Kobel

Re: Rush Island April 2009 Performance Report

The last report was on April 9, 2009 and covered operation through March 2009. The information provided within this report covers unit operation from the last report through April 2009.



Plant	2009 Actual	Threshold	Target	Stretch
Rush Island	10276	10186	10066	9996

Executive Summary

- Unit 1 Heat Rate remains consistent with what was seen in last month's report. Unit 2 Heat Rate has decreased by approximately 1% following the recent SBO.
- Valve repairs and replacements during the Unit 2 outage did not result in a significant decrease in the mismatch between MS and FW flow. Suspect Feedwater flow instrumentation.
- Unit 1 Load Degradation appears to be due to LP turbine performance. An additional meeting is being planned to discuss our study results in further detail.
- We plan to perform an impact analysis from the 8800/8400 BTU Test burn once the fuel analysis is received.

Action Items

- Performance engineering to set-up a meeting with RI plant and Turbine Engineering to discuss Unit 1 Turbine Crossover pressure limitation and causal factors leading to the crossover pressure and status of performance engineering's evaluation.
- Performance engineering to analyze operating data, fuel deliveries, and fuel lab analysis and provide a report on the 8800/8400 test burn at approximately the same time as the May thermal Report is completed.
- Performance engineering to work with the plant on JR'ing the correct instrumentation to be calibrated so the U2 FW flow indication can be validated.
- The Instrument & other issue spreadsheet has been updated and JRs initiated for instruments that are not functional. Could the plant please review and comment on if the JRs initiated are OK, or what should be done differently?
  I:\RUSH\Performance\Instrument & other issues.xls
- Performance engineering would like to be copied on notes from morning meetings

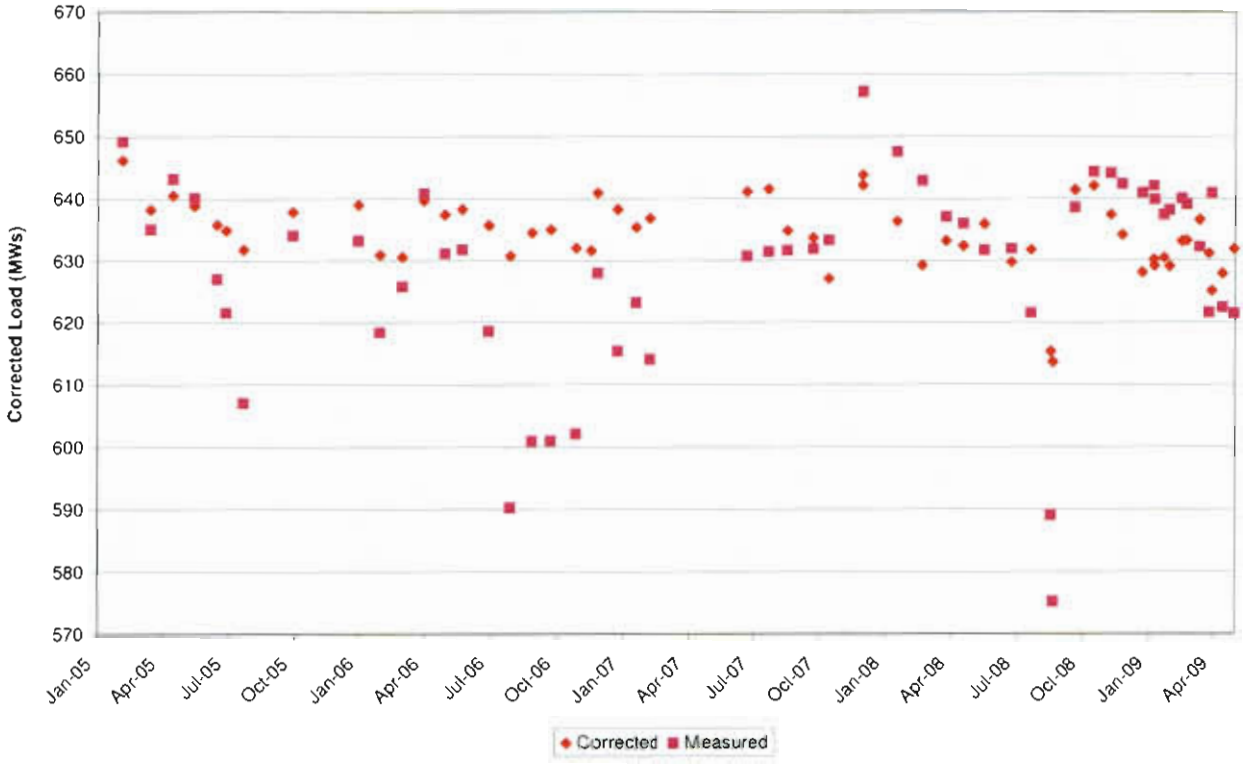
Unit 1 Observations

Summary of Performance Report for:

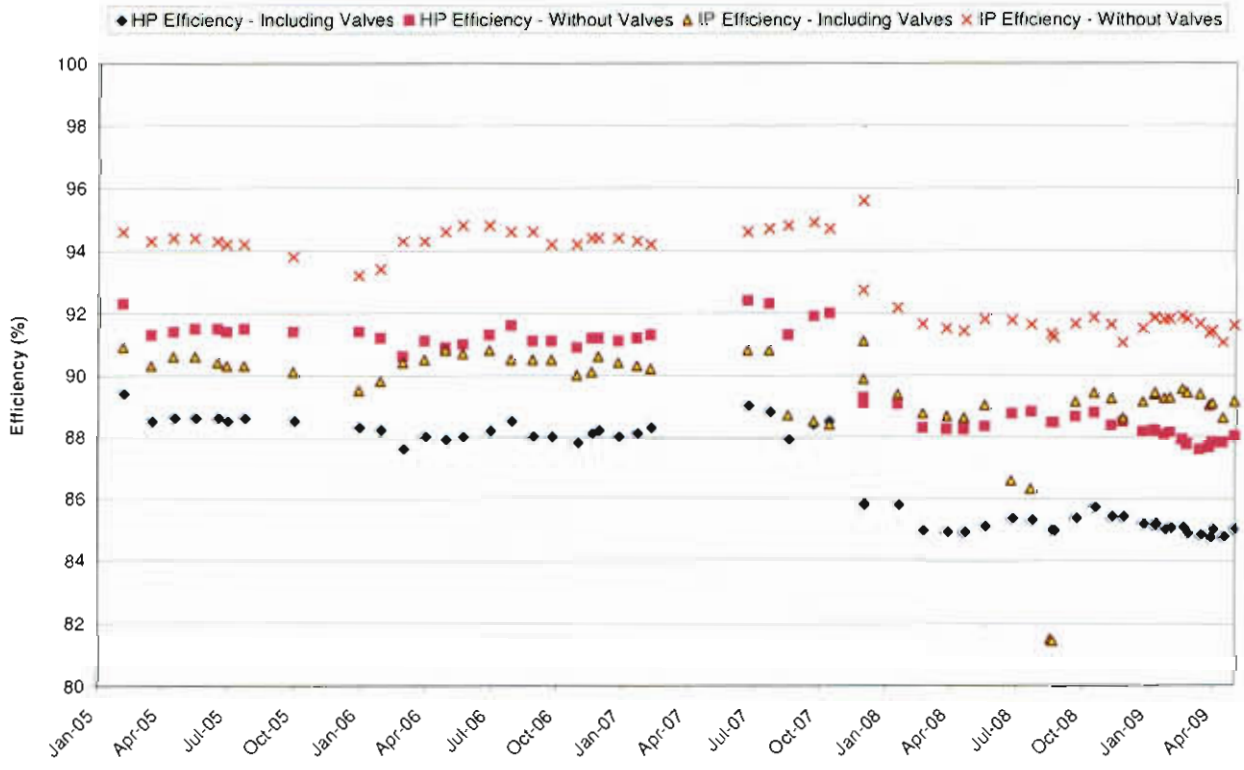
Plant	Rush Island
Unit	1
Period	

		Apr-08	Mar-09	Apr-09
Full Load Performance				
Hours of Data		122	203	163
		Averages	**Averages**	**Averages**
GENERATOR MEGAWATTS	MW	634.4	627.9	626.1
AUX POWER	MW	30.3	29.9	32.4
Net Unit Heat Rate Actual (GPHI)	BTU/KW-HR	9801	9849.6	9906.2
Boiler Efficiency Actual	%	86.4	86.6	86.5
CONTROL VALVE POSITION LVDT	%	100.0	100.0	99.9
FEEDWATER TEMP TO ECON	degF	496	495.1	495.0
FEEDWATER TEMP TO HTR 1	degF	446	446.3	446.2
HP Turbine Efficiency Actual	%	84.8	84.8	84.8
IP Turbine Efficiency Corrected	%	92.4	89.2	88.7
Condenser Pressure	inHga	1.9	2.4	2.0
AIRHTR-A GAS OUTLET TEMP	degF	279	291.8	292.9
AIRHTR-B GAS OUTLET TEMP	degF	290	306.0	309.5
AMBIENT AIR TEMP	degF	54.0	52.5	55.6
CIRC WTR TEMP TO LP CONDB	degF	51.1	49.3	53.2
CIRC WTR TEMP TO LP CONDB	degF	49.6	47.7	51.6
Minimum River Temperature	degF	49.6	47.7	51.6
FWH 1 Temperature Rise	degF	49.9	48.8	48.8
Net Load	MW	604.1	598.1	593.7
Average Exit Gas Temperature	degF	284.3	298.9	301.2
Aux Power	%	4.8	4.8	5.2
Gross Unit Heat Rate	BTU/KW-HR	9334	9381.0	9393.6
Gross Turbine Heat Rate	BTU/KW-HR	8066	8121.4	8121.4
Measured Feedwater Flow	KPPH	4255	4258.5	4235.3
Calc Steam Evaporated	KPPH	4248	4247.3	4223.5
Steam Flow From First Stage	KPPH	4041	4076.4	4054.7
FW/Steam		1.05	1.0	1.0
Steam/Load		6.37	6.5	6.5
FW/Load		6.71	6.8	6.8
Rolling 12 Month Heat Rate Average			9816.3	9825.0

Rush Island Unit 1 - Load



Rush Island Unit 1 - HP and IP Efficiencies

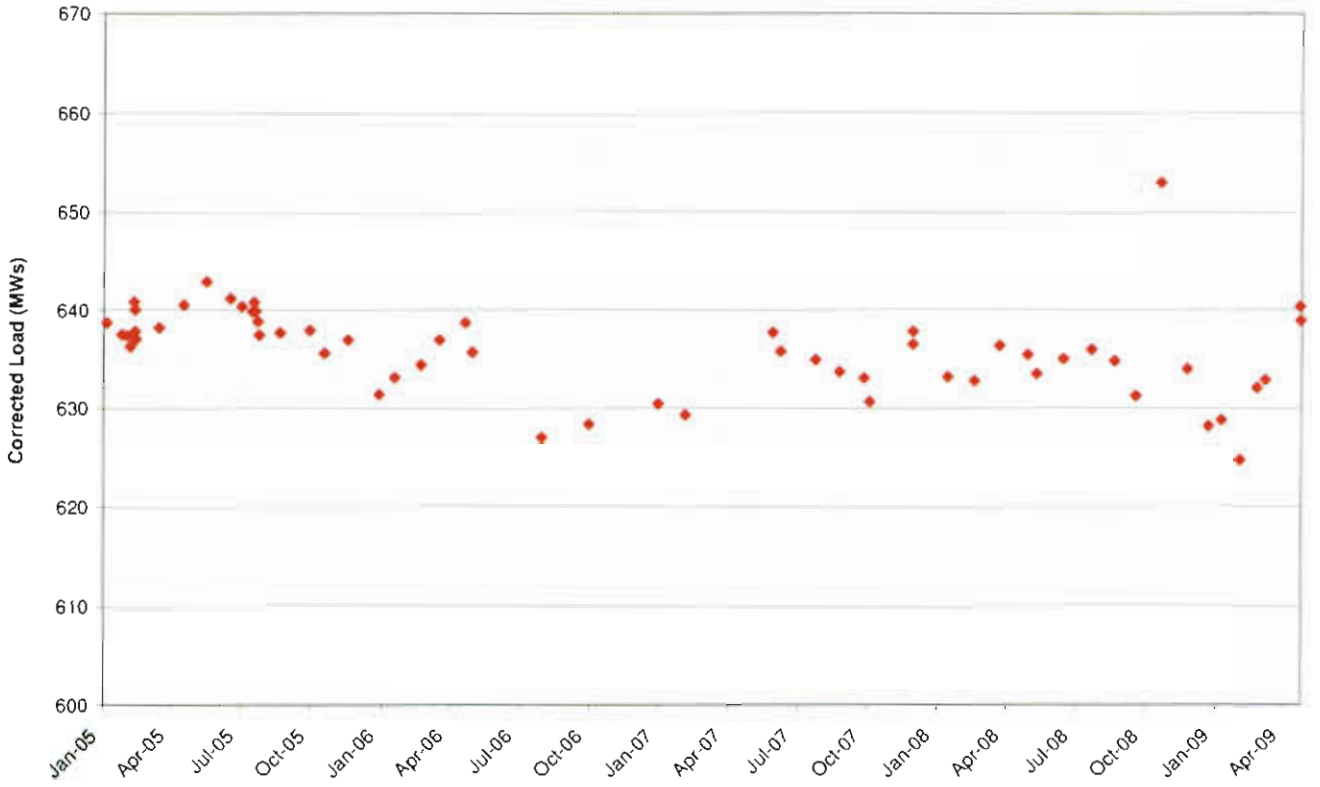


Summary of Performance Report for:

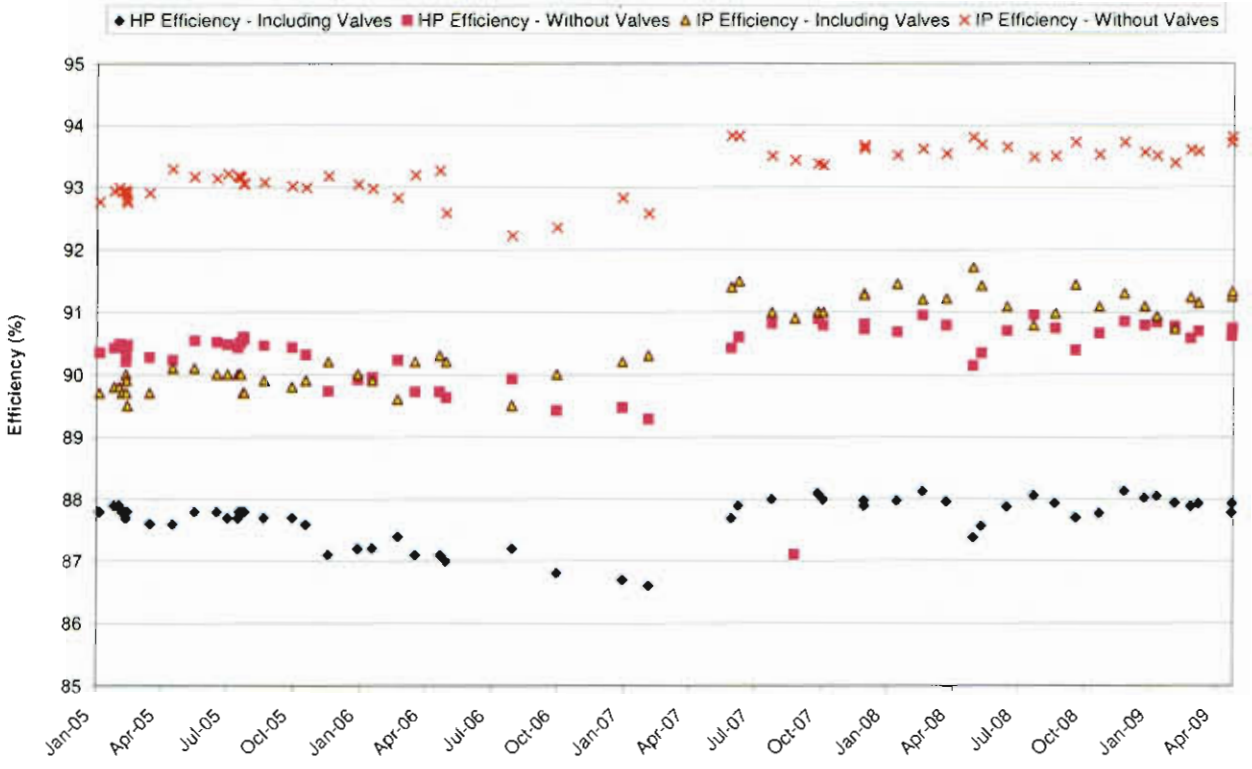
Plant Rush Island
Unit 2
Period

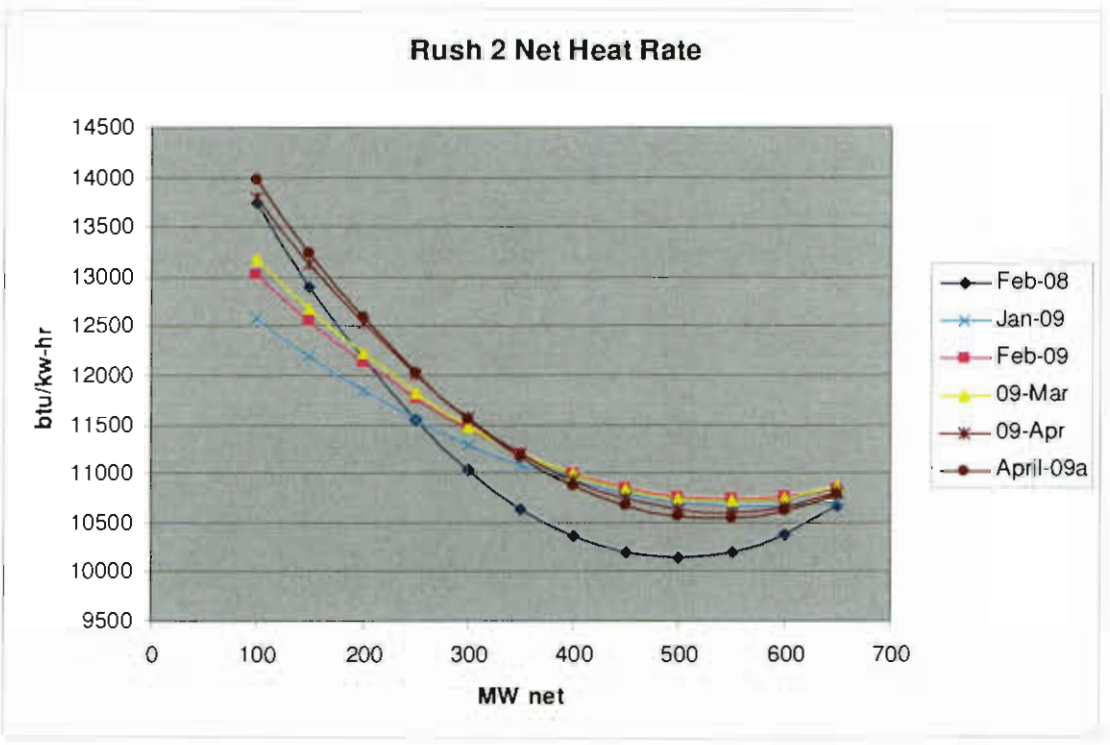
		Apr-08	Mar-09	Apr-09
Full Load Performance				
Hours of Data		137	262	105
		Averages	**Averages**	**Averages**
GENERATOR MEGAWATTS	MW	587.2	608.6	624.5
AUX POWER	MW	32.0	37.2	36.1
Net Unit Heat Rate Actual (GPHI)	BTU/KW-HR	10282	10734.2	10652.1
Boiler Efficiency Actual	%	85.7	86.2	85.6
CONTROL VALVE POSITION LVDT	%	99.8	99.6	99.8
FEEDWATER TEMP TO ECON	degF	487	489.6	488.9
FEEDWATER TEMP TO HTR 1	degF	439	441.4	443.7
HP Turbine Efficiency Actual	%	90.0	88.0	87.9
IP Turbine Efficiency Corrected	%	91.4	92.5	92.6
Condenser Pressure HP	inHga	2.4	2.1	1.8
AIRHTR-A GAS OUTLET TEMP	degF	287	290.7	311.7
AIRHTR-B GAS OUTLET TEMP	degF	302	330.0	326.5
AMBIENT AIR TEMP	degF	53.7	47.7	68.1
CIRC WTR TEMP TO LP CONDB	degF	51.3	47.4	58.2
CIRC WTR TEMP TO LP CONDB	degF	51.3	47.4	58.2
Minimum River Temperature	degF	51.3	47.4	58.2
FWH 1 Temperature Rise	degF	47.8	48.2	45.2
Net Load	MW	555.2	571.4	588.4
Average Exit Gas Temperature	degF	294.2	310.3	319.1
Aux Power	%	5.4	6.1	5.8
Gross Unit Heat Rate	BTU/KW-HR	9722	10078.5	10035.8
Gross Turbine Heat Rate	BTU/KW-HR	8330	8684.0	8591.9
Measured Feedwater Flow	KPPH	4290	4340.0	4374.3
Calc Steam Evaporated	KPPH	4454	4427.1	4484.4
Steam Flow From First Stage	KPPH	4096	3974.4	4007.6
FW/Steam		1.05	1.09	1.09
Steam/Load		6.60	6.53	6.42
FW/Load		6.91	7.13	7.00
Rolling 12 Month Heat Rate Average			10601.9	10632.8

Rush Island Unit 2 - Corrected Load

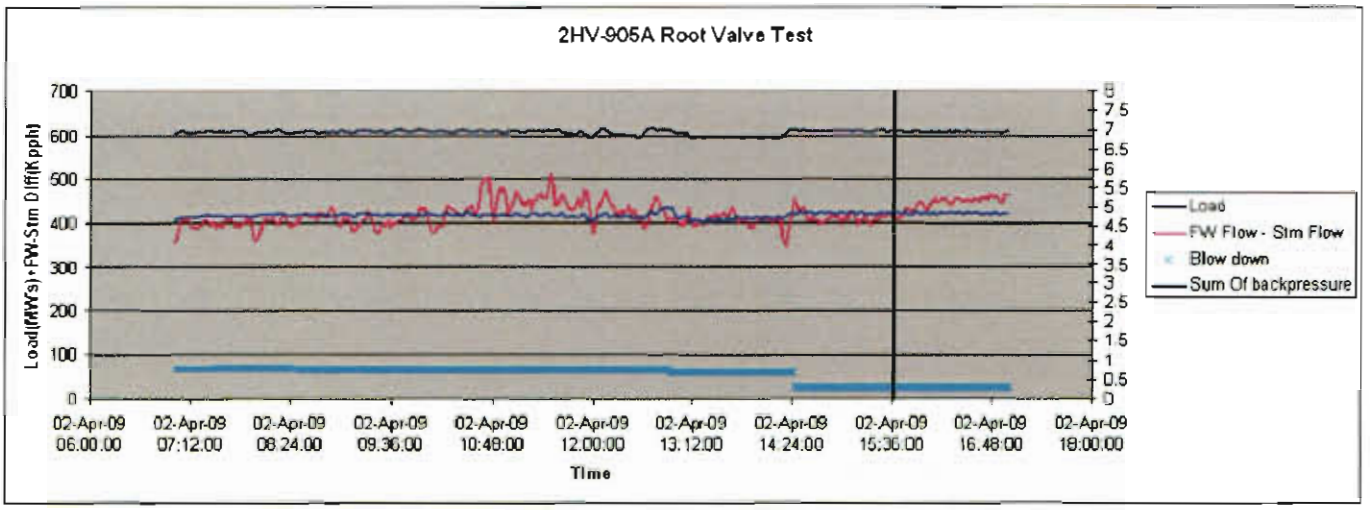


Rush Island Unit 2 - HP and IP Efficiencies





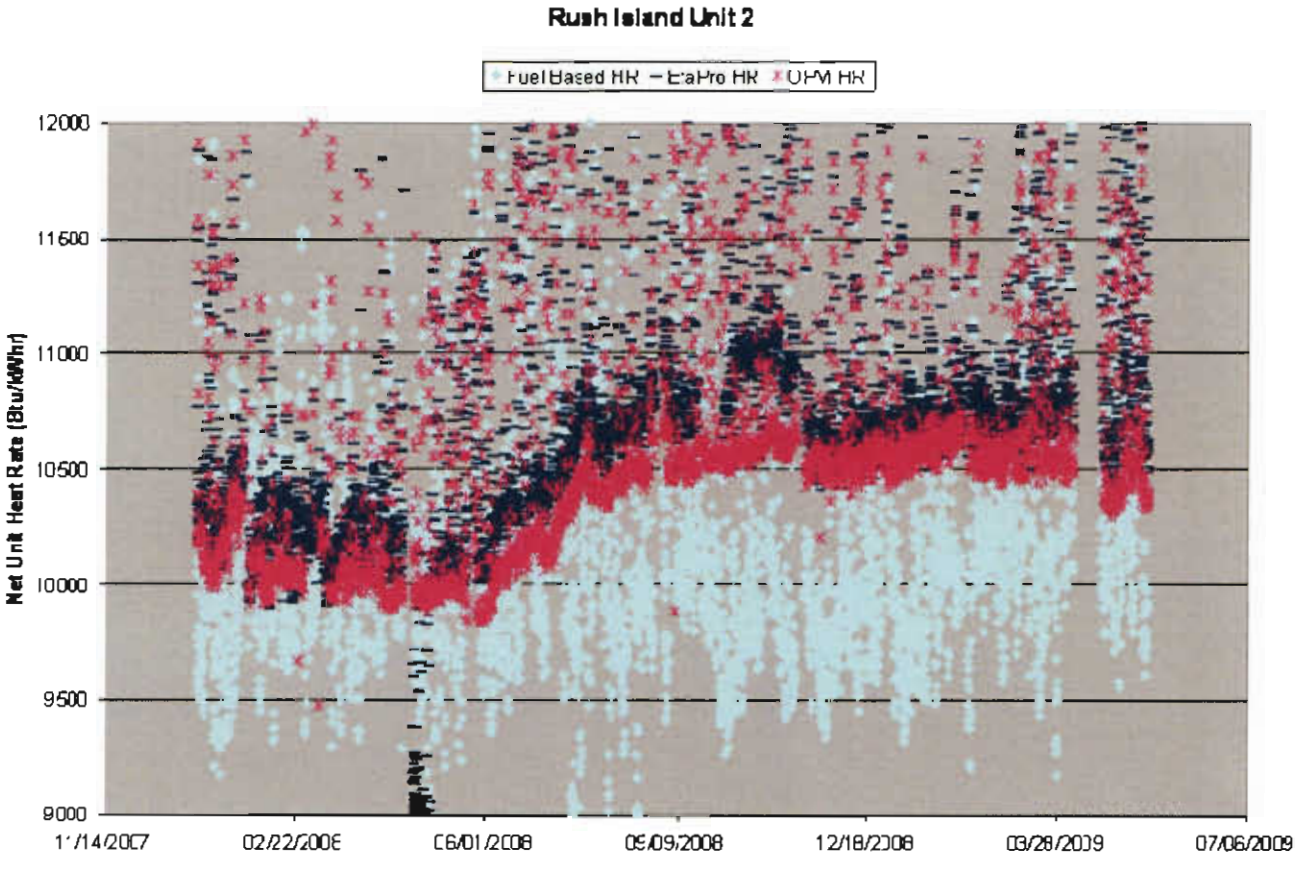
The above chart is a plot of the NUHR vs Net Load. April-09 plotted above is the entire month's data vs load and the April-09a is the April data post outage. The post-outage data shows a slight decrease in NUHR.



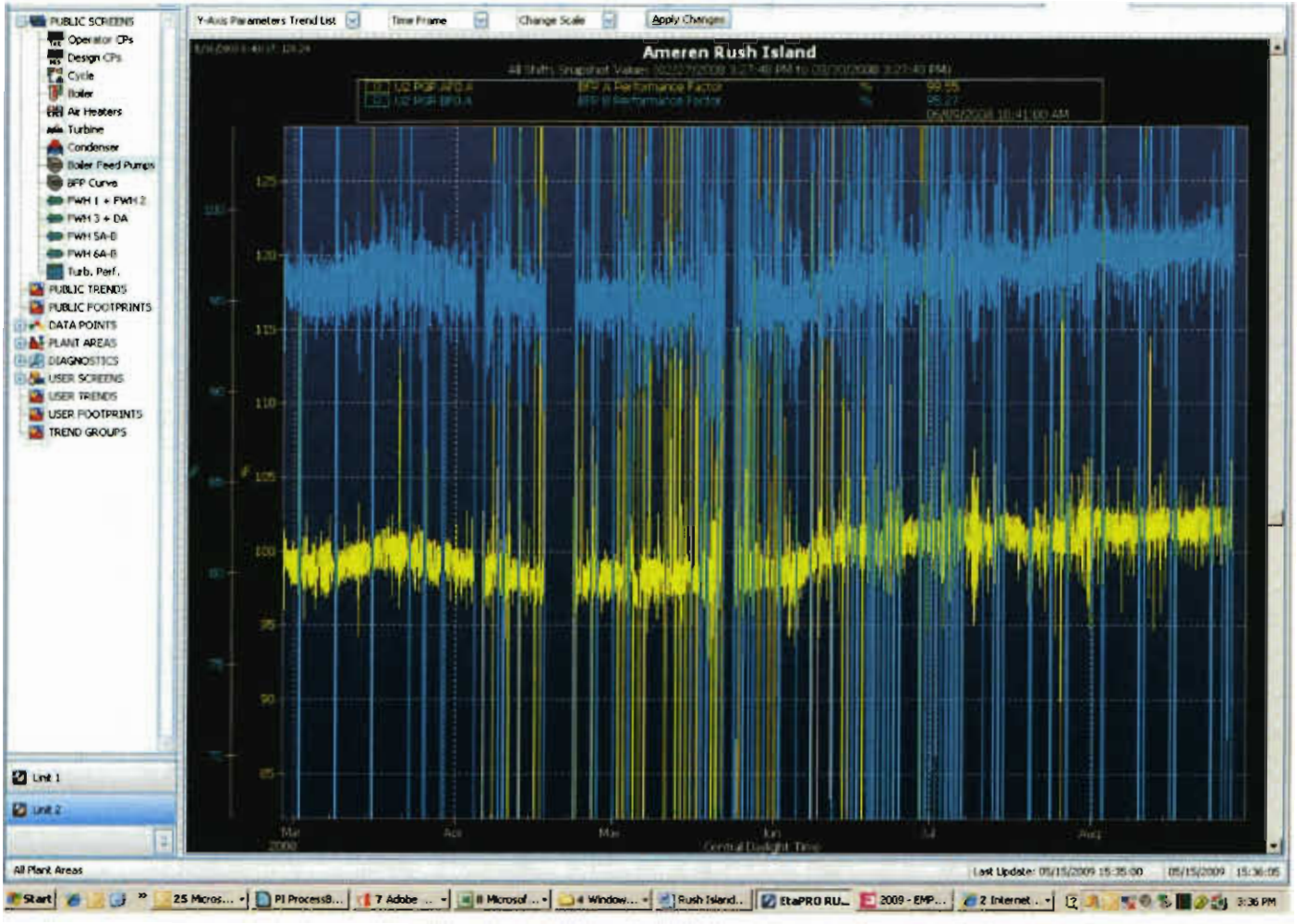
Prior to the outage there was a test completed on 04/03/09 where the root valve on valve 2HV-905A was closed and then later reopened. The change in the indicated difference between MS and FW flow was monitored and observed to be 38kpph, which correlates to 93 btu/kw-hr heat rate impact. During this test, the unit was run at steady state conditions with the Root valve to 905A closed for approximately 1 hour then the root valve was opened and the change noted above was observed. During the outage valves 2FV-612, 613 and 905A were replaced. All three noted valves were suspected to be leaking significantly based on temperature data obtained prior

to the unit coming off line, but the expected reductions based on the test noted above were not observed, after the unit was returned to service. Since the outage, all three valves that were replaced have been inspected and the seats show significant damage on each of the valves.

When heat rate reductions were not observed on U2, Performance Engineering took a look at the Heat Rate based on FW flow versus the heat rate based on fuel flow. Below is a chart of this data. As you can see from the chart below, there was an increase in the heat rate based on the indicated FW flow in early June last year, but the fuel flow heat rate slope stays relatively shallow.



After seeing these results, Perf. Eng. suspected an indication error with the feedwater flow measurement. To investigate further, Perf. Eng. reviewed some boiler feedpump data. Below is a plot of the A and B boiler feed pump performance factors. Notice around the first part of June an increase in both the A and B pumps.



The pump performance factor is basically a ratio of corrected flow based on the rated speed to the actual speed to the corrected capacity at design head. Since variables involved to make this calculation are flow, pressure, and speed any one of the field indicated values could be in error, but since the heat rate based on FW flow took a significant jump at approximately the same time that the pump performance factors trended up, performance engineering suspects there is a problem with the FW flow indication on U2 and requests a calibration of the instrumentation associated with feedwater flow. Performance engineering will investigate instruments that provide this indication and work with Rush Island plant to JR accordingly.

4/9/09

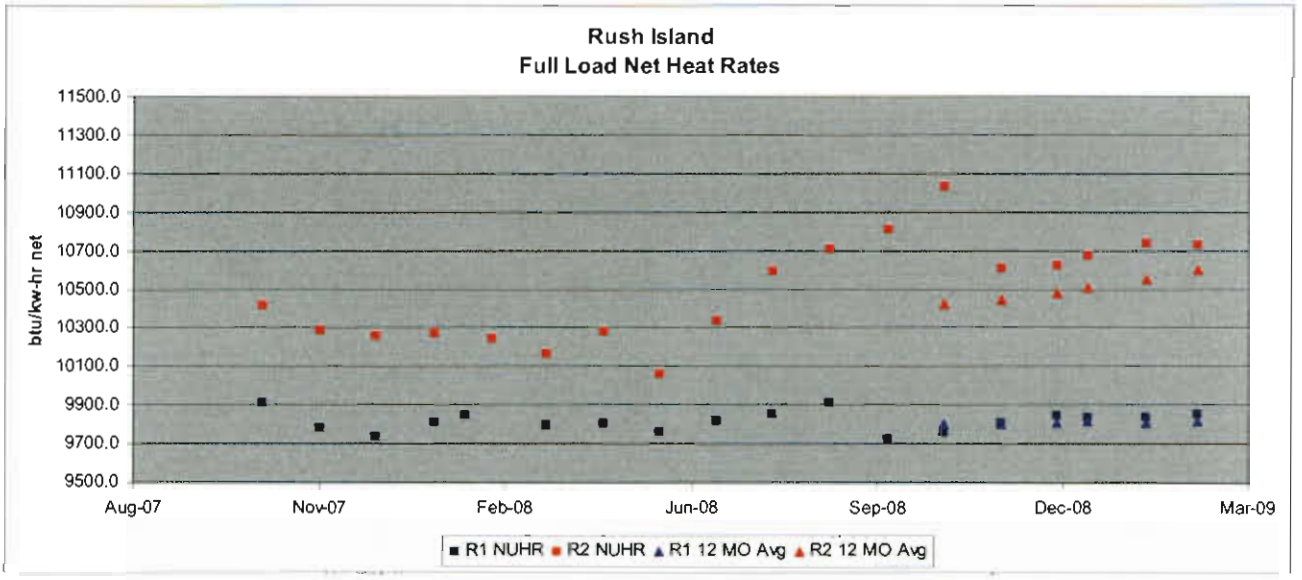
Mr. David Strubberg

From: Joe Sind and Jim Barnett

Cc: Bob Meiners, Andy Williamson, Paul Starks, Greg Vasel, Gary Blessing, Mike Clonts, Matt Wallace, Ken Stuckmeyer, Don Clayton, Jeff Shelton, Jim Barnett, Scott Hixson, Glenn Tiffin, Fred Kutilek, Tom Ziegler, Jeff Colter, Tim Finnell, Scott McCormack, Mike Kobel

Re: Rush Island March 2009 Performance Report

The last report was on March 3, 2009 and covered operation through February 2009. The information provided with in this report covers unit operation from the last report through March 2009.



Executive Summary

- Unit 1 and Unit 2 Heat Rates remain consistent with what was seen in last month's report.
- Jeff Shelton created a Steam Turbine Performance Page for Unit 2 in EtaPro (labeled Turb. Perf.) which shows an operating corrected load.
- Condenser cleaning has decreased unit back pressure on unit 1 and unit 2 backpressure continues to rise.
- Identified significant leakage in U2 Main Steam Drains and Governor Drain Valves which is suspect at being responsible for a majority of the on-going mismatch between MS and FW flow on Unit 2.

Action Items

- In our 3/6 quarterly performance meeting, Rush Island mentioned that there were several known leaking valves at the main steam energy state (these include the valves mentioned in the Executive Summary) and that some were scheduled to be replaced in the April SBO. Performance Engineering partially surveyed these valves using temperature and sonic methods. Rush Island has action to retain the old replaced valves for visual inspection and correlation to the surveyed data.
- Starting in very late March, Rush Island began a mini test burn to try and quantify the effects of burning 8400 (or less) btu/lb PRB coal as opposed to 8800 btu/lb. Performance Engineering has action to quantify the heat rate effects during the test burn. The test will probably end sometime around the end of the SBO.
- Performance Engineering has action to quantify and summarize the causal factors leading to a cross over pressure limitation on unit 1 and explain any changes in the factors since the HP/IP replacement in the fall of 2007. Results expected by the time of the next regular report.
- The Instrument & other issue spreadsheet has been updated and JRs initiated for instruments not functional. Could the plant please review and comment on if the JRs initiated are OK, or what should be done differently? I:\RUSH\Performance\Instrument & other issues.xls

Unit 1 Observations

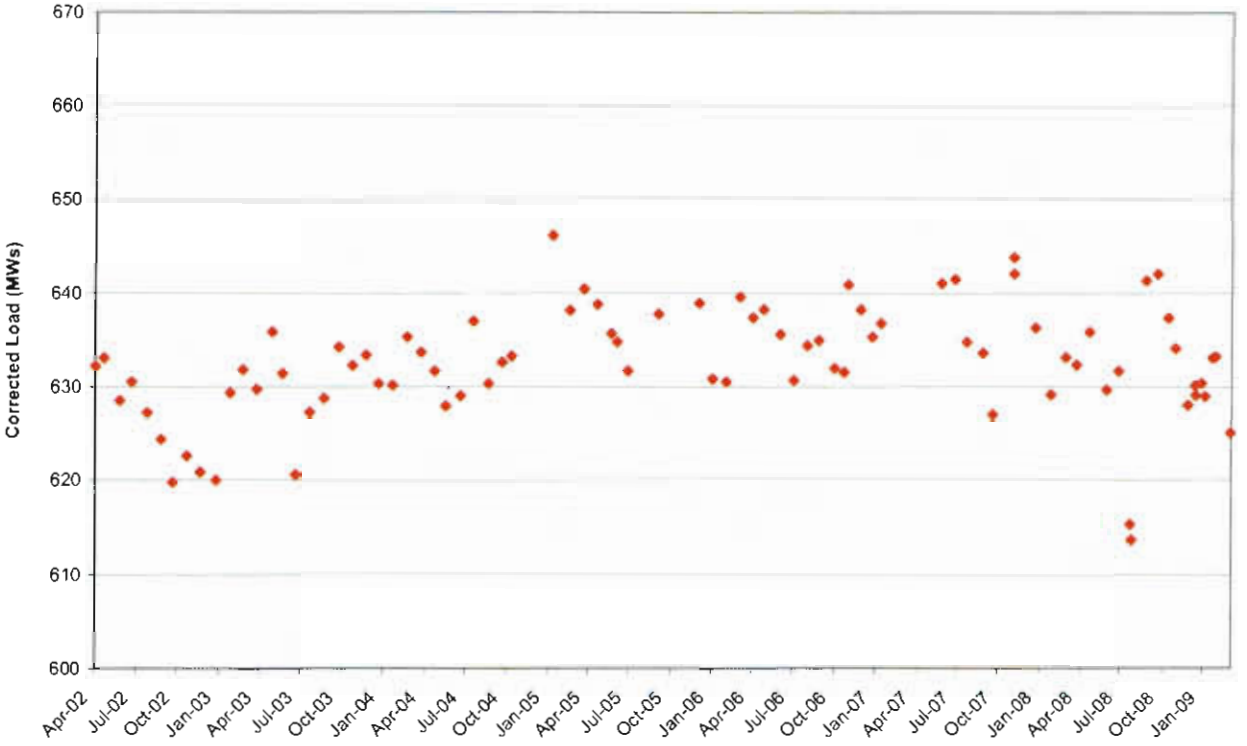
Summary of Performance Report for:

Plant	Rush Island			
Unit	1			
Period				
		Mar-08	Feb-09	Mar-09
Full Load Performance				
Hours of Data		397	362	203
		Averages	**Averages**	**Averages**
GENERATOR MEGAWATTS	MW	631.2	634.7	627.9
AUX POWER	MW	30.0	31.7	29.9
Net Unit Heat Rate Actual (GPHI)	BTU/KW-HR	9790.9	9839.1	9849.6
Boiler Efficiency Actual	%	86.7	86.9	86.6
CONTROL VALVE POSITION LVDT	%	100.0	100.0	100.0
FEEDWATER TEMP TO ECON	degF	495.6	495.4	495.1
FEEDWATER TEMP TO HTR 1	degF	445.5	446.2	446.3
HP Turbine Efficiency Actual	%	84.7	85.7	84.8
IP Turbine Efficiency Corrected	%	92.5	89.4	89.2
Condenser Pressure	inHga	1.8	2.4	2.4
AIRHTR-A GAS OUTLET TEMP	degF	281.8	294.2	291.8
AIRHTR-B GAS OUTLET TEMP	degF	289.9	313.5	306.0
AMBIENT AIR TEMP	degF	46.1	34.9	52.5
CIRC WTR TEMP TO LP CONDB	degF	44.9	39.4	49.3
CIRC WTR TEMP TO LP CONDB	degF	43.3	37.8	47.7
Minimum River Temperature	degF	43.3	37.8	47.7
FWH 1 Temperature Rise	degF	50.1	49.1	48.8
Net Load	MW	601.3	603.0	598.1
Average Exit Gas Temperature	degF	285.8	303.9	298.9
Aux Power	%	4.7	5.0	4.8
Gross Unit Heat Rate	BTU/KW-HR	9326	9347.6	9381.0
Gross Turbine Heat Rate	BTU/KW-HR	8083	8125.3	8121.4
Measured Feedwater Flow	KPPH	4235	4316.1	4258.5
Calc Steam Evaporated	KPPH	4227	4310.0	4247.3
Steam Flow From First Stage	KPPH	4027	4132.4	4076.4
FW/Steam		1.05	1.0	1.0
Steam/Load		6.38	6.5	6.5
FW/Load		6.71	6.8	6.8
Rolling 12 Month Heat Rate Average			9811.4	9816.3

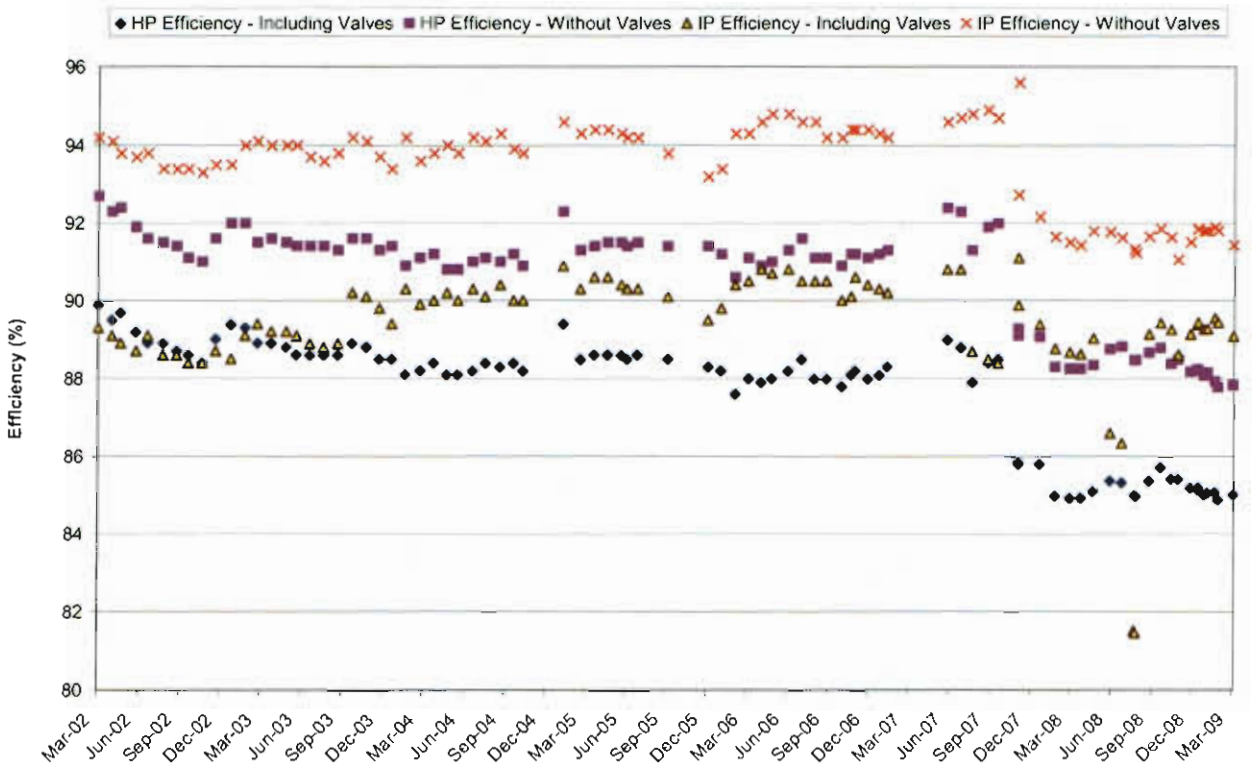
Conatins some bad quality data for CRH temp Tag 1pmn15051

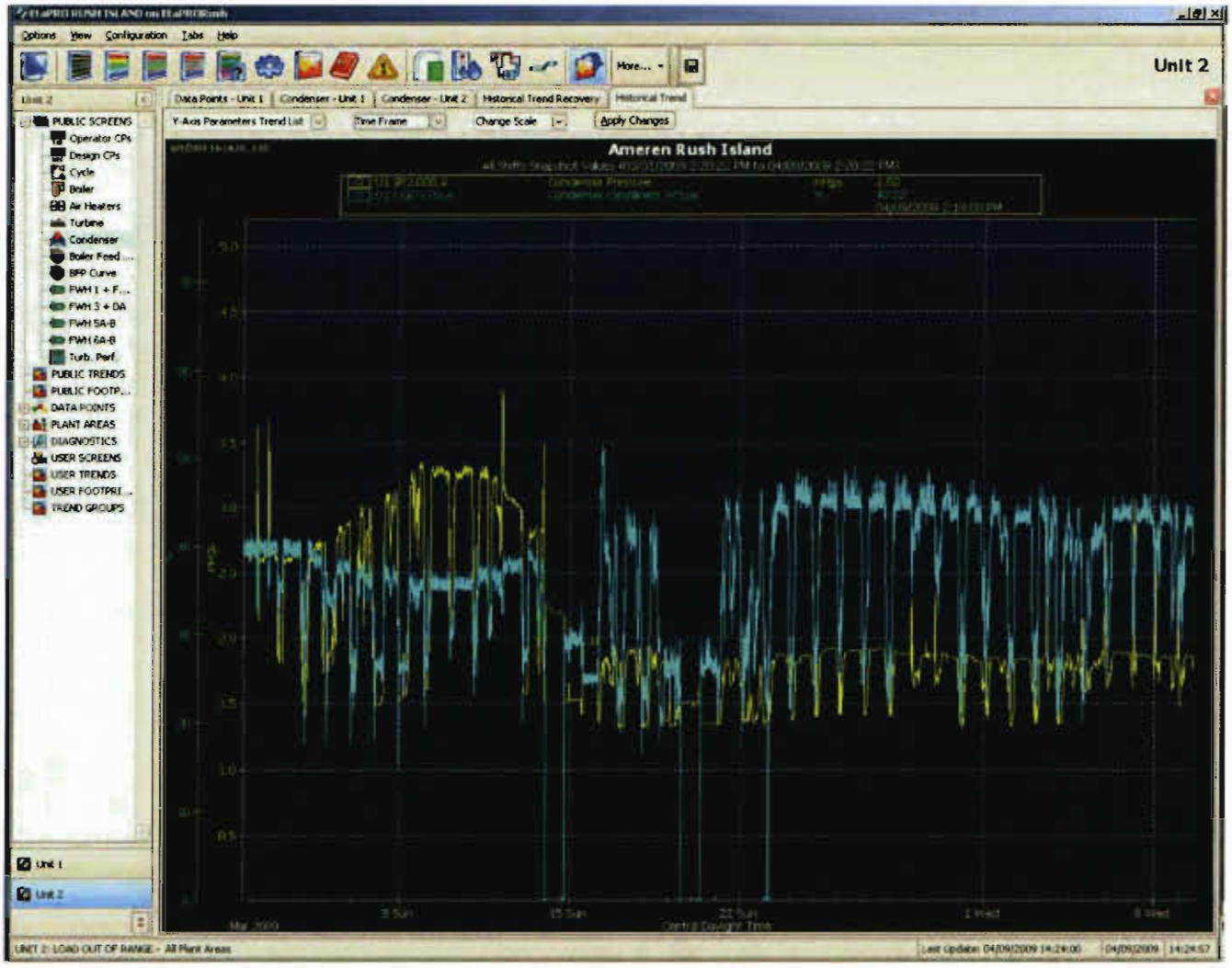
The low turbine efficiencies shown in the trend below and mentioned in last months report will be investigated as part of the cross over limitation study.

Rush Island Unit 1 - Corrected Load



Rush Island Unit 1 - HP and IP Efficiencies





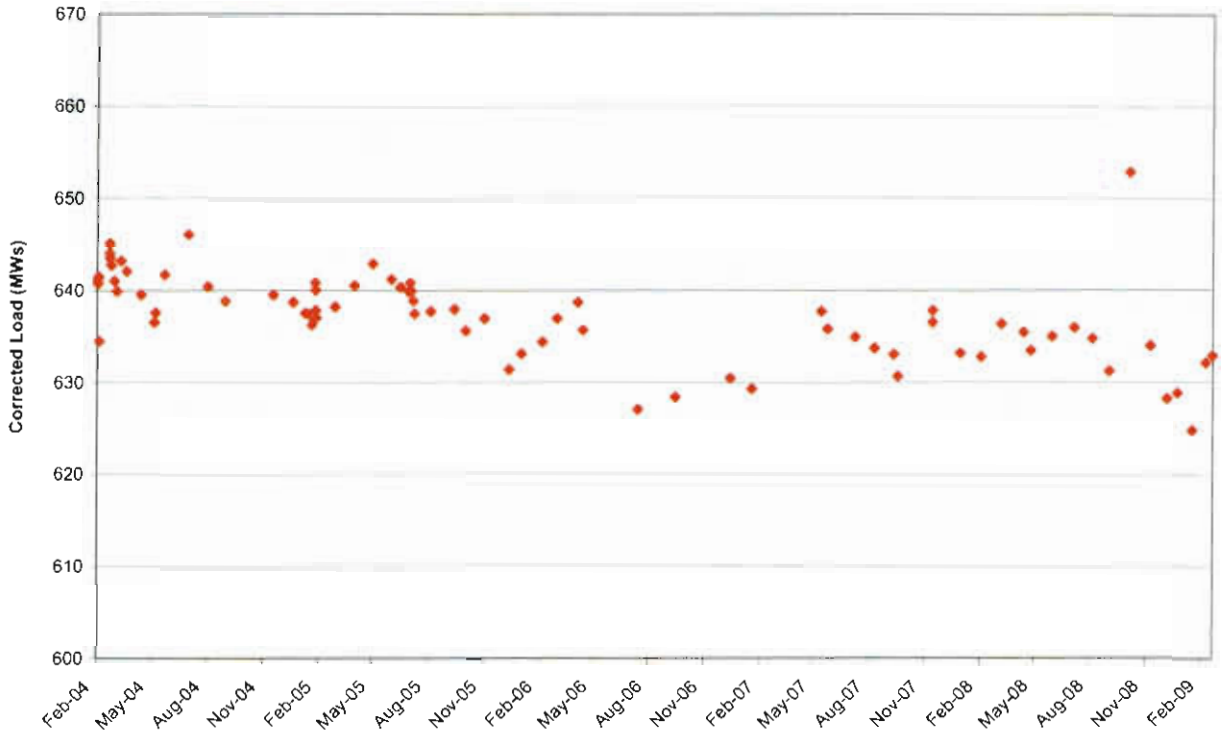
The above trend shows the effect of the condenser cleaning on unit 1. Condenser pressures improved by about 0.8 inHg and cleanliness improved less than 10%.

Unit 2 Observations

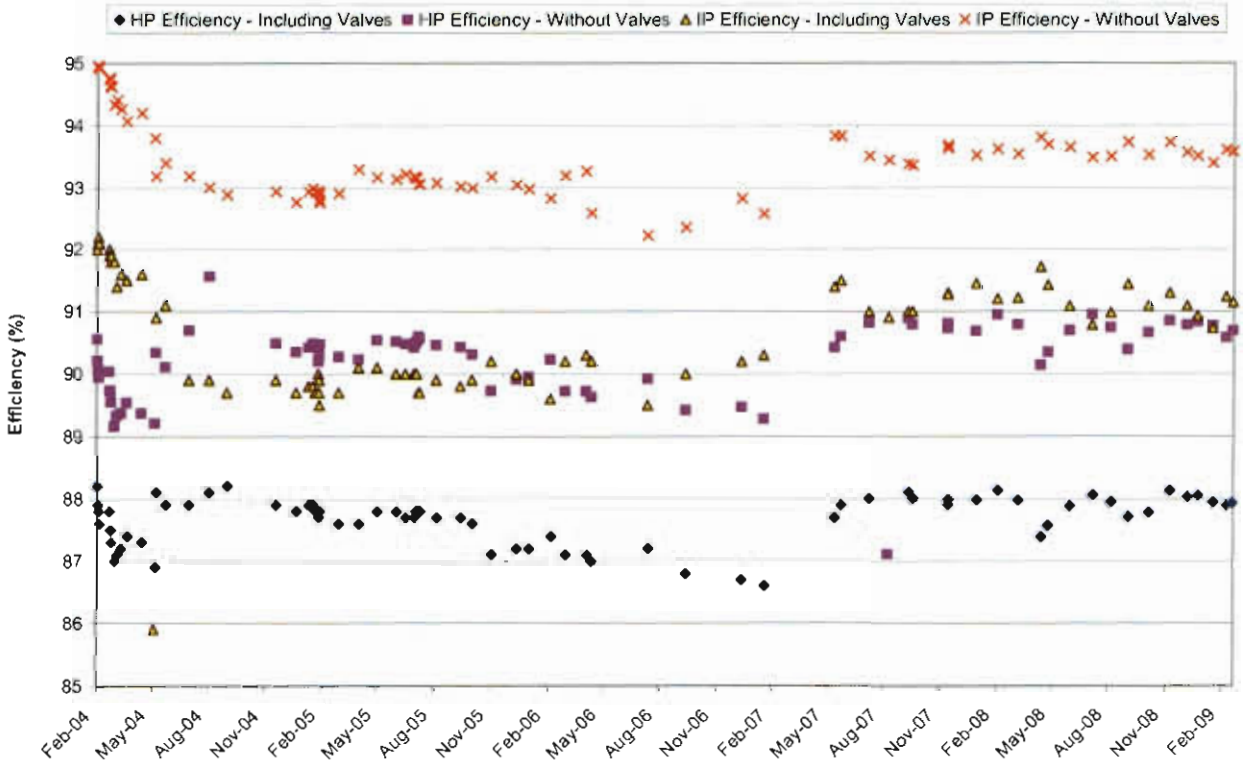
Summary of Performance Report for:

Plant	Rush Island			
Unit	2			
Period				
		Mar-08	Feb-09	Mar-09
Full Load Performance				
Hours of Data		494	328	262
		Averages	**Averages**	**Averages**
GENERATOR MEGAWATTS	MW	598.5	613.5	608.6
AUX POWER	MW	32.0	37.4	37.2
Net Unit Heat Rate Actual (GPHI)	BTU/KW-HR	10170.0	10742.5	10734.2
Boiler Efficiency Actual	%	86.0	86.2	86.2
CONTROL VALVE POSITION LVDT	%	99.8	99.6	99.6
FEEDWATER TEMP TO ECON	degF	488.1	490.0	489.6
FEEDWATER TEMP TO HTR 1	degF	440.3	441.5	441.4
HP Turbine Efficiency Actual	%	89.0	87.9	88.0
IP Turbine Efficiency Corrected	%	91.3	92.5	92.5
Condenser Pressure HP	inHga	2.7	1.8	2.1
AIRHTR-A GAS OUTLET TEMP	degF	291.7	294.7	290.7
AIRHTR-B GAS OUTLET TEMP	degF	304.9	331.8	330.0
AMBIENT AIR TEMP	degF	46.7	35.9	47.7
CIRC WTR TEMP TO LP CONDB	degF	44.3	40.2	47.4
CIRC WTR TEMP TO LP CONDB	degF	44.2	40.1	47.4
Minimum River Temperature	degF	44.2	40.1	47.4
FWH 1 Temperature Rise	degF	47.7	48.5	48.2
Net Load	MW	566.5	576.1	571.4
Average Exit Gas Temperature	degF	298.3	313.2	310.3
Aux Power	%	5.3	6.1	6.1
Gross Unit Heat Rate	BTU/KW-HR	9626.0	10087.2	10078.5
Gross Turbine Heat Rate	BTU/KW-HR	8273.8	8695.0	8684.0
Measured Feedwater Flow	KPPH	4052.5	4359.9	4340.0
Calc Steam Evaporated	KPPH	4128.6	4467.9	4427.1
Steam Flow From First Stage	KPPH	3894.3	4006.3	3974.4
FW/Steam		1.04	1.09	1.09
Steam/Load		6.51	6.53	6.53
FW/Load		6.77	7.11	7.13
Rolling 12 Month Heat Rate Average			10554.9	10601.9

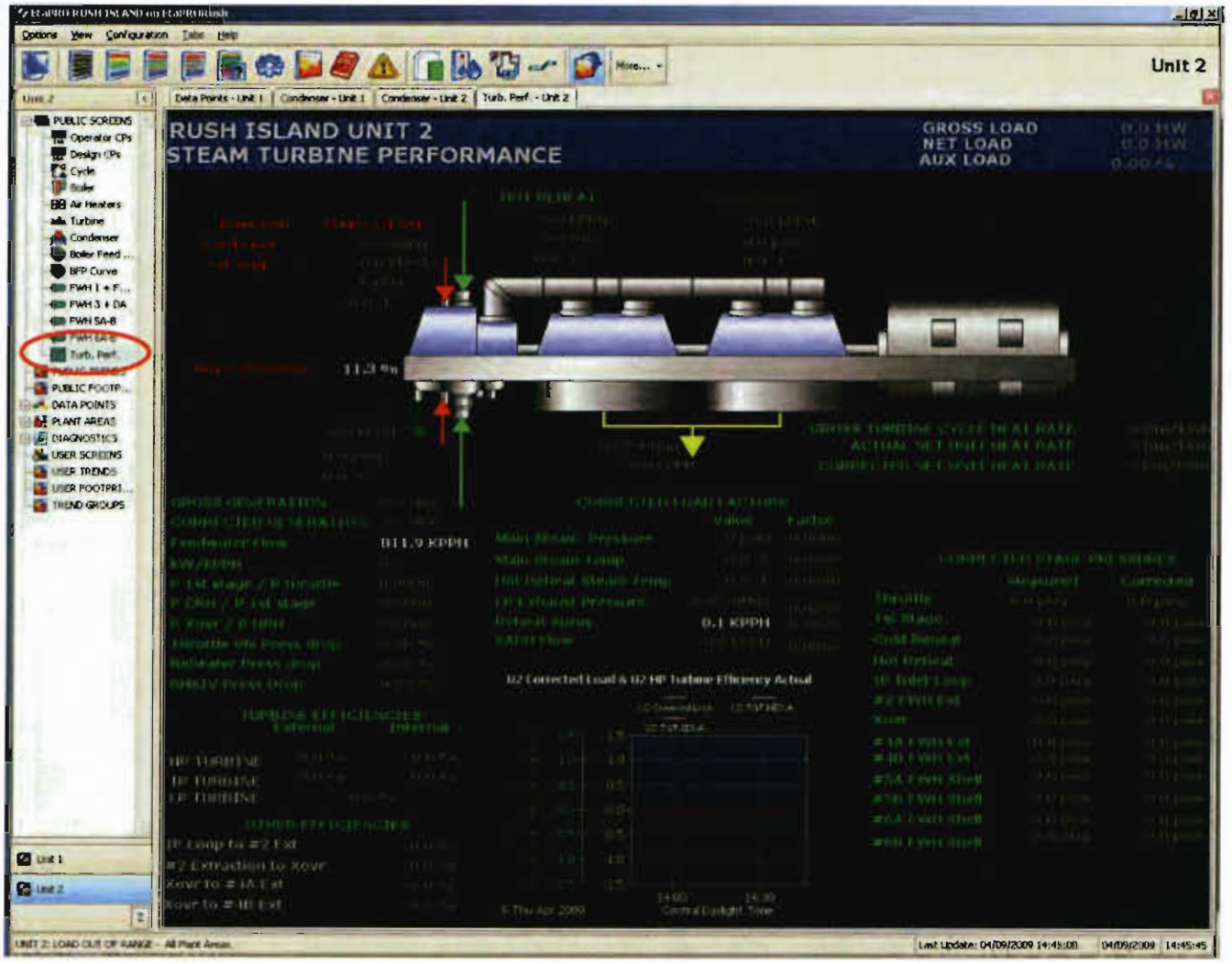
Rush Island Unit 2 - Corrected Load



Rush Island Unit 2 - HP and IP Efficiencies



Although no data is available with the unit off, the following screen shot shows the large quantity of calculated parameters Jeff Shelton added for turbine performance analysis. It also shows where the page can be found in the EtaPRO screen directory. It should be noted that these parameters are not available in Pi yet. Performance Engineering needs to meet with the Rush Pi administrator to get there approval to add approximately 100 new Pi tags to their server to accommodate EtaPRO enhancements.

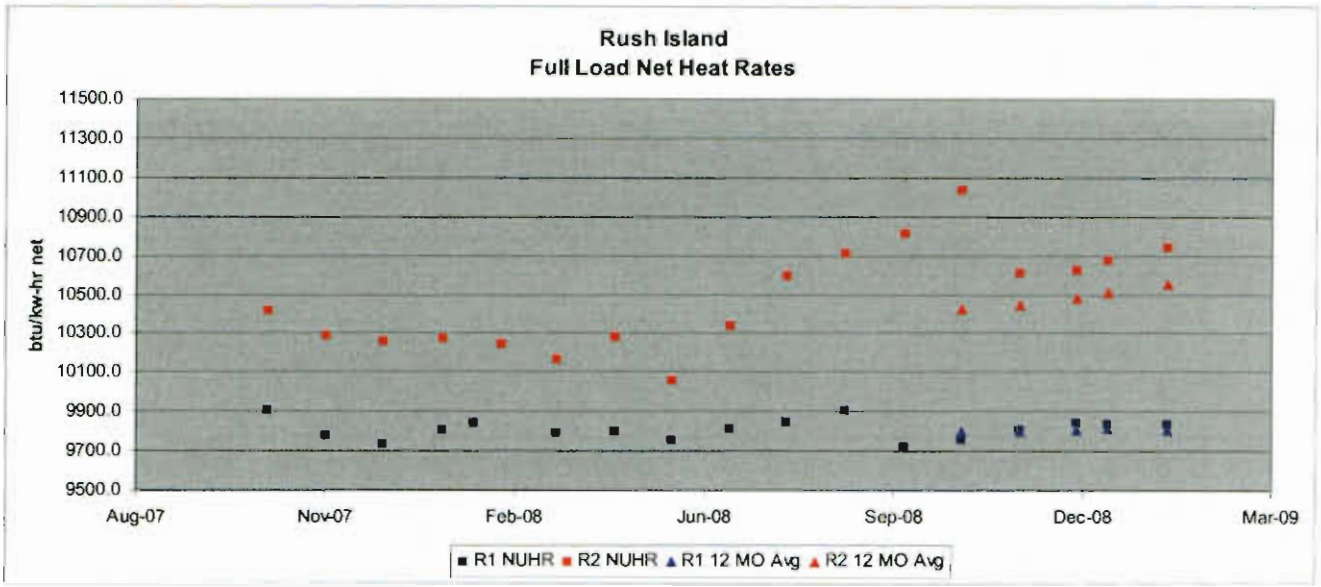


March 3, 2009

To: Mr. David Strubberg
From: Joe Sind
Cc: Bob Meiners, Andy Williamson, Paul Starks, Greg Vasel, Gary Blessing, Mike Clonts, Matt Wallace, Ken Stuckmeyer, Don Clayton, Jeff Shelton, Jim Barnett, Scott Hixson, Glenn Tiffin, Fred Kutilek, Tom Ziegler, Jeff Colter, Tim Finnell, Scott McCormack, Mike Kobel

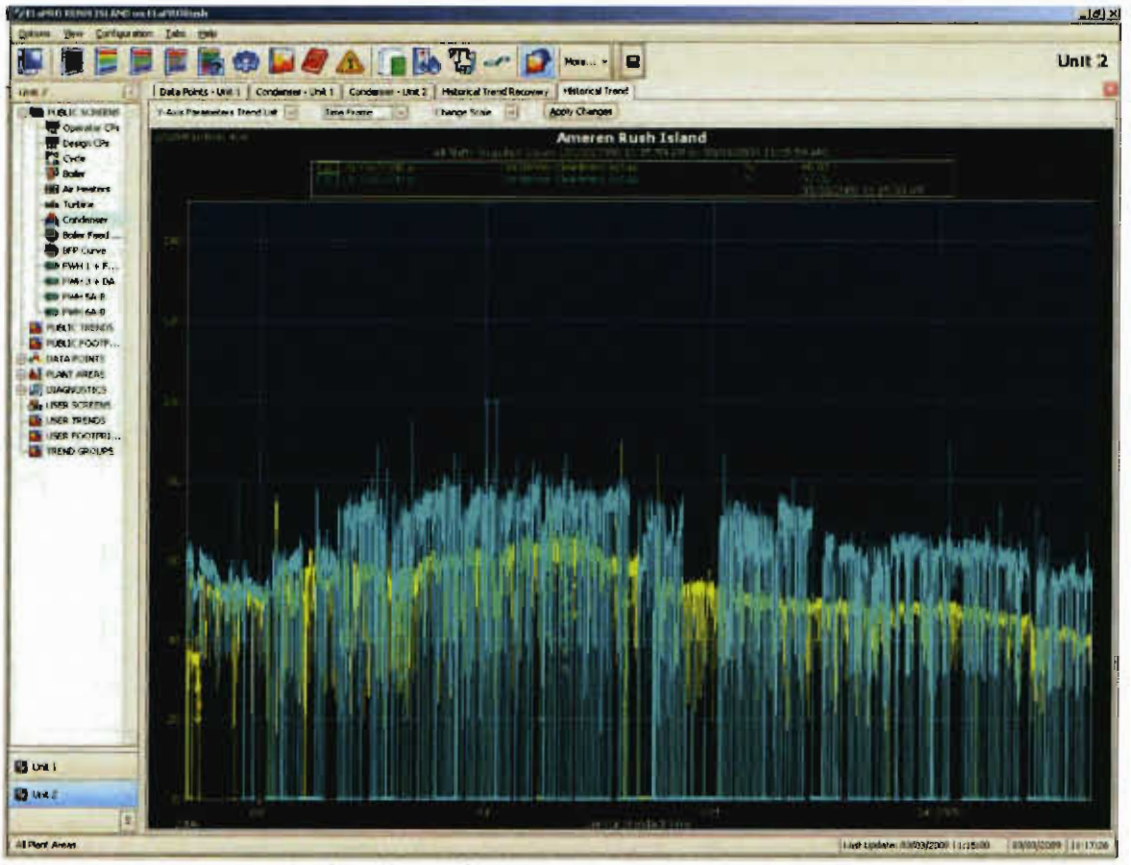
Re: Rush Island February 2009 Performance Report

The last report was on January 9, 2008 and covered operation through December 2008. Jim Barnett will be assuming primary responsibilities for Rush Island performance monitoring and reporting activities in the near future.



Executive Summary

- Unit 1 net heat rates remain stable, however Unit 2 heat rate continues it's apparent trend of getting worse.
- Both units show a decrease in condenser cleanliness, Unit 1 is by far the worse however. Hopefully plans are in place for a spring cleaning. Back pressure correction curves in EtaPRO were not configured correctly, and at high loads and low backpressures, associated losses were erroneous. This was corrected in the latter part of February.
- Unit 2 full load data indicates an increase in auxiliary power of 0.8% compared to the same period last year.



Unit's 1and 2 condenser cleanliness factors over one year

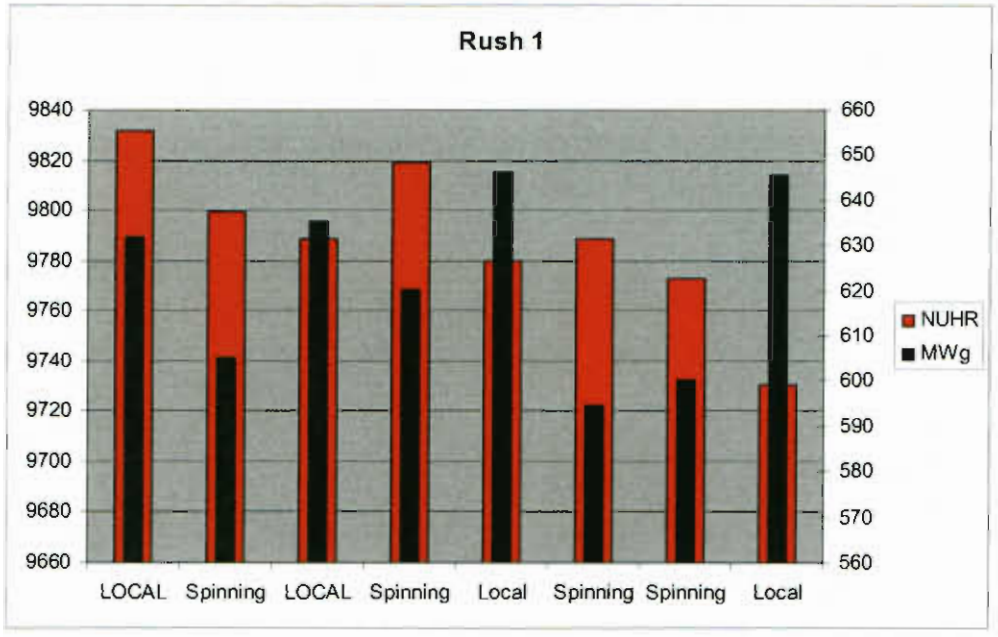
Action Items from Previous Meetings

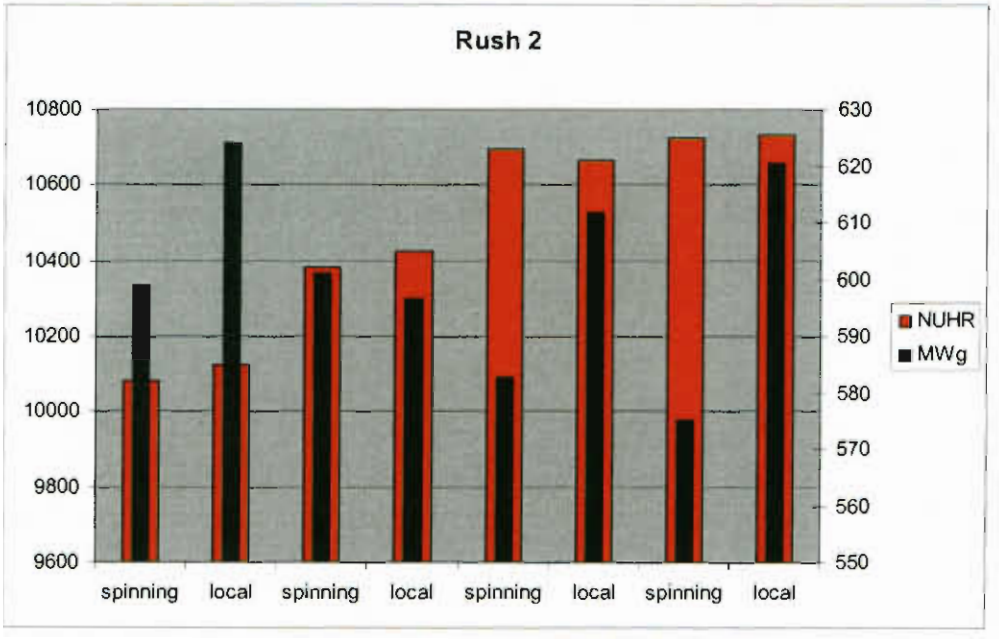
In the January report the plant was asked to take action or comment on several things.

- Provide comment and guidance on further work, if any, on the heat rate costs associated with area control operation. Any comments or guidance?
- Comment on a spreadsheet proposed to keep track of instrument issues, as well as noted EtaPRO mistakes or shortcomings. Any comments or suggestions? An updated version of the spreadsheet is attached.
- Begin investigating any cause or explanation from the difference in steam and feedwater flows on Unit 2 as this could be driving the high indicated heat rate. Any progress?

In the November 2008 meeting J. Sind got an action item to look into the heat rate effect from spinning reserve operation. A Rush Island elog search was done on the word "spinning" and several time periods (3 to 12 hours or so for each) for each unit were noted. Unit net heat rate from each of these periods, as well as a period close to those times when the unit was not in spinning reserve and not in ALC were compared. Results are shown in the attached graphs.

Note each set of bars represents a time period in 2008. No spinning reserve notations were found for 2009 when this study was done.





These graphs don't indicate any appreciable or repeatable effect of spinning reserve operation on heat rate. Any questions or comments as those requested for the ALC study, are also requested here.