SNCR Optimization Report

Wheelabrator Saugus Inc.
WTE Units 1 & 2
Two 750 TPD MSW Combustors

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Saugus, Massachusetts 01906-1899

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1.0 EXECUTIVE SUMMARY

Fuel Tech performed furnace gas temperature profiling and conducted SNCR optimization testing at the Wheelabrator Saugus J.V. waste to energy (WTE) facility in accordance with the NOx Control Optimization Program submitted to MADEP for Best Available Retrofit Technology (BART). The overall objective was to try and achieve lower NOx emissions while minimizing ammonia slip levels below the current permit limit of 10 ppm (dry, 7% O_2).

Phase I- Furnace Temperature Profiling January 18 to 22, 2010

Furnace gas temperature profiling was done on Units 1 and 2 using the SpectraTemp Gas Temperature Monitor with data logger. These data were then analyzed with boiler operating data taken from the boiler distributive control system (DCS) process data historian to determine present operating conditions of the furnace and NOx control.

Phase II- SNCR Process Optimization January 25 to 29, 2010

The SNCR system configuration and operating conditions were then changed to the extent allowed by the available furnace injector points and number of operating injectors to determine the capability of reducing the NOx emissions while minimizing ammonia slip. Present and alternative SNCR injector arrangements (location and number of injectors in service and reagent feed rates were adjusted to determine the best SNCR system configuration to achieve and sustain lower NOx emissions.

Four and six injectors were tested on Saugus Units #1 and #2 and six injectors were tested on Saugus Unit #2 at reagent feed rates of 0, 5, and 10 gallons per hour and results show a capability of reducing NOx consistently down to 185 ppmv (dry, 7% O2) with loads at or above 150,000 lbs/hr steam flow. Based on these tests it was determined that:

- Injector locations are near the lower end of the optimum SNCR operating range at normal boiler operating conditions.
- There was no significant performance difference between in utilizing 4 or 6 injectors in each furnace
- Baseline NOx varied between 240 and 280 ppm (dry, 7% O_2)
- A reduced NOx setpoint of 185 ppm (dry, 7% O_2) was achieved on both units even at higher NOx baselines
- Increasing reagent feed rates from 5 to 10 gph did not appreciably lower NOx

Therefore, the present injector configurations may be maintained and reagent flow increased to reduce NOx emissions to a target of 185 ppm (dry, 7% O_2) at loads above 150,000 lbs/hr.

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3.0 Unit Description

The Wheelabrator Saugus J.V. waste-to-energy (WTE) facility has two Riley Stoker boilers rated for 650 psig operating steam pressure at 850 degrees F. both driving a 56 MWg turbine/generator which is operated at approximately 35 MWg. The generator rating was originally sized for three units but only two units were installed. MSW is fired on early Von Roll ("L" style) grates designed for a maximum firing rate of 750 tons per day of municipal solid waste or refuse. Each unit is fit with two auxiliary oil fired burners for preheating the furnace prior to refuse combustion. The boiler, furnace and grate combustion system represent the earliest Von Roll design (circa 1975) and still are reflective of current WTE European designs where tail end boilers dominate.

Primary air is fed underneath the fuel bed through individually controlled air plenums in each of three (3) grate zones. Secondary air is added just above the fuel bed via front and rear wall headers in the lower furnace. Total combustion air flow is split between primary air and secondary air to optimize air penetration, turbulence and air-to-fuel mixing, to ensure low flame height and to minimize fly ash carryover to the boiler convection sections.

Combustion testing this past year has led operators to run a minimum rate of overfire air with enough rear wall pressure to keep the combustion path towards the front furnace wall. Operators use fan amps as a guide to minimizing overfire air flow from day-to-day. This ensures more radiant cooling in the furnace thus minimizing attemperating water flow and lowering radiant tube metal temperatures. These adjustments also appear to have succeeded in minimizing combustion-generated NOx.

4.0 SNCR System Description

The Fuel Tech urea-based NOxOUT® SNCR Systems were supplied by Wheelabrator Air Pollution Control. The Systems were installed in 2000 to meet the USEPA's Maximum Achievable Control Technology (MACT) limit of 205 ppm (dry, 7% O_2) required by the 1990 Clean Air Act. The original System was designed so that up to eight ports per furnace with air-atomized injectors could be utilized to achieve the 205 ppm limit. Each injector had individual injector air pressure control with four injectors located on one distribution module for each furnace sidewall (four distribution modules in all).

The original injectors were replaced this past summer by improved new injectors sold by DeNOx Technologies (DNT). These injectors are capable of higher liquid flows with larger droplets, have more open liquid internals and are therefore less subject to plugging than the original injectors (the plant uses service water as the supply). The new DNT injectors also have an Inconel atomizing spray tube eliminating the need for a shield (the original injectors had ceramic coated 300 series stainless steel ¾" tubing shields). These new injectors improve the overall system performance and reliability while minimizing injector maintenance. Operators have found that only four of the new injectors need be operating on each boiler with settings of 0.5 gpm liquid flow per injector and 40 psig air pressure (originally eight were used) to ensure compliance with the 205 ppm limit. The typical urea consumption for this compliance level averages between 2 and 4gph per unit.

The new DNT injectors allowed the replacement of the original individual injector air pressure regulators from the distribution modules with a single upstream air pressure regulator to control the air to all four injectors on each distribution module. With the improved performance of the new DNT injectors only two injectors need to be operated on each distribution module.
The injector ports are located on the sidewalls of the units as shown below in Figure 1. Due to relative differences in furnace temperature and combustion conditions between the two furnaces, operators have been locating the injectors on Unit 1 with more of a mixed arrangement than on Unit 2.

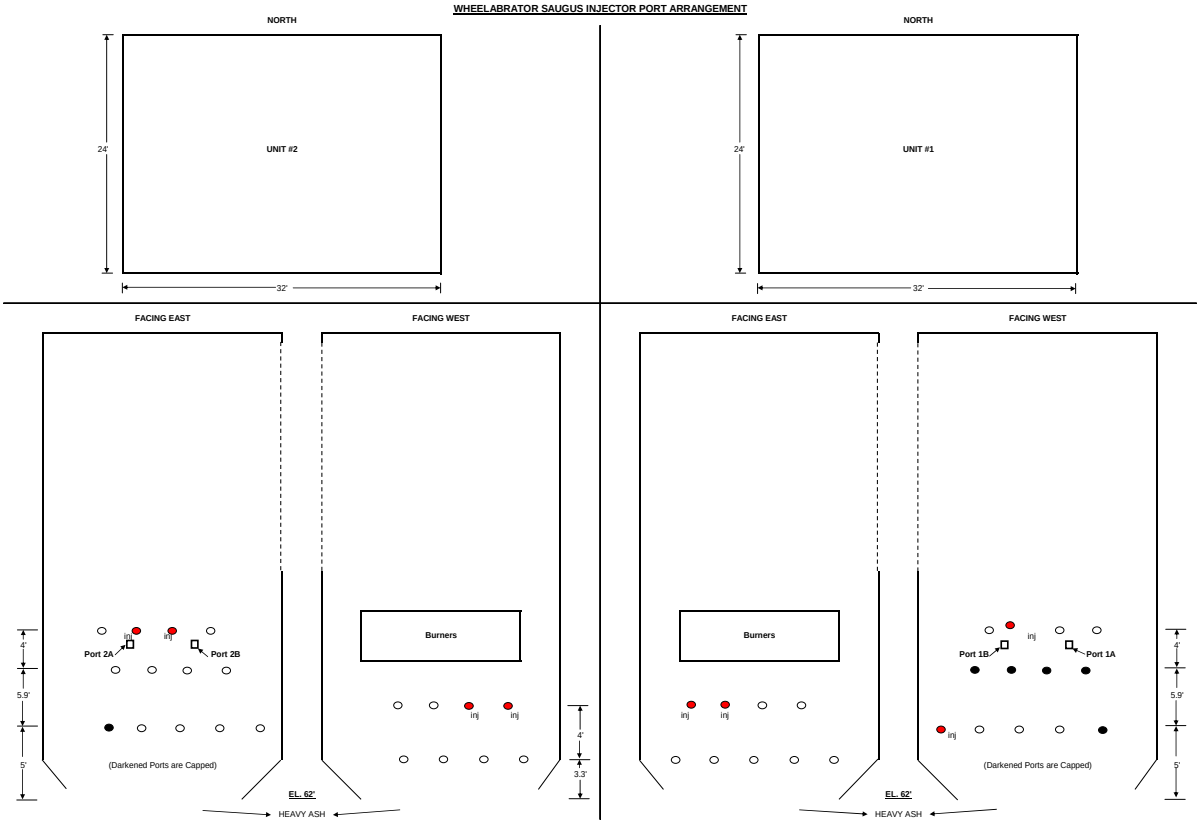


Figure 1 SNCR Injector Ports and Furnace Temperature Monitoring Locations

The original injector port locations were determined during the SNCR system design phase based on furnace temperature profiling. Because of the short furnace height and tail end boiler the optimum SNCR temperature window of 1650 to 2100 deg F in the furnace is relatively narrow and access to the furnace for SNCR injector installation is limited.

5.0 Phase 1 Furnace Temperature Measurements

Phase I furnace temperature measurements were obtained using a Spectratemp monitor. The Spectratemp monitor is an optical based pyrometer designed to continuously monitor average furnace flue gas temperature across the entire furnace width. The Spectratemp senses light radiated from ~30 µm diameter ash particles (these particles come to equilibrium temperature with the flue gas very quickly) in three differing wavelengths to determine the flue gas temperature. Energy levels seen in these wavelengths are proportioned to find the gas temperature. The measurement principle of the Spectratemp ensures that temperature readings are not biased by water wall temperatures or radiant heat. A Spectratemp monitor was used in the original furnace temperature profiling during the SNCR design phase in 2000.

Furnace temperature data were utilized to evaluate current injector locations relative to the optimum operating temperature window for SNCR. By properly selecting the zone of injection based on flue gas temperature, the SNCR process can be optimized with regard to NOx reduction, chemical flows, and ammonia slip. Furnace temperature monitoring was conducted using two test ports located opposite the auxiliary oil burners on each unit just above the injector locations as follows:

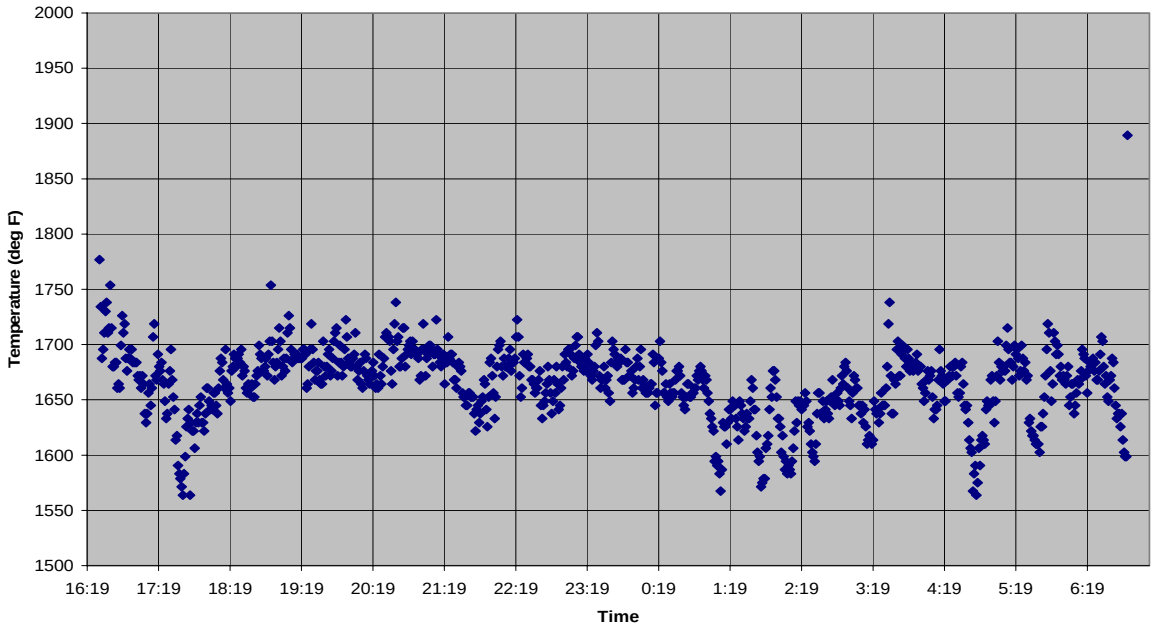
	Start	Stop	
Unit 2A port:	1/20/10- 15:42	1/21/10- 08:01	(Boiler outage Jan 11-16, 2010)
Unit 2B port:	1/21/10- 14:02	1/21/10- 15:15	
Unit 1A port:	1/21/10- 16:29	1/22/10- 08:18	(Shutdown for water wash Jan 27, 2010)
Unit 1B port:	1/22/10- 08:53	1/22/10- 13:09	

The Port designations are Boiler Number (1 or 2) and front/rear wall (A for front; B for rear- see port layout in Figure 1 above). Furnace temperatures were monitored with both boilers operating at normal load between 145 to 155 klb/hr steam flow. Longer term furnace temperature data was obtained by leaving the Spectratemp in Test Port A overnight. Hourly average boiler conditions are shown in the tables following the temperature plots. A summary of the gathered data follows:

	Port #1A	Port #1B	Port #2A	Port #2B	
Average	1666.0	1653.0	1677.7	1744.6	Deg.F.
Maximum	1889.4	1835.0	1908.1	1850.6	
Minimum	1563.8	1551.9	1560.0	1652.5	
Standard Deviation	32.5	55.5	49.2	44.6	

The temperatures on both ports for Unit #1 were found to be generally lower than the temperatures on Unit 2's ports even though Unit 1 was a few days away from a scheduled water wash. The optimum temperature window for SNCR is between 1700-2100 degrees F. The furnace temperature monitoring data indicate that available injector ports are located near the lower end of the optimum SNCR operating temperature window of 1650 degrees F.

Saugus Unit 1 A Port
Jan 21 to 22, 2010



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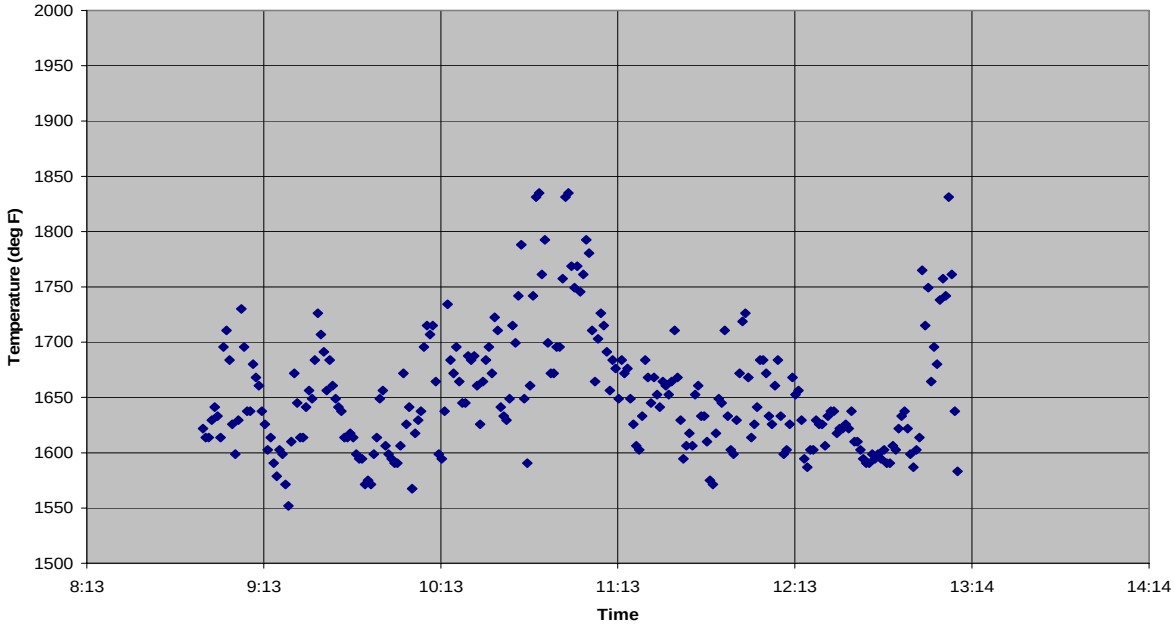
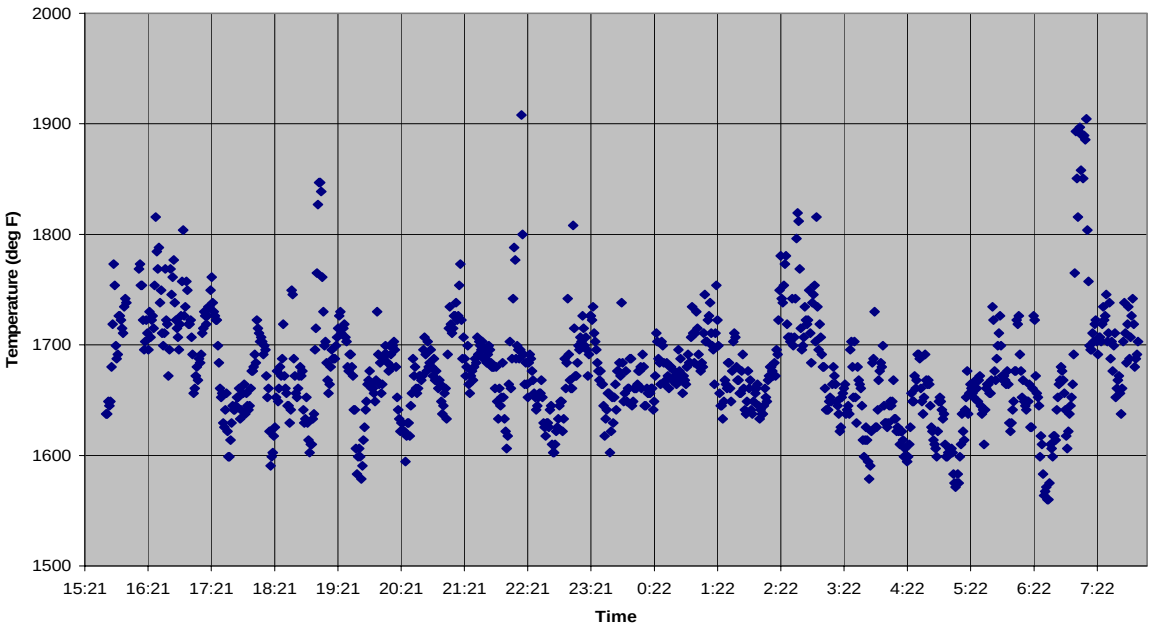
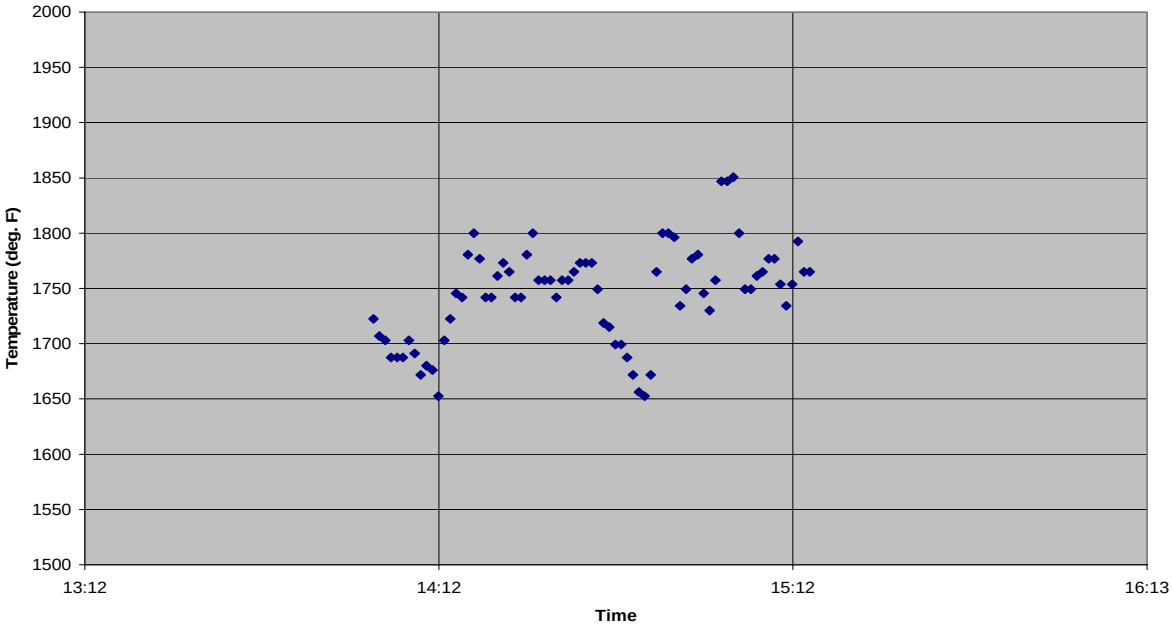
Saugus Unit 1 B Port
Jan 22, 2010



Saugus Unit 2 A Port
Jan. 20 to 21, 2010



Saugus Unit 2 B Port
Jan 21, 2010



1/20/2010

BOILER 2
1/20/2010

TIME	STEAM	BLR	FEED E	FEED W	MAIN I	MAIN W	PRIMARY AIR			SECONDARY AIR							IN	NOX	SH OUTLET	
START	FLOW	MSTR	SPD	SPD	SPD	SPD	PRESS	FLOW	CURRENT	FLOW	DUCT	FRONT		BACK		CURRENT	O2	AVG.	GAS TEMP	
12:00 AM	KLB/HR	%	%	%	%	%	inWC	KCFM	AMPS	KCFM	PRESS	FLOW	PRESS	FLOW	PRESS	AMPS	%	PPM	A	B
0:00	FI201	#2_BLR_MAST_OUT	SC230	SC240	SC231	SC241	PI208	FI208	II251	#2_SEC_AIR_FLOW	PI209	FI2122	PI2114A	FI2114	PI2114B	II252	AI2201	AI6264B	TI264	TI265
1:00	153.10	37.90	28.86	24.86	32.86	34.86	3.76	41.48	11.74	33.98	27.97	23.27	11.01	10.24	15.04	55.34	7.13	179.22	857.13	754.90
2:00	154.20	34.98	25.94	21.94	29.94	31.94	3.90	40.53	11.65	33.95	27.98	23.24	11.02	10.25	15.02	55.37	6.91	188.39	859.31	760.23
3:00	153.66	38.56	29.57	25.57	33.57	35.57	3.92	39.02	11.27	33.96	28.01	23.23	11.00	10.25	14.98	55.35	7.13	190.67	854.82	750.24
4:00	153.09	39.86	30.84	26.84	34.84	36.84	3.78	39.75	11.36	33.96	28.03	23.17	11.01	10.24	14.98	55.33	7.17	186.98	867.99	753.41
5:00	153.71	35.17	26.17	22.18	30.17	32.17	3.77	38.62	10.83	33.97	28.05	23.25	11.03	10.25	15.01	55.32	7.04	178.55	866.49	755.94
6:00	153.72	41.12	32.13	28.13	36.13	38.13	3.67	38.86	10.71	33.98	28.03	23.25	11.01	10.23	14.98	55.35	6.99	187.58	868.10	752.99
7:00	152.99	43.72	33.67	30.09	38.74	40.74	4.05	36.58	10.32	34.01	28.00	23.23	10.99	10.26	14.99	55.15	6.68	204.95	854.80	750.03
8:00	154.50	50.10	37.07	34.41	45.08	47.10	3.87	37.75	10.46	37.02	28.01	23.91	11.01	12.57	23.27	56.75	7.51	208.29	822.17	743.20
9:00	153.86	54.92	41.15	34.80	48.09	51.84	3.83	38.37	10.50	37.76	28.00	24.15	11.00	13.15	25.27	57.20	7.83	207.55	818.32	737.14
10:00	153.57	52.22	36.06	30.38	43.73	48.31	3.90	37.81	10.40	38.05	27.97	24.41	12.02	13.18	25.25	57.52	7.33	203.16	819.33	734.32
11:00	152.87	53.44	35.27	30.43	42.43	49.40	3.68	37.96	10.35	38.33	27.99	24.70	12.98	13.19	25.27	57.80	7.70	191.36	823.70	739.23
12:00	147.22	59.16	40.15	32.48	44.30	53.11	3.57	37.66	10.28	38.40	28.00	24.70	12.93	13.20	25.28	57.68	7.71	191.36	815.53	728.25
13:00	152.76	58.53	39.36	30.14	41.38	51.52	3.60	39.17	10.46	38.36	28.00	24.67	12.93	13.21	25.27	57.66	7.60	191.36	825.93	738.06
14:00	153.18	53.24	32.97	26.27	34.49	46.21	3.71	38.30	10.43	38.43	28.00	24.72	12.92	13.21	25.27	57.65	7.69	197.71	831.34	736.02
15:00	153.41	56.94	34.84	30.83	36.65	48.57	3.63	38.66	10.41	38.40	28.00	24.75	12.85	13.21	25.27	57.58	7.66	208.68	831.48	738.84
16:00	148.18	61.60	39.55	35.55	39.61	51.66	3.54	39.60	10.68	38.50	28.00	24.77	13.22	13.21	25.26	57.73	8.14	201.26	827.22	733.10
17:00	153.15	66.69	45.50	40.94	44.12	56.12	3.48	39.61	10.58	38.50	28.00	24.81	13.35	13.20	25.26	57.80	8.09	205.12	833.86	737.86
18:00	145.86	67.59	47.57	40.80	46.86	58.77	3.57	39.80	10.74	38.34	28.00	24.62	12.96	13.23	25.24	57.69	8.45	202.09	828.94	733.14
19:00	141.54	60.27	41.56	31.85	60.17	70.20	3.82	41.20	11.95	38.47	28.00	24.74	13.39	13.22	25.25	57.92	8.45	196.68	829.00	729.47
20:00	149.68	55.35	38.39	25.39	55.39	65.39	4.03	41.04	12.27	38.41	27.99	24.66	13.34	13.23	25.25	58.01	7.53	198.82	843.32	735.51
21:00	144.80	51.69	34.72	21.73	51.72	61.72	3.89	41.29	12.11	38.39	27.99	24.62	13.29	13.22	25.26	58.09	8.49	203.96	834.72	733.20
22:00	148.72	65.26	48.01	35.01	65.01	75.01	3.44	42.68	12.08	38.30	28.00	24.62	13.31	13.24	25.25	58.28	8.26	198.70	839.82	737.33
23:00	147.32	65.74	48.71	35.72	65.71	75.71	3.98	40.63	12.12	38.33	28.00	24.61	13.31	13.25	25.26	58.41	7.80	198.52	847.46	738.10
0:00	144.64	48.12	31.09	21.31	48.09	58.09	4.24	38.51	11.55	38.36	28.00	24.54	13.39	13.25	25.25	58.53	8.06	200.56	832.56	732.41
TOTAL	150.82	52.17	36.63	29.90	43.71	50.79	3.78	39.37	11.05	37.01	28.00	24.19	12.30	12.32	22.18	57.06	7.64	196.73	838.89	740.96

1/21/2010

BOILER 2
1/21/2010

TIME	STEAM	BLR	FEED E	FEED W	MAIN I	MAIN W	PRIMARY AIR			SECONDARY AIR							IN	NOX	SH OUTLET	
START	FLOW	MSTR	SPD	SPD	SPD	SPD	PRESS	FLOW	CURRENT	FLOW	DUCT	FRONT		BACK		CURRENT	O2	AVG.	GAS TEMP	
12:00 AM	KLB/HR	%	%	%	%	%	inWC	KCFM	AMPS	KCFM	PRESS	FLOW	PRESS	FLOW	PRESS	AMPS	%	PPM	A	B
0:00	FI201	#2_BLR_MAST_OUT	SC230	SC240	SC231	SC241	PI208	FI208	II251	#2_SEC_AIR_FLOW	PI209	FI2122	PI2114A	FI2114	PI2114B	II252	AI2201	AI6264B	TI264	TI265
1:00	152.87	52.42	35.38	32.38	52.38	62.38	4.09	39.25	11.68	38.34	28.00	24.55	13.43	13.25	25.25	58.67	7.41	209.32	844.61	739.48
2:00	157.49	54.26	37.26	34.27	54.26	66.24	4.21	38.54	11.62	38.34	28.00	24.56	13.44	13.25	25.24	58.75	7.00	194.28	854.77	747.63
3:00	158.09	43.72	26.72	23.70	43.72	58.70	4.31	37.99	11.53	38.31	28.00	24.57	13.44	13.26	25.25	58.82	6.92	195.73	859.69	746.95
4:00	148.48	62.35	45.32	42.32	62.32	77.32	4.06	39.45	11.78	38.29	28.00	24.53	13.44	13.26	25.24	58.92	7.49	199.46	836.56	742.32
5:00	148.49	45.69	26.48	18.47	45.31	59.81	3.78	40.80	11.92	38.23	28.01	24.47	13.25	13.26	25.26	58.88	7.73	194.22	842.94	739.30
6:00	146.39	60.78	40.68	20.68	55.68	65.68	3.84	47.02	16.04	38.17	28.00	24.42	12.93	13.26	25.25	58.76	8.50	204.27	846.90	742.26
7:00	143.60	68.50	49.24	28.50	63.13	73.04	4.16	45.81	15.56	38.14	28.01	24.44	12.88	13.26	25.24	58.67	8.67	229.87	850.02	740.48
8:00	154.21	63.13	43.60	26.42	54.89	63.90	4.62	48.60	18.21	38.15	28.00	24.37	12.97	13.27	25.25	58.72	8.04	183.66	883.10	748.66
9:00	148.39	62.79	41.58	27.79	50.82	61.81	4.42	46.57	16.57	38.26	28.00	24.45	13.40	13.27	25.26	58.82	8.90	188.26	852.60	742.92
10:00	152.69	61.77	39.74	26.74	47.74	58.75	4.25	46.05	15.86	38.39	28.00	24.63	13.36	13.33	25.23	58.66	8.36	203.15	877.35	748.14
11:00	151.43	76.51	54.47	41.48	61.40	72.46	3.69	44.12	13.67	38.44	28.00	24.52	13.13	13.40	25.19	58.46	8.58	197.32	859.01	746.13
12:00	147.76	63.20	41.17	28.17	46.35	59.17	3.72	42.60	12.76	38.43	28.00	24.53	12.81	13.41	25.17	58.21	8.24	195.12	849.87	739.42
13:00	148.35	75.82	53.87	40.87	58.87	71.87	3.70	43.58	13.38	38.50	28.00	24.61	13.08	13.40	25.16	58.18	8.11	201.52	852.77	739.38
14:00	157.50	58.47	35.89	22.92	41.46	53.22	3.92	43.10	13.60	38.68	28.00	24.81	13.32	13.41	25.18	58.18	7.91	207.22	866.73	749.95
15:00	149.07	66.53	45.15	32.06	52.31	60.38	3.83	43.57	13.59	38.55	28.01	24.68	12.91	13.41	25.17	57.97	8.81	203.14	850.65	739.16
16:00	156.68	59.66	43.19	30.20	57.00	50.98	4.23	43.31	14.21	38.58	28.00	24.72	12.96	13.40	25.16	57.94	8.09	207.79	861.54	748.73
17:00	156.92	61.83	50.28	42.88	58.96	52.81	4.31	44.77	15.27	38.59	28.00	24.72	13.29	13.41	25.18	58.13	8.33	193.66	873.71	749.96
18:00	152.03	73.05	62.96	62.95	71.96	63.96	4.37	45.66	15.96	38.52	28.00	24.61	13.28	13.39	25.17	58.12	8.15	196.50	876.08	747.20
19:00	145.65	58.95	47.69	56.61	51.52	46.27	4.06	46.87	16.39	38.46	28.00	24.57	13.29	13.40	25.18	58.24	8.79	199.90	874.31	739.95
20:00	154.20	56.54	46.58	58.74	52.74	52.25	4.45	42.96	14.59	38.48	28.00	24.46	13.29	13.42	25.17	58.46	7.94	205.44	861.96	748.67
21:00	157.71	40.88	35.87	35.89	40.88	40.89	4.53	39.90	12.97	38.37	28.00	24.49	13.36	13.42	25.18	58.62	7.77	200.61	861.22	748.62
22:00	157.73	45.29	40.28	40.31	45.28	45.31	4.28	38.84	12.01	38.31	27.99	24.37	13.36	13.44	25.17	58.84	7.74	192.64	862.53	749.88
23:00	157.84	38.52	33.52	33.52	38.52	38.51	4.24	36.77	10.99	38.28	28.00	24.36	13.37	13.44	25.17	58.93	7.34	191.31	861.64	748.13
0:00	158.16	38.40	31.42	31.40	38.40	38.40	4.20	36.98	11.05	38.31	28.00	24.42	13.37	13.44	25.17	59.03	7.32	206.92	862.79	749.32
TOTAL	152.57	57.88	42.02	34.97	51.91	58.09	4.14	42.63	13.80	38.38	28.00	24.54	13.22	13.35	25.20	58.54	8.00	200.06	859.31	745.11

Unit 2 Boiler Operating Data for January 20th and 21st

BOILER1

1/21/2010

TIME	STEAM	BLR	FEED E	FEED W	MAIN I	MAIN W	PRIMARY AIR			SECONDARY AIR							IN	NOX	SH OUTLET	
START	FLOW	MSTR	SPD	SPD	SPD	SPD	PRESS	FLOW	CURRENT	FLOW	DUCT	FRONT		BACK		CURRENT	O2	AVG.	GAS TEMP	
12:00 AM	KLB/HR	%	%	%	%	%	inWC	KCFM	AMPS	KCFM	PRESS	FLOW	PRESS	FLOW	PRESS	AMPS	%	PPM	A	B
0:00	FI101	#1_BLR_MAST_OUT	SC130	SC140	SC131	SC141	PI108	FI108	II151	#1_SEC_AIR_FLOW	PI109	FI1122	PI1114A	FI1114	PI1114B	II152	AI1201	AI6164B	TI164	TI165
1:00	145.02	64.16	59.19	64.19	97.19	62.19	4.39	60.00	12.80	31.65	30.00	23.51	11.02	7.51	16.12	50.39	8.80	199.34	813.10	856.22
2:00	142.48	72.65	65.51	68.04	105.66	75.76	4.18	59.60	12.87	31.98	30.01	23.85	11.01	7.53	16.11	50.44	8.73	191.68	809.46	852.77
3:00	144.69	65.22	58.65	57.19	98.19	70.19	4.00	61.19	13.60	32.21	30.01	24.04	11.02	7.52	16.12	50.49	8.89	185.66	814.56	852.36
4:00	138.63	55.04	49.02	47.02	78.47	55.62	4.32	58.66	12.35	32.22	30.00	24.06	11.00	7.51	16.12	50.54	9.50	177.30	812.28	848.95
5:00	148.79	55.54	48.80	45.51	38.63	39.34	4.06	58.90	12.22	32.65	30.00	24.47	11.01	7.47	16.13	50.55	9.38	179.34	837.83	865.94
6:00	133.54	67.92	57.99	56.98	48.99	43.99	4.51	62.22	16.26	32.80	30.01	24.57	11.01	7.53	16.13	50.55	10.11	201.89	797.97	848.07
7:00	136.75	71.89	60.00	59.35	52.66	47.46	4.38	62.11	15.55	32.68	30.00	24.53	10.98	7.42	16.13	50.46	9.90	222.52	802.15	855.35
8:00	135.04	70.59	58.61	56.26	49.33	43.38	5.13	60.88	15.69	32.72	29.99	24.47	10.99	7.51	16.13	50.50	9.72	190.42	799.56	851.05
9:00	139.64	59.73	47.53	43.99	37.21	32.66	5.17	63.37	17.66	31.62	29.99	23.51	10.99	7.46	16.13	50.44	9.71	199.83	804.97	851.49
10:00	144.73	75.33	62.27	60.27	50.27	47.27	4.42	62.33	15.44	31.22	29.99	23.02	11.01	7.49	16.13	50.32	9.76	208.20	811.04	854.88
11:00	146.69	70.39	57.36	55.36	45.36	42.36	4.35	61.29	14.34	31.22	30.00	23.01	11.02	7.48	16.14	50.19	9.45	204.45	814.35	860.51
12:00	140.65	71.91	58.86	56.86	45.87	42.84	4.24	61.52	13.92	31.39	30.00	23.20	11.00	7.49	16.14	50.08	9.67	202.91	806.90	849.79
13:00	149.99	71.66	58.70	58.11	44.70	41.70	4.10	61.00	13.34	31.14	30.00	22.92	11.02	7.55	16.13	50.02	9.02	203.36	820.65	860.26
14:00	147.09	67.72	54.77	54.77	40.05	37.77	4.02	61.22	13.33	30.84	30.00	22.57	10.99	7.56	16.13	49.95	9.27	199.39	815.80	856.31
15:00	146.22	73.46	62.15	62.13	45.49	43.49	3.93	60.88	12.95	31.22	30.00	22.97	10.99	7.55	16.13	49.88	9.40	203.79	812.25	857.19
16:00	152.16	56.46	55.96	55.96	28.07	26.05	4.36	59.67	12.72	31.06	30.00	22.74	11.01	7.59	16.14	49.85	9.06	200.58	816.11	865.78
17:00	156.80	54.28	56.06	56.06	25.26	23.26	4.75	59.97	13.58	31.20	30.00	22.94	11.00	7.55	16.14	49.91	8.87	197.69	824.47	872.05
18:00	145.58	67.05	73.59	73.60	38.07	36.07	4.95	58.72	13.68	31.41	30.00	23.17	11.01	7.50	16.13	49.90	8.53	204.01	823.99	856.74
19:00	147.59	38.39	45.41	45.41	9.41	7.41	4.94	58.66	13.82	31.54	30.00	23.34	11.01	7.55	16.13	50.00	9.09	195.10	808.39	865.58
20:00	153.23	45.13	52.15	52.19	16.44	14.69	4.88	59.29	13.96	31.26	30.00	23.13	10.99	7.50	16.14	50.14	8.58	200.19	818.34	872.07
21:00	153.68	29.79	24.90	24.85	29.83	29.76	5.00	57.66	13.30	31.43	30.00	23.13	11.01	7.53	16.15	50.26	8.68	200.07	815.45	872.98
22:00	152.67	43.28	38.32	38.32	43.32	43.32	4.61	57.79	12.30	31.60	30.00	23.50	11.02	7.50	16.15	50.44	8.68	201.18	811.68	871.97
23:00	154.75	36.09	31.09	31.09	36.09	36.09	4.83	53.54	10.88	31.98	30.00	23.78	11.00	7.53	16.14	50.53	8.10	199.97	818.91	864.35
0:00	153.80	36.45	29.46	29.47	36.45	36.45	4.78	54.54	10.96	32.31	29.99	24.13	10.99	7.50	16.13	50.60	8.18	204.31	820.81	863.02
TOTAL	146.26	59.17	52.76	52.21	47.54	40.80	4.51	59.79	13.65	31.72	30.00	23.52	11.00	7.51	16.13	50.27	9.13	198.88	813.79	859.40

BOILER1
1/22/2010

1/22/2010

TIME	STEAM	BLR	FEED E	FEED W	MAIN I	MAIN W	PRIMARY AIR			SECONDARY AIR							IN	NOX	SH OUTLET	
START	FLOW	MSTR	SPD	SPD	SPD	SPD	PRESS	FLOW	CURRENT	FLOW	DUCT	FRONT		BACK		CURRENT	O2	AVG.	GAS TEMP	
12:00 AM	KLB/HR	%	%	%	%	%	inWC	KCFM	AMPS	KCFM	PRESS	FLOW	PRESS	FLOW	PRESS	AMPS	%	PPM	A	B
0:00	FI101	#1_BLR_MAST_OUT	SC130	SC140	SC131	SC141	PI108	FI108	II151	#1_SEC_AIR_FLOW	PI109	FI1122	PI1114A	FI1114	PI1114B	II152	AI1201	AI6164B	TI164	TI165
1:00	154.12	50.21	42.13	42.13	50.13	50.13	4.43	57.03	11.30	32.55	30.00	24.31	11.01	7.55	16.14	50.64	8.20	200.25	827.29	862.35
2:00	145.93	69.89	58.84	58.66	72.37	72.37	4.36	57.77	12.01	32.64	30.00	24.56	11.00	7.45	16.14	50.66	8.27	195.85	822.43	851.14
3:00	149.86	43.52	27.35	27.11	46.63	46.63	5.10	62.32	16.76	32.61	30.00	24.41	11.00	7.53	16.13	50.63	8.26	194.96	829.77	857.76
4:00	148.54	51.92	34.94	34.94	54.94	54.94	4.46	63.53	16.93	32.57	30.01	24.44	10.99	7.48	16.14	50.58	9.24	198.38	820.60	859.77
5:00	148.01	68.12	51.09	48.09	71.09	71.09	4.07	61.64	14.42	32.62	29.99	24.48	11.02	7.48	16.13	50.63	8.97	208.90	826.91	860.49
6:00	147.01	53.42	34.80	30.77	56.51	56.51	3.90	60.13	12.26	32.43	30.01	24.14	10.98	7.51	16.14	50.63	8.66	198.97	821.93	849.55
7:00	150.52	71.64	56.30	50.65	74.65	74.65	3.67	59.87	11.93	32.35	30.00	24.22	10.98	7.47	16.14	50.57	8.77	225.31	836.60	856.77
8:00	148.08	44.12	32.13	26.13	47.10	47.10	2.31	52.52	7.06	32.51	29.36	24.37	10.97	7.51	15.72	50.76	10.26	173.14	816.72	875.53
9:00	157.85	58.02	49.62	41.44	61.02	61.02	3.72	60.39	11.83	32.70	29.99	24.51	11.02	7.48	16.12	50.71	8.79	200.41	832.55	872.49
10:00	157.19	61.22	52.93	38.34	61.53	61.53	3.59	59.88	11.71	32.65	30.00	24.46	11.03	7.54	16.14	50.48	8.70	200.04	846.82	867.49
11:00	157.96	63.34	79.94	58.17	61.37	61.37	3.47	59.79	11.40	31.92	29.99	23.73	10.97	7.46	16.14	50.28	8.63	190.37	837.86	868.30
12:00	158.42	45.10	66.32	43.27	43.10	43.10	3.65	58.77	10.89	31.59	30.01	23.27	10.99	7.60	16.14	50.04	8.24	193.28	837.74	870.90
13:00	158.50	34.67	54.32	31.29	32.67	32.67	3.82	57.93	10.68	31.13	30.01	22.89	11.02	7.59	16.13	49.93	7.81	198.65	840.68	868.59
14:00	156.11	33.19	49.40	26.35	31.18	31.18	3.98	56.84	10.63	31.18	29.99	22.94	11.00	7.57	16.12	50.00	8.07	208.92	834.59	869.99
15:00	153.90	30.72	35.53	13.06	28.73	28.73	3.91	57.38	10.71	31.25	30.01	23.13	11.01	7.55	16.13	50.07	8.36	199.95	825.59	863.55
16:00	152.04	58.02	60.97	38.93	56.05	56.05	3.66	59.32	11.29	31.34	30.00	23.25	10.98	7.52	16.13	50.12	8.99	206.00	818.75	866.39
17:00	154.48	40.78	57.74	37.14	38.72	38.72	3.94	58.83	11.46	31.30	30.00	23.08	11.01	7.52	16.13	50.15	8.64	194.57	827.45	868.53
18:00	153.84	34.82	49.50	36.38	33.59	34.41	4.24	57.32	11.23	31.31	30.00	23.13	11.01	7.53	16.14	50.09	8.73	198.33	824.61	871.97
19:00	153.71	34.60	34.61	38.64	34.64	36.64	4.42	57.35	11.16	31.36	30.00	23.05	10.99	7.58	16.14	50.11	9.11	196.96	826.04	872.11
20:00	153.63	39.58	39.58	43.58	39.58	41.58	4.18	58.69	11.36	31.45	30.00	23.26	11.00	7.51	16.12	50.25	9.10	202.18	815.64	886.51
21:00	153.99	32.89	32.89	36.63	32.89	34.89	4.46	56.58	11.18	31.73	30.00	23.67	11.03	7.48	16.13	50.32	8.71	199.24	818.70	877.52
22:00	153.57	31.00	25.70	25.63	31.85	33.88	4.53	56.50	11.18	32.01	30.00	23.75	10.99	7.50	16.13	50.40	8.60	204.42	821.08	876.78
23:00	152.54	40.41	26.85	26.72	44.16	45.28	4.15	58.98	11.52	32.20	30.00	24.06	11.00	7.50	16.13	50.47	8.99	200.56	816.47	880.36
0:00	152.99	54.66	40.66	40.66	58.73	59.73	4.00	60.40	12.13	32.45	30.01	24.38	11.02	7.50	16.14	50.50	8.65	204.83	825.94	873.22
TOTAL	153.03	47.74	45.59	37.28	48.47	48.92	4.00	58.74	11.79	31.99	29.97	23.81	11.00	7.52	16.12	50.38	8.70	199.77	827.20	867.84

Unit 1 Boiler Operating Data for January 21st and 22nd

6.0 Phase 2 SNCR Optimization Testing

Phase 2 optimization tests were performed on Units 1 and 2 on Tuesday, January 26th, 2010 and on Unit 2 on Wednesday, January 27th, 2010. Tests on Tuesday were comprised of running reagent pumps manually with approximately 0, 5, and 10 gallons of reagent an hour to each unit for enough time to gather hourly average performance data. Unit #1 went into a water wash outage on Wednesday, so two new style injectors were borrowed from Unit #1 and mounted in Unit #2 making use of three injectors in each sidewall on Unit 2 (see following detail). Reagent pump rate tests of 0, 5, and 10 gallons per hour were repeated for comparison to Tuesday's performance. The following tables summarize the performance observed:

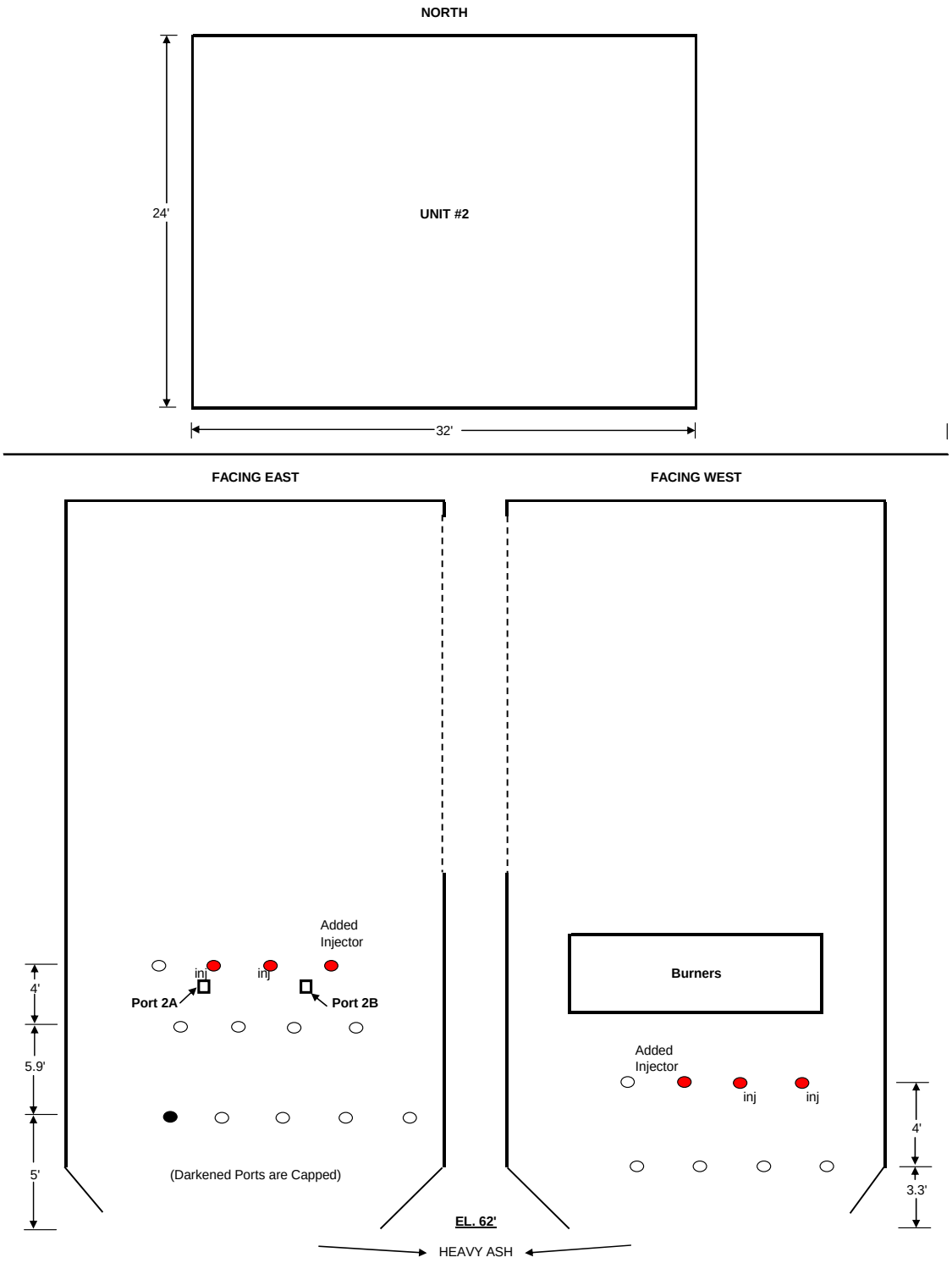
Wheelabrator Saugus
Unit #1

Test No.	Injector Location	No. of Injectors	Steam Flow [Klb/Hr]	Heat Input [Mmbtu/hr]	Urea Flow [GPH]	Dilution Flow [GPM]	Injector Type	NOx @ 7% O2 [ppmvc]	NOx Baseline [ppmvc]	NOx Reduction [%]
1	See	4	153.2	248.9	4.4	2.0	DNT	174.7	240.7	27.4%
2	Sketch	4	153.7	249.8	5.1	2.0	DNT	177.1	240.7	26.4%
3	Page 6	4	153.1	248.8	5.1	2.0	DNT	180.4	240.7	25.0%
4		4	150.9	245.3	5.1	2.0	DNT	190.6	240.7	20.8%
6		4	155.7	253.1	0.0	2.0		240.7	240.7	0.0%
8		4	153.8	250.0	10.7	2.0	DNT	166.1	240.7	31.0%
9		4	151.8	246.6	10.7	2.0	DNT	164.0	240.7	31.9%

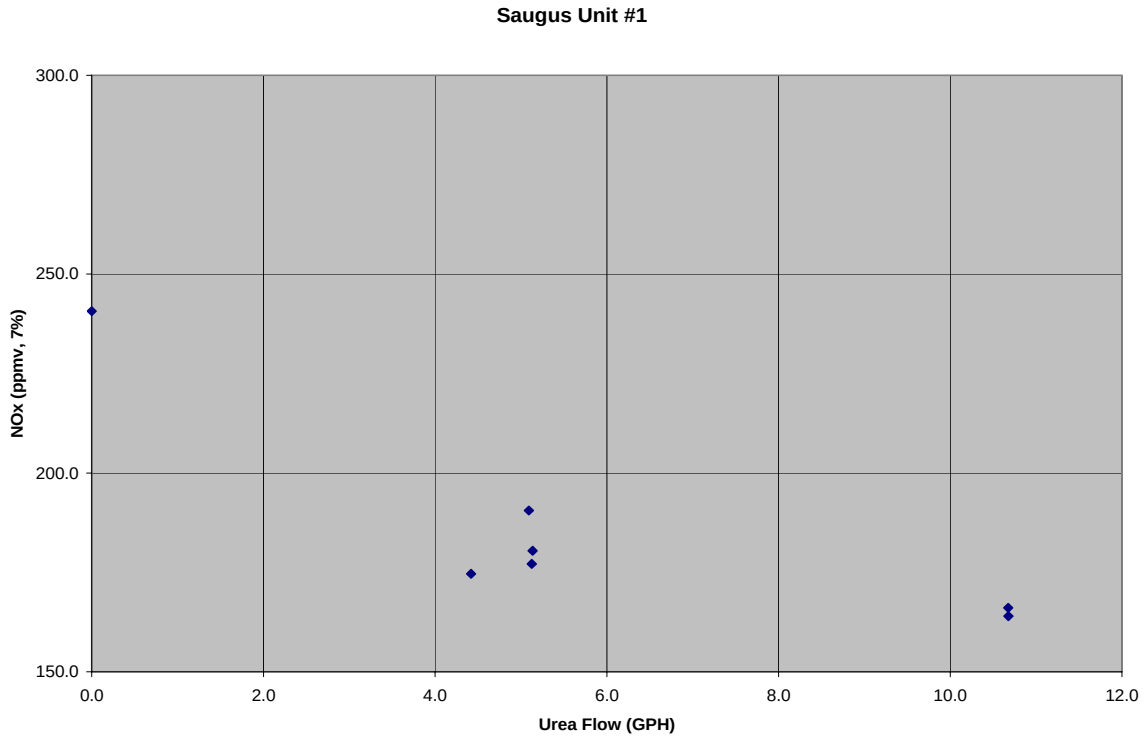
Wheelabrator Saugus
Unit #2

Test No.	Injector Location	No. of Injectors	Steam Flow [Klb/Hr]	Heat Input [Mmbtu/hr]	Urea Flow [GPH]	Dilution Flow [GPM]	Injector Type	NOx @ 7% O2 [ppmvc]	NOx Baseline [ppmvc]	NOx Reduction [%]
1	See	4	153.6	249.6	4.4	2.0	DNT	189.0	268.0	29.5%
2	Sketch	4	153.5	249.4	4.7	2.0	DNT	192.7	268.0	28.1%
3	Page 6	4	153.1	248.8	4.7	2.0	DNT	195.0	268.0	27.2%
4		4	153.0	248.7	4.8	2.0	DNT	185.7	268.0	30.7%
5		4	154.4	250.9	0.0	2.0		268.0	268.0	0.0%
6		4	151.1	245.5	10.3	2.0	DNT	185.5	268.0	30.8%
7		4	153.7	249.8	10.3	2.0	DNT	175.4	268.0	34.6%
8		6	153.7	249.7	4.9	2.0	DNT	210.6	280.0	24.8%
9		6	155.0	251.9	5.1	2.0	DNT	204.6	280.0	26.9%
10		6	158.7	257.9	5.2	2.0	DNT	186.4	280.0	33.4%
11		6	157.7	256.3	9.9	2.0	DNT	181.3	280.0	35.3%
12		6	158.0	256.7	10.1	2.0	DNT	156.4	280.0	44.1%
13		6	156.0	253.5	0.0	2.0	DNT	280.0	280.0	0.0%

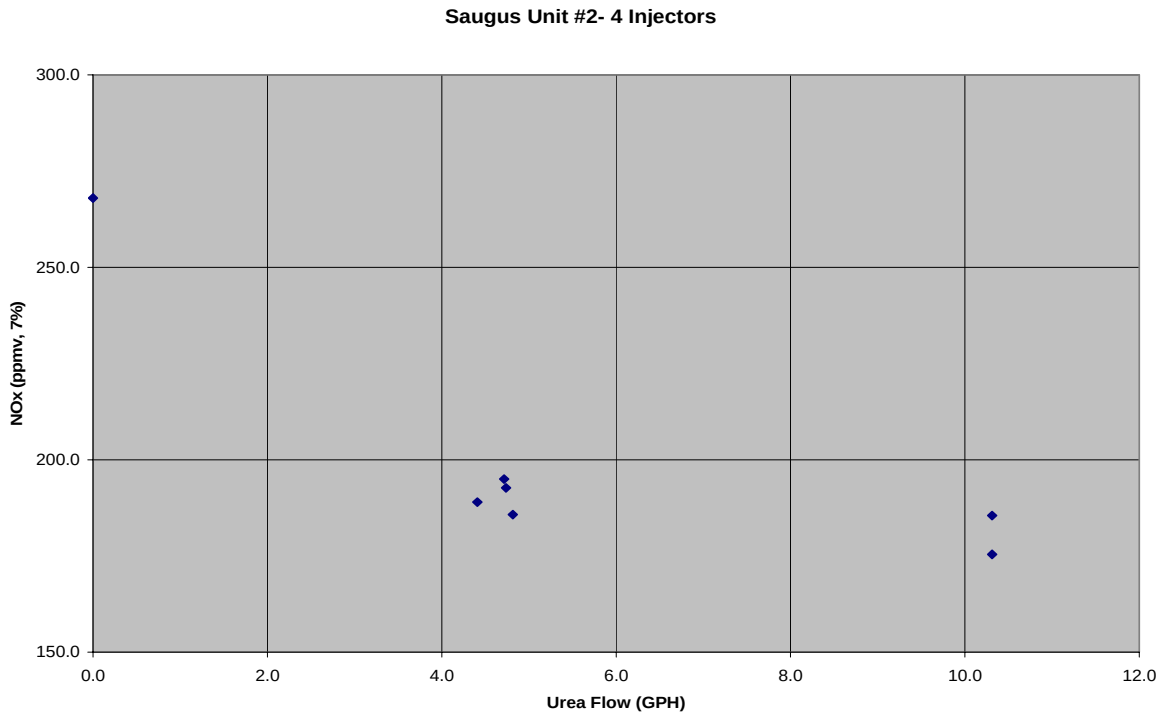
Note: Added one injector towards rear wall same level

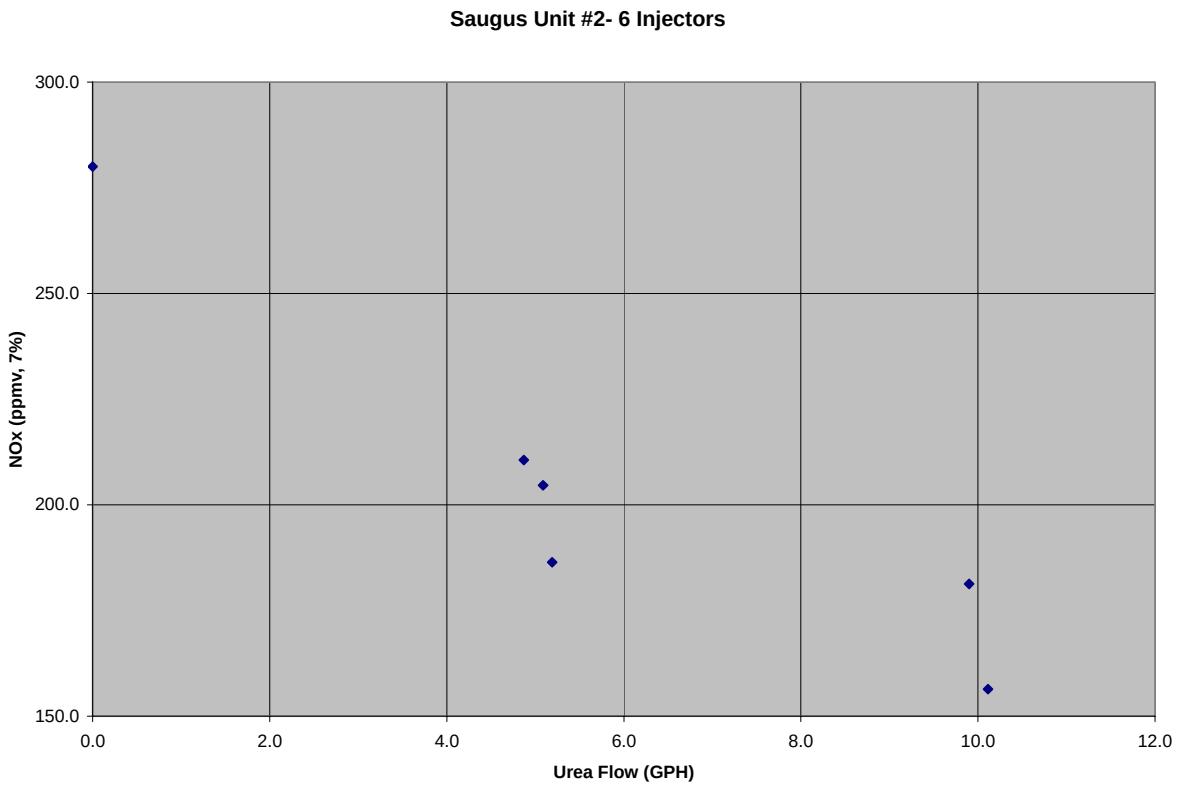

NORTH
24'
UNIT #2
32'
FACING EAST
FACING WEST
Added
Injector
inj
inj
Port 2A
Port 2B
4'
5.9'
5'
(Darkened Ports are Capped)
Burners
Added
Injector
inj
inj
4'
3.3'
EL. 62'
HEAVY ASH

Note: Added injectors in service on Unit #2 for second set of tests on January



27





The results show a small incremental increase in NOx reduction and decrease in NOx emissions by doubling reagent flow from 5 to 10 gallons per hour. This marginal improvement in NOx removal and NOx reduction at twice the reagent flow rate is indicative that the injectors are located at the lower end of of the SNCR operating window where potential for ammonia slip generation is highest due to limited reaction time in SNCR operating window. It should be noted that there was an extremely heavy rainfall the weekend before these tests and that due to the wet refuse, higher than normal primary air flow was needed for the combustion; the baseline NOx was therefore higher during these tests than typically found on these units, but baselines which can be expected during the course of the year.

7.0 SNCR Optimization Test Conclusions

Four and six injectors were tested on Saugus Units #1 and #2 and six injectors were tested on Saugus Unit #2 at reagent feed rates of 0, 5, and 10 gallons per hour and results show a capability of reducing NOx consistently down to 185 ppmv (dry, 7% O2) over a 24 hour average with loads at or above 150,000 lbs/hr steam flow. Based on these tests it was determined that:

- Because of furnace configuration, there was no significant performance difference between in utilizing 4 or 6 injectors in each furnace using the DNT injectors.
- Baseline NOx varied between 240 and 280 ppm (dry, 7% O_2)
- A reduced NOx setpoint of 185 ppm (dry, 7% O_2) was achieved on both units even at higher baselines
- Increasing reagent feed rates from 5 to 10 gph did not appreciably lower NOx or increase NOx reduction.
- This marginal improvement in NOx removal and NOx reduction at twice the reagent flow rate (5 gpm to 10 gpm) indicates that the injector locations are the lower end of the SNCR operating window where potential for ammonia slip generation is highest due to limited reaction time in optimum SNCR operating window.

Therefore, a reduced NOx emissions target of 185 ppm (dry, 7% O_2) at current boiler operating loads of approximately 150,000lbs/hr may be achieved with the existing SNCR system configuration and an increase in reagent feed rate from 2-4 gpm to 4-6 gpm. Long term operation at this lower NOx target should be evaluated with ammonia slip testing to verify the current limit of 10 ppm 7% O2 is consistently achieved..